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BAYSHORE VILLAGE SEWAGE WORKS EFFLUENT SPRAY IRRIGATION

Township of Ramara

Class Environmental Assessment Phases 1 and 2 Project File

prepared by:

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prepared for

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1 Introduction

The Township of Ramara (Township) has established the need to improve the operation of the Bayshore Village effluent spray irrigation system in order to ensure the treated effluent is disposed in an environmentally acceptable manner.

A Class Environmental Assessment (Class EA) study was completed to consider alternatives in consultation with the public and review agencies, and identify the preferred approach. The project was conducted as a Schedule B undertaking under the Municipal Engineers Association Municipal Class EA. Phases 1 and 2 of the Class EA process were completed.

This report presents the need for the project, the assessment and evaluation of the alternatives, the consultation process, and the recommended solution.

1.1 Background

Bayshore Village, located on the east shore of Lake Simcoe, was built by a developer and assumed by the Township in 1991. Figure 1 presents the study area. At build-out, the community will consist of 343 single-family homes on Lots 21 and 26 in Concession VI, as well as 29 lots on Southview Drive and, in the future, 10 lots in Block H. In 2016, there were 322 built lots. At the Township's average occupancy of 2.6 people per dwelling, the total estimated population currently connected to the municipal sewer system is 837 residents.

The Bayshore Village Sewage Works consist of a gravity collection system with a satellite sewage pumping station and a main sewage pumping station, a two-cell waste stabilization pond, referred to as lagoons in this report, and an effluent spray irrigation system on two fields referred to as the South Field and the North Field.

1.2 Study Objectives – Problem Statement

The Class EA was initiated in October 2010 to consider the expansion of the effluent spray irrigation fields serving the Bayshore Village Sewage Works. Over the years, the soils of the effluent spray fields have become compacted and their infiltrative capacity has deteriorated. The addition of spare spray irrigation capacity needed to be considered in order to provide operational flexibility so that spray fields could be taken out of service for aeration and/or tilling as needed to maintain their capacity for the disposal of the lagoons content. The initial problem statement was:

The Township of Ramara needs spare capacity at the effluent spray irrigation system serving the Bayshore Village Sewage Works, in order to provide operational flexibility. Spray irrigation fields need to be occasionally taken out of service for aerating and/or tilling as needed to restore and maintain their performance and their effluent absorption capacity.

Figure 1: Study Area

Following the first Public Information Centre (PIC) and consultation with the Ministry of the Environment and Climate Change (MOECC), the project evolved and the Township decided to widen the scope of the Class EA to consider alternatives to effluent spray irrigation. The problem statement was revised to:

Bayshore Village effluent spray irrigation fields have been in continuous operation for 25 to 38 years. Soils have become compacted and have reduced absorption capacity. A longer spray irrigation period is often required.

There is no spare capacity in the spray irrigation system to temporarily take spray irrigation fields out of service for aerating and/or tilling the soils as needed to restore and maintain their original effluent absorption capacity.

The effluent disposal system must have sufficient capacity to adequately dispose of the effluent from the Bayshore Village lagoons.

The effluent disposal system should minimize impacts on the environment and on adjacent residents and farms, meet current regulatory requirements, satisfy the Township's operational needs, and be affordable.

1.3 Report Organization

This report is intended to document and summarize the Class EA study from its inception in 2010 to completion in 2017.

- Chapter 2 presents the existing environmental conditions in the study area that could be impacted by the alternative solutions.
- Chapter 3 describes the existing sewage works and effluent spray irrigation system, and outlines the issues that need to be addressed in more detail.
- Chapter 4 outlines the regulatory context in which the Class EA study was completed and how current regulations, policies and guidelines affect the evaluation of alternatives.
- Chapter 5 presents the alternative solutions that were considered during the study, and their assessment.
- Chapter 6 summarizes the public and review agency consultation and the comments that were received.
- Chapter 7 presents the final evaluation and recommendations.

1.4 References

The following reports were consulted for the preparation of this Class EA report:

- Preliminary Report for the Proposed Bayshore Village Waste Water Spray Irrigation Site, Beak Consultants Limited, November 1988.
- Hydrogeological and Spray Lands Operation Report for the Proposed Bayshore Village Waste Water Spray Irrigation Site, Beak Consultants Limited.
- Bayshore Village Sewage Treatment System Spray Irrigation Pilot Study, Totten Sims Hubicki Associates, March 1996.
- Subsurface Investigation, Proposed Expansion Areas, Bayshore Village Sewage Treatment Works, Concession 7, Lot 22 and Concession 7 Lot 20, Township of Ramara, Ontario, Terraprobe Inc., May 3, 2010.
- Approved Assessment Report: Lake Simcoe and Couchiching-Black River Source Protection Area, Part 1: Lake Simcoe Watershed, South Georgian Bay - Lake Simcoe Source Protection Committee, January 2015.
- Bayshore Village Sewage Works, 2016 Annual Performance Report, March 2017.

2 Environmental Conditions in the Study Area

The Bayshore Village effluent spray fields are located at the intersection of Concession Road 8 and Sideroad 20, north of Bayshore Village, as shown on Figure 1.

2.1 Natural Environment

The effluent spray fields are located on both sides of Wainman's Creek, which flows from upstream wetlands and agricultural areas to Barnstable Bay in Lake Simcoe. Wainman's Creek crosses Concession Rd. 8 between the South Field and the North Field. The creek's high water mark at this point was established at 218.95 m in 1993. Stream flows have not been measured.

A small ditch drains the northern portion of the North Field to a central wooded and low-lying area, which is drained by a ditch on the east side of the access road that flows to Wainman's Creek at Concession Rd. 8. The South Field drains towards the northwest to Wainman's Creek and to the east into the Sideroad 20 ditch.

The spray fields are approximately 1.2 to 1.6 km east of the Lake Simcoe shoreline.

The lagoons and spray fields are almost entirely surrounded by the Barnstable Bay wetland, which is a Class 2 Provincially Significant Wetland. Barnstable Bay is noted to have significant fisheries. There is also a regionally significant Area of Natural and Scientific Interest (McGinnis Point ANSI) to the south and west of the spray fields. The ANSI is a 200 ha shoreline swamp; no specific species occurrences are noted for this area.

2.2 Geology and Hydrogeology

Ground elevations on the spray irrigation lands range from 220 m to 222 m in the North Field and from 220 m to 224 m in the South Field (TSH, 1993, 1995). The areas around the spray fields are similarly flat with lower areas in proximity to Wainman's Creek. The spray fields are located on lands that have slopes that are less than 3%.

In a 1988 study by Beak Consultants, drilled boreholes indicated the soils are varved and compact glacio-lacustrine clays overlying glacial till, which in turn lies on bedrock. Fractured limestone bedrock outcrops to the north of the lagoons and was found at a maximum depth of 5.4 m south of the lagoons.

The Beak study also concluded the lands form a groundwater discharge zone. In the South Field, static groundwater was found 1.5 to 3.5 m above the bedrock/sediment interface. The soil's saturated hydraulic conductivity at shallow depths ranged between 2×10^{-8} m/s to 2×10^{-6} m/s. Hydraulic conductivities were generally lower at greater depths. Upward vertical gradients were greater than horizontal gradients. As a result, water moving from the site is not expected to enter the deep groundwater.

In the North Field, shallow depths to water table were measured, but variations were encountered reflecting seasonal variations. The horizontal hydraulic gradients were very small, resulting in long retention time for groundwater in the subsurface. Groundwater flows south towards Lake Simcoe but is controlled locally by topography. Upward gradients are expected because of the predominance of wet surface conditions. The soils were found to have surface saturated hydraulic conductivities ranging from 2×10^{-8} m/s to 5×10^{-7} m/s.

2.3 Land Uses

Lands outside of the wetlands to the east, north and west of the spray irrigation lands are mostly in active agricultural use, except for some low-lying areas covered in bush or small trees.

There are residences and farm operations in proximity to the spray irrigation fields on Concession Rd. 8: one residence is immediately north of the South Field, the others are west of the North Field.

Land designations are mostly Agriculture, with the exception of:

- areas designated Environmental Protection–High around and upstream of Wainman's Creek, and in the area directly south of the South Field; and
- an area west of South Field to Barnstable Bay that is designated Shoreline Residential.

3 Existing Sewage Works

3.1 Approvals

The Bayshore Village Sewage Works were originally constructed under Certificate of Approval (C of A) No. 3-0304-77-006, dated June 1, 1977. They were upgraded under C of A No. 3-1337-81-827, dated November 25, 1982, and amended by notices dated June 6, 1985, July 7, 1992, April 18, 1994 and November 1, 1995.

The system currently operates under C of A No. 3-1337-81-968 issued July 17, 1996, and amended by a notice dated October 4, 1996. The C of A identifies an average daily flow rated capacity of 399 m^3/day. A copy of this certificate is included in Appendix A.

3.2 System Description

3.2.1 Wastewater Collection and Pumping

Two pumping stations serve the Bayshore Village development. The West Sewage Pumping Station (SPS), which serves approximately 30% of the development, and the East SPS, which serves the entire development. Two 16.7 L/s submersible pumps (one duty, one stand-by) in the East SPS convey wastewater via a 150 mm forcemain to the lagoons. Raw wastewater flows to the lagoons are measured at the East SPS.

3.2.2 Wastewater Treatment

The wastewater treatment system consists of a two-cell facultative waste stabilization pond, located 2.5 km north of the community on Sideroad 20, on Lot 21, Concession 7. Raw wastewater is pumped from the East SPS to Cell B (small lagoon) from where it flows by gravity to Cell A (large lagoon). The lagoons provide biological treatment and storage during the winter months when the effluent spray irrigation system is not in operation.

One lagoon was constructed in 1977 and the second lagoon was constructed in 1982. They were relined with imported clay in 1995.

The effective volume (excluding freeboard and sludge storage) of the small lagoon was estimated at 30,000 m^3 when lagoon level and sludge measurements were taken early in 2014. The effective volume of the large lagoon was estimated at 110,000 m^3 in 1995.

3.2.3 Effluent Disposal

During the spray irrigation season, effluent from the large lagoon is drawn from a concrete sump via a 250 mm diameter pipe to the pump house. The pipe is equipped with a rotating self-cleaning strainer.

The pump house consists of a 3 m by 3.6 m wood frame building that houses a 132 L/s effluent pump with variable speed drive, a pressure reducing valve, and a magnetic flow meter on a 300 mm diameter discharge line.

The lagoon effluent is spray irrigated on two fields adjacent to the lagoons. The typical spray irrigation season is 134 days from May 18 to September 28 each year.

The South Field covers an area of 23 ha immediately north of the lagoons on Lot 21, Concession 7. The North Field has an area of 18.6 ha, and is located just north of the South Field, north of Concession Rd. 8 on Lot 22, Concession 8. The Township uses approximately 13.6 ha in the South Field and 10 ha in the North Field for effluent spray irrigation. The remainder of the land is treed or low-lying. An aerial view of the existing sewage works is shown on Figure 2.

From 1977 to 1994, the Township was utilizing the South Field only. Following a two-year pilot testing program, the spray irrigation system was upgraded and expanded to distribute effluent to both the South and North Fields. As of 2017, the South Field has been in operation for 40 years, and the North Field has been in operation for 23 years.

The spray irrigation fields are equipped with above-ground irrigation piping and sprinklers:

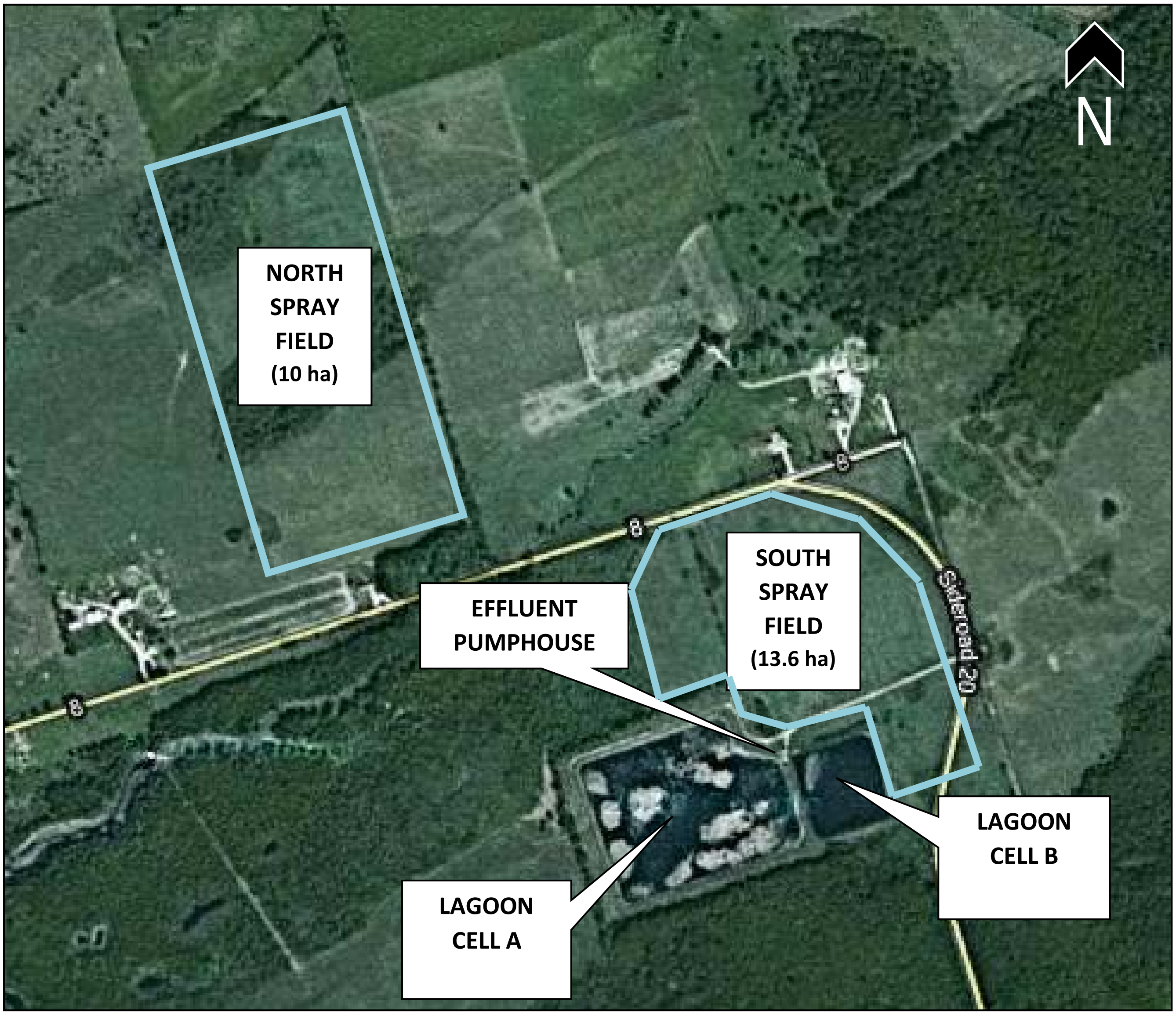
- The South Field has 4,066 m of 75 mm to 300 mm PVC piping, with 146 sprinklers.
- The North Field is connected by 634 m of 250 mm piping, and has approximately 3,560 m of 75 mm to 200 mm piping and 148 sprinklers.

3.3 Spray Irrigation System Design

Following a study by Beak Consultants Limited (1988), the South and North spray lands were divided into four management zones for the purposes of designing and operating the spray irrigation system. These zones were established based on the soil's ability to accommodate the application of effluent and on the depth to the water table. Table 1 presents the relevant soil characteristics reported by Beak (1988). In summary:

- Zone A contains soils with the greater hydraulic conductivities and the deepest unsaturated zone. These soils can accommodate higher effluent application rates.
- The hydraulic properties of Zone B are only slightly different than those of Zone A. The differences are the slightly lower surface saturated hydraulic conductivity and higher groundwater table.
- Half of the spray land falls into Zone C. These areas have reasonable hydraulic conductivities but the water table is closer to the surface than those of Zones A and B.
- Zone D is found in the North Field only. It has a significantly lower hydraulic conductivity.

Figure 2. Existing Sewage Works



Beak suggested a schedule of application rates as a starting point for the design, subject to further pilot testing and soil moisture measurements. The application rates include precipitation.

Table 1: Soil Characteristics by Zone and Original Proposed Schedule of Application (Beak)

Zone	Area (ha)	Saturated Hydraulic Conductivity (cm/s)		Application Rate		Application Periods		Total Application (m^3/yr)
		Surface Soli	Subsurface Soil	(mm)	(mm/hr)	(days)	No.	
A	5.4	10^{-4}	10^{-6} to 10^{-5}	75	9.4	7	14	57,000
B	4.6	5×10^{-5}	10^{-6} to 10^{-5}	60	7.5	8	12	33,000
C	11.7	$1.3 – 3.7 \times 10^{-5}$	Not given	50	6.25	9	11	64,000
D	1.6	1.9×10^{-6}	8.6×10^{-7}	30	3.75	12	8	3,800
Total	23.3							157,800

In 1994, Totten Sims Hubicki (TSH) initiated a spray irrigation pilot study as requested by the MOE prior to the use of the North Field. The report, relying extensively on Beak's hydrogeological investigation, established maximum hourly effluent application rates based on the soils' unsaturated hydraulic conductivities. These rates are shown in Table 2. The TSH application rates were conservative when compared with the unsaturated hydraulic conductivity and Beak's proposed application rates.

Table 2: TSH Pilot Study - Recommended Maximum Application Rates

Zone	Area (ha)	Estimated Surface Unsaturated Hydraulic Conductivity (mm/hr)	Hourly Application Rates (mm/hr)	Total Application (m^3/year)
A	6.53	3.6 to 36	3.6	35,182
B	6.45	3.6 to 36	3.6	34,790
C	11.35	Not given	1.33	61,152
D	1.63	Not given	0.07	940
Total	25.96			132,064

The pilot study concluded the entire content of the sewage lagoons could be disposed of adequately on the available 26 ha of spray lands over a 98-day period, using the application rates shown in Table 2. This is just two days short of the maximum number of spray days recommended by the MOECC. TSH recommended that the effluent be sprayed at the design maximum rates for a short period of time

- ranging from 1.5 to 4.1 hours - on each of these 98 days, so as not to exceed a daily total of 5.5 mm/d. This maximum value translates to 55 m^3/ha/d, the maximum application rate specified in the Certificate of Approval.

With a 134-day spray season, this approach includes 36 days for renewing the absorptive capacity of the soil between applications, and for providing an allowance for rainy and/or windy days when spraying is not permitted.

During the pilot study, instances of aerosol drift, ponding and runoff to the ditches along Sideroad 20 were observed and recorded. These problems were addressed by the hiring of a full-time inspector, whose responsibilities were to monitor and control the spray irrigation program closely. If ponding was observed, the area was allowed to dry up before spraying was resumed.

The TSH pilot study report also recommended annual aeration of the spray fields in order to improve the absorption capacity of the surficial soils and prevent consolidation with time, which would promote runoff.

3.4 Spray Irrigation System Operation

Township staff found the originally recommended operation of the Bayshore spray irrigation system difficult to implement. A full-time attendant is no longer employed, and as a result, spraying for short periods of time daily is not feasible. Further, varying the spraying duration between the various spray areas is difficult because of the labour involved and because of the pumping/piping design. Shutting off sprinklers in some areas causes excessive pressure in the piping in other areas resulting in breaks. The system appears to be designed with sufficient pumping capacity to spray all fields concurrently.

The operating practice has evolved to a system whereby the operators spray irrigate for 7 or 8-hour days over most of the available spraying land, but allow longer drying and recuperation periods between spray days. Currently, lagoon effluent is sprayed over approximately 85 to 95 days per season, at a rate of 1,200 m^3/day to 1,400 m^3/day. This application rate corresponds to between 4.6 mm/d and 6 mm/d. Zones A and B are used the most frequently. The spray irrigation operation is managed such that the rate of application does not exceed 55 m^3/ha/day, in accordance with the Certificate of Approval.

The typical method of operation of the spray irrigation system is as follows:

- The spray irrigation piping, including the piping across Wainman's Creek, and the spray nozzles are installed and pressure tested in May.
- The spray irrigation fields are inspected daily to determine whether conditions are favourable for spray irrigation. Spray irrigation is carried out when there is good weather (i.e., no rain and wind velocity less than 15 km/hr), no ponding of surface water on site, and sufficiently dry soils.

- If spraying is possible, the operator starts the effluent pump. A further inspection of the field is made to verify that sprinkler heads are operational. If problems are found such as broken pipes, clogged sprinkler heads, surface ponding, and aerosol drift, then the spray operation is modified, discontinued or repairs are completed as needed.

During periods when the fields are left to dry, the grass is cut to promote evapotranspiration. The grass is not removed from the fields.

As the spray fields' surface soils have become compacted over the years and their infiltrative capacity visibly reduced, it has become increasingly difficult for Township operators to spray irrigate the entire content of lagoon Cell A within the allowed 5-month spray irrigation period while meeting the preferred operational guidelines to minimize runoff. Runoff from less permeable areas occurs more frequently. During rainy summers when there is a limited opportunity to let the fields dry up between spray irrigation days, the effluent is at times sprayed when the soils are wet and the conditions are unfavourable, resulting in runoff to drainage ditches and Wainman's Creek.

The spray fields were not aerated in many years. In 2016, deep aeration was completed on the South Field. No significant improvement in the soil's infiltration capacity was noted.

3.5 Performance Monitoring

3.5.1 Lagoon Effluent

The quality of the lagoons effluent disposed by the spray irrigation system is summarized in Table 3, based on the average of lagoon content data collected in May and October each year since 2004. The data shows that the Bayshore Village lagoons produce effluent typical of secondary treatment facilities.

Table 3: Lagoon Content Characteristics (2004-2016 Averages)

Parameter	Concentrations in Large Lagoon (mg/L)
BOD_5	10
Suspended Solids	13
Total Phosphorus	0.9
Total Kjeldahl Nitrogen	2.8
Total Ammonia Nitrogen	1.3
Nitrate	0.3

3.5.2 Groundwater, Surface Water and Soil Quality

The impact of the effluent disposal on groundwater quality, surface water quality and soil characteristics is monitored by the following sampling program, which has been in place since 1995 in accordance with the Certificate of Approval:

- groundwater samples taken in six boreholes in and around the north and south fields;
- water samples taken in Wainman's Creek upstream and downstream of the spray fields; and,
- soil samples taken in the north and south spray fields.

Samples are taken:

- In May, before the start of the spray irrigation season;
- In August, during spraying; and,
- In October, after spraying was completed.

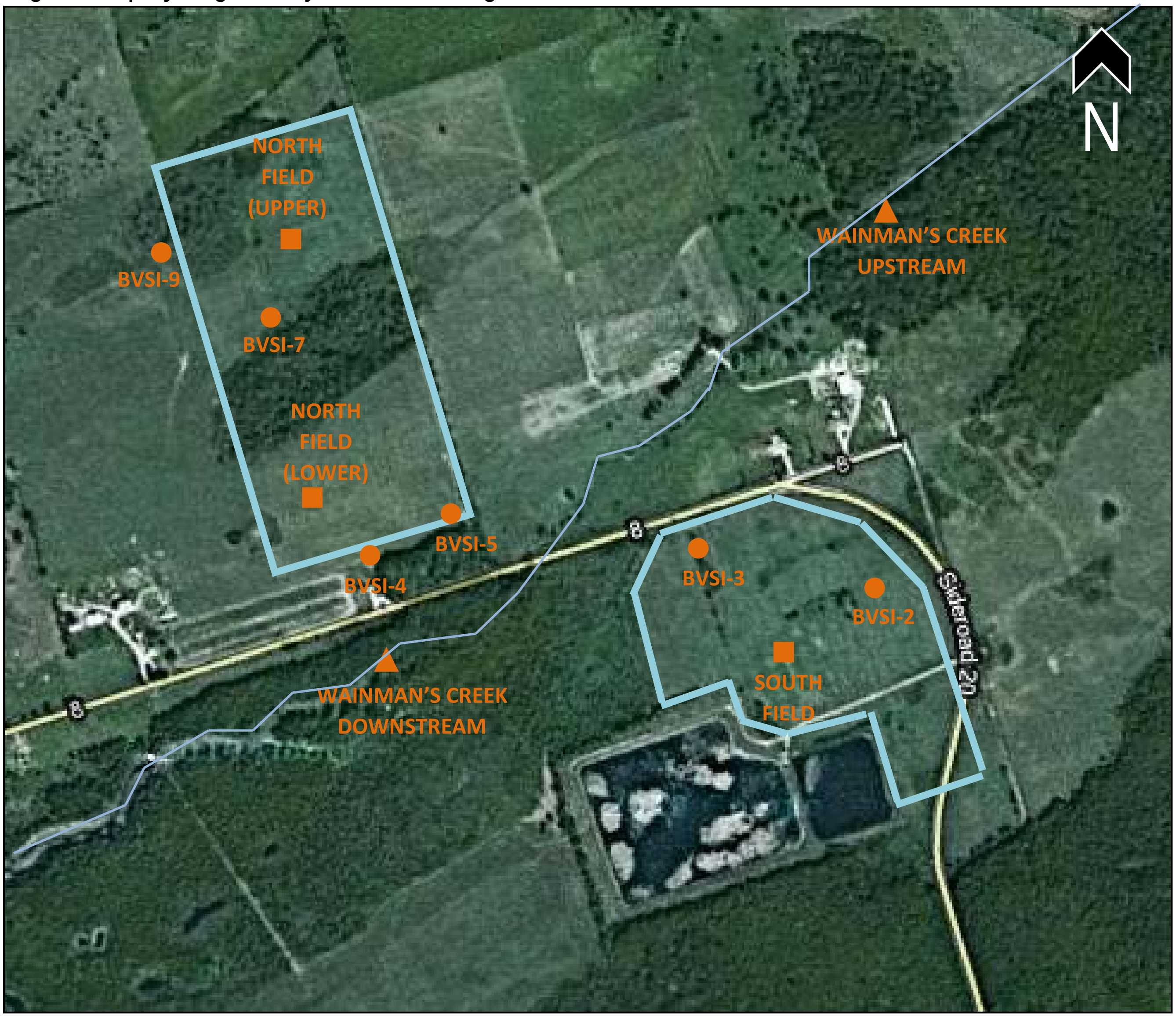
The locations of the sampling points are shown on Figure 3. All laboratory results from the monitoring program are tabulated and presented in graphs attached in Appendix B.

Groundwater quality is compared annually with the Ontario Drinking Water Standards, Objectives and Guidelines (ODWS) and with previous monitoring data to assess potential impacts and trends. High chloride levels have been noted, particularly at locations close to the road in the South Field. Concentrations of nitrogen, including TKN and TAN, are mostly undetectable during and after the spray irrigation season. Nitrate levels are very low. Effluent spray irrigation during the growing season does not add nitrogen because of the plants' nitrogen uptake. The overall average Total phosphorus concentration in groundwater is 0.1 mg/L.

Wainman's Creek water quality has frequently exceeded the phosphorus Provincial Water Quality Objective (PWQO) for streams of 0.03 mg/L. The data show very consistent water quality between the upstream and downstream sampling locations, indicating no impact from the spray irrigation operation. Using the ammonia results obtained from the upstream and downstream samples, unionized ammonia concentrations are below the PWQO. Surface water quality does not appear to have been impacted by the spray irrigation operation.

Soil core samples show localized increases in the concentration of some contaminants during the spray irrigation season. However, the concentration levels are consistent with levels recorded in previous years, and therefore do not show increases over the years. Higher concentrations of phosphorus are measured in the South Field than in the North Field.

Figure 3: Spray Irrigation System Monitoring Locations



LEGEND

- GROUNDWATER
- SURFACE WATER
- SOIL

4 Regulatory Context

4.1 Lake Simcoe Protection Plan

The construction and operation of sewage treatment facilities in the Lake Simcoe basin are regulated under the *Ontario Water Resources Act*, 1990 (OWRA). Further, O. Reg. 60/08 (amended under O. Reg. 130/09) Lake Simcoe Protection, governs point source discharges of phosphorus to Lake Simcoe.

The *Lake Simcoe Protection Act*, 2008 (LSPA) provides the framework for the development of the Lake Simcoe Protection Plan (LSPP). The LSPP, issued in June 2009, establishes objectives to protect and enhance the Lake Simcoe water quality, including reducing loadings of phosphorus and other nutrients of concern to Lake Simcoe and its tributaries. The LSPP sets out policies to prohibit the establishment of new municipal sewage treatment plants in the Lake Simcoe watershed. The MOECC released the Lake Simcoe Phosphorus Reduction Strategy in 2010. It includes compliance effluent concentrations and loadings for sewage treatment plants within the watershed.

The LSPA allows the creation of a water quality trading and offsetting program for phosphorus, with new regulations under OWRA. Phosphorus trading around Lake Simcoe is considered as a tool to achieve overall phosphorus loading reductions via financial incentives to implement Best Management Practices for urban, rural and agricultural runoff. A water quality trading program is not included in the Phosphorus Reduction Strategy, however remains under consideration by the MOECC.

The Bayshore Village Sewage Works is not listed as one of the municipal sewage treatment plants in the Lake Simcoe watershed (O. Reg. 60/08, amended by O. Reg. 130/09). This is believed to be because the facility does not have a direct effluent discharge to the lake. However, the LSPP objectives and policies to protect the lake's water quality and reduce phosphorus loadings apply to the Bayshore Village system as it is located within the watershed and in close proximity to the lake.

4.2 Source Water Protection

Under the *Clean Water Act*, 2006, source water protection plans were developed to protect municipal water supplies from various threats including sewage works. The Source Protection Plan for the South Georgian Bay Lake Simcoe Protection Region has defined the Well Head Protection Areas (WHPA) for the Bayshore Village municipal wells. The existing sewage lagoons and effluent spray irrigation fields are just outside of the Bayshore Village wells' WHPA 5-year capture zone.

5 Alternative Solutions

During the Class EA study, a long list of alternative solutions were considered and analyzed. These alternatives are described and assessed below.

5.1 List and Descriptions of Alternative Solutions

At the first PIC, the following alternative solutions were presented to address the original Problem Statement:

- Do Nothing
- Acquire additional land for effluent spray irrigation

Following the first PIC and receipt of comments and concerns with the operation of the spray fields (see Chapter 6), the Problem Statement was expanded and as a result, new alternative solutions were considered, and alternatives were modified. The long list of all alternatives considered during the Class EA study was as follows:

Alt. 1 Do nothing

Alt. 2 Alter spray irrigation practices

Alt. 3A Establish one new spray irrigation field

Alt. 3B Establish two new spray irrigation fields and abandon the North field

Alt. 4 Build an effluent recharge bed and abandon the North field only

Alt. 5 Discontinue spray irrigation and build an effluent recharge bed

Alt. 6 Discontinue spray irrigation, upgrade sewage treatment and discharge to Wainman's Creek

Alt. 7 Pump sewage or effluent to the Lagoon City STP

Alt. 8 Plant trees on the spray fields

5.1.1 Alternative 1: Do Nothing

Do Nothing at the Bayshore Village Sewage Works involves continuing with the current spray irrigation operation with the existing equipment on the existing spray fields. It would not result in any additional capital costs or changes in operating costs other than any ongoing maintenance costs.

The main concerns with Do Nothing are that:

- The existing spray fields do not provide any spare effluent disposal capacity to take a field out of service for rejuvenation.
- It is likely to result in further deterioration of the soil conditions and further reduction in the effluent disposal capacity, leading to increased potential for ponding, runoff and contamination of ditches, Wainman's Creek and Lake Simcoe.
- There will become more and more difficult to dispose of the lagoon content over the allowed spray irrigation period.
- The existing above-ground irrigation piping and spray nozzles require labour intensive setup and maintenance.
- The concerns of the adjacent residents with the spray irrigation operation are not addressed.

5.1.2 Alternative 2: Alter Spray Irrigation Practices

This alternatives involves making changes to the current spray irrigation operation without implementing any significant capital upgrades or modifications.

All existing spray fields and equipment would be maintained. The spray irrigation scheduling would be modified to reduce the spray irrigation frequency to provide a one-week period between spray irrigation events to ensure the clay soils dry up between applications and thus allow spray irrigation at the design application rates with minimal runoff.

Lagoon effluent UV disinfection would be implemented to mitigate local residents' concerns with aerosols from the spray irrigation operation.

Although this alternative would decrease the potential for ponding and runoff, has a low capital cost, and mitigates local residents' concerns with the spray irrigation operation, it would reduce the available effluent disposal capacity to 60% of the required capacity. Therefore reducing the number of spray days, on its own, cannot meet the Township needs and address the Problem Statement.

5.1.3 Alternative 3A: Establish One New Spray Irrigation Field

This alternative involves acquiring 16 ha of additional land for spray irrigation, such as the field west of the lagoons, and equipping this new land with spray irrigation equipment.

Including the existing spray fields and equipment (23.6 ha), there would be a total of 40 ha of land set-up for effluent spray irrigation. The additional spray irrigation land would allow part of a field to be taken out of service on a rotational basis for a year, to till it and rebuild its infiltration capacity, providing approximately 20% spare capacity.

The additional land would allow the spray irrigation scheduling to be modified to reduce the frequency, providing a one-week drying period between spray irrigation events and thus allow spray irrigation at the design application rates with minimal runoff.

UV disinfection of the lagoon effluent prior to spray irrigation would be added, as well as tree buffers at Concession Road 8, to mitigate residents' concerns with aerosols from the spray irrigation operation.

This alternative maintains and expands the current effluent disposal approach in a manner that provides spare capacity and reduces the potential for runoff and contamination of the receiving waters.

However, there remains potential for surface runoff to occur occasionally if there is more precipitation than normal and fields cannot dry sufficiently between spray applications. Further, the operation and maintenance of a spray irrigation system remains a labour intensive process, particularly if fields need to be isolated to optimize the application frequencies.

The estimated capital cost of this alternative is $1 M, excluding land acquisition costs.

5.1.4 Alternative 3B: Establish Two New Spray Irrigation Fields and Abandon the North Spray Fields

This alternative is the same as Alternative 3A except that two new spray irrigation fields would be set up and the North Fields would be abandoned.

The North Fields are currently not used extensively due to their lower infiltration capacity and to minimize potential aerosol impacts on immediately adjacent residents. The two new fields, potentially one to the west and one to the east of the existing South Field, would add approximately 22 ha of spray irrigation area. Including the existing South Field, the total spray area would be 36 ha. The new fields would provide adequate buffers from existing residences and would provide approximately 20% spare capacity as per Alternative 3A. It would be more expensive than Alternative 3A.

As for Alternative 3A, there remains potential for surface runoff to occur occasionally if there is more precipitation than normal, and effluent is spray irrigated before the soils have dried up. Further, the operation and maintenance of a spray irrigation system remains a labour intensive process, particularly if fields need to be isolated to optimize the application frequencies.

This alternative was not considered further and was not presented at PIC No. 2 as it does not offer any further advantage to Alternative 3A but would incur additional costs to set up two new spray irrigation fields.

5.1.5 Alternative 4: Build an Effluent Disposal Bed and Abandon the North Fields

This alternative would involve utilizing two effluent disposal approaches: spray irrigation and subsurface disposal. Spray irrigation would continue on the South Field. The North Field would be abandoned. Additional land would be acquired on which a fully-raised effluent disposal bed would be constructed for the disposal of the remaining effluent volume.

The effluent disposal bed, with a capacity of 330 m^3/day would be dosed year-long with lagoon effluent, after a minimum treatment period in the lagoons and effluent filtration. Due to the clay soils and high groundwater table, a raised tile bed would be required with a large sand mantle, covering a total area of about 5 ha. The remainder of the effluent would be disinfected by UV and spray irrigated during the summer months on the South Field. This approach would be designed to provide approximately 20% spare effluent disposal capacity, with a reduced spray irrigation frequency to provide a drying period between spray irrigation events. Tree buffers would also be added along Concession Road 8.

This approach was considered as it would reduce the volume of effluent that is spray irrigated and therefore the potential for effluent runoff and potential negative impacts on the adjacent residents.

However, the capital costs would be significant for a large raised bed constructed with imported sand. The estimated cost of this alternative is $4.1 M. Further, the operating and maintenance requirements of the multiple tile bed cells dosing systems would be onerous, and there remains the risk of effluent breakout due to the impermeable native soils on which the effluent disposal bed would be constructed.

5.1.6 Alternative 5: Discontinue Spray Irrigation and Build an Effluent Disposal Bed

This alternative would involve abandoning spray irrigation as the effluent disposal method, and disposing all the lagoon effluent in a large (400 m^3/day) raised disposal bed. The bed would require the acquisition of a land area of approximately 7 ha as the loading rate is low due to the low permeability native soils.

The advantage of this approach is that it reduces the potential for runoff and aesthetic negative impacts of spray irrigation. However the capital costs are high due the large amount of fill material to be imported to build the bed (estimated at $4.5 M plus land acquisition costs). Further, there remains the potential for effluent breakout from a fully raised bed built on relatively impermeable soils. As the life of a disposal bed is limited, the bed would need to be replaced in 20 to 30 years.

5.1.7 Alternative 6: Discontinue Spray Irrigation, Upgrade STP and Discharge Effluent to Wainman's Creek

This alternative involves discontinuing the spray irrigation operation and replacing it with a direct effluent discharge to Wainman's Creek, which flows to Lake Simcoe. It would require upgrading the sewage lagoons with the addition of a 400 m^3/day tertiary treatment facility. The estimated capital cost of Alternative 6 is $3 M.

The secondary effluent from the lagoons would be treated with chemical addition and filtration, to achieve a high level of phosphorus removal (best available technology can achieve a total phosphorus effluent concentration of 0.05 mg/L), as well as UV for disinfection. At this effluent concentration, the annual phosphorus load would be 7.3 kg/year. The additional level of treatment could achieve a reduction to the estimated current phosphorus load to the lake from the effluent spray irrigation operation through groundwater and runoff.

The current phosphorus load from the Bayshore Village sewage works reaches Lake Simcoe from diffused groundwater discharge and from occasional runoff. It is expected that some phosphorus attenuation occurs by absorption in the soils and uptake from plants. The historical (1988 to 2016) phosphorus concentrations measured in the spray fields' groundwater monitoring wells have ranged from less than 0.03 mg/L to 3 mg/L, with seasonal and local variations, with an overall average of 0.11 mg/L. Total phosphorus levels in Wainman's Creek have ranged between 0.02 mg/L and 0.9 mg/L, with an average of 0.06 mg/L (1994-2016), at both upstream and downstream monitoring locations.

The effluent could be discharged either directly to Wainman's Creek or to the wetland area that is drained by Wainman's Creek. Although discharging the STP effluent to the adjacent wetland is expected to be beneficial in terms of reducing nutrient loadings to the lake, the effluent compliance criteria would be met at the discharge from the STP.

The advantage of this alternative is that it ensures that only tertiary-treated effluent is discharged to Lake Simcoe (eliminates the potential for the runoff of secondary-treated effluent) and addresses the related concerns of adjacent residents. It provides the required effluent disposal capacity without limitations caused by the soil's infiltrative capacity and unfavourable weather for spray irrigation. It also provides a well-defined effluent point source that can be easily controlled and monitored.

The main disadvantage of this alternative is that it will be very difficult to obtain approval for a direct effluent discharge to Lake Simcoe. The LSPP prohibits any new municipal sewage treatment plants in the Lake Simcoe watershed. Lake Simcoe Protection Plan's Policy 4.3DP states that a new municipal sewage treatment plant cannot be established in the Lake Simcoe watershed, unless the new plant is intended to replace an existing municipal STP, or it services a development where one or more sub-surface sewage systems are failing. Review of this policy with the MOECC indicated that:

- The Bayshore Village Sewage Works is not included in the list of existing municipal sewage treatment plants (O. Reg.60/08 amended by O. Reg.130/09)) because it does not discharge directly to Lake Simcoe.

- A spray irrigation system does not fit the definition of a sub-surface disposal system or on-site sewage system under the LSPP. Therefore as stated, Policy 4.3DP cannot be used to enable approval of a new direct-discharging STP to Lake Simcoe.

The MOECC indicated that Policy 4.3DP would need to be amended or clarified to state it applies to effluent spray irrigation systems. Further, the Township would have to demonstrate that the spray irrigation system is failing. The STP would also have to not increase the phosphorus load to the watershed, i.e., the phosphorus load from the new effluent discharge would have to be less than it was with the spray irrigation effluent disposal system.

5.1.8 Alternative 7: Pump Sewage or Effluent to Lagoon City STP

This alternative involves pumping the effluent from the Bayshore Village lagoons to the Lagoon City STP. The effluent forcemain's route via municipal roads and Highway 12 would be approximately 15 km long. Alternatively, the forcemain could be routed via the abandoned railway line which cuts through wetlands from Concession Road 7 to the Lagoon City STP. This alternate route is approximately 7.5 km long and presents a number of challenges, including difficult construction access in the wetland areas and potential environmental impacts on the wetlands, and need to acquire municipal easements along the railway line.

Construction costs would be extremely high. Operational and maintenance concerns would include odour control and regular flushing of a long sanitary forcemain. Residual capacity at the Lagoon City STP is currently available but capacity for Bayshore Village would be borrowed against capacity allocated for growth in Brechin and Lagoon City. Additional flows would trigger the need for the addition of tertiary filters at the Lagoon City STP to meet the phosphorus limit to Lake Simcoe.

This option was not considered viable and was not considered further.

5.1.9 Alternative 8: Plant Trees on the Spray Fields

At the suggestion of the local MOECC, the option of planting willows or poplars on the spray field was investigated. It was determined that the trees can uptake nutrients, however the evapotranspiration rate achieved with a willow or poplar plantation only results in a small increase in effluent disposal capacity. Further, the trees do not grow well in heavy clay soils. Other disadvantages include the costs of maintaining/weeding a tree plantation and the absence of a market for the wood once it is harvested.

This option was not considered further.

5.2 Assessment of Alternatives

Table 4 overleaf presents a comparative assessment of the alternatives that were not screened out. The assessment table compares the alternatives on the basis of technical and operational criteria; potential impacts on the natural environment including the potential for contamination of the lake water; potential impacts on adjacent properties; and capital and operating costs. Project cost estimates for these alternatives are enclosed in Appendix C.

Table 4: Assessment of Alternatives

	Alternative 1	Alternative 2	Alternative 3A	Alternative 3B	Alternative 4	Alternative 5	Alternative 6
	EXISTING SPRAY FIELDS		NEW SPRAY IRRIGATION FIELDS		SPRAY IRRIGATION FIELD AND DISPOSAL BED	DISPOSAL BED	DISCHARGE TO LAKE
	Do Nothing	Alter Spray Irrigation Practices	Establish One New Spray Irrigation Field	Establish Two New Spray Irrigation Fields and Abandon North Spray Fields	Build Effluent Disposal Bed and Abandon North Spray Fields	Build Effluent Disposal Beds and Discontinue Spray Irrigation	Discontinue Spray Irrigation, Upgrade Sewage Treatment and Discharge Effluent to Wainman's Creek
Description	Continue with current spray irrigation operations on existing fields.	Maintain existing spray fields. Reduce application frequency. Add effluent UV disinfection.	Maintain existing 23.6 ha spray fields. Reduce application frequency. Establish new 16 ha spray field. Add effluent UV disinfection. Add tree buffers.	Abandon North spray fields. Maintain South 13.6 ha spray field. Reduce application frequency. Establish two new spray fields (22 ha). Add effluent UV disinfection. Add tree buffers.	Abandon North spray fields. Maintain South 13.6 ha spray field. Reduce application frequency. Build new 5 ha raised effluent disposal bed on new land. Add UV disinfection. Add tree buffers.	Discontinue spray irrigation. Build new 7 ha raised effluent disposal bed on new land.	Discontinue spray irrigation. Upgrade sewage lagoons with tertiary treatment for phosphorus removal and UV disinfection. Add effluent outfall to Wainman's Creek.
TECHNICAL CRITERIA							
Maintains the Required Effluent Disposal Capacity?	No. With time, the infiltrative capacity of the soils will continue to deteriorate.	No. Reduced application frequency would reduce the volume of effluent that can be spray irrigated over the authorized May - October period.	Yes. It will provide 20% spare capacity, sufficient to take fields out of service for aerating or tilling and maintain the required effluent disposal capacity.	Yes. It will provide 20% spare capacity, sufficient to take fields out of service for aerating or tilling and maintain the required effluent disposal capacity.	Yes. It will provide 20% spare capacity, sufficient to take fields out of service for aerating or tilling and maintain the required effluent disposal capacity.	Yes. The new disposal bed will be designed for the required effluent disposal capacity.	Yes. The required effluent disposal capacity will be provided.
	No	No	Yes	Yes	Yes	Yes	Yes
Provides Operational Flexibility?	Does not improve operational flexibility.	Does not improve operational flexibility.	Spare field will provide flexibility to take spray fields out of service, as needed.	Spare field will provide flexibility to take spray fields out of service, as needed.	Spare disposal capacity will give flexibility to take spray fields or disposal bed cells out of service, as needed.	Spare disposal cdDisposal bed cells out of service, as needed.	STP would be designed to provide operational flexibility and redundancy.
	No	No	Yes	Yes	Yes	Yes	Yes
Operation and Maintenance Requirements	Labour-intensive set-up and maintenance of above-ground piping and nozzles.	Labour-intensive set-up and maintenance of above-ground piping and nozzles.	Labour-intensive set-up and maintenance of above-ground piping and nozzles. O&M for new spray field & equipment and for UV.	Less above-ground piping and nozzles will reduce set-up and maintenance work. O&M for new spray fields and equipment and for UV.	Less above-ground piping and nozzles will reduce set-up and maintenance work. O&M for disposal bed area and dosing pumps, and for UV.	O&M for disposal bed area and dosing pumps only.	More complex O&M of treatment and pumping equipment, and maintenance of stringent effluent quality criteria.
	High	High	Higher	High	High	Less	High
Permits and Approval Requirements	No approvals required.	MOECC approval required for UV equipment.	MOECC approval required for additional field and UV equipment.	MOECC approval required for additional fields and UV equipment.	MOECC approval required for new disposal bed and UV equipment.	MOECC approval required for new disposal bed.	MOECC approval for effluent discharge to Lake Simcoe will be difficult to obtain due to LSPP policies.
	None	Obtainable	Obtainable	Obtainable	Obtainable	Obtainable	Difficult

	Alternative 1	Alternative 2	Alternative 3A	Alternative 3B	Alternative 4	Alternative 5	Alternative 6
	EXISTING SPRAY FIELDS		NEW SPRAY IRRIGATION FIELDS		SPRAY IRRIGATION FIELD AND DISPOSAL BED	DISPOSAL BED	DISCHARGE TO LAKE
NATURAL ENVIRONMENT AND CULTURAL/HERITAGE IMPACTS							
Surface Water Quality	Potential for contamination of ditches, Wainman's Creek and Lake if runoff occurs as a result of reduced soil infiltrative capacity.	Reducing application frequency will reduce potential for surface water contamination from spray field runoff.	Reducing application frequency will reduce potential for surface water contamination from spray field runoff.	Abandoning fields with lowest infiltrative capacity will reduce potential for surface water contamination from spray field runoff.	Abandoning fields with lowest infiltrative capacity will reduce potential for surface water contamination from spray field runoff. Potential for effluent breakout from raised bed if overloaded.	Discontinuing spray irrigation will eliminate potential for surface water contamination from spray field runoff. Potential for effluent breakout from raised bed if overloaded.	Tertiary STP will produce high effluent quality to meet provincial surface water quality objectives. Effluent quality will be monitored and controlled to comply with MOECC criteria. STP effluent discharge can be interrupted and flow contained in existing lagoons if upset at STP.
	Potential Negative Impact	Less Potential Impact	Less Potential Impact	Less Potential Impact	Lower Potential Impact	Least Potential Impact	Least Potential Impact
Groundwater Quality	Low potential for contamination of groundwater.	Low potential for contamination of groundwater.	Low potential for contamination of groundwater.	Low potential for contamination of groundwater.	Low potential for contamination of groundwater.	Low potential for contamination of groundwater.	No potential for contamination of groundwater.
	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	No Potential Impact
Woodlands, Wetlands and Vegetation	No potential impacts. Spray irrigation fields are near but outside a wetland, and are farmed.	No potential impacts. Spray irrigation fields are near but outside a wetland, and are farmed.	Low potential impacts. Proposed new field is near but outside wetland areas. It has no significant woodlands or vegetation.	Low potential impacts. Proposed new fields are near but outside wetland areas. They have no significant woodlands or vegetation.	Low potential impacts. Proposed new beds are near but outside wetland areas. They have no significant woodlands or vegetation.	Low potential impacts. Proposed new beds are near but outside wetland areas. They have no significant woodlands or vegetation.	Low potential impacts. STP and outfall site on Township's existing spray field. Few if any existing vegetation would be removed for construction.
	No Potential Impact	No Potential Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact
Wildlife and Habitat	No potential impacts. Spray irrigation fields are farmed. They are near but outside potential wildlife habitat, and are not within an ANSI.	No potential impacts. Spray irrigation fields are farmed. They are near but outside potential wildlife habitat, and are not within an ANSI.	Low potential impacts. Proposed new field is near but outside potential wildlife habitat.	Low potential impacts. Proposed new fields are near but outside potential wildlife habitat.	Low potential impacts. Proposed new beds are near but outside potential wildlife habitat.	Low potential impacts. Proposed new beds are near but outside potential wildlife habitat.	Low potential impacts. STP and outfall site on Township's existing spray field. No potential wildlife habitat affected during construction.
	No Potential Impact	No Potential Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact
Archaeological and Heritage Resources	No potential impacts.	No potential impacts.	Stage 1 archaeological assessment would be completed to determine archaeological potential of proposed field. Full mitigation if artefacts are found.	Stage 1 archaeological assessment would be completed to determine archaeological potential of proposed fields. Full mitigation if artefacts are found.	Stage 1 archaeological assessment would be completed to determine archaeological potential of proposed beds. Full mitigation if artefacts are found.	Stage 1 archaeological assessment would be completed to determine archaeological potential of proposed beds. Full mitigation if artefacts are found.	No potential impacts. STP and outfall site on Township's existing spray field.
	No Potential Impact	No Potential Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	Low Potential Negative Impact	No Potential Impact

	Alternative 1	Alternative 2	Alternative 3A	Alternative 3B	Alternative 4	Alternative 5	Alternative 6
	EXISTING SPRAY FIELDS		NEW SPRAY IRRIGATION FIELDS		SPRAY IRRIGATION FIELD AND DISPOSAL BED	DISPOSAL BED	DISCHARGE TO LAKE
SOCIO-ECONOMIC ENVIRONMENT IMPACTS							
Public Health	If ponding and runoff occur, potential for more breeding of mosquitoes and localized bacterial contamination of Wainman's Creek and Lake Simcoe. Potential for wind dispersion of microbiological aerosols.	Lower potential for public health concerns from reduced potential for ponding and runoff. Effluent UV would eliminate potential for microbiological aerosols.	Lower potential for public health concerns from reduced potential for ponding and runoff. Effluent UV would eliminate potential for microbiological aerosols.	Lower potential for public health concerns from reduced potential for ponding and runoff. Effluent UV would eliminate potential for microbiological aerosols.	Lower potential for public health concerns from reduced potential for ponding and runoff. Effluent UV would eliminate potential for microbiological aerosols, but bed breakout may occur.	Very low potential for public health concerns as potential for ponding, runoff and aerosols is eliminated, but bed breakout may occur.	Very low potential for public health concerns. Highly treated and disinfected effluent discharged to Wainman's Creek, which is not used for recreation.
	Potential Negative Impact	Less Potential Impact	Less Potential Impact	Less Potential Impact	Less Potential Impact	Very Low Potential Impact	Very Low Potential Impact
Existing Land Uses and Property Values	No change to existing land uses or to impacts on adjacent land uses (agricultural). Adjacent property values may be affected by current issues with effluent spray operation.	No change to existing land uses or to impacts on adjacent land uses (agricultural). Adjacent property values may be affected by current issues with effluent spray operation.	New spray field is in rural area and will be used for agriculture. Minor change to existing land use. Minor reduction in impacts on adjacent agricultural uses. Adjacent property values may be slightly less affected by effluent spray operation.	New spray fields are in rural area and will be used for agriculture. Changes to existing land uses. Reduction in impacts on adjacent agricultural uses. Adjacent property values may be less affected by effluent spray operation.	New disposal bed is in rural area and will not be used for agriculture. Changes to existing land uses. Reduction in impacts on adjacent agricultural uses. Adjacent property values may be less affected by effluent spray operation.	New disposal beds are in rural area and will not be used for agriculture. Changes to existing land uses. Reduction in impacts on adjacent agricultural uses. Adjacent property values not expected to be affected by effluent disposal beds.	Changes to existing land uses. Reduction in impacts on adjacent agricultural uses. Adjacent property values not expected to be affected by proximity of STP and outfall.
	Negative Impact	Negative impact	Less Negative impact	Less Negative Impact	Less Negative Impact	Improvement	Improvement
Aesthetic Impacts (Noise, Visual, Odour)	Spray irrigation operation does not cause noise or have odours. Minor visual impacts from sprinklers.	Spray irrigation operation does not cause noise or have odours. Minor visual impacts from sprinklers.	Spray irrigation operation does not cause noise or have odours. Visual impacts from sprinklers minimized by tree buffers. Additional spray field not visible to neighbouring residents.	Spray irrigation operation does not cause noise or have odours. Visual impacts from sprinklers minimized by tree buffers. Additional spray field not visible to neighbouring residents.	Spray irrigation and disposal bed do not cause noise or have odours. Visual impacts from sprinklers minimized by tree buffers and fewer spray fields. New disposal bed not visible to neighbouring residents.	Disposal beds do not cause noise or have odours. New disposal beds have very minor visual impact.	Potential for minor noise and odour from STP. Minor visual impact from new building can be mitigated by landscaping.
	Minor negative impact	Minor negative impact	Less Negative impact	Less Negative impact	Least Negative Impact	Improvement	Least Negative Impact
Temporary Construction Impacts	No construction required.	No construction required.	Installation of piping and equipment for one new spray field would cause very minor disruption to local residents or traffic.	Installation of piping and equipment for two new spray fields would cause very minor disruption to local residents or traffic.	Construction of disposal bed and installation of piping would cause minor disruption to local residents or traffic.	Construction of disposal bed and installation of piping to new beds would cause minor disruption to local residents or traffic.	Construction of new STP and outfall would cause minor disruption to local residents or traffic.
	No Potential Impact	No Potential Impact	Very Minor Potential Impact	Very Minor Potential Impact	Minor Potential Impact	Minor Potential Impact	Minor Potential Impact
Capital Costs	None.	UV equipment in pump house expansion. Additional piping and valves.	Irrigation equipment, piping and UV equipment in pump house expansion	Irrigation equipment, piping and pumps for two fields, plus UV equipment in pump house expansion.	Disposal bed, piping and pumps to bed, plus UV equipment in pump house expansion.	Disposal bed, and piping and pumps to bed.	Sewage treatment equipment in new building, and outfall.
	None	$0.29 M	$1.0 M	$1.4 M	$4.1 M	$4.5 M	$3.0 M

	Alternative 1	Alternative 2	Alternative 3A	Alternative 3B	Alternative 4	Alternative 5	Alternative 6
	EXISTING SPRAY FIELDS		NEW SPRAY IRRIGATION FIELDS		SPRAY IRRIGATION FIELD AND DISPOSAL BED	DISPOSAL BED	DISCHARGE TO LAKE
Land Acquisition	None	None	Land acquisition (16 ha).	More land acquisition (22 ha).	Land acquisition (16 ha).	Land acquisition (16 ha)	No land acquisition.
Operating and Maintenance Costs	No change.	Increase in labour costs to isolate fields for variable spray rates.	Increase in electricity costs to pump to new field. Increase in labour costs for additional irrigation equipment.	Increase in electricity costs to pump to two new fields. Reduction in labour costs due to new irrigation equipment.	Increase in electricity costs to pump to new bed. Increase in labour costs for additional dosing equipment and for cutting grass. Less labour for O&M of spray fields.	Increase in electricity costs to pump to new beds. Increase in labour costs for additional dosing equipment and for cutting grass. Eliminates O&M of spray fields.	Increase in electricity costