9.0 PRESENTATION AND EVALUATION OF PROPOSED ALTERNATIVES

9.1 General

Based on the general review of the alternative solutions outlined in Section 8.0 of this report, this section further evaluates those alternatives which would be feasible solutions to expanding/upgrading the existing sewage treatment plant and presents a general, technical and environmental evaluation of those alternatives.

A more detailed technical and environmental evaluation of the preferred alternative would be conducted in Phases 3 and 4 of the study.

The alternatives to be evaluated further are outlined below:

1. Alternative 1 - Expand Existing Sewage Treatment Plant with Outlet Sewer to Drag River;

2. Alternative 2 - Expand Existing Sewage Treatment Plant with Outlet Sewer to Grass Lake;

3. Alternative 3 - Construct a New Sewage Treatment Plant to Service Highway 121 Development;

4. Alternative 4 - Construct a New Sewage Treatment Plant to Service Highway 121 Development and Hamlet of Haliburton; and

5. Alternative 5 - Expand Existing Sewage Treatment Plant with Outlet Sewer to Burnt River.

9.2 Description of the Alternatives

The following subsections will describe the treatment process to be utilized for each alternative, outline the estimated capital and operating costs, and evaluate the technical merits and potential environmental impacts. Based on the afore-noted considerations, the preferred solution will be selected.

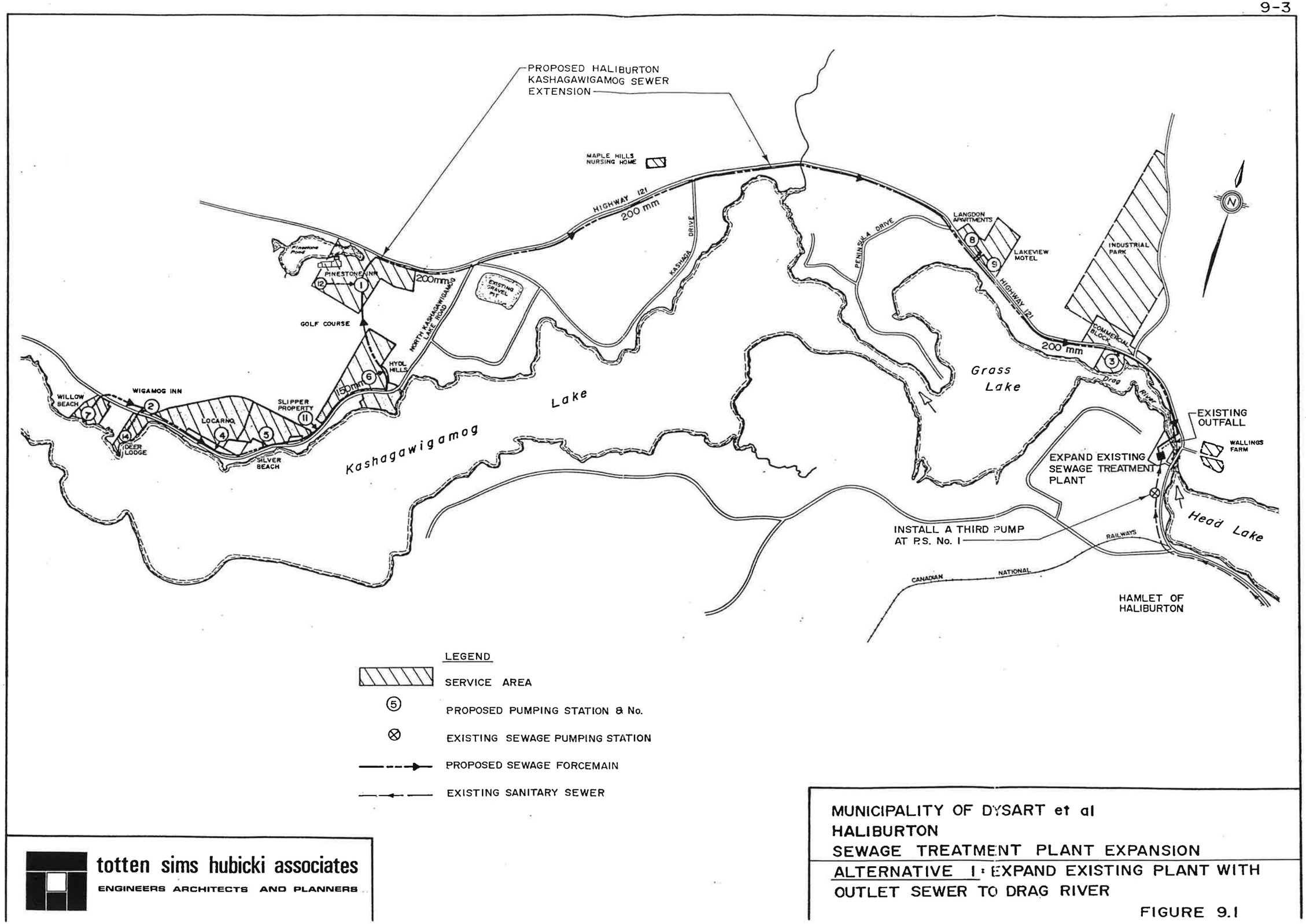
9.2.1 Alternative 1 - Expand Existing Sewage Treatment Plant with Outlet Sewer to Drag River

Under Alternative 1, it is proposed to expand the existing Haliburton Sewage Treatment Plant to service the projected growth in the Hamlet of Haliburton as well as the resorts and commercial/industrial developments along Highway 121. This alternative is shown in Figure 9.1.

The resorts to be serviced include Deer Lodge, Hydl Hills, Locarno Resort, Pinestone Inn, Silver Beach Camp, Skippers Property, Wigamog Inn and Willow Beach. The commercial/industrial development includes the area near Haliburton Marina, Lakeview Motel, Langdon Apartments, Maple Hills Nursing Home and Walling Farm Subdivision on Highway 121.

The existing sanitary sewer system in the Hamlet has adequate capacity to handle the projected flows with the only upgrading required consisting of the installation of one additional pump in Pumping Station No. 1. During the initial design of the pumping station, provision had been made for the installation of this pump in the future.

The Highway 121 development will be serviced by the Haliburton-Kashagawigamog Sewer Extension which has already been designed for the Municipality by Rysco Engineering Corporation under the MOE Project No. 3-0579.



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ALTERNATIVE 1: EXPAND EXISTING PLANT WITH OUTLET SEWER TO DRAG RIVER

FIGURE 9.1

9.2 Description of the Alternatives (Cont'd)

The basic design parameters for the plant expansion will be as follows:

Design Period	20 Years
Service Population:	
Hamlet of Haliburton	1,928 persons
Highway 121 Development	2,331 persons
Total	4,259 persons
Per Capita Flow (Including Extraneous Flow)	454 L/d
Average Design Flow	1,933 m^3/d
Peak Flow	6,911 m^3/d

As noted previously, the existing plant has a rated capacity of 542 m^3/d as compared to the required capacity of 1,933 m^3/d, thus the expansion will have to provide an additional capacity of 1,391 m^3/d. The expansion will include:

- 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
- upgrading and replacement of existing equipment which is in poor condition.

Phosphorus removal will be accomplished by the continuous addition of ferric chloride to the aeration chamber.

Effluent from the plant will be chlorinated and discharged into the Drag River through the existing 300 mm diameter outfall.

Digested sludge will be hauled away for off-site disposal, as is the current practice at the existing plant.

9.2 Description of the Alternatives (Cont'd)

9.2.2 Alternative 2 - Expand Existing Sewage Treatment Plant with Outlet Sewer to Grass Lake

Under Alternative 2, it is proposed to expand the existing Haliburton Sewage Treatment Plant to service the projected growth in the Hamlet of Haliburton as well as the resorts and commercial/industrial developments along Highway 121. A schematic of this alternative is shown in Figure 9.2.

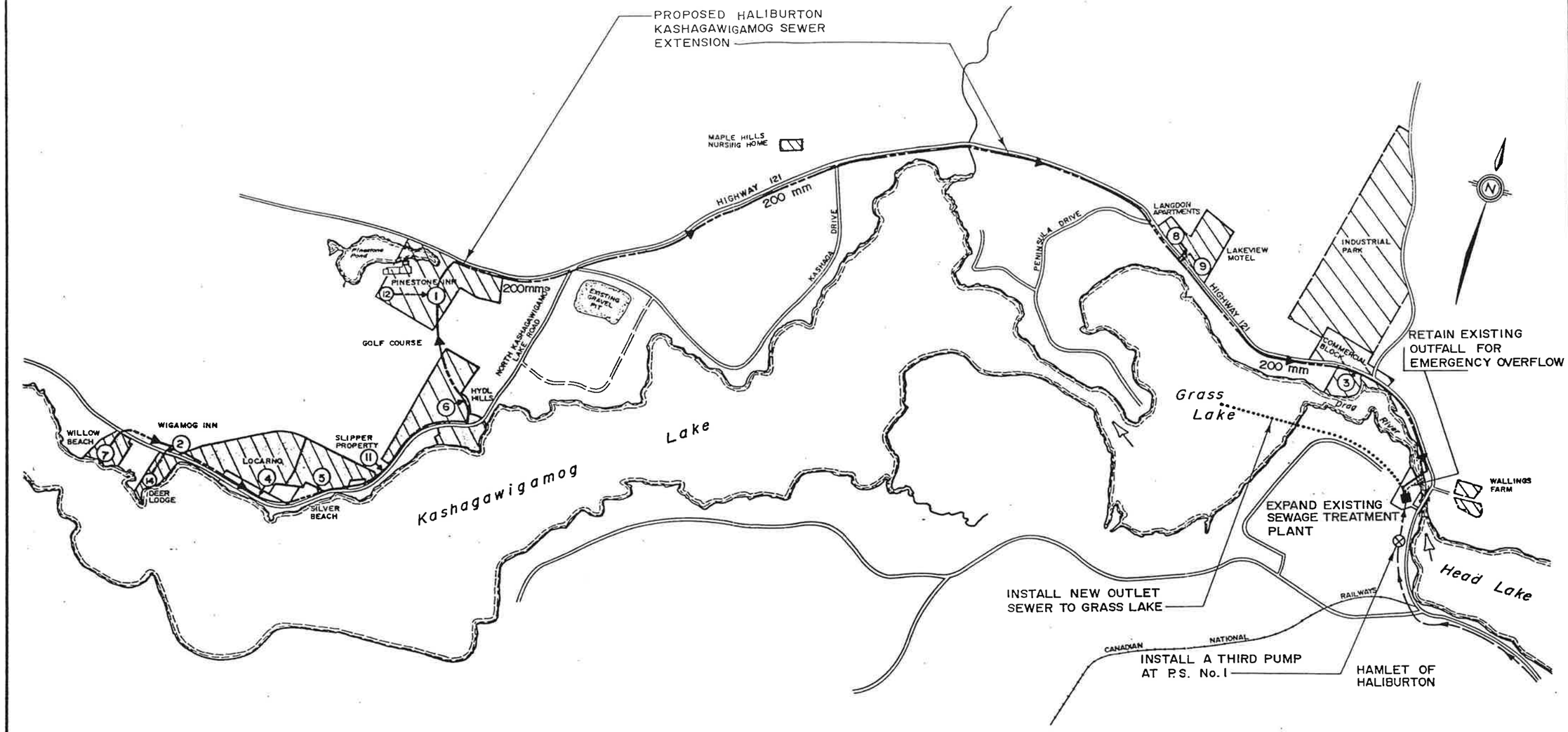
The resorts to be serviced include Deer Lodge, Hydl Hills, Locarno Resort, Pinestone Inn, Silver Beach Camp, Skippers Property, Wigamog Inn and Willow Beach. The commercial/industrial development includes the area near Haliburton Marina, Lakeview Motel, Langdon Apartments, Maple Hills Nursing Home and Walling Farm Subdivision on Highway 121.

As noted with Alternative 1, the only upgrading of the sanitary sewer system required is the installation of one additional pump in Pumping Station No. 1.

The Highway 121 development will be serviced by the Haliburton-Kashagawigamog Sewer Extension which has already been designed for the Municipality by Rysco Engineering Corporation under the MOE Project No. 3-0579.

The basic design parameters for the plant expansion are similar to those outlined for Alternative 1:

Design Period	20 Years
Service Population:	
Hamlet of Haliburton	1,928 persons
Highway 121 Development	2,331 persons
Total	4,259 persons
Per Capita Flow (Including Extraneous Flow)	454 L/d
Average Design Flow	1,933 m^3/d
Peak Flow	6,911 m^3/d



LEGEND

- SERVICE AREA
- ⑤ PROPOSED PUMPING STATION & No.
- ⊗ EXISTING SEWAGE PUMPING STATION
- PROPOSED SEWAGE FORCEMAIN
- EXISTING SANITARY SEWER
- ..... OUTLET SEWER

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ALTERNATIVE 2: EXPAND EXISTING PLANT WITH OUTLET SEWER TO GRASS LAKE

FIGURE 9.2

9.2 Description of the Alternatives (Cont'd)

For Alternative 2, the plant expansion will require the following:

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

The water depth contours of Grass Lake indicate that the depth of water at the discharge point will be approximately 6 m to 8 m. The proposed route of the outlet sewer is shown in Figure 9.2. The existing outfall will be retained for emergency overflow purposes.

Phosphorus removal will be accomplished by the continuous addition of ferric chloride to the aeration chamber.

Effluent will be chlorinated and discharged into Grass Lake. Digested sludge will be hauled away for off-site disposal, as is the current practice at the existing plant.

9.2.3 Alternative 3 - Construct a New Sewage Treatment Plant to Service Highway 121 Development

Alternative 3 includes expansion of the existing sewage treatment plant and construction of a new sewage treatment plant near the existing gravel pit at Kashaga Drive, as shown in Figure 9.3.

9.2 Description of the Alternatives (Cont'd)

Under this alternative, the new plant will service only the resorts, including Deer Lodge, Hydl Hills, Locarno Resort, Pinestone Inn, Silver Beach Camp, Skippers Property, Wigamog Inn and Willow Beach. The proposed Maple Hills Nursing Home will not be serviced. The existing plant will be expanded to serve the projected growth in the Hamlet of Haliburton and the Highway 121 development located near the plant. This development includes the industrial and commercial blocks located near Haliburton Marina, Lakeview Motel, Langdon Apartments, and Walling Farm Subdivision.

The scope of work for the Haliburton-Kashagawigamog Sewer Extension will be reduced as shown in Figure 9.3 due to the reduction in the length of transmission main required.

The basic design parameters for the two plants will be as follows:

A. Expansion of Existing Haliburton Sewage Treatment Plant:

Design Period	20 years
Service Population:	
- Hamlet of Haliburton	1,928 persons
- Commercial/Industrial Blocks, Lakeview Motel, Langdon Apartments and Walling Farm Subdivision	693 persons
Total	2,621 persons

CONSTRUCT A SECOND SEWAGE TREATMENT PLANT AND OUTLET SEWER

PROPOSED FORCEMAIN

PROPOSED FORCEMAIM

MAPLE HILLS NURSING HOME

HIGHWAY 121

KASHAGA DRIVE

PENINSULA DRIVE

LANGDON APARTMENTS

LAKEVIEW MOTEL

INDUSTRIAL PARK

COMMERCIAL BLOCK

PINESTONE INN

200mm

EXISTING GRAVEL PIT

NORTH KASHAGAWIGAMOG LAKE ROAD

GOLF COURSE

HYDL HILLS

150 mm

Grass Lake

Drag River

WILLOW BEACH

WIGAMOG INN

SLIPPER PROPERTY

LOCARNO

DEER LODGE

SILVER BEACH

Kashagawigamog Lake

WALLINGS FARM

EXPAND EXISTING SEWAGE TREATMENT PLANT

Head Lake

INSTALL A THIRD PUMP AT P.S. No. 1

RAILWAYS

CANADIAN NATIONAL

HAMLET OF HALIBURTON

LEGEND

- SERVICE AREA
- ⑤ PROPOSED PUMPING STATION & No.
- ⊗ EXISTING SEWAGE PUMPING STATION
- PROPOSED SEWAGE FORCEMAIN
- EXISTING SANITARY SEWER
- OUTLET SEWER

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ALTERNATIVE 3: EXPAND EXISTING PLANT TO SERVICE HIGHWAY 121 DEVELOPMENT & HALIBURTON AND CONSTRUCT NEW PLANT TO SERVICE RESORTS

FIG. 9.3

9.2 Description of the Alternatives (Cont'd)

Per Capita Flow (Including Extraneous Flow)	454 L/d
Average Design Flow	1,189 m^3/d
Peak Flow	4,399 m^3/d

B. Sewage Treatment Plant at New Site:

Design Period	20 years
Service Population	1,488 persons
Per Capita Flow (Including Extraneous Flow)	454 L/d
Average Design Flow	676 m^3/d
Peak Flow	2,488 m^3/d

As noted previously, the existing plant has a rated capacity of 542 m^3/d as compared to the required capacity of 1,189 m^3/d, thus, the expansion will have to provide an additional capacity of 647 m^3/d. However, the effluent filters will have to be designed to treat the peak flow from the entire plant. The expansion will include:

- construction of additional grit removal facilities
- construction of another extended aeration plant
- construction of effluent filters with a backwash system
- upgrading and replacement of existing equipment which is in poor condition

The existing sanitary sewer system in the Hamlet of Haliburton has adequate capacity to handle the projected flows. However, Pumping Station No. 1 will require upgrading so that it can pump the projected peak flow to the new treatment plant. It is estimated that three (3) 30 kW submersible pumps will be required to handle the projected flow requirements.

Phosphorus removal will be accomplished by the continuous addition of ferric chloride to the aeration chamber. Effluent from the expanded plant will be chlorinated and discharged to Drag River through the existing 300 mm diameter outfall. Digested sludge will be hauled away for off-site disposal.

9.2 Description of the Alternatives (Cont'd)

The new sewage treatment plant to service the resorts will consist of:

- grit removal facilities
- extended aeration type of sewage treatment plant
- effluent filters with backwash system
- main control building to house chemical feed equipment, air blowers, laboratory, washrooms and electrical room
- standby power facilities.

Phosphorus removal will be accomplished by the continuous addition of ferric chloride or alum to the aeration chamber. Effluent from the new plant will be chlorinated and discharged to Kashagawigamog Lake through a 300 mm diameter outlet sewer. Digested sludge will be hauled away for off-site disposal.

9.2.4 Alternative 4 - Construct a New Sewage Treatment Plant to Service Highway 121 Development and Hamlet of Haliburton

Alternative 4 involves the construction of a new sewage treatment plant near the existing gravel pit at Kashaga Drive, as shown in Figure 9.4. The plant will service the resorts and commercial/industrial development along Highway 121 as well as the Hamlet of Haliburton.

The resorts to be serviced include Deer Lodge, Hydl Hills, Locarno Resort, Pinestone Inn, Silver Beach Camp, Skippers Property, Wigamog Inn and Willow Beach. The commercial/industrial development includes the area near Haliburton Marina, Lakeview Motel, Langdon Apartments, Maple Hills Nursing Home and Walling Farm Subdivision on Highway 121.

The basic design parameters for the plant expansion will be as follows:

Design Period	20 Years
Service Population	4,259 persons
Per Capita Flow	454 L/d
Average Design Flow (Including Extraneous Flow)	1,933 m^3/d
Peak Flow	6,443 m^3/d

CONSTRUCT A NEW SEWAGE TREATMENT PLANT AND OUTLET SEWER

MAPLE HILLS NURSING HOME

HIGHWAY 121

200 mm

KASHAGA DRIVE

PENINSULA DRIVE

LANGDON APARTMENTS

LAKEVIEW MOTEL

INDUSTRIAL PARK

HIGHWAY 121

COMMERCIAL BLOCK

200mm

RETIRE EXISTING SEWAGE TREATMENT PLANT

PINESTONE INN

GOLF COURSE

EXISTING GRAVEL PIT

NORTH KASHAGAWIGAMOG LAKE ROAD

HYDL HILLS

WILLOW BEACH

WIGAMOG INN

LOCARNO

SLIPPER PROPERTY

DEER LODGE

SILVER BEACH

Kashagawigamog Lake

Grass Lake

Drag River

WALLINGS FARM

Head Lake

INSTALL THREE NEW PUMPS AT P.S. No. 1

RAILWAYS

CANADIAN NATIONAL

HAMLET OF HALIBURTON

LEGEND

- SERVICE AREA
- ⑤ PROPOSED PUMPING STATION & No.
- ⊗ EXISTING SEWAGE PUMPING STATION
- PROPOSED SEWAGE FORCEMAIN
- EXISTING SANITARY SEWER
- OUTLET SEWER

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ALTERNATIVE 4: CONSTRUCT NEW PLANT TO SERVICE HIGHWAY 121 DEVELOPMENT & HALIBURTON

FIGURE 9.4

9.2 Description of the Alternatives (Cont'd)

The new plant will be similar to that required under Alternative 3, consisting of:

- grit removal facilities
- extended aeration type of sewage treatment plant (two modules)
- effluent filters with backwash system
- main control building to house chemical feed equipment, air blowers, laboratory, washrooms and electrical room
- standby power facilities.

Phosphorus removal will be accomplished by the continuous addition of ferric chloride or alum to the aeration chamber. Effluent from the plant will be chlorinated and discharged after chlorination into Kashagawigamog Lake through a 400 mm diameter outlet sewer. Digested sludge will be hauled away for off-site disposal.

9.2.5 Alternative 5 - Expand Existing Sewage Treatment Plant with Outlet Sewer to Burnt River

Under Alternative 5, it is proposed to expand the existing Haliburton Sewage Treatment Plant to service the projected growth in the Hamlet of Haliburton as well as the resorts and commercial/industrial developments along Highway 121. Effluent from the plant will be pumped via a forcemain to the Burnt River. This alternative is shown in Figure 9.5.

The resorts to be serviced include Deer Lodge, Hydl Hills, Locarno Resort, Pinestone Inn, Silver Beach Camp, Skippers Property, Wigamog Inn and Willow Beach. The commercial/industrial development includes the area near Haliburton Marina, Lakeview Motel, Langdon Apartments, Maple Hills Nursing Home and Walling Farm Subdivision on Highway 121.

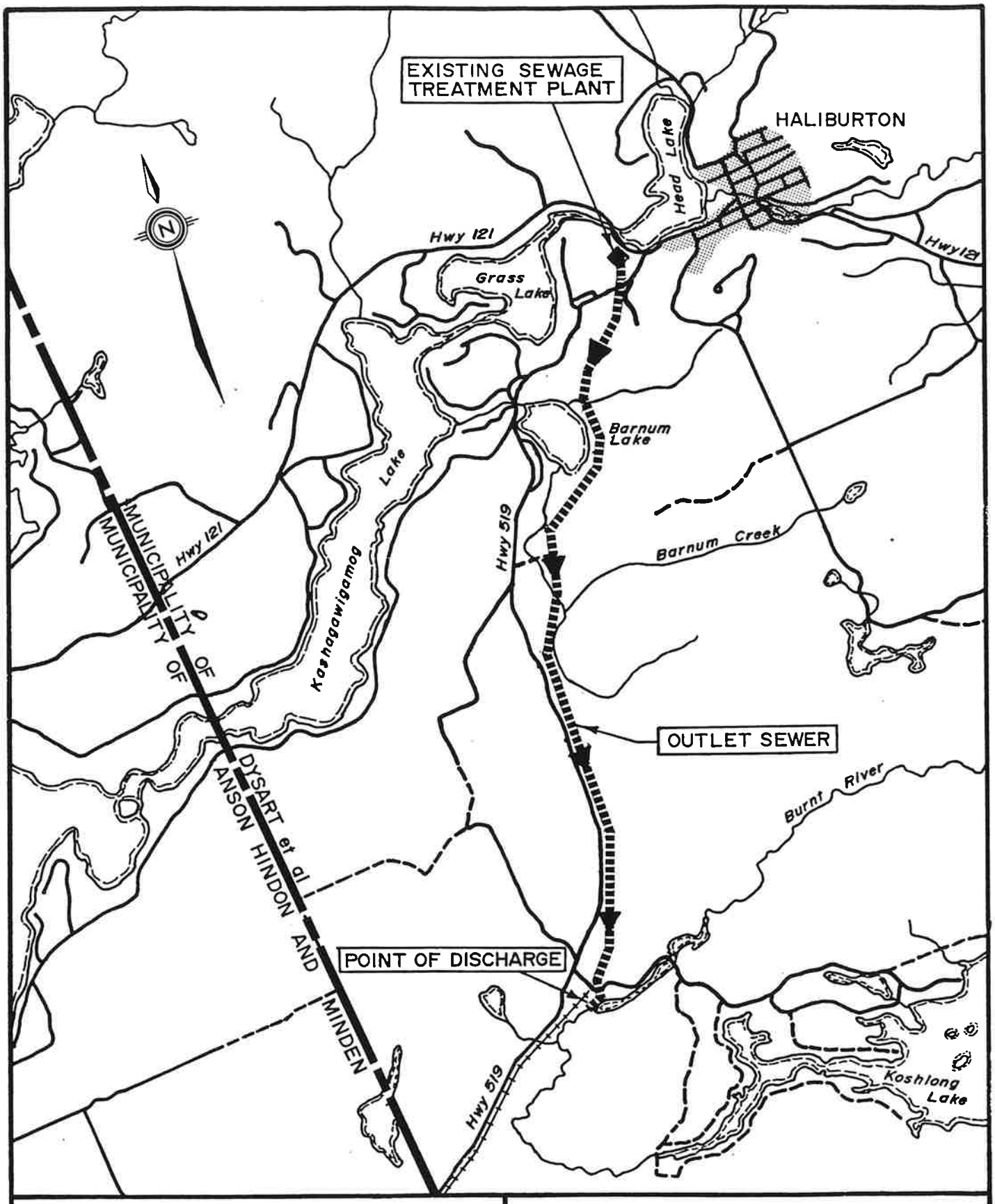
9.2 Description of the Alternatives (Cont'd)

The existing sanitary sewer system in the Hamlet has adequate capacity to handle the projected flows with the only upgrading required consisting of the installation of one additional pump in Pumping Station No. 1. During the initial design of the pumping station, provision had been made for the installation of this pump in the future.

