RE: WATER TREATMENT FOR THE CITY'S WATER SUPPLY

APPROVED FOR SUBMISSION TO THE CHIEF ADMINISTRATIVE OFFICER

ORIGINAL SIGNED BY

_____

Barry D. MacBride, P. Eng.
Director
Water and Waste Department

Attachments

May 30, 2000

RE: WATER TREATMENT FOR THE CITY'S WATER SUPPLY

RECOMMENDATIONS:

It is recommended that:

1. The City proceed with treatment of the water supply as described herein.

2. Design and construction activities be undertaken so that the water treatment plant be operational in the year 2006.

3. That the water treatment process as identified through the pilot testing and described herein be adopted as the baseline process for comparison to alternatives and new technologies.

4. The Administration:

    a) Investigate and report on emerging technologies such as ultraviolet disinfection and membranes;
    b) Investigate and report on alternative project delivery strategies;
    c) Prepare documents in support of any application by Council for Federal and Provincial funding.

REASON:

Council approval is required to proceed with the plan for the construction of a water treatment plant for the City's water supply.

HISTORY:

1993 Council approved the creation of the Water Treatment Reserve Fund to cash finance a portion of the cost of a water treatment plant.

1994 The Regional Water Supply Conceptual Planning Study recommended that the City conduct pilot water treatment testing to develop a process to treat Shoal Lake water.

1996 A group which included international experts, and City and Provincial Health Officials completed a risk assessment. They concluded that while the risk of a waterborne disease outbreak is low, the consequences are high, justifying the implementation of comprehensive water treatment facilities for the existing water supply for Winnipeg.

1998 June, Pilot Water Treatment Program recommended the baseline water treatment process.

1999 On May 26, Council approved a process for public consultation on whether or not to proceed with a water treatment plant.

1999 On October 6, a Council Seminar was held to present a summary of water quality guidelines, public health risks and consequences, recommended water treatment process, cost and financing of a water treatment plant.

1999 On October 21 and 28, Special Meetings of Executive Policy Committee (EPC) were held to hear from the public on the need to construct a water treatment plant. A summary of proceedings prepared by the Clerk of the Executive Policy Committee is included as Appendix A. A discussion of questions arising from the special meeting of EPC has been prepared by the Department and is included as Appendix B.

DISCUSSION:

Safe water is an absolute requirement for any community. Winnipeg residents expect that the City will take all necessary and reasonable steps to provide a water supply that is reliable and safe. This report recommends continued commitment to water treatment for Winnipeg. In the opinion of the Water and Waste Department, supported by health professionals, the risk to public health associated with drinking water in Winnipeg is too high and a water treatment plant is required. Experience elsewhere has demonstrated conclusively that the consequences of a waterborne disease outbreak are severe in terms of human health, economic losses, and loss of public confidence.

This report is organized under the following major headings:

A. The Need for Water Treatment
B. Public Consultation and Special Meetings of Executive Policy Committee
C. Baseline Water Treatment Process
D. Alternative Processes and Emerging Technologies
E. Financial Impact
F. Timing of Water Treatment
G. Alternate Project Delivery Strategies
H. Federal And Provincial Funding of Water Treatment Infrastructure
I. Overall Schedule

A. The Need for Water Treatment:

There are two fundamental reasons why a water treatment plant is needed:

1. To reduce the risk of a waterborne disease outbreak caused by chlorine-resistant microorganisms.

To date Winnipeg uses chlorine as the primary disinfectant. It is now recognized that chlorine resistant pathogens such as *Cryptosporidium and Giardia* are present in surface water supplies and that water treatment processes, such as the use of alternative disinfectants and filtration, are required to prevent waterborne disease outbreaks.

To our knowledge, there has been no waterborne disease outbreak over the last 80 years in Winnipeg, but positive *Cryptosporidium and Giardia* samples have been obtained from Shoal Lake. In fact, Iskatewizaagegan No. 39 First Nation commissioned a water treatment plant in 1998 to protect their community of 370 persons from waterborne microorganisms in Shoal Lake.

While the risk is low in any year, when viewed over a longer term, say the next 50 years, the risk that an outbreak will occur becomes unacceptable. In addition the growth in human activity within the Shoal Lake watershed that has been occurring will continue.

The consequences of disease outbreaks are high. Large numbers of residents would be sick and some would die. Of particular concern are the proportion of Winnipeg's population with severely weakened immune systems. This population includes, persons with HIV/AIDS, persons with cancer, recipients of organ or bone marrow transplants and those being treated with immunosuppressing drugs.

In addition to illness and death, consequences generally involve boil water advisories, lawsuits from affected groups and inevitably a decision to quickly install or improve water treatment.

Recently *Cryptosporidium* and *Giardia* have been associated with waterborne disease outbreaks or boil water orders in other locations in Canada using surface water supplies such as Thunder Bay, Dauphin, Kelowna, Kamloops and Moncton.

In 1989, in response to emergent chlorine resistant pathogens, the US Advanced Surface Water Rule was passed which stated that all surface water systems must be filtered unless exceptional circumstances apply. The Canadian drinking water quality guidelines typically follow regulation trends established by the Safe Drinking Water Act

in the USA. If this rule was adopted in Canada, Winnipeg would be required to build a water treatment plant.

The concept of a multiple barrier approach to protection from pathogens is well recognized in the water supply industry. The multiple barrier approach requires utilities to have source protection programs, water treatment, and disinfection throughout the distribution system. A treatment plant is a critical component in the overall protection of the water supply.

2. To reduce the levels of disinfection by-products to conform with the *Guidelines for Canadian Drinking Water Quality* established to reduce the risk of cancer.

The second fundamental reason for treatment is that Winnipeg's drinking water does not meet current limits set to protect public health for chlorinated disinfection by-products. Treatment is necessary to reduce disinfection by-products.

Public health research in the last 25 years has significantly enhanced the knowledge surrounding the constituents in drinking water. Although chlorine has provided invaluable public health benefits by controlling typhoid and cholera, it was first recognized in 1974 that chlorine reacts with natural organic matter in water to form chlorinated disinfection by-products. Studies since that time have shown an association between long-term exposure to disinfection by-products and cancer.

In 1993, the Canadian interim maximum acceptable concentration for disinfection by-products measured as Total Trihalomethanes (TTHMs) was reduced from 350 to 100 micrograms per litre. Studies undertaken since 1993 have indicated that even the 100 micrograms per litre limit may not be sufficiently protective and the guideline is currently under review. In 1999, the USA limit was reduced from 100 to 80 micrograms per litre. The USA EPA has formally announced that the disinfection by-product limit for TTHMs may be lowered to 40 micrograms per litre.

These guidelines and regulations have been set to minimize the risk of cancer from disinfection by-products to negligible levels. In 1998, the City's water supply had an average disinfection by-product concentration of 112 micrograms per litre exceeding even the current guideline of 100 micrograms per litre.

In a March 1999 survey of customers expectations of the utility, residents gave "providing water that is safe and healthy to drink" an importance rating of 9.7 (1 least important to 10 most important). Customers rated the City's current performance on this measure as 7.1 out of 10.

Overall, as shown in Table 1, the present water supply system does not meet Canadian guidelines for total trihalomethanes, turbidity, taste and odour. However, with treatment, compliance with the guidelines will be achieved. It is important that Winnipeg strive to meet these guidelines to protect public health.

Table 1: Comparison of Canadian and USA Water Quality Targets

Treatment Goal	**Specific Parameter**	**Typical Winnipeg Drinking Water Quality**	**Canadian Guidelines**	**USA Regulations**	
				Current	**Future**
Clear water	Turbidity (NTU)	0.3 - 2.6	<1.0	0.3	0.1
DBP control	TTHMs (µg/L)	50-205	100	80	40
	THAAs (µg/L)	50-120	NG	60	30
Taste & Odour control	TON (threshold odour number)	10 to >200	Aesthetic	3	3

NG - no guideline

Other Benefits of Water Treatment:

The fundamental reasons for a water treatment plant are protection of public health through increased protection from pathogens and reduction in exposure to disinfection by-products linked to cancer to comply with the Canadian drinking water quality guidelines. Additional benefits will occur. Water treatment will result in improved taste, odour and appearance. The existing water system is subject to episodes of algae blooms resulting in undesirable taste and odour. A recent survey suggests that 41% of utility customers are not satisfied with the taste and odour of the water. Taste, odour and appearance of the water will dramatically improve with full treatment. Public confidence in the perceived safety of the drinking water increases with improved appearance, taste and odour.

Economic activity may also be enhanced. Many industries need high water quality meeting the Canadian drinking water quality guidelines. A high quality water is important to those businesses when considering a site for new facilities or expansions.

Support of Public Health Officials

Water treatment is about public health. While the service is delivered by organizations such as the Water and Waste Department, oversight is under the Public Health Act of Manitoba. It is important that Council be aware of the recommendations from Health officials who are fully familiar with the Shoal Lake Water Supply and with the proposed water treatment plant.

As outlined in the next section on public consultation, Dr. Jim Popplow, Medical Officer of Health with the Province of Manitoba made a presentation in support of the water treatment plant.

In addition, Dr. Margaret Fast, who at the time was the City's Medical Officer of Health, made a presentation in support of water treatment. As part of recent reorganization of responsibilities, Dr. Fast is now Medical Officer of Health with the Winnipeg Regional Health Authority. In a letter to the Director of Water and Waste, dated May 24, 2000, Dr. Fast indicated:

> *"It is my understanding that your Department will be requesting the approval of City Council to proceed with the construction of a water treatment plant for the City's water supply. The rationale for construction of a water treatment plant is based primarily on health concerns and it is for this reason that I offer my support for this request.*
>
> *The risks associated with waterborne parasites like Cryptosporidium and Giardia are well documented and, although an outbreak associated with our water supply is unlikely, the consequences could be significant. The risks related to elevated levels of disinfection by-products in drinking water are less clear but increasing evidence indicates associations with adverse pregnancy outcomes and elevated cancer risks.*
>
> *You have previously heard support from the international, national and provincial public health community for the construction of a water treatment facility and I would like to reiterate my support for this initiative."*

B. Public Consultation and Special Meetings of Executive Policy Committee

Extensive public consultation was carried out on water treatment. On October 6, 1999 a Council Seminar was held to brief Council on the issues surrounding water treatment. A media briefing was held on the same day to provide an opportunity for the media to be informed and ask questions of experts on health impacts and water treatment. The

media attended the pilot plant and reported extensively on water treatment. Staff appeared on local media shows to explain water treatment.

Newspaper ads were placed on water treatment and announcing the special afternoon and evening meetings of Executive Policy Committee. The public was invited to make presentations to Executive Policy Committee. An eight-page brochure entitled ***"Should Winnipeg Build a Water Treatment Plant?"*** was distributed on request to 2000 Winnipeg residents. Information was placed on the City of Winnipeg's web page including the engineering studies on water treatment processes for Winnipeg.

On October 21 and 28, Special Meetings of Executive Policy Committee (EPC) were held to hear from the public on the need to construct a water treatment plant. The Water and Waste Department made two presentations and the City's Medical Health Officer made one presentation in support of water treatment.

As detailed in the summary report of the Clerk (Appendix A), there were 12 delegation presentations heard by EPC. There were 20 additional submissions in the form of letters and emails to the City pertaining to this subject, for a total of 32 submissions. The 32 public submissions were grouped into 3 categories: 20 "In Support", 6 "In Opposition" and 6 "For Information".

In Support

The majority of the delegations "In Support" believed that a water treatment plant should be built for the protection and enhancement of Winnipeg's drinking water. They indicated support as follows:

- That the citizens of Winnipeg are dependant on the City for safe water;
- A delay in the construction of a water treatment plant was unacceptable;
- Concern with seasonal taste and odour events and questioned whether the drinking water was actually safe;
- Customer confidence and public trust in the City's water supply will be enhanced because a water treatment plant will provide more consistent taste and odour.

In Opposition

Various messages were received from those "In Opposition":

- That the current water supply system was adequate;
- That bottled water could be purchased for the small volume of drinking water required;
- That the City should look at alternatives to water treatment.

For Information

- Can the water treatment plant be constructed in stages to reduce cost?
- Can new technologies be used to reduce cost?
- What is the benefit of Deacon Reservoir?

The questions raised during the public meetings and responses prepared by the Department are attached in Appendix B.

C. Baseline Water Treatment Process

An extensive testing program was carried out to develop a baseline water treatment process to meet the water quality goals. A pilot water treatment plant was constructed and operated to test various treatment processes and to optimize production rates for Shoal Lake water.

The recommended water treatment process consisting of:

> Rapid mix + enhanced coagulation (ferric chloride) + flocculation + dissolved air flotation (DAF) + ozone (O_3) + biological activated carbon filtration (BAC) + monochloramine (NH_2C1) for secondary disinfection + water stabilization,

provided the most cost effective option on a life-cycle cost basis, considering both capital and operating costs, while meeting established drinking water quality goals. This process will meet the current and foreseeable drinking water quality guidelines.

The water treatment plant would be constructed at the Deacon Reservoir in the Rural Municipality of Springfield. It would be subject to environmental approval under the Environment Act of Manitoba.

D. Alternative Processes and Emerging Technologies

Water treatment and disinfection technologies continue to evolve rapidly. Staff will monitor and investigate these over the next three years to ensure that the most effective technology is used in the water treatment plant. At the present time, the most promising emerging technologies include ultraviolet (UV) light for disinfection in place of ozone, and the use of membrane technology in place of biological activated carbon (BAC) for filtration. These technologies in particular will be studied in pilot form. Any others that warrant consideration will be evaluated against water quality goals and the recommended baseline treatment process. To be acceptable, any new technology must meet the water quality goals and be more economical.

E. Financial Impact

Capital Costs

The capital cost of a water treatment plant is estimated at $204 million. This estimated cost is based upon conceptual engineering and is considered to be accurate within plus or minus 10%. It includes design, engineering, construction, environmental approvals, inflation, contingency and finance/administration charges.

In 1993, Council approved the establishment of the Water Treatment Plant Reserve to accumulate funds towards the future construction of a water treatment plant. The Reserve is funded through the water rates and under the current financial plan, will fund 50% or $102 million of the estimated cost. The remaining 50% will be financed through long-term debt.

