E03

HALIBURTON SEWAGE TREATMENT PLANT EXPANSION

MUNICIPALITY OF DYSART et al

ENVIRONMENTAL STUDY REPORT ADDENDUM

M.O.E.E. PROJECT NO. 40-0706-01

HALIBURTON SEWAGE TREATMENT PLANT EXPANSION

MUNICIPALITY OF DYSART et al

ENVIRONMENTAL STUDY REPORT ADDENDUM

M.O.E.E. PROJECT NO. 40-0706-01

JANUARY 1994
REF. NO. 4881 (1)
This report is printed on recycled paper.

CONESTOGA-ROVERS & ASSOCIATES

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) has been retained by the Municipality of Dysart et al (Dysart) to prepare an addendum to an Environmental Study Report (ESR) for the expansion to the Haliburton Sewage Treatment Plant (STP). This report is the addendum to the original ESR which was completed in October, 1989.

The Terms of Reference for the ESR addendum are presented in Appendix A.

1.1 BACKGROUND

The Haliburton Sewage Treatment Plant and sewage collection system were constructed in 1975, by the Ministry of Environment and Energy (MOEE) (formerly Ministry of the Environment). In 1983, a study was prepared to extend the sewage collection system to several resorts located along the north shore of Lake Kashagawigamog. In 1985, approval was applied for to construct the North Kashagawigamog Sewer Extension, under MOEE Direct Grant Project No. 3-0579. A capacity study of the existing sewage treatment plant was requested by MOEE prior to granting approval. The capacity study concluded that the existing plant did not have sufficient capacity to accommodate the anticipated future flows from Haliburton and the sewer extension and recommended an expansion to the existing plant to accept these future flows.

The expansion of the Haliburton Sewage Treatment Plant (STP) falls under the requirements of Class Environmental Assessment (Class EA), due to its expanding beyond its rated capacity. As such, the Class EA process was followed, beginning in May, 1988. The scope of the Class EA process involves the evaluation of alternatives to expanding the plant and, based on the evaluation of various factors including social, aesthetic, environmental and financial, making a recommendation of a preferred solution. Public involvement is a key component to the process, and two

Public Meetings were conducted. The resultant Environmental Study Report was filed for public review in October, 1989.

Requests were submitted to the Minister of the Environment to bump the project up to an individual Environmental Assessment, which were subsequently denied. The Minister did, however, direct the Municipality to complete further water quality studies and incorporate this information in an addendum to the ESR.

1.2 SCOPE OF REPORT

This report is an addendum to the original ESR. It incorporates information developed since the original ESR was filed, reviews the original alternative solutions, presents additional alternative solutions, and recommends a preferred solution. It is intended that, once accepted by the Public and MOEE, this addendum will form the basis for the design of the Haliburton Sewage Treatment Plant Expansion.

Much of the 1989 ESR remains current and is unchanged by this addendum. Only those items specifically referred to in this addendum should be considered affected.

2.0 SUMMARY OF THE 1989 ENVIRONMENTAL STUDY REPORT

This section presents a summary of the findings presented in the 1989 Environmental Study Report. For detailed information, the 1989 report should be referred to.

2.1 ALTERNATIVE EVALUATION

The 1989 ESR considered five proposed alternative solutions for the expansion to the Haliburton Sewage Treatment Plant using the extended aeration, activated sludge process. These were as follows:

Alternative 1	Expand Existing Sewage Treatment Plant with Outlet Sewer to Drag River
Alternative 2	Expand Existing Sewage Treatment Plant with Outlet Sewer to Grass Lake.
Alternative 3	Construct a New Sewage Treatment Plant to Service Highway 121 Development.
Alternative 4	Construct a new Sewage Treatment Plant to Service Highway 121 Development and Hamlet of Haliburton
Alternative 5	Expand Existing Sewage Treatment Plant with Outlet to the Burnt River.

The above alternatives were reviewed on the basis of environmental impacts, technical performance and estimated costs. Alternative 1 was selected as the preferred alternative based on its low capital and operating costs, and minimum impact on the receiving waters. Alternative 1 is summarized in the following section.

2.2 PREFERRED ALTERNATIVE

Alternative 1 was proposed as the preferred alternative to expand the existing sewage treatment plant to service the projected growth in the Hamlet of Haliburton and the resorts and commercial development along Highway 121. Included in Alternative 1 was the upgrading of pumping station No. 1, involving the installation of an additional pump.

The North Kashagawigamog Sewer Extension, designed under MOEE Project No. 03-0579, will deliver flows from the resorts and Highway 121 development to the expanded plant.

The design of the plant expansion under Alternative 1 included:

- construction of a flow equalization tank;
- construction of additional grit removal facilities;
- construction of an additional extended aeration plant;
- construction of effluent filters with a backwash system; and
- upgrading and replacement of existing equipment which is in poor condition.

Phosphorus removal down to a level of 0.2 mg/L would be accomplished by the continuous addition of ferric chloride to the aeration chamber. Effluent would be chlorinated, filtered and discharged into the Drag River through the existing 300 mm diameter outfall. Digested sludge would be hauled away for off-Site disposal, as is the current practice at the existing plant.

The capital cost to construct the expansion was estimated to be $2,310,000, including engineering and contingencies. The annual operating costs were estimated to be $159,000. Costs are in 1990 dollars.