The Highway 121 development will be serviced by the Haliburton-Kashagawigamog Sewer Extension which has already been designed for the Municipality by Rysco Engineering Corporation under the MOE Project No. 3-0579.

The basic design parameters for the plant expansion will be as follows:

Design Period	20 Years
Service Population:	
Hamlet of Haliburton	1,928 persons
Highway 121 Development	2,331 persons
Total	4,259 persons
Per Capita Flow (Including Extraneous Flow)	454 L/d
Average Design Flow	1,933 m^3/d
Peak Flow	6,911 m^3/d



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SEWAGE TREATMENT PLANT EXPANSION
ALTERNATIVE 5: EXPAND EXISTING PLANT WITH OUTLET SEWER TO BURNT RIVER

FIGURE 9.5

9.2 Description of the Alternatives (Cont'd)

As noted previously, the existing plant has a rated capacity of 542 m^3/d as compared to the required capacity of 1,933 m^3/d, thus the expansion will have to provide an additional capacity of 1,391 m^3/d. The expansion will include:

- 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
- upgrading and replacement of existing equipment which is in poor condition.
- construction of an effluent pumping station
- construction of an effluent forcemain to the Burnt River.

Under this alternative, phosphorus removal will be accomplished by the continuous addition of ferric chloride to the aeration chamber.

Effluent from the plant will flow through the chlorine contact tank and the effluent filters to the effluent pumping station located adjacent to the effluent filter building. Two (2) effluent pumps will be provided, each rated at 80 L/s at 50 m TDH and driven by a 75 kW electric motor. One pump will act as duty and the other as standby. In addition, a 100 kW diesel generator set will be provided as a standby power facility.

Effluent from the effluent pumping station will be pumped via approximately 7.5 km of 350 mm diameter along the easement and Highway 519 to the Burnt River as shown in Figure 9.5.

Similar to the other alternatives, digested sludge will be hauled away for off-site disposal, as is the current practice at the existing plant.

9.3 Estimated Costs

9.3.1 Capital Costs

The estimated capital costs of the alternatives are presented in Tables 9.1 to 9.5. All costs are based on Fall 1990 prices and include an allowance for engineering and contingencies.

Table 9.1
Estimated Capital Costs - Alternative 1

Proposed Works	Estimated Capital Cost ($)
1. Pumping Station No. 1	
1.1 Install one additional pump	48,000
2. Treatment Plant	
2.1 Sitework	48,000
2.2 Excavation and backfill	120,000
2.3 Cast-in-place concrete	840,000
2.4 Yard piping and appurtenances	60,000
2.5 Equipment	648,000
2.6 Misc. metal and process piping	120,000
2.7 Air piping	36,000
2.8 Superstructure at effluent filters	84,000
2.9 Electrical	156,000
TOTAL	2,160,000

9.3 Estimated Costs (Cont'd)

Table 9.2

Estimated Capital Costs - Alternative 2

Proposed Works	Estimated Capital Cost ($)
1. Pumping Station No. 1	
1.1 Install one additional pump	48,000
2. Treatment Plant	
2.1 Sitework	48,000
2.2 Excavation and backfill	120,000
2.3 Cast-in-place concrete	840,000
2.4 Yard piping and appurtenances	60,000
2.5 Equipment	648,000
2.6 Misc. metal and process piping	120,000
2.7 Air piping	36,000
2.8 Superstructure at effluent filters	84,000
2.9 Electrical	156,000
3. New Outlet Sewer to Grass Lake	516,000
TOTAL	2,676,000

9.3 Estimated Costs (Cont'd)

Table 9.3

Estimated Capital Costs - Alternative 3

Proposed Works	Estimated Capital Cost ($)
1. Pumping Station No. 1	
1.1 Install one additional pump	48,000
Sub-Total	48,000
2. Treatment Plant	
2.1 Sitework	28,800
2.2 Excavation and backfill	72,000
2.3 Cast-in-place concrete	540,000
2.4 Yard piping and appurtenances	38,400
2.5 Equipment	576,000
2.6 Misc. metal and process piping	96,000
2.7 Air piping	28,800
2.8 Superstructure at effluent filters	72,000
2.9 Electrical	120,000
Sub-Total	1,620,000

9.3 Estimated Costs (Cont'd)

Table 9.3 (Cont'd)

Proposed Works	Estimated Capital Cost ($)
3. New Treatment Plant	
3.1 Land acquisition and legal	96,000
3.2 Sitework	36,000
3.3 Excavation and backfill	48,000
3.4 Cast-in-place concrete	540,000
3.5 Yard piping and appurtenances	48,000
3.6 Equipment	660,000
3.7 Mechanical and process piping	120,000
3.8 Superstructure	240,000
3.9 Standby power facilities	120,000
3.10 Electrical and telemetering	240,000
3.11 Inlet sewers, 400 mm of 200 mm diameter FM	86,400
3.12 New outlet sewer	420,000
Sub-Total	2,654,400
4. Cost Adjustment for Change in Scope of Work of Haliburton-Kashagawigamog Sewer Extension	
4.1 Additional engineering costs for re-designing the system	60,000
4.2 Reduction in cost for deletion of 3,000 m of 200 mm diameter FM	- 648,000
4.3 Reduction in cost for downsizing 1,400 m of 200 mm FM to 150 mm FM	- 50,400
Sub-Total	- 638,400
TOTAL	3,684,000

9.3 Estimated Costs (Cont'd)

Table 9.4 (Cont'd)

Table 9.4

Estimated Capital Costs - Alternative 4

Proposed Works	Estimated Capital Cost ($)
1. Pumping Station No. 1	
1.1 Install three additional pumps	108,000
1.2 Modifications to electrical works	48,000
Sub-Total	156,000
2. Sewage Treatment Plant	
2.1 Land acquisition and legal	132,000
2.2 Sitework	48,000
2.3 Excavation and backfill	84,000
2.4 Cast-in-place concrete	960,000
2.5 Yard piping and appurtenances	72,000
2.6 Equipment	960,000
2.7 Mechanical and process piping	144,000
2.8 Superstructure	304,800
2.9 Standby power facilities	180,000
2.10 Electrical and telemetering	300,000
2.11 Inlet sewer 400 mm of 250 mm diameter FM	96,000
2.12 New outlet sewer	576,000
Sub-Total	3,856,800
TOTAL	4,012,800

9.3 Estimated Costs (Cont'd)

Table 9.5

Estimated Capital Costs - Alternative 5

Proposed Works	Estimated Capital Cost ($)
1. Pumping Station No. 1	
1.1 Install one additional pump	48,000
2. Treatment Plant	
2.1 Sitework	48,000
2.2 Excavation and backfill	120,000
2.3 Cast-in-place concrete	840,000
2.4 Yard piping and appurtenances	60,000
2.5 Equipment	648,000
2.6 Misc. metal and process piping	120,000
2.7 Air piping	36,000
2.8 Superstructure at effluent filters	84,000
2.9 Electrical	156,000
3. Effluent Pumping Station and Forcemain	2,700,000
TOTAL	4,860,000

9.3 Estimated Costs (Cont'd)

9.3.2 Annual Operating Costs

The estimated annual operating costs of the sewage treatment plant(s) for each alternative are summarized in the following Table 9.6

Table 9.6
Annual Operating Costs of Alternatives
(Year 1 Costs)

	Alter. 1	Alter. 2	Alter. 3		Alter. 4	Alter. 5
			Exist. STP	New STP		
Operator	$ 36,000	$ 36,000	$24,000	$24,000	$ 36,000	$ 36,000
Power Cost	$ 36,000	$ 36,000	$24,000	$18,000	$ 42,000	$ 49,000
Chemicals	$ 6,000	$ 6,000	$ 3,600	$ 3,600	$ 6,000	$ 6,000
Repair & Maintenance	$ 18,000	$ 18,000	$14,400	$ 9,600	$ 18,000	$ 24,000
Sludge Disposal	$ 36,000	$ 36,000	$24,000	$18,000	$ 36,000	$ 36,000
Miscellaneous	$ 6,000	$ 6,000	$ 3,600	$ 3,600	$ 6,000	$ 6,000
			$93,600	$76,800		
Total Cost	$138,000	$138,000	$170,400		$144,000	$157,000

9.4 Technical Evaluation

Both the proposed sewage treatment plant expansion and the new sewage treatment plant consist of an extended aeration type of plant followed by effluent filtration. The treatment process would produce a high quality of effluent containing BOD_5 less than 5 mg/L, suspended solids less than 5 mg/L and phosphorus concentration less than 0.3 mg/L. Preliminary calculations, based on the ${}_7Q_{20}$ flow and the capacity of the proposed sewage treatment plant show that the initial dilution ratios of all alternatives can result in an initial dilution of each parameter to concentrations less than the proposed effluent criteria.

9.4 Technical Evaluation (Cont'd)

Under Alternative 1, an initial dilution ratio of 14:1 would be realized. Based on the average concentration from the period 1985 to 1987, the initial concentrations would be as follows: BOD_5 0.24 mg/l, SS 0.36 mg/l, and phosphorus 0.04 mg/l.

Assuming an initial dilution ratio of 20:1, as outlined in Section 5.4, the initial dilution concentrations under Alternative 2 would be BOD_5 0.16 mg/l, SS 0.26 mg/l, and phosphorus 0.026 mg/l.

Under Alternative 3, an initial dilution ratio of 21:1 would be realized for the discharge of treated effluent to the Drag River, with an initial dilution ratio of 20:1 for the discharge of effluent into Kashagawigamog Lake. In accordance with the above ratios, the parameters of concern would be diluted to the following concentrations upon initial mixing of the wastewater effluent with the receiving water, assuming similar effluent quality at both sewage treatment plants: a) Drag River - BOD_5 0.16 mg/l, SS 0.24 mg/l, phosphorus 0.024 mg/l; b) Kashagawigamog - BOD_5 0.26 mg/l, SS 0.24 mg/l and phosphorus 0.023 mg/l.

Under Alternative 4, an initial dilution ratio of 20:1 is assumed for the discharge of the wastewater effluent to Kashagawigamog Lake. The concentrations of the parameters after initial dilution would be BOD_5 0.26 mg/l, SS 0.24 mg/l, and phosphorus 0.023 mg/l.

Under Alternative 5, an initial dilution ratio of 11:1 would be realized with discharge of the treated effluent to the Burnt River. Based on flow records measured at the Gauging Station No. 02HF003, located on the Burnt River, a 7_Q20 flow was determined.

9.4 Technical Evaluation (Cont'd)

The area of the watershed contributing to the section of the Burnt River proposed to receive treated effluent from the expanded sewage treatment plant was pro-rated to determine the 7_Q20 characteristics for that area. The drainage area of the proposed discharge location is depicted in the following Figure 9.6. The contributing area was determined to be 110 km^2, with a 7_Q20 flow of 0.23 m^3/s. This flow resulted in the initial dilution rate of 11:1. The concentrations of BOD_5, SS, and P, at initial dilution would thus be 0.47 mg/l, 0.44 mg/l and 0.04 mg/l, respectively.

A more detailed evaluation of the dilution of the above parameters would be undertaken during Phase 3 of the study and the evaluation of the preferred alternative.

The extended aeration process is commonly used in small and medium sized sewage treatment plants in Ontario. It is reliable, relatively simple to operate and less susceptible to shock hydraulic loading as compared to other processes.

The existing treatment plant uses the same process, thus, the operations staff of the Municipality would be familiar with the operation and maintenance requirements.

9.5 Environmental Evaluation

9.5.1 Aesthetics

Aesthetic concerns are generally long term in nature. Short term effects due to construction are normal and are generally tolerated. Implementation of any of these alternatives will not involve the construction of high structures which may have adverse effects on the landscape of Haliburton.

OUTLET SEWER AS PER ALTERNATIVE 5

POINT OF DISCHARGE AS PER ALTERNATIVE 5

110 km²

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HALIBURTON
SEWAGE TREATMENT PLANT EXPANSION
CONTRIBUTING DRAINAGE AREA TO BURNT RIVER AT POINT OF DISCHARGE AS PER ALTERNATIVE 5
FIGURE 9.6

9.5 Environmental Evaluation (Cont'd)

The major portion of construction activity will be restricted to the plant site(s). The area surrounding the existing plant is hilly terrain, heavily wooded and secluded from any development. The new plant will be located near an existing open gravel pit. The site is surrounded by mature trees and is not visible from either Highway 121 or Kashagawigamog Lake.

As the proposed sewage treatment plant(s) are not readily visible to the community, none of the alternatives will have any negative impacts on the aesthetic quality of Haliburton.

9.5.2 Economic and Social Effects

The construction of the Kashagawigamog Sewer Extension and the expansion of the treatment plant will enable the resort owners to expand their businesses. This, in turn, will stimulate tourism and commercial and industrial development, thereby creating job opportunities and raising the standard of living of the residents.

The Municipality will benefit from the resultant increase in tax base and the higher revenues which could be utilized to provide better services to the residents. Thus, the Municipality, and the Hamlet of Haliburton in particular, will reap significant long term economic and social benefits from the project.

In the short term, the money spent and the temporary jobs created during the construction will also benefit the local economy.

As far as the capital cost of the project is concerned, the Ministry of the Environment has already approved a grant of 81% for the treatment plant expansion under the "Direct Grant Program for Sewage Works". The remaining 19% of the cost will be shared by the users of the proposed sewer extension.

9.5 Environmental Evaluation (Cont'd)

9.5.3 Public Health

Protection of public health will be improved by the implementation of any of the proposed alternatives. Provision of adequate hydraulic capacity and proper sewage treatment will reduce the discharge of untreated or inadequately treated sewage from individual disposal systems to Head, Grass and Kashagawigamog Lakes.

9.5.4 Conflicting Land Use

The existing sewage treatment plant site will be used for the expansion of the treatment facilities, therefore, no land use conflicts are anticipated with Alternatives 1, 2, 3 or 5.

The new sewage treatment plant will be located near an existing gravel pit on Kashaga Drive. The surrounding area has rural (R4), rural residential (RR) and extractive industrial (MX) zoning. The plant site will have to be rezoned as disposal industrial (MD) zone. Although the location of the plant is not expected to have adverse impacts on the existing land use of the surrounding area, property owners may object to the location of the plant near their property.

9.5.5 Effects on Groundwater Supply

There is no piped municipal water supply system in the general area and the residents as well as the commercial and industrial establishments rely on private wells for their water supply. Expansion of the sewage treatment plant will reduce the number of individual sewage disposal systems utilized, thus decreasing the chances for groundwater contamination.

9.5 Environmental Evaluation (Cont'd)

9.5.6 Aquatic Environment

The effluent criteria have been set to ensure that the discharge of the effluent does not have an adverse impact on the quality of the receiving waters and that the water quality is in compliance with the Provincial Water Quality Objectives (PWQO).

To evaluate the potential impacts on water quality resulting from the sewage treatment plant expansion, impacts on total phosphorus and dissolved oxygen concentrations were considered. Various models were utilized by Senes Consultants to predict phosphorus and dissolved oxygen concentrations in the lakes downstream of the Town of Haliburton. These models are detailed in Appendix 5.

a) Phosphorus Loading

The projected phosphorus budgets for each proposed alternative are presented in the following Tables 9.7 and 9.11. The budgets were determined by including the baseline phosphorus concentrations for those cottages and resorts not connected to the sewage collection system and a phosphorus concentration of 0.3 mg/L in the treated effluent from the expanded sewage treatment plant. The anthropogenic values of phosphorus were 20.6 kg/yr. in Grass Lake, 108.2 kg/yr. in the north basin of Kashagawigamog Lake and 121.3 kg/yr. in the south basin of Kashagawigamog Lake. The phosphorus load from the sewage treatment plant was estimated at 211.7 kg/yr. for the design flow of 1,933 m^3/d.

9.5 Environmental Evaluation (Cont'd)

Table 9.7

Projected Nutrient Budgets

Planned Expansion But No Sewage Treatment

	Grass Lake	Kashagawigamog Lake (North Basin)	Kashagawigamog Lake (South Basin)
Natural Load from Watershed (kg/y)	20.7	181.2	336.4
Anthropogenic Sources (kg/y)	327.9	1,864.8	121.3
Influent Load (kg/y)	607.4	908.2	2,127.0
Total Load (kg/y)	956.0	2,954.2	2,584.7
Retention Coefficient	0.05	0.28	0.30
Areal Loading ($mg/m^2.y$)	1,500.0	937.8	524.3
Total Phosphorus (mg/m^3)	12.0	21.8	13.3

Table 9.8

Alternative 1 - Projected Phosphorus Budgets

1,933 m^3/d Treated Effluent with Outlet Sewer to Drag River

	Grass Lake	Kashagawigamog Lake (North Basin)	Kashagawigamog Lake (South Basin)
Natural Load from Watershed (kg/y)	17.6	181.2	336.4
Anthropogenic Sources (kg/y)	20.6	108.2	121.3
Influent Load (kg/y)	1,042.1	1,026.3	947.3
Total Load (kg/y)	1,080.3	1,315.7	1,405.0
Retention Coefficient	0.05	0.28	0.30
Areal Loading ($mg/m^2.y$)	1,695.9	417.7	285.0
Total Phosphorus (mg/m^3)	13.6	9.7	7.2

9.5 Environmental Evaluation (Cont'd)

Table 9.9

Alternative 2 - Projected Phosphorus Budgets

1,933 m^3/d Treated Effluent with Outlet Sewer to Grass Lake

	Grass Lake	Kashagawigamog Lake (North Basin)	Kashagawigamog Lake (South Basin)
Natural Load from Watershed (kg/y)	17.6	181.2	336.4
Anthropogenic Sources (kg/y)	232.2	108.2	121.3
Influent Load (kg/y)	830.5	1,026.3	947.3
Total Load (kg/y)	1,080.3	1,026.3	1,405.0
Retention Coefficient	0.05	0.28	0.30
Areal Loading ($mg/m^2.y$)	1,695.9	417.7	285.0
Total Phosphorus (mg/m^3)	13.6	9.7	7.2

Table 9.10

Alternative 3 - Projected Phosphorus Budgets

1,189 m^3/d Treated Effluent to Drag River

676 m^3/d Treated Effluent to Kashagawigamog Lake (North Basin)

	Grass Lake	Kashagawigamog Lake (North Basin)	Kashagawigamog Lake (South Basin)
Natural Load from Watershed (kg/y)	17.6	181.2	336.4
Anthropogenic Sources (kg/y)	20.6	182.2	121.3
Influent Load (kg/y)	960.7	949.0	944.9
Total Load (kg/y)	998.9	1,312.4	1,402.6
Retention Coefficient	0.05	0.28	0.30
Areal Loading ($mg/m^2.y$)	1,568.1	416.6	284.5
Total Phosphorus (mg/m^3)	12.5	9.7	7.2

9.5 Environmental Evaluation (Cont'd)

Table 9.11

Alternative 4 - Projected Phosphorus Budgets

1,933 m^3/d Treated Effluent to Kashagawigamog Lake

	Grass Lake	Kashagawigamog Lake (North Basin)	Kashagawigamog Lake (South Basin)
Natural Load from Watershed (kg/y)	17.6	181.2	336.4
Anthropogenic Sources (kg/y)	20.6	319.8	121.3
Influent Load (kg/y)	830.5	825.3	954.9
Total Load (kg/y)	868.7	1,326.3	1,412.6
Retention Coefficient	0.05	0.28	0.30
Areal Loading ($mg/m^2.y$)	1,363.7	421.0	286.5
Total Phosphorus (mg/m^3)	10.9	9.8	7.3

Table 9.12

Alternative 5 - Projected Phosphorus Budgets

1,933 m^3/d Treated Effluent to Burnt River

	Grass Lake	Kashagawigamog Lake (North Basin)	Kashagawigamog Lake (South Basin)
Natural Load from Watershed (kg/y)	17.6	181.2	336.4
Anthropogenic Sources (kg/y)	20.6	108.2	121.3
Influent Load (kg/y)	830.5	825.3	802.6
Total Load (kg/y)	868.7	1,114.7	1,260.3
Retention Coefficient	0.05	0.28	0.30
Areal Loading ($mg/m^2.y$)	1,363.7	353.9	255.6
Total Phosphorus (mg/m^3)	10.9	8.2	6.5

9.5 Environmental Evaluation (Cont'd)

The five alternatives proposed for the expansion of the sewage treatment plant would thus provide the anthropogenic phosphorus loadings to the receiving water bodies downstream as outlined in Table 9.13.

Table 9.13
Baseline Phosphorus Budget for Alternatives
Based on 1985 Water Quality Data

	Altern. 1	Altern. 2	Altern. 3	Altern. 4	Altern. 5
Drag River	211.7 kg/y	-	130.2 kg/y	-	-
Grass Lake	20.6 kg/y	232.3 kg/y	20.6 kg/y	20.6 kg/y	20.6 kg/y
Kashagawigamog Lake (North Basin)	108.2 kg/y	108.2 kg/y	182.2 kg/y	319.8 kg/y	319.8 kg/y
Kashagawigamog Lake (South Basin)	121.3 kg/y	121.3 kg/y	121.3 kg/y	121.6 kg/y	121.6 kg/y

b) Dissolved Oxygen Concentrations

Dissolved oxygen criteria have been established by the MOE for the protection of aquatic life. The minimium allowable concentration for cold water biota is 5 mg/L.

Senes Consultants utilized two models to predict the impacts on the dissolved oxygen concentrations resulting from the sewage treatment plant expansion. Senes evaluated the hypolimnetic oxygen demand of Kashagawigamog Lake based on phosphorus, BOD and ammonia discharges from the existing and proposed sewage treatment plant. The predicted volumetric oxygen demand data reproduced from the Senes report are summarized in Tables 9.14 and 9.15. The detailed calculations for these data are outlined in Section 4.0 of the Senes report.

9.5 Environmental Evaluation (Cont'd)

Table 9.14

Predicted Volumetric Hypolimnetic Oxygen Demand

(g O_2/m^3.month)

Sewage Treatment Alternative	Kashagawigamog Lake			
	North Basin		South Basin	
	(1)	(2)	(1)	(2)
Current/Chl-a*	-	1.62*	-	1.15*
Current/TP**	1.85**	1.78**	0.99**	0.99**
Alternative 1)	1.71	1.83	0.82	0.99
Alternative 2)	1.71	1.83	0.92	0.99
Alternative 3)	1.71	1.83	0.92	0.99
Alternative 4)	1.72	1.84	0.92	1.00
Alternative 5)	1.61	1.63	0.88	0.92

Notes:

* Based on measured chlorophyll-a concentration.

** Based on measured phosphorus concentrations.

(1) Welch-Perkins Model

(2) Vollenweider-Janus Model

Table 9.15

Distribution of Hypolimnetic Oxygen Demand

In Kashagawigamog Lake, North Basin

	Phosphorus Related Oxygen Demand (g O_2/m^3.month)	BOD Related Oxygen Demand (g O_2/m^3.month)	NH_3 Related Oxygen Demand (g O_2/m^3.month)
Current	1.78	1.4×10^{-3}	4.5×10^{-3}
Alternative 2	1.83	8.6×10^{-3}	1.9×10^{-2}*
Alternative 4	1.83	8.6×10^{-3}	1.9×10^{-2}*

* Evaluated at estimated steady state concentration of 0.10 mg/L NH_3-N.

9.5 Environmental Evaluation (Cont'd)

The expected minimum oxygen concentrations over the depth of the hypolimnion at the end of summer stratification were 5.2 and 6.5 mg/L O_2 for the north and south basins of Kashagawigamog Lake, respectively. Somewhat lower values may be expected at lake turnover in the fall.

It is expected that the proposed alternatives would have little effect on the dissolved oxygen demand in Kashagawigamog Lake. The first four alternatives will result in similar impacts, where Alternative 5 is predicted to result in about 5 percent reduction in the volumetric oxygen demand in Kashagawigamog Lake. It is anticipated that Policy 2, no further degradation in the water quality of Kashagawigamog Lake can be met.

In summary, due to the relatively short hydraulic retention times, little difference exists between Alternatives 1 to 4. The predicted phosphorus concentrations in Kashagawigamog Lake are essentially equivalent to the baseline concentrations measured in 1985. The predicted concentrations in Grass Lake vary by plus or minus 15 percent of the baseline concentration. The highest phosphorus concentrations are associated with Alternatives 1 and 2 where the treated effluent is discharged to Drag River and Grass Lake, respectively.

Under Alternative 5, diverting all of the effluent outside the immediate watershed, approximately 7.5 km to the Burnt River, the phosphorus concentrations in Grass and Kashagawigamog Lakes will decline by 10 to 15 percent. Compared to the baseline concentrations of 12.0, 9.6 and 7.2 mg/m^3, the predicted phosphorus levels under this alternative are 10.9, 8.2 and 6.5 mg/m^3, respectively. The comparison does not effect any changes which may occur in the water quality downstream of the discharge point on the Burnt River.