As at December 31, 1999 there was $26.4 million in the Water Treatment Plant Reserve and that balance is expected to grow to $35 million by the end of 2000.

A summary of the capital program and related financing is shown in Table 2.

Table 2
WATER TREATMENT PLANT
CAPITAL EXPENDITURE AND FINANCING PLAN
(thousands of dollars)

Year	CAPITAL EXPENDITURE	BLOCK 1 WATER RATE (per hcf)	FINANCING			BALANCE, END OF YEAR	
			Reserve Fund		Debt	Reserve Fund	Debt
			Rate per hcf	Annual Contribution			
1994	$0	$1.55	$0.07	$1,503		$1,503	
1995	$240	$1.70	$0.13	$3,435		$4,698	
1996	$977	$1.89	$0.02	$1,287		$5,008	
1997	$533	$2.10	$0.02	$904		$5,379	
1998	$362	$2.32	$0.40	$9,640		$14,657	
1999	$261	$2.54	$0.42	$12,024		$26,420	
2000	$2,500	$2.70	$0.44	$11,318		$35,238	
2001	$3,000	$2.75	$0.44	$11,477		$43,715	
2002	$6,127	$2.75	$0.46	$11,986		$49,574	
2003	$26,000	$2.78	$0.59	$15,157		$38,694	
2004	$84,000	$2.82	$0.47	$12,530	$34,012	$1,235	$34,012
2005	$80,000	$2.83	$0.44	$10,739	$67,988	$0	$102,000
2006				$0		$0	$102,000
Total	**$204,000**			**$102,000**	**$102,000**	**$0**	**$102,000**

hcf = hundred cubic feet

Operating Costs

The annual operating and maintenance costs, including property taxes, are estimated at $12 million. These costs, as well as the annual debt servicing costs of approximately $10 million are incorporated into the utility's ten year financial and rate plan.

Impact on Water Rates

In 2000, the combined water and sewer rate increased by 2.6% for the typical residential customer (family of four), resulting in a $2.94 increase in the typical quarterly bill.

The 2000 rate strategy, based upon the then available information, did not anticipate further rate increases over the planning time frame. While this plan cannot be considered a rate freeze (results are based upon a series of assumptions that are subject to change) it does include all capital and operating costs associated with a water treatment plant.

Impact on Water Rates if the Water Treatment Plant is Not Proceeded With

If Council decides not to proceed with the plant, a decrease in the combined water and sewer rate of approximately 18% could be considered by City Council for implementation over the next four to six years. This drop in the cost of water and sewer services would result from both a decision not to build a water treatment plant, and completion of the Aqueduct Rehabilitation Program in 2003. This decrease also assumes no other major improvements in Winnipeg's water and sewer system would be required.

F. Timing of Water Treatment

Proposed Schedule

The current financial plan and water rate model calls for construction of the water treatment plant to commence in 2004 with an in-service date of 2006. A change in timing would impact the current financial plan.

Advance the Project

Advancing the project would shorten the time to accumulate funds in the Water Treatment Plant Reserve which would require more long-term debt financing for the project. If the project was advanced by three years (the soonest date the plant could be in service would be 2003 since it will take 3 years to design and build), debt servicing

costs would rise by approximately 40%. The residential (Block 1) water rate would have to increase by approximately 6% to support the increased debt service costs.

Another disadvantage to advancing the project would be the inability to investigate emerging technologies and alternative project delivery strategies.

Delay the Project

Delaying the project would lengthen the time to accumulate funds in the Water Treatment Plant Reserve which would require less long-term debt financing for the project. For each year the project is delayed, long-term debt requirements would decrease by approximately 10%. The reduced debt servicing requirements would approximate a 1% decrease in the residential (Block 1) water rate.

While a project delay would result in a slight decrease in the water rate, it is not recommended because of the ongoing risk of a waterborne disease outbreak.

G. Alternate Project Delivery Strategies

There are several alternatives with respect to how a water treatment plant can be designed, constructed and operated. For example, an alternative to the conventional project tender and subsequent operation by City staff would be to enter into a long-term public-private operation to build and operate the plant.

This was done recently in Seattle, WA, Dauphin, MB, and Cartier, MB. In order to consider the alternatives and the advantages and disadvantages, a consultant will be engaged to conduct a study of the full range of project delivery options. The water industry has developed an innovative process for conducting this analysis of alternative project delivery which will be useful in this study. The results of this work will be included in a report to Council with a recommendation on the preferred project delivery strategy.

H. Federal And Provincial Funding of Water Treatment Infrastructure

The City of Winnipeg finances 100% of water and sewer capital and operating costs through the utility rates. The financial plan shown herein is based on continuing this method of financing. It is appropriate that City Council weigh the total costs of water treatment against the need. The total cost must be justified.

Typically large urban centres such as Winnipeg, Calgary and Edmonton have not received Federal or Provincial money for water treatment projects. At the same time, Federal and Provincial governments have made contributions to water treatment infrastructure in the past to smaller communities or rural areas through jointly funded

programs. The Dauphin water treatment plant is an example. Other examples of provision of funding from senior levels of government are the Cartier water system and the Sanford water system.

Should Council elect to proceed with a water treatment plant, inter-governmental discussions concerning funding should take place. The Department will prepare appropriate documentation in support of any application by Council for Federal and Provincial Funding.

I. Overall Schedule

The design and construction of a water treatment plant is a significant undertaking. The following work activities have been identified in order to bring the water treatment plant into service by late 2006.

2000 - 2001:

- X Evaluate the benefits and costs of emerging technologies such as UV and Membrane processes.
- X Appoint a Major Capital Project Steering Committee (pursuant to the recommendations of the Main Norwood Audit).
- X Develop and implement a project risk assessment and major capital projects reporting program which will be ongoing for the duration of the project.
- X Engage an independent consultant to conduct a study of the full range of project delivery options for this water treatment plant. The study will rely on methodology developed for the water industry. A report and recommendations concerning the outcome of this study will be made to Council before implementation of any delivery alternative.
- X The Department will prepare appropriate documentation in support of any application for Federal and Provincial Funding.

2002:

- X A consultant will be engaged to conduct an Environmental Impact Assessment and prepare an application for approval of the project in conformance with Provincial regulation and City policy.

2002 - 2003:

- X Once the above studies are completed, the selected project delivery alternative will be implemented for the design of the water treatment plant.

2004 - 2006:

- X It is anticipated that it will take 2½ to 3 years to construct the water treatment plant.

2006:

X Commissioning and operation of the water treatment plant is scheduled to take place in the last quarter of 2006.

THIS REPORT SUBMITTED BY:

Water and Waste Department

BDM/TRP/MAS/DEG:jb:bdm:gk

Attachments:

Appendix A – Special Meeting of EPC October 21 and 28, 1999 on the Need to Construct a Water Treatment Plant

Appendix B – Discussion of Questions Arising From October 6, 1999 Council Seminar and Special Meeting of EPC October 21 and 28, 1999 on the Need to Construct a Water Treatment Plant

May 30, 2000

APPENDIX A

SPECIAL MEETING OF EPC OCTOBER 21 & 28, 1999

ON THE NEED TO CONSTRUCT A WATER TREATMENT PLANT

THE CITY OF WINNIPEG

SPECIAL MEETINGS of the EXECUTIVE POLICY COMMITTEE

TO HEAR REPRESENTATIONS ON THE NEED FOR A WATER TREATMENT PLANT FOR WINNIPEG'S WATER SUPPLY

PROPOSAL:	To determine the need for a Water Treatment Plant for Winnipeg's Water Supply File WS-7 (Vol. 3)
	Council Chamber, Council Building, 510 Main Street October 21 and 28, 1999 3:00 p.m.
BEFORE:	Councillor De Smedt, Chairperson His Worship Mayor Murray Deputy Mayor Thomas Councillor Clement Councillor Eadie Councillor Steek Councillor Vandal
ADMINISTRATIVE PERSONNEL:	Mr. B. MacBride, Director, Water and Waste Dr. Margaret Fast, Medical Officer of Health Mr. M. Shkolny, Project Management Engineer Water and Waste Department Mr. K. Kjartanson, Research Engineer, Water and Waste Department
CONSULTANT:	Mr. G. Rempel, TetrES Consultants Inc.
CLERKS:	Mr. R. S. MacCallum, Clerk of the Executive Policy Committee Miss F. Kroeker, Assistant Clerk

Appendix A

SUMMARY OF REPRESENTATIONS AND SUBMISSIONS MADE AT THE SPECIAL MEETINGS ON THE SUBJECT MATTER

OCTOBER 21, 1999

Mr. B. MacBride, Director of Water and Waste, made an overhead presentation on behalf of the City of Winnipeg regarding the need for a Water Treatment Plant for Winnipeg's water supply. A copy of his presentation has been placed on file.

Dr. Margaret Fast, Medical Health Officer also made an overhead presentation on behalf of the City in support of the proposed Water Treatment Plant. A copy of her presentation has been placed on file.

The following presentations were made before the Executive Policy Committee:

1. Dr. Jim Popplow, Medical Health Officer, Environment, Department of Health, Province of Manitoba was heard in support of the proposed Water Treatment Plant to improve the quality of water and reduce the low risk but high consequences of a C*ryptosporidium* outbreak from contamination in the Winnipeg water supply. He submitted a copy of his presentation dated October 21, 1999 which has been placed on file.

2. Paul McKenzie, was heard in opposition to the Water Treatment Plant and submitted copy of documentation in support of his position.

3. Dr. Eva Pip, was heard in support of the Water Treatment Plant and addressed various issues including *Cryptosporidium* and *Giardia*, chlorination as well as ozonation, which has advantages over chlorination. A copy of her comments (by email) dated October 18, 1999 have been placed on file.

4. Clifford Baschuk, 113 Sunnyside Boulevard submitted a written presentation dated October 21, 1999 and indicated his support for the Water Treatment Plant in order to improve the quality of water for all citizens.

5. Dr. B. Des Marais, Senior Dental Consultant, Department of Health, Province of Manitoba was heard in support of the need for a Water Treatment Plant and submitted guidelines on fluoride documentation dated August 1996 which has been placed on file in the office of the City Clerk.

6. Darla D. Campbell, Engineering Services & Technology, United Water Services Canada was heard in support of the need for a Water Treatment Plant and submitted a copy of her presentation dated October 21, 1999 which has been placed on file.

OCTOBER 28, 1999

Mr. B. MacBride, Director of Water and Waste made an overhead presentation on behalf of the City of Winnipeg regarding the need for a Water Treatment Plant for Winnipeg's water supply. A copy of his presentation has been placed on file.

The following presentations were made before the Executive Policy Committee:

1. Paul Moist, President, CUPE Local 500 was heard in support of the need for a Water Treatment Plant and submitted a copy of his brief dated October 28, 1999 which has been placed on file.

2. Theresa Ducharme, Private Citizen, was heard in support of the Water Treatment Plant for Winnipeg's water supply in view of the need to have a good safe supply of water for persons with health concerns.

3. Ed Burgener, Private Citizen was heard questioning the rationale and need to build a Water Treatment Plant and submitted a copy of his communication dated October 19, 1999 and recap email dated October 28, 1999, which have been placed on file.

4. Reeve Holland, R.M. of Springfield was heard with respect to the proposal for a Water Treatment Plant and raised concerns with respect to the environmental impacts on the adjacent municipalities. He was of the opinion that a complete environmental impact review should be conducted on the proposed facility. He was concerned with respect to the adjacent ground water resources which are the main source of water for the residents of the Rural Municipality. He also raised concerns regarding the unpleasant odour and persistent leak from the Deacon Reservoir.

5. Walter Fraser, Private Citizen was heard in opposition to the proposal to build a Water Treatment Plant. He suggested that the majority of the water used is not consumed by the people, but used for washing clothes and cars. He was of the opinion that the cost of building a new treatment plant could not be justified.

6. Vincent Proteau, Private Citizen was heard in opposition to the proposal for a Water Treatment Plant and submitted a copy of his communications dated October 21 and 28, 1999, together with a report dated October 1, 1999 entitled "The Shoal Lake Aqueduct Report - 2nd Edition", which has been placed on file. He cited concerns regarding the effects of the present aqueduct and inasmuch as he indicated that the water treatment plant would be positive for the City, he was of the opinion that the City's water supply system should not be given priority over other communities without providing compensation for development activities which negatively affect the communities it passes through. He felt that there should be a complete Environmental Impact Study conducted before commencement of the new treatment plant.

The following emails/communications were received in this office and placed on file, namely:

IN SUPPORT

1. Dave Yallits, Plumbers and Pipefitters Union Local 254 (email dated October 5, 1999)
2. Sue DeYoe-Harwood (email dated October 18, 1999)
3. Dr. Eva Pip, University of Winnipeg (email dated October 18, 1999)
4. Ron Dalmyn (email undated)
   The Organization, Provincial Coalition for Responsible Resource Management
5. Janis Burton (email undated)
6. Mr. & Mrs. E. L. Clay (communication dated October 17, 1999)
7. Mr. E. MacKinder (communication dated October 18, 1999)
8. Ms A. MacDonald (communication dated October 18, 1999)
9. Margaret and Hartley Stinson (email undated)
10. Nona Brotchie (communication dated October 21, 1999)
11. A. B. Sparling (communication dated October 25, 1999)
12. Clifford Baschuk (communication dated October 21, 1999)
13. Dr. Jim Popplow, Medical Officer of Health (presentation dated October 21, 1999)
14. Dr. B. Des Marais, Senior Dental Consultant, Department of Public Health, Province of Manitoba (Fluoride Guidelines dated August 26, 1996)
15. Darla D. W. Campbell, United Water Services Canada (communication and presentation dated October 18, 1999)
16. Paul Moist, President, CUPE Local 500 (presentation dated October 28, 1999)
17. Mrs. C. Borean (communication dated October 28, 1999)
18. R. F. Manning, Chief Engineer, Deer Lodge Centre (communication dated October 25, 1999)
19. K. Radcliffe (email dated November 3, 1999)
20. Katherine Martens (communication undated)