2.3 PUBLIC INVOLVEMENT

As required by the Class Environmental Assessment Process, Public Meetings were held to involve the public in the planning and design process and to provide the opportunity for the public to express concerns and ask questions. The results of the public participation process were taken into account in the selection of the preferred alternative and in the final design.

Mandatory contacts, which included government agencies and local cottages associations, were also contacted and their input solicited.

As a result of the public involvement, several "bump-up" requests were submitted to the Minister by concerned citizens and local cottager groups. These requests were based on concerns that water quality in the Drag River Lake Chain would deteriorate at an increased rate due to the expansion of the plant.

The Minister denied the bump-up requests, but shared the concern that the impacts on lake water quality may not have been adequately addressed. In denying the bump-ups, Dysart was directed to complete a comprehensive assessment of water quality, including a water quality sampling program and an assimilative capacity study. The results of this work were to be incorporated in an Addendum to the 1989 ESR.

3.0 LAKE WATER QUALITY ASSESSMENT

3.1 GENERAL

As a result of the Minister's direction to undertake further water quality assessments, Dysart et al retained Michael Michalski Associates to complete the water quality sampling program, and MOEE completed the phosphorus modelling analysis. The findings of these studies are summarized and discussed in the following sections.

3.2 WATER QUALITY MONITORING

Michael Michalski Associates was retained by Dysart in 1991 to complete a water quality sampling program. The Terms of Reference for the program were developed in conjunction with MOEE and included monthly sampling for one year at eight locations between Head Lake and South Kashagawigamog Lake. The results of this program are presented in a report entitled "Drag River System Evaluation - Water Quality and Sewage Treatment Plant Expansion". The draft report was issued in February 1993 and finalized in September 1993.

The sampling program concluded that dissolved oxygen (DO) concentrations diminished with depth in all lakes except Head Lake, and in the Drag River between Grass and Head Lakes. Anaerobic or oxygen poor conditions were not detected, however DO levels below 1.0 milligram per litre (mg/L) were measured in Grass Lake and North Kashagawigamog Lake during August of 1992.

Secchi disc readings in all lakes were consistently above 3 metres (m) and frequently between 4 m and 5 m, indicating a moderately productive, or mesotrophic condition.

Phosphorus is the principle nutrient causing eutrophication where excessive algae and plant growth interfere with natural fish habitat and recreational and aesthetic uses. The annual mean total phosphorus values for all lakes except South Kashagawigomog Lake were found to be slightly above 10 micrograms per litre (µg/L) which is considered to be the level below which a high degree of protection against aesthetic deterioration is provided. South Kashagawigamog Lake was slightly below 10 µg/L.

Nitrogen levels, in its various forms, were well below applicable guidelines in all lakes in the study area.

3.3 LAKE TROPHIC STATUS MODELLING

The MOEE completed an analysis of phosphorus levels predicted to occur in the lake chain under various scenarios of development and plant expansion alternatives. The analyses were completed by the Limnology Section of the Ministry's Water Resources Branch and utilized the Lake Trophic Status Model to predict phosphorus concentrations. The results were presented in two memoranda, the first by B. Neary dated October 1991, the second by N. Hutchinson dated October 1992. These memos are presented in Appendix B and C respectively.

The Trophic Status Model simulates phosphorus movement and concentrations in the lake chain taking into account phosphorus contributions from anthropogenic, or man-made sources including urban runoff, fertilizers, sewage, and septic tile beds, and naturally occurring sources such as organic decomposition. The model was calibrated using phosphorus measurements taken at spring overturn in 1991 and 1992.

The phosphorus contribution to an individual lake from septic tile beds in close proximity to the shoreline can be significant. Phosphorus, which is present in human waste and detergents, is not efficiently removed by septic tile bed systems, and up to 50 percent of the phosphorus passes through the system and is discharged into the shoreline overburden. Phosphorus is retained in shoreline soils until a limiting capacity is reached, beyond which phosphorus is discharged directly into the lakes.

In order to calibrate the Trophic Status Model, the amount of phosphorus retained by shoreline soils had to be assumed. In the work completed by Dr. Hutchinson in 1992, it was determined that 80 percent phosphorus retention yielded a reasonable correlation between measured and predicted values. This means that an average of 80 percent of the phosphorus emanating from shoreline tile beds was being retained by shoreline soils and not reaching the lakes.

As mentioned above, phosphorus retention by shoreline soils becomes limited, therefore the amount of phosphorus retention is expected to reduce with time. It is not possible to reliably predict the rate at which the reduction in phosphorus retention will occur, however it is thought that retention will tend towards zero percent over the next 20 to 30 years. As indicated by the results presented by Dr. Hutchinson, the predicted phosphorus levels in the lake chain increase significantly between 80 percent phosphorus retention and zero percent retention in shoreline soils.