IN OPPOSITION

1. Barry MacKay (email undated)
2. Harold W. Patterson (email dated October 18, 1999)
3. Mr. Ernest S. Behr (communication dated October 16, 1999)
4. Vincent Proteau, Pine Tree Campground & Trailer Park (communications dated October 21 and 28, 1999 and Presentation dated October 1, 1999)
5. Paul Mackenzie (communication undated)
6. Dr. R. A. Gallop (brief dated October 28, 1999)

Emails/Communications FOR INFORMATION

1. Fred Petrie, Senior Policy Consultant, Policy and Service Development Branch, Manitoba Highways and Transportation (email dated October 5, 1999)
2. Ed Burgener (communication dated October 19, 1999 and email dated October 28, 1999)
3. Rod Raphael, Director General, Environmental Health Directorate (communication dated October 15, 1999)
4. Pat Driscoll (communication dated October 22, 1999)
5. Ms Ellowyen Thornton-Trump (communication - undated)
6. William (Bill) Barker, Laboratory Manager, MFC Testing and Research Inc. (communication - undated)

Robert S. MacCallum
Clerk of the
Executive Policy Committee

APPENDIX B

DISCUSSION OF QUESTIONS ARISING FROM OCTOBER 6, 1999 COUNCIL SEMINAR AND SPECIAL MEETING OF EPC OCTOBER 21 and 28, 1999 ON THE NEED TO CONSTRUCT A WATER TREATMENT PLANT

Appendix B

Summary of Questions: **Page**

Water Source:

1. Is Shoal Lake water quality changing over time?

The water quality is relatively stable but greater risks of waterborne contamination exist today.

Monitoring of water quality done by the City of Winnipeg and other government agencies shows that the water quality of Shoal Lake has not changed significantly over decades. There has been no waterborne disease outbreak over the last 80 years of the City's use of the Shoal Lake supply. However, the risk is real albeit low. It is generally accepted that chlorine resistant pathogens are present in surface water supplies, and that filtration is required to prevent waterborne disease outbreaks. When viewed over the next 50 years, the risk that an outbreak will occur becomes larger. The consequences of disease outbreaks are high and are increasing with time. The consequences generally involve illness, boil water advisories, lawsuits from affected groups and inevitably a decision to quickly install or improve water treatment.

While there has been some ongoing development in the watershed, the development has been fairly limited. Cottage development is low, with about 300 to 400 cottages on Shoal Lake itself. About 800 cottages are at Falcon Lake. Other developments, such as mining and forestry, have been relatively limited to date. The City of Winnipeg is participating in a multi-government activity, with the objective of preparing a sustainable water quality management plan for development in the watershed.

2. What is the City doing about protecting the Shoal Lake watershed?

The City has long believed that sound watershed management is essential to the preservation of water quality and to providing a "first barrier" against waterborne contaminants. However, a watershed management plan cannot replace a water treatment plant.

Watershed management issues within the watershed are complex because of the varied interests of the many stakeholders and jurisdictions involved. Governments with jurisdiction in the watershed include the provinces of Manitoba and Ontario, the Federal Government and Shoal Lake First Nations communities #39 and #40 (Indian Affairs). Environment Canada has jurisdiction over interprovincial and international waters.

There is a need to review potential development impacts on a watershed-wide basis and to establish criteria for sustainable development so that the stakeholders within the region (particularly First Nations) are not deprived of potential economic opportunities which are sustainable and do not detract from water quality. A watershed plan would result in a higher level of certainty with respect to the types of developments which may occur within the watershed.

The Ontario Government signed an agreement with five First Nations in the watershed to develop such a plan in 1994, which expired in September 1999. Ontario and the First Nations spent a number of years building a working relationship before they agreed to involve Manitoba and Canada in the Shoal Lake working group in November of 1998. In July 1999 Ontario, Manitoba and Canada agreed to funding and preparing a watershed plan with a target completion date of March 2001. The work to-date has resulted in a draft Vision, Principles, and Objectives for a watershed plan. A public consultation process has taken place with public meetings held in November 1999.

The City is also able to exercise some influence over activities by Shoal Lake First Nations #40 through the Shoal Lake Tripartite Agreement. The relationships with Shoal Lake First Nations #39 have been cordial and First Nations #39 has kept the City abreast of developments which may impact water quality.

3. Are there alternative sources available for Winnipeg that would avoid the cost of a treatment plant?

No. A full range of alternative water supply sources were evaluated in a major planning study conducted for the Department in 1994. The study found the following*:*

- The Red and Assiniboine Rivers would require extensive treatment because of their naturally poor water quality characteristics with respect to drinking water. Both rivers are subject to very low flows during drought cycles and would not be able to provide a reliable source of water supply for the City of Winnipeg.

- A ground water supply of good quality, except for high hardness, is potentially available near the aqueduct about 50 km east of Winnipeg. However, this source is very limited in quantity. It could potentially provide a modest additional water supply (say 10%) if the City needed such supplement, but it could not be a main water supply for the City of Winnipeg.

- Natalie Lake: Natalie Lake is the head pond of Seven Sisters power station. The water quality is similar to Shoal Lake, except it is high in natural colour. Natalie Lake would require equivalent treatment to Shoal Lake, and colour removal would also be required. There is also a higher risk of waterborne contaminants with this watershed than with Shoal Lake, which is more remote. Supplying water from Natalie Lake would be much costlier than treating the existing Shoal Lake water supply.

Other Cities:

4. Other cities don't seem to be planning on spending as much as Winnipeg, for example Calgary, why?

Calgary, AB: Calgary already has two conventional treatment plants (alum coagulation, flocculation, sedimentation basins, filtration and chlorination) which were constructed in the 1960's. Calgary has a goal to provide a finished water quality that is better than current Canadian guidelines for pathogens and DBP control. A 4-phased expansion program is planned for the Glenmore plant with a review of the other plant to follow. Total costs are approximately $110 – 130 million in 4 phases which is proposed to be City debt-funded. The treatment process is similar to Winnipeg (Dissolved Air Flotation/Ozone/Deep-bed Biological Active Carbon). The cost for Calgary to build new water treatment plants would be significantly higher, as many treatment components are already in place (i.e., raw water pumping, rapid mix building, filter building, administration building, distribution pumping).

Edmonton, AB: Edmonton is upgrading their two existing treatment plants in anticipation of more stringent guidelines with respect to pathogens and DBPs. Future improvements to disinfection (ozone) and filter upgrades will cost about $30 – 50 million, financed through the water rates.

Vancouver, BC: Vancouver is planning for filtration at its three sources, but will begin the program with ozone and filtration at the largest Seymour source. The cost is approximately $120 million, which is to be financed through water rates. Vancouver's water supply typically has lower turbidity, except during heavy rainfall events, and lower organic matter than Shoal Lake water. This water quality allows for less extensive treatment at this time.

Kelowna, BC: Kelowna is studying implementation of ozone and filtration. The costs are estimated at approximately $30 – 50 million for a population of 92,000. The costs would be borne by the City.

5. What activities are other cities that have similar water supply systems to Winnipeg taking (i.e., unfiltered supplies from lakes or rivers)?

There are a number of major cities in North America that have unfiltered water supplies.

Vancouver, B.C.: Vancouver is supplied by three water supply sources and at present Vancouver does not provide flow treatment to any of these sources other than free chlorine. Vancouver does have control of each of these watersheds. Vancouver has identified a risk due to pathogens in the water supply served to the customers. As a result of extensive studies, their plan is to ozonate the Coquitlam source, which is a very high quality source (it does not have the high organic content that Shoal Lake water has), and to discontinue use of the Capilano source, whenever this water supply is turbid and there might be a risk of pathogens in the water. For the major source (Seymour Reservoir), they intend to provide filtration. Vancouver is considering filtration at the other sources as well.

Boston, MA: Boston is implementing water treatment at their Wachusetts Reservoir. Testing demonstrated that the DAF/ozone/filtration process provided the best overall treatment. The testing in Boston produced almost the same results as Winnipeg. The Wachusetts Reservoir has medium organic content. As with Winnipeg, chloramines are required to keep the Trihalomethanes (THMs) and Haloacetic Acids (HAAs) below long-term target levels.

Portland, Maine: Portland Maine has installed ozone only for pathogen treatment. This system has been operating for a couple of years. The water source is very low in turbidity and organics which permits the use of ozone only.

New York City, NY: New York City is being sued by the United States Environmental Protection Agency (USEPA). The City has tried to avoid filtration by gaining control of the watershed. The USEPA is not satisfied that watershed control will provide an adequate substitute and is insisting on the implementation of treatment.

Seattle, WA: Seattle is currently building a water treatment plant on their Tolt River water supply. This water had been previously delivered to the public after only pH adjustment and chlorination. Water treatment is being implemented primarily to protect public health from waterborne pathogens. The Tolt River organic and turbidity levels are often quite low and as a result, ozone followed by direct filtration was considered acceptable treatment. Seattle is also in the

process of installing treatment on their second water supply, the Cedar River. The actual treatment system has not been specified but it appears that it will be either ozone and direct filtration or ozone only. Water treatment is being implemented primarily to protect public health from water-borne pathogens.

Moncton, NB: Moncton just commissioned a new water treatment plant. Over the last two years residents were required to boil their water because of the presence of coliform and *E.coli* bacteria. A significant loss of public trust has occurred within the community as a result of the contaminated water supply.

Water Disease Outbreaks and Incidents:

6. What has been the recent experience of other cities with waterborne disease outbreaks?

There have been many reported waterborne disease outbreaks. There are few, but still very significant, cases of widespread outbreaks associated with the public water supply and the balance have been found to relate to contaminated swimming pools, contaminated wells, or other locally-specific problems. One reason is that a severe outbreak is required for a gastrointestinal (GI) outbreak to be detectable from the normal background of GI cases from all other sources in the community. The people who seek medical attention will see different doctors and hence a relatively large number have to be affected before an episode is detected.

Most of the severe outbreaks reported in recent years appear to be caused by chlorine-resistant protozoa, e.g., *Cryptosporidium* and *Giardia*, because typical disinfection procedures are effective against most other pathogens. Even when an outbreak does occur, it is difficult to assign the cause to these protozoa, because they are difficult to detect and continuous monitoring of parasites is not practicable. Thus, it is not always possible to determine what organism or water quality problem caused the outbreak.

Some recent experience with the incidence of waterborne diseases resulting from contamination of drinking water from these two parasites are provided below.

A) Cryptosporidiosis

CANADA

- **Kitchener/Waterloo, ON**: Approximately 1,000 people were affected by a Cryptosporidiosis outbreak in 1993. The water is taken from ground water or the river. In this case the conventional treatment, including pre-ozonation, was being supplied from the river source.

- **Collingwood, ON**: An outbreak of Cryptosporidiosis was detected in 1996. About 182 cases of Crypto were identified. The water source was river water and chlorine was used for disinfection.

- **Cranbrook, BC**: Cranbrook, a city of 19,000, draws its water supply from Joseph Creek and Gold Creek. The water is stored in a reservoir, chlorinated and then piped by gravity to the city. In July 1996, the City had an outbreak of Cryptosporidiosis. Swimming pools were closed and restaurants, dentists and other commercial operations had to use bottled water. The cause of the outbreak is still under debate. The City plans to control the problem by creating a bypass to divert water in the Creek past the City's system during high runoff periods.

- **Kelowna, BC**: Kelowna, a city of 92,000, is served by 5 different water systems. The largest of these is the City of Kelowna system which serves about 50,000 people and gets its water from intakes about 70 ft deep in Okanogan Lake. In 1996, Kelowna had an outbreak of Cryptosporidiosis following high run-off. A study by the B.C. Centre for Disease Control suggested that it was likely spread via the City of Kelowna's water system. The City chlorinates at its pump stations. However, the relative closeness of the intakes to the City restricts the contact times to a period which may not be sufficient to reduce *Giardia* to an acceptable level. Chlorine is not effective for *Cryptosporidium*. Between June 1 and August 20, there were 157 confirmed cases of Cryptosporidiosis, and an estimated 14,400 additional suspected cases. A Boil Water Advisory was in effect from August 12 to September 24, 1996. Kelowna is planning to implement ozonation.

- **First Nations 39, Ontario**: In February 1997, the community experienced an outbreak of Cryptosporidiosis. Twelve positive cases were confirmed in the population of 370 persons. A membrane treatment facility was installed shortly thereafter at a cost of $3.5 million.

- **Kamloops, BC**: In Kamloops, *Cryptosporidium* and *Giardia* have been detected in the water system and as a consequence the Ministry of Health has issued an Order to have water treatment in place by 2003.

UNITED STATES

- **San Antonio, Texas**: Approximately 2,000 people were estimated to be affected by an outbreak of Cryptosporidiosis due to a contaminated drinking water source (artesian well).

- **Albuquerque, New Mexico**: About 56 people were considered to be affected with Cryptosporidiosis in 1986 with the source being an untreated lake water supply.

- **Carrolton, Georgia**: In 1987, approximately 13,000 people were affected with Cryptosporidiosis with the suspected source being contamination at the treatment plant with improper backwashing.

- **Jackson County, Oregon**: About 3,000 people were affected in a Cryptosporidiosis outbreak in 1992. *Cryptosporidium* was found in the surface water supply. Treatment consisted of chlorination with a package filtration plant.

- **Milwaukee, Wisconsin**: Largest waterborne disease outbreak in recent North American history occurred in April 1993. The outbreak was identified as Cryptosporidiosis and caused approximately 400,000 people to become ill. Over 100 deaths were associated with the outbreak, mostly immunocompromised persons. The outbreak is estimated to have cost millions of dollars and many lawsuits are pending. Milwaukee has a treatment plant but unusually circumstances resulted in parasites passing through the facility and contaminating the water. Milwaukee has since upgraded its treatment plant and made many improvements including better water quality monitoring.

- **Cook County, Illinois**: About 27 cases of Cryptosporidiosis were identified in 1993 from contaminated drinking water.

- **Las Vegas, Nevada**: About 80 cases of Cryptosporidiosis were found in 1994 with the suspected cause being contamination of the drinking water supply.

UNITED KINGDOM

- There have been numerous cases of Cryptosporidiosis outbreaks in the U.K. dating back to the mid-1980s, which were related to contamination of the drinking water supply. The suspected cases for the individual outbreaks ranged from 20 to 4,000.

B) Giardiasis

CANADA

Health Canada reports that confirmed outbreaks of Giardiasis have occurred in most of the provinces. There are a number of additional suggested but unproven outbreaks of Giardiasis, mostly in communities relying on surface water sources with only chlorination as treatment. Health Canada has recorded the locations of *Giardia* outbreaks, however, details with respect to each incident were not available. Some of the locations where these outbreaks occurred are listed below:

- **Ontario**
  - Temagami
  - Napanee
  - Kingston
  - Kapuskasing
  - York Region
  - Toronto
  - Simcoe County
  - Guelph
  - Haliburton
  - Peterborough
  - Camp Tawingo

The number of confirmed cases involved ranged from 4 to 35.

- **Alberta**
  - Canmore
  - Banff
  - Morley
  - Sylvan Lake

The number of cases ranged from 5 to 121.

- **Saskatchewan**
  - 25 locations, often with localized water supply, with minor outbreaks

The number of cases ranges from 2 to 7.

- **Quebec**
  - 5 locations, with the number of cases ranging from 1 to 10.

- **British Columbia**
  - 9 locations, including Kelowna, 100 Mile House, with the number of cases ranging from 1 to 111.

- **Newfoundland**
  - 8 outbreaks

- **Manitoba**
  - an outbreak occurred in Dauphin's water supply, with 26 cases reported in the first 3 months of 1996. In 1995, 19 cases were reported. A boil-water advisory was issued and a treatment plant is now under construction.

UNITED STATES

In the United States, Giardiasis outbreaks have been reported in 24 states. During 1965 through 1992, 115 outbreaks involving 26,500 known cases were reported.

7. The City of Kelowna, B.C. had an outbreak of Cryptosporidiosis. Did the Public Health officials conclude that protection against Cryptosporidiosis was not required?

No. Health officials recommended a comprehensive and long-range strategy to deal with water quality improvement in Kelowna. This strategy included improvements in watershed and source water quality; an operational procedure review and implementation plan; review of treatment options; and customer information and consultation. Their overall approach is very similar to that which the City of Winnipeg has already undertaken. Unfortunately, Kelowna had to deal with the issue in a reactive mode because they experienced an outbreak.

Kelowna experienced a Cryptosporidiosis outbreak in July of 1996. A Mayors Task Force was appointed in September 1997 to report to the Council. The Committee consisted of 16 people with a number of Public Health officials, i.e., the Medical Health Officer and also some representatives of the local medical profession. The Task Force was mandated to review all of the overall information, recommend new studies, determine costs, alternatives, etc., and report as to how to prioritize expenditures to improve the water quality. The Task Force unanimously recommended that Kelowna do the following:

- proactively move forward to reduce risk by reviewing and participating in new technologies to control and monitor *Giardia* and *Cryptosporidium*;
- prepare a long-term implementation strategy to allow for the eventual construction of water treatment technology which will provide for three-log removal of *Giardia* and allow for the installation of *Cryptosporidium* treatment as required and financially feasible;
- give consideration to increasing the water-quality surcharge, i.e., establish a reserve, in anticipation of long-term capital expenditures that will be required.

A funding reserve is in place in Kelowna and the longer term plan is to implement ozone to provide protection against both *Giardia* and *Cryptosporidium*.

It should also be noted that Kamloops, which is under an Order to implement treatment by 2003 received a commitment from the Province of British Columbia to share the cost of water treatment. Kelowna, on the other hand, has not applied yet and as a result, provincial cost-sharing has not been assured. This has affected their implementation schedule.

Canadian Drinking Water Guidelines:

8. Why are the Canadian Drinking Water Quality Guidelines becoming more stringent?

Water quality science and public health research in the last 20 years has significantly expanded the knowledge surrounding the constituents that are now being detected in water. These studies are referenced as reason to make the water quality guidelines more stringent to protect public health.

In 1974 it was discovered that trihalomethanes (THMs) could be formed as a by-product of water chlorination. Efforts commenced to assess the health significance of trihalomethanes in drinking water and their control. During this time the TTHM guideline was set at 350 µg/L. In 1993 the TTHM guideline was

set at 100 µg/L as interim until such time as the risks from the disinfection by-products are ascertained. Chlorine disinfection by-products have been linked to chronic, harmful health effects such as cancer. Recent research on THMs has also indicated a potential linkage to acute effects such as miscarriages. Currently, there is a Federal-Provincial Task Force reviewing the trihalomethane guideline.

The Canadian drinking water quality guidelines typically follow regulation trends established by the Safe Drinking Water Act in the USA. In 1989, the US Advanced Surface Water Rule was passed which stated that all surface water systems must be filtered unless exceptional circumstances apply. If this rule was adopted in Canada, Winnipeg would be required to build a water treatment plant.

The present water supply system does not meet these guidelines for total trihalomethanes, turbidity, taste and odour. However, with treatment compliance with guidelines will be achieved.

Water Treatment Plant Financing:

9. What is the financial impact of a water treatment plant?

Capital Costs

The capital cost of a water treatment plant is estimated at $204 million. This estimated cost is based upon conceptual engineering and is considered to be accurate within plus or minus 10%. It includes design, engineering, construction, environmental approvals, inflation, contingency and finance/administration charges.

In 1993, Council approved the establishment of the Water Treatment Plant Reserve to accumulate funds towards the future construction of a water treatment plant. The Reserve is funded through the water rates and under the current financial plan, will fund 50% or $102 million of the estimated cost. The remaining 50% will be financed through the issuance of long-term debt.

As at December 31, 1999 there was $26.4 million in the Water Treatment Plant Reserve and that balance is expected to grow to $35 million by the end of 2000.

Operating Costs

The annual operating and maintenance costs, including property taxes, are estimated at $12 million. These costs, as well as the debt servicing costs of approximately $10 million are incorporated into the utility's ten year financial and rate plan.

Impact on Water Rates

In 2000, the combined water and sewer rate increased by 2.6% for the typical residential customer (family of four), resulting in a $2.94 increase in the typical quarterly bill. This rate increase factored in all capital and operating costs associated with a water treatment plant.

10. Could the construction of the water treatment plant be advanced or delayed?

The current financial plan and water rate model call for construction of the water treatment plant to commence in 1993 with an in-service date of 2006. A change in timing would impact the current financial plan.

Advancing the project would shorten the time to accumulate funds in the Water Treatment Plant Reserve which would require more long-term debt financing for the project. If the project was advanced by three years (the soonest date the plant could be in service would be 2003 since it will take 3 years to design and build), debt servicing costs would rise by approximately 40%. The residential (Block 1) water rate would have to increase by approximately 6% to support the increased debt service costs. Another disadvantage to advancing the project would be the inability to investigate emerging technologies and alternative project delivery strategies.

Delaying the project would lengthen the time to accumulate funds in the Water Treatment Plant Reserve which would require less long-term debt financing for the project. For each year the project is delayed, long-term debt requirements would decrease by approximately 10%. The reduced debt servicing requirements would approximate a 1% decrease in the residential (Block 1) water rate. Although a project delay might result in a decrease in the water rate, there is greater risk of a waterborne disease outbreak.

Water Treatment Plant Implementation Alternatives:

11. Why do we treat all the water, when we drink so little?

All of the City water is treated to meet regulatory requirements. It also costs less to treat all the water when compared to other alternatives.

The City endeavors to meet the Canadian drinking water quality guidelines as part of the Manitoba Public Health Act. If all of the water produced by the City was not treated, then the ability to obtain consistent water quality i.e. regulated, is influenced by socio-economic status. Those who can afford to purchase bottled water or in-house treatment systems may do so, while others are unable. The customer would then be responsible for maintaining the alternate treatment devices in a safe fashion. Bottled water products such as “spring water” are not regulated for water quality.

It is more economical to treat all the water than to require customers to buy bottled or point of use devices or construct a dual water main system (potable and non potable). To illustrate this point**,** the follow examples are put forward for **drinking water use only**.

Water purchased in one litre bottles:

- assume 620,000 population use one litre per day
- cost about $1.00 per one litre bottle
- Projected Cost is $226 Million per year + taxes* or $365 per person per year
- Quality of bottled water is not regulated.

Bulk bottled water in a water cooler:

- assume 620,000 population use one litre per day
- cost per litre is $0.35 + annual cooler rental of $99.00/year + taxes and deposits
- Projected cost is $96 Million per year + taxes +deposits* or $155 per person per year. Bulk bottled water must be stored out of direct sunlight to prevent bacteria growth between the time of delivery and use.

Installation of point-of-use device (Reverse Osmosis unit fixed in premise):

- assume 620,000 population and 170,000 – 250,000 dwelling units
- purchase cost is $699.00 + installation + taxes + filter replacement
- rent unit at $35.00 month + installation + taxes
- filtration rate is 60% i.e. produces 3 litres of filtered water from 5 litres of source water

- Projected cost is from $72 to $106 Million per year + taxes + installation, based on rental alternative* or $116 to $171 per person per year. The reverse osmosis process removes the chlorine and fluoride which provides bacteria control and tooth decay protection respectively.

*It is important to note that if a customer were to select one of the above options, these costs are in addition to their City water and sewer charges for other domestic uses.

In summary**,** the City can construct a water treatment plant to produce water for the entire City's consumption (drinking, commercial, industrial, etc) at $204 Million capital and $12 Million O&M (operation and maintenance) in 2006 dollars.

12. Can the water treatment plant be built in stages over time?

Because of the high organic matter suspended in the Shoal Lake water, constructing a portion of a water treatment plant, such as ozone only, with additional processes to be constructed at a later date is not viable. There must be a substantial removal of organic matter prior to chlorination to prevent the formation of disinfection by-products.

13. Why not use Ultra Violet (UV) light to kill *Cryptosporidium* to avoid the construction of a water treatment plant?

The Department is investigating two promising technologies, UV and filtration membranes. Both of these technologies show promising application within the water treatment process. However, neither technology can replace the entire proposed water treatment system and meet the water quality goals. It is possible that UV could be used as a primary disinfectant in place of the ozone contactors. Ozonation is just one component in a series of processes proposed to treat the water. The processes that remove the organic matter from the water are still required to allow for effective disinfection and control the disinfection by-products. To date, membranes have not been shown to be cost-effective at the capacities required for large cities.

Water treatment and disinfection technologies continue to evolve and will be monitored over the next three years to ensure that the best technology is used. At the present time, the most promising emerging technologies include ultraviolet (UV) light for disinfection and the use of membrane technology in place of biological activated carbon (BAC) for filtration. Any new technologies will be

evaluated against water quality goals and the recommended baseline treatment process. To be acceptable, any new technology must meet the goals and be more economical.

14. Why not bypass Deacon Reservoir to improve turbidity and coliform to avoid the construction of a water treatment plant?

Turbidity:

Generally the average water quality over time, including turbidity, in Deacon's four large open earthen reservoir cells is similar to, or better than, the water quality in Shoal Lake. The reasons to build a water treatment plant are to protect against *Giardia*, *Cryptosporidium* and reduce exposure to disinfection by-products which are in the water prior to entering Deacon Reservoir. Bypassing Deacon Reservoir would not affect the situation or factors for the decision to construct a water treatment plant. In the meantime, bypassing Deacon Reservoir would limit the City's options for dealing with a water quality event in the aqueduct or in Shoal Lake and is therefore not recommended.

In the summer time, TTHM's are dissipated from the open water surface. The water supply is routed through Deacon Reservoir thereby resulting in detention for extended periods of time (from several days to months). As a result of this detention period, there is a natural removal of waterborne organisms due to natural die-off and settling. Additionally, this detention of water in Deacon Reservoir allows for isolation of a portion of the water supply should water quality concerns develop.

Coliform:

The fenced grounds and deterrence methods used to discourage birds and mammals from using the site afford watershed protection for the Deacon Reservoir. An effective waterfowl management program has been in place for a number of years to discourage waterfowl including geese, ducks and gulls from staging and/or roosting in Deacon Reservoir.

Operational Concerns:

15. Why is there an odour from the Deacon Reservoir?

Deacon Reservoir is odour free for the most part. A slight algae odour is noticeable when the water levels are very low, such as during an aqueduct shut-down usually in October. The exposed sediments on the reservoir banks may emit a musty odour.

16. When will the City fix the leaking reservoir?

The reservoir is not leaking however, the interconnection pipe leakage has been a problem for both the Municipality of Springfield and the City.

The pipes crossing under PR 207 and connecting Cell 1 and 2 are large 6 ft by 8 ft rectangular box culvert sections. The City has made several attempts over the years to correct the problem only to have short-term success. In August 1999, the City made short-term drainage improvements to direct the leaking water to the aqueduct underdrains. A noticeable drainage improvement has been observed in the last two months. Long-term repairs are scheduled for the fall of 2000 because the water level in Cell 1 must be lowered to permit access to the inside of the pipe.

To facilitate the repair of the interconnecting pipe, the City has undertaken the following tasks:

- assembly and review of all background documentation relative to the original construction and past remedial effort
- review of all historical piezometer (groundwater) monitoring data
- development and implementation of additional monitoring as required
- identification of the primary leakage sources
- review of alternate repair strategies, and
- recommended the most appropriate repair strategy including an estimate of cost and schedule for implementation.

Given that there are approximately 100 joints, careful evaluation of all options is required as the very preliminary estimates indicate that the final repairs could cost as much as $1 million.

17. Why does the City spill water from the aqueduct into the Boggy River?

Engineering studies identified that the aqueduct could float in three areas between Mile 85 and the Intake if all the water was drained from the aqueduct. The aqueduct is submerged in portions of this area due to natural standing water. Significant work has taken place to address this problem and the City anticipates that by 2001, this structural problem will be addressed and the spilling of water at Mile 83 will no longer be required.

In the meantime, the City spills a limited amount of water from the aqueduct during the fall maintenance program to safeguard the aqueduct. Typically, water will be spilled from the Mile 83 aqueduct overflow into the Boggy River. The City provides a hand delivered notice to the residents along the river and also advertises in the local newspaper for each spill event. The chlorine is shut off at the intake prior to the water being spilled to ensure the water is free from chlorine when entering the river.