The acceptable level of phosphorus in a particular lake depends on several factors, such as the natural or background concentrations. MOEE presently considers a "suggested maximum" concentration of background plus 50 percent, with background concentrations defined as that which would occur naturally, with no man-made contributions. The background levels as modelled by Dr. Hutchinson (from Table 8, Dr. Hutchinson's Memo, Appendix C), and the corresponding maximum acceptable concentration for each lake is summarized below:

	Total Phosphorus (µg/L)	
	Modelled Background	***Background plus 50%***
Head Lake	8.97	13.5
Grass Lake	8.62	12.9
North Kashagawigamog	7.48	11.2
South Kashagawigamog	5.69	8.5
Canning Lake	5.33	8.0

Numerous scenarios of development and treatment plant discharge characteristics were modelled, to determine the resultant phosphorus concentrations in the lake chain. Each development scenario was modelled with both 80 percent and zero percent soils retention, and an expanded sewage treatment plant with an effluent phosphorus discharge level of 0.2 and 0.3 mg/L. The results are presented in tabular and graphical format in the memo prepared by Dr. Hutchinson presented in Appendix C.

3.4 RESULTS INTERPRETATION

The results of the water quality monitoring and the lake trophic status modelling were used to evaluate the existing conditions and to predict what may happen to phosphorus levels in the lake chain under various plant expansion alternatives.

As mentioned in Section 3.2, annual mean total phosphorus levels in the monitored lakes were generally found to be above 10 µg/L, which is the level below which a high degree of protection against aesthetic deterioration is provided. They were, however, well below 20 µg/L, which is the level above which nuisance algae growth can be expected. Excessive plant growth may occur at levels above 30 µg/L.

The annual mean total phosphorus values presented in Section 3.2, when compared to the MOEE "suggested maximum" concentrations presented in Section 3.3 indicate that the phosphorus levels currently existing in the lake chain are approaching the maximum acceptable concentrations. Being in the range between 10 µg/L and 20 µg/L also indicates that any further increase in phosphorus levels may yield a deterioration in the aesthetic quality of the lakes.

The lake trophic status modelling completed by Dr. Hutchinson revealed several important issues regarding phosphorus levels resulting from various development scenarios. The modelling predicts that the trophic status of the lake chain will continue to deteriorate under all alternatives that were evaluated. This included the alternative featuring discharge of the treatment plant effluent to the Burnt River, bypassing the lakes entirely. It was concluded that this continued deterioration was due to increasing phosphorus loadings from private septic tile beds along the lakeshores of all of the lakes in the chain.

In addition, it was noted that reducing the treatment plant phosphorus discharge levels from 0.3 mg/L to 0.2 mg/L had little impact on water quality, and that relocating the outfall to North Kashagawigamog had a positive impact of Grass Lake, but little effect on water quality downstream of Grass Lake.

The solution to minimize deterioration of the water quality therefore, is to connect as many lakeshore developments as possible to an expanded sewage treatment plant, thereby minimizing the contribution of phosphorus from lakeshore tile beds. The treatment plant expansion must therefore be sized to accommodate flows from an expanded service area, which would include all development on Head, Grass and North Kashagawigamog Lakes. The effluent discharge criteria should also be less than 0.2 mg/L to achieve the desired longterm phosphorus objectives.

4.0 SERVICE AREA

4.1 NORTH KASHAGAWIGAMOG SEWER EXTENSION

The existing service areas for the treatment plant and collection system are described in the 1989 ESR and include much of the developed area of Haliburton. It is proposed that, to permit future resort expansion and commercial development along Highway 121, a sewer extension be constructed along Highway 121 to connect this area to the sewage treatment plant. The extent of this sewer extension and the developments proposed to be serviced are described in the 1989 ESR.

In addition to the added flows resulting from the North Kashagawigamog Sewer Extension, the 1989 ESR identified a flow increase projection due to growth in the Hamlet of Haliburton over a 20 year planning horizon. The projected average daily design flows for the plant expansion were 875 cubic metres per day (m^3/d) from Haliburton and 1,058 m^3/d from the North Kashagawigamog Sewer Extension for a total of 1,933 m^3/d. These flows were based on an average per capita flow rate of 454 litres per day (L/d).

A review of municipal population records indicates that the population has remained relatively constant since 1989, which may be attributed to, among other things, general economic downturn in the region, and a freeze on further development due to the limited sewage treatment plant capacity. Therefore, the population projections are considered valid for the 20 year period beginning with 1994, and the corresponding average daily design flow of 1,933 m^3/d is also valid. The equivalent population and corresponding design flow are shown in Table 1.

4.2 SERVICE AREA EXPANSION

As discussed in Section 3.4, it is necessary to connect all lakeshore development from Head, Grass and North Kashagawigamog Lakes to an expanded sewage treatment plant in order to prevent long term deterioration in lake water quality due to phosphorus loadings. Therefore, the proposed service area for the plant expansion should include development along the shores of these lakes.

Based on the development figures provided by Dysart and used in the trophic status modelling by Hutchinson, the equivalent service populations for the lakeshore areas have been determined and are shown in Table 1.

Based on an average per capita flow of 454 L/d, for permanent residential units and 275 L/d for seasonal residential units the average daily design flow from the expanded area is 974 m^3/d, for a total ultimate design flow of 2,907 m^3/d.

5.0 ALTERNATIVE EVALUATION

5.1 NEW ALTERNATIVES

In addition to the five alternative plant expansion scenarios considered in the 1989 ESR, presented in Section 2.1 of this report, three additional alternative scenarios were added for consideration by the ESR Addendum, in view of the additional water quality information discussed in Section 3. These additional alternatives are as follows:

Alternative 6 — Expand Existing Sewage Treatment Plant with Outlet to North Kashagawigamog Lake.

Alternative 7 — Expand Existing Sewage Treatment Plant with Wetlands Treatment and Outlet to North Kashagawigamog Lake.

Alternative 8 — Expand Existing Sewage Treatment Plant Using Best Available Technology to Reduce Phosphorus Discharge to 0.05 mg/L with Outlet to Drag River.

These alternatives were added for evaluation of the phosphorus loading to the lake chain using the Trophic Status Model.

Recent advancements in biological and chemical treatment processes indicate that it is possible to achieve a phosphorus discharge concentration of 0.1 mg/L with the use of enhanced biological treatment and the addition of ferric chloride or alum. Ferric chloride is the chemical proposed for use in the expanded plant under all alternatives to achieve the phosphorus criteria of 0.2 mg/L, including the previously preferred Alternative 1. Therefore, a modified Alternative 1 was considered, with a phosphorus discharge level of 0.1 mg/L, and is designated Alternative 1(a).

Alternative 6 is essentially the same as Alternatives 1 and 2 except the location of the outfall was moved to North Kashagawigamog Lake. This outfall location was not considered previously, and was added to examine the benefits to Grass Lake if the outfall were moved further downstream.

Alternative 7 was considered to investigate the benefits of wetlands treatment as a final polishing step in the treatment process. Existing wetlands located north of Highway 121 and draining to North Kashagawigamog Lake would be used. This alternative would involve pumping the treated effluent from the expanded plant with a phosphorus discharge level of 0.2 mg/L, to the upstream end of the wetlands, and allowing natural treatment processes to occur and further reduce the phosphorus concentrations. It is expected that wetlands treatment may reduce phosphorus levels by up to 50%, therefore the expected phosphorus concentrations in the effluent reaching North Kashagawigamog Lake would be in the order of 0.1 to 0.15 mg/L.

Alternative 8 involves the application of advanced treatment technology to reduce phosphorus concentrations as much as possible. State-of-the-Art final clarification equipment is expected to be able to achieve consistent phosphorus discharge concentrations of 0.05 mg/L. Alternative 8 results from applying this advanced treatment technology to Alternative 1. Alternative 8 is considered to be the Best Available Technology (BAT) alternative.

As discussed in previous sections, it is apparent from the assimilation capacity work completed by MOEE, that the service area must be expanded to include all development on Head, Grass and North Kashagawigamog Lakes. The additional design flow generated by the expanded service area, as discussed in Section 4.2, brings the required total capacity of the expanded plant to 2,907 m^3/d. All alternatives, 1 through 8, were evaluated at the total capacity level of 2,907 m^3/day, and the varying phosphorus discharge levels discussed above. A summary of all Alternatives is presented in Table 2, and shown on Figures 1 through 8.

5.2 ALTERNATIVE EVALUATION

The above expansion alternatives were evaluated on the basis of construction costs, operating and maintenance costs, and the ability of each to meet the water quality objectives for phosphorus concentrations based on the Trophic Status Model. Practical issues such as location, aesthetics and ability to implement were also considered.

5.2.1 Construction and Operating Costs

The construction, operating and maintenance costs for each alternative were estimated in 1994 dollars and are presented on Table 3. Each construction cost estimate includes sitework, buildings, process tanks and equipment, electrical controls and instrumentation, modifications to Pumping Station No. 1, and general repairs to the existing plant.

Alternatives 1, 2, 5, 6 and 7 involve identical plant expansions, and differ only in the location of the outfall. The differences in construction cost estimates for these alternatives are due to the varying costs associated with the construction of a new outlet sewer or forcemain.

Alternatives 3 and 4 involve constructing a new facility on a new site, therefore the cost estimates include an allowance for acquiring land and associated legal costs.

Alternative 8 features Best Available Technology (BAT), including enhanced biological treatment, clarification and filtration, and the cost estimate reflects the additional costs associated with the additional treatment equipment.

The estimated annual operating and maintenance costs (one year) associated with each alternative are also presented on Table 3. These costs include power, chemicals, routine maintenance and repairs, sludge handling and disposal, and staff.

5.2.2 Water Quality Evaluation

To predict the future impact of each alternative on the water quality in the lake chain, additional trophic status modelling was completed. Each alternative was simplified and related to a scenario previously modelled in the trophic status modelling completed by MOEE. A description of the required additional modelling runs were prepared and submitted to MOEE, who had agreed to conduct the additional work. The letter requesting the analysis and summarizing the modelling required is presented in Appendix D.

The results of this work were presented by MOEE in a letter dated August 24, 1993, which is presented in Appendix E. Modelling was performed using 80% and 0% phosphorus retention in shoreline soils, as in the previous analysis.

The results are tabulated and presented in Tables 4 and 5. Also shown on each table is the MOEE "suggested maximum" concentrations (background plus 50%) from the October 1992 modelling, existing conditions from the water quality monitoring program by Michalski, and two "do-nothing" alternatives, with existing vacant shoreline lots developed and undeveloped, respectively.

There are two important observations immediately apparent upon examination of Tables 4 and 5. The first is the similarity between the objective, or "background plus 50%" values and the existing conditions, or measured values for each lake. Head and Grass Lakes are presently below their objective values, however the existing phosphorus concentrations in downstream lakes are above the suggested maximum concentrations. This emphasizes the importance of lakewater quality assessment and the sensitivity of the lake chain to accept further phosphorus loadings.

The second important observation is the phosphorus concentrations associated with the "do-nothing" alternative. The long-term results of doing nothing, in other words limiting growth to current levels and not expanding the sewage treatment plant, are indicated by the phosphorus concentrations associated with the 0% soil retention scenario. All of the predicted phosphorus concentrations are well above both the existing conditions and suggested maximum levels. This emphasizes the need for a solution to the further decline in lakewater quality, and, since the treatment plant is not expanded under the do nothing alternative, the impacts of continued contributions of phosphorus from lakeshore tile bed systems.

The difference between Tables 4 and 5 is the service areas included in the consideration of each alternative. Table 4 presents the predicted phosphorus concentrations associated with a plant expansion to service Haliburton and the proposed Highway 121 sewer extension. These are the expansion conditions considered in the 1989 ESR and modelled by Hutchinson in 1992. As discussed in Section 3.4, all alternatives will result in the continued deterioration of lake trophic conditions, including Alternative 5 which discharges no effluent into the lake chain at all. This again illustrates the impact of lakeshore tile beds and the need to expand the service area thereby removing their contribution from the lake chain.

Table 5 presents the results with the service area expanded to include Haliburton and the Highway 121 extension, as before, and all lakeshore development on Grass, Head and North Kashagawigamog Lakes. A significant decrease in predicted phosphorus concentrations is apparent, both in the short term (80% soil retention) and longterm (0% soil retention). By comparing the data presented in Tables 4 and 5, it is apparent that the connection of all lakeshore development on Head, Grass and North Kashagawigamong Lakes is necessary to produce a future reduction in phosphorus concentrations in the lake chain. The objective concentrations cannot be met otherwise, and increases over existing conditions will result unless the service area is expanded. Therefore, the comparison and evaluation of the alternatives are based on the results presented in Table 5. The evaluation is also based on the results corresponding to the 0% retention of phosphorus in shoreline soils, to reflect predicted longterm conditions.

Due to the extreme sensitivity to lakewater quality, and the areas dependence on the lake chain to support economic and recreational activities, the lakewater quality impacts are weighted more heavily than costs when comparing alternatives. Based on this criteria, Alternative 8, the BAT alternative, would be preferred, since it offers the best predicted longterm water quality, provides a significant improvement over existing conditions in both the short and longterm, and comes the closest to meeting the MOEE objective concentrations.

Alternatives 3, 4 and 7 were removed from further consideration because they did not offer an improvement in water quality and were more expensive than Alternative 8.

Alternatives 5 and 6 were also evaluated, as both offer some water quality benefits, but are more costly than Alternative 8. Alternative 5 was ruled out because the marginal improvement in water quality (less than 0.5 µg/L) over Alternative 8 is not considered significant enough to warrant an additional $1.4 million to construct an outfall to the Burnt River.

Alternative 6 was similarly considered. The additional cost of approximately $800,000 to construct an outfall to North Kashagawigamog Lake provides a marginal (0.5 µg/L) improvement to Grass Lake. This marginal improvement is not considered significant enough to warrant the expenditure of an additional $800,000. In addition, the predicted phosphorus concentrations for Alternative 8 in Grass Lake would already meet MOEE objectives and result in a significant improvement over existing conditions. Therefore, Alternative 6 was not considered to be preferable to Alternative 8.

The least costly alternatives, Alternatives 1, 1(a) and 2, were not considered an improvement over Alternative 8, based on the fact that they would sacrifice water quality a significant amount (in the range of 1.5 µg/L) compared to Alternative 8, and would not represent a significant improvement over existing conditions.

5.2.3 Practical Considerations

Although environmental considerations, in particular water quality, was paramount in the evaluation of alternatives, practical considerations were also reviewed to determine their impacts on the selected alternative.

These considerations included the requirements for additional land, having a new plant remote from the existing one, proximity to and disruption of residential areas during construction of the expansion or a new outfall, and space requirements on the existing Site.

All of these considerations are favourable with respect to Alternative 8 and therefore confirm its selection.

5.3 PREFERRED ALTERNATIVE

Based on the above analyses and evaluation of the alternatives, Alternative 8 is selected as the preferred alternative. This alternative represents the best that can be done using Best Available Technology with respect to protecting the lake chain from further water quality deterioration and can be implemented at a reasonable cost.

6.0 PUBLIC INVOLVEMENT

6.1 PUBLIC MEETINGS

As required by the Class Environmental Assessment Process and reflected in the Terms of Reference for this project, two Public Meetings were conducted to provide information and allow questions and concerns to be expressed. The meetings were held on July 9, 1993 and September 3, 1993. Both were held at the Community Centre in Haliburton, and conducted on Friday evenings to maximize the opportunity to attend for seasonal residents who may only be in town for weekends.

The first meeting was held to re-acquaint the public with the project, and to present the results of the water quality monitoring and modelling studies. It was also intended to provide an opportunity for municipal staff, elected officials and the Consulting Engineers to hear the concerns the public had regarding the project and in particular their concerns with regard to lake water quality protection. The meeting began with an Open House style period to allow informal review of the presentation material, which was displayed on boards, after which a formal presentation was made. A question and answer period concluded the meeting.

Handouts containing the presentation material and comment sheets were available. A copy of this material is presented in Appendix F. Approximately 54 people attended the meeting, and the guest registration list is presented in Appendix G.

The second meeting was held on September 3, 1993. The purpose of the meeting was to review the water quality assessment data, present the alternative solutions that were considered, and to present the preferred alternative.

The meeting format was similar to the July 9 meeting, beginning with an Open House style opportunity to review display boards, followed by a formal presentation of the results of the alternative evaluation and the preferred alternative. A question and answer period concluded the meeting.

Again, handouts containing the presented material and comment sheets were provided to those attending. A copy of this material is presented in Appendix H. Approximately 30 people attended the meeting, and the Guest Registration list is presented in Appendix I.

6.2 PUBLIC COMMENTS

Several comments were received from concerned individuals, on the comment sheets provided at the two public meetings. A copy of each comment sheet received and the responses provided are presented in Appendix J.

7.0 DESIGN AND CONSTRUCTION REQUIREMENTS

7.1 IMPLEMENTATION

The preferred alternative is sized to accommodate anticipated future flows from an expanded service area, as discussed in Section 4.0. The ultimate design capacity is 2,907 m^3/day. Since it is expected that it will take a period of several years for the flows to reach this level, as the population increases, resorts expand and the collection system is extended, it is proposed to implement the expansion in two stages. The size of the Stage 1 expansion is derived based on a multiple of equivalent size process units, and should also correspond to the flow expected from growth in Haliburton and the North Kashagawigamog Lake Sewer extension, which totals 1,933 m^3/day, as discussed in Section 4.0. The Stage 1 expansion size is set as follows:

Total required capacity	2,907 m^3/day
less existing capacity	542 m^3/day
Net Expansion	2,365 m^3/day

Set Stage 1 at 2/3 of total net expansion to allow a 50% future expansion.

Therefore,

Stage 1 Expansion = 2,365 x 2/3 =	1,575 m^3/day
plus existing capacity	542 m^3/day
Stage 1 Design Capacity	2,117 m^3/day

This exceeds 1,933 m^3/day, and is therefore acceptable. Using a similar ratio of seasonal to permanent residents as the ultimate, or Stage 2 expansion, the Stage 1 design flow corresponds to an equivalent population of 4,945 persons.

The staging of the expansion also has the obvious benefit of reducing the immediate capital expenditure and operating costs. These costs are presented in Section 8.0.

7.2 DESIGN CONSIDERATIONS

This section describes the major considerations in the design of the preferred alternative relating to engineering and environmental concerns. The preferred alternative also includes some modifications to the existing system. Construction of the new plant will involve an initial expansion of 1,575 m^3/day average flow capacity giving a total capacity with the existing plant of 2,117 m^3/day, as discussed above. The design has been completed so that the new plant may be expanded to a capacity of 2,365 m^3/day giving an ultimate total capacity of 2,907 m^3/day with the existing plant.

The preferred design alternative generally involves the following facilities which will be incorporated into the new plant:

(a) Installation of a third pump in the main sewage pumping station and concrete and piping rehabilitation work as required;

(b) Modifications to the existing plant and site services required for the plant expansion;

(c) Construction of a new grit removal facility to handle the expanded plant flow capacity;

(d) Provision of flow equalization facilities to eliminate any major fluctuations in flow to the plant;

(e) Provision of a modified activated sludge biological process which provides enhanced biological nutrient removal (phosphorus and nitrogen) along with complete nitrification and denitrification, including anaerobic and anoxic reactors, aeration basins and aeration equipment;

(f) One circular clarifier for final settling with provision for the addition of a second clarifier in the Stage 2 expansion;

(g) Provisions for adding a "Claricone" clarifier after the secondary clarifiers to lower the effluent phosphorus levels to 0.05 - 1.0 mg/L. The Claricone is the Best Available Technology for reducing phosphorus levels. The Claricone is sized to serve both the existing plant and the proposed plant expansion and would be added as part of the Stage 2 expansion;

(h) Tertiary filtration for final polishing of the effluent to remove residual phosphorus and suspended solids by chemical/physical means;

(i) Ultraviolet disinfection facilities to replace chlorination at the existing facility and provide disinfection of the final effluent;

(j) A single building which will house the following facilities for the plant expansion:

 i) New electrical service, motor control centre, automatic controls, instrumentation and diesel standby power facilities with fuel storage and automatic transfer switch;

 ii) Three air blowers (one standby) for the Stage 1 expansion with provision for adding a fourth blower for Stage 2. Blowers will provide air for aeration, mixing of equalization storage and aerobic digestion of sludge;

 iii) Two return activated sludge pumps (one standby) for the Stage 1 expansion with provision for a third sludge pump for Stage 2 expansion;

 iv) Filtration facilities including filters, backwash storage, waste storage, backwash pumps and mudwell pumps complete with automatic control of filter operation. Provision for expansion of filtration for the Stage 2 plant capacity upgrading;

v) Chemical storage and feed facilities for assistance in phosphorus and suspended solids removal by the final filters;

vi) Ultraviolet disinfection channel and UV system designed for effluent disinfection of the ultimate plant capacity; and

vii) Pump chamber for two return sludge pumps (one standby) which return sludge from the aeration basins to the anoxic reactor;

(k) Future addition of sludge digestion tanks when the third aeration basin is required for future plant expansion to a total of 2,907 m^3/day;

(l) The layout of the plant also provides for addition of sludge storage tanks sized for up to 150 days of sludge storage if required due to a change in plant sludge storage and disposal requirements; and

(m) The Stage 1 plant expansion will include sludge loading facilities for the existing and proposed plant expansion.

Many of the design features of the plant are driven either by economic or environmental considerations or by a combination of these. Environmental considerations were the major concerns when selecting the preferred design alternative with features to be included in the design.

7.2.1 Effluent Discharge Criteria

One of the primary objectives of the plant design is to minimize phosphorus discharges to the lowest economically obtainable level. The proposed plant effluent criteria also limit BOD, suspended solids and total ammonia to very low levels. The following are the proposed design objective and non-compliance levels for these parameters set for the plant:

	Design Objective (mg/L)	*Non-Compliance Level (mg/L)*
Biochemical Oxygen Demand (BOD)	3.0	5.0
Total Suspended Solids (TSS)	3.0	5.0
Total Phosphorus (P)	0.1	0.2
Total Ammonia	2.0	5.0

Based on these levels, the total average phosphorus discharge for the Stage 1 plant expansion up to 2,117 m^3/day is 0.318 kg/day or 116.1 kg/year. Total phosphorus discharge for the Stage 2 expansion up to 2,907 m^3/day is 0.218 kg/day or 79.6 kg/year. This is the absolute minimum phosphorus levels which are consistent with economics of the entire treatment system. The existing plant at an ultimate capacity of 542 m^3/day and existing phosphorus discharge levels of 0.5 mg/L would therefore result in 0.271 kg/day or 98.9 kg/year average discharge rate. The proposed effluent criteria will therefore result in substantially improved discharge from the upgraded sewage treatment plant.

The Provincial Water Quality Objectives (PWQOs) for ammonia indicate that the concentrations of un-ionized ammonia should not exceed 0.02 mg/L for the protection of aquatic life. The proposed total ammonia levels presented above, together with expected dilution levels in the Drag River, will meet this objective over a range of expected temperature and pH levels. Supporting calculations are provided in Appendix K.

7.2.2 Increased Treatment Capacity

The increase in treatment capacity will allow for increased development in Haliburton and the surrounding area and will eliminate future phosphorus discharges from the breakdown of many existing septic tank systems. The effluent criteria set for the plant in Stage 1 absolutely minimizes any impact on the environment due to additional phosphorus loadings. The phosphorus loadings are essentially unchanged from those which would be allowed from the existing plant with no chance of future improvement. Biochemical Oxygen Demand (BOD), nitrogen and suspended solids loadings are also reduced with the upgraded plant.

Stage 2 construction increases sewage treatment capacity further but allows for elimination of many more potential septic tile bed discharges including some which are upstream of the plant outlet. Total phosphorus loading from the plant in kg/year will also actually be reduced from that which would be allowed from the existing plant. Inclusion of total nitrogen in plant effluent criteria places limits on nitrates and nitrites which are toxic to many fish species. There is presently no limit on total nitrogen discharges in the Certificate of Approval (C of A) for the existing plant. Expansion of the sewage treatment plant can only result in positive impacts regarding levels of nutrients being discharged to the lake chain.

Negative impacts from the plant expansion and increased development must be controlled by the use of appropriate local official plans and zoning bylaws.

7.2.3 Ultraviolet Disinfection

The proposed use of an ultraviolet system for disinfection purposes will eliminate chlorination of the plant effluent and will have a substantial positive environmental impact. Chlorine itself is very toxic to most fish species therefore, this alone is a substantial positive environmental impact. When chlorine is added to water containing organic matter, products called THM's (trihalomethanes) are formed. Coloured water (organic colour) which is common in the Haliburton area is usually more susceptible to THM formation. Many THM's are believed to be carcinogens and their formation in drinking water is currently limited. Dechlorination of the plant effluent would not eliminate the formation of THM's in the sewage effluent. Chlorine would be used only as a backup to the proposed UV system.

7.2.4 Use of Existing Site

The entire plant expansion can be designed so that the existing site may be utilized. This situation has several environmental benefits as well as cost benefits.

The existing site is very well screened from any existing or future development thereby minimizing the potential or concern for a visual nuisance. The use of the existing site also allows for the use of the existing plant and therefore minimizes both the cost and size of the proposed plant expansion. Service disruptions due to construction activities are therefore limited. By utilizing the current site costs associated with land aquisition and the inherent legal fees are avoided.

Construction of the plant will consist of concrete tanks and a concrete block structure. It is anticipated that some trees will need to be removed to facilitate the proposed expansion. If required, to restore visual screening, removals will be replaced with new plantings compatible with the natural surroundings of the area. All areas affected by construction activities will be restored to their original condition or better.

7.3 PLANT CONSTRUCTION CONSIDERATIONS

This section describes the major considerations in the construction of the preferred alternative as they relate to engineering and environmental concerns. Construction of the plant will generally involve the following activities:

(a) Work at the main sewage pumping station including concrete rehabilitation, piping rehabilitation, pump installation and modification of electrical and control systems;

(b) Construction of the treatment plant expansion, including the following major activities:

- clearing of trees and brush including disposal of materials;
- excavation for yard works and structures including removal of rock where required, and disposal of excess materials;
- construction of concrete structures with installation of mechanical equipment, process piping and valves; and
- construction of one main building to house electrical equipment, standby power, automatic controls, air blowers, sludge pumps and filters.

All of the above activities will be conducted in such a manner as to minimize disruption to the Site and surrounding areas. Of particular importance will be measures to protect existing vegetation and prevent construction activities from impacting the Drag River adjacent to the Site. These measures will include protective fencing, erosion and sediment control structures, and maintaining an undisturbed buffer strip between the River and construction activities.

7.4 PLANT OPERATION CONSIDERATIONS

This section describes the major operational considerations in the design of the preferred alternative as they relate to engineering and environmental concerns. Operation of the plant will involve equipment such as air blowers, compressors, pumps and diesel standby generator sets which have potential to create substantial noise levels both for plant operators and adjacent developments. There is also some possible impact from air emissions from the diesel generator sets and sludge storage tanks.

Possible impacts from excessive noise will be eliminated by reducing noise levels at the nearest receptor to less than 50 dB. There will therefore be no impact on any development or activity off of the site. Enclosures on the site itself and equipment specified will minimize the local impact to operations staff working at the plant.

Emissions from diesel generator sets are subject to MOEE approval and will be limited to acceptable levels. Standby power sets are not frequently used under high loads and are usually exercised approximately once per week.

7.4.1 Effluent Discharge Criteria

One of the primary objectives of the plant design is to assure that the treated effluent meets the discharge criteria at all times. This objective is obtained by proper monitoring and data interpretation, provision of proper equipment (with backup units) and having sufficient automatic and other types of controls and instrumentation to assure that the plant is operated properly at all times. The following is a summary of measures to ensure correct operation of the plant:

(a) All key pieces of equipment such as pumps, air blowers and the electrical system have backup to provide 100% capability with the largest pump or blower out of service. Standby power with automatic transfer is provided to insure that the plant always has electrical power to operate. If diesels fail to start or backup units fail to operate then alarms are issued before a sewage bypass or other serious excursion event could occur;

(b) Many key process units have duplicate tanks so that maintenance can be completed without affecting treatment. In the expanded plant design the equalization tanks, aeration tanks, filters and UV disinfection banks have duplicate units to allow maintenance or cleaning of one tank while maintaining at least one tank in service. Stage two provides a second clarifier along with the "claricone" for settling capability. Bypass capability is provided for the anaerobic tank and anoxic tank if maintenance is required on these tanks;

(c) Controls for certain processes within the plant will be automatically controlled to ensure correct operation. Minimum dissolved oxygen (DO) levels in the aeration basins are particularly important in this process. Operation of blowers will be automatically controlled by a programmable controller and DO instruments to maintain proper DO levels in the system. Pumping from the equalization basins will also be automatically controlled based on level and rate of increase or decrease in level to provide even and continuous flow into the plant treatment system;

(d) Control of return activated sludge (RAS) pumping rate will be continuous but manually adjustable by the operator so that sludge may be continuously pumped from the final clarifiers to the anaerobic basin;

(e) Sufficient chemical storage and duplicate pumping equipment for standby will be available to assure that chemical feed to remove residual phosphorus is maintained at all times; and

(f) Appropriate laboratory equipment will be provided to assist in proper control of the plant processes.

8.0 FINANCIAL CONSIDERATIONS

8.1 CONSTRUCTION COSTS

Estimated capital costs for completion of Stage one of the preferred design concept (upgrade capacity to a total of 2117 m^3/day) based on 1994 prices including engineering and contingencies is shown in Table 6.

8.2 ESTIMATED OPERATING COSTS

The estimated operating cost of the new sewage treatment plant including the existing section for the first year of operation are summarized in Table 7.

8.3 FINANCIAL ASSISTANCE

Provincial funding under the Jobs Ontario Program is committed to this project. It is contingent upon a contact award date prior to March 31, 1994. The funding commitment is based on and limited to 80.9% of eligible construction costs, which were previously estimated at $2.99 million. The provincial share is therefore capped at approximately $2,450,000, leaving the municipality with the balance of $550,000 to be generated from municipal sources.

The current budget estimate for the Stage 1 expansion is $3.8 million. Supplemental funding under the Municipal Assistance Program (MAP) is currently being sought by the municipality, in the amount of the difference between the previous and current estimates.

9.0 IMPLEMENTATION SCHEDULE

9.1 CLASS ENVIRONMENTAL ASSESSMENT

This ESR Addendum will be placed on the Public Record for a required review period, during which the public has the opportunity to review the document and comment on it. A Public Information Session will be held during the review period to provide further opportunity for public comment.

Upon completion of the review period, and once any concerns expressed by the public are resolved successfully, the Municipality will proceed with construction of the Stage 1 Expansion.

9.2 STAGE 1 EXPANSION

The provincial funding commitment for this project is valid until March 31, 1994. In order to secure this funding the Municipality must award a contract for construction by this date. Once the Class Environmental Assessment process is successfully completed, and a Certificate of Approval is issued by MOEE, the Municipality can award the construction contract.

Based on the above schedule, construction would be anticipated to commence in May, 1994. Construction would continue through the balance of 1994, with completion expected in the summer of 1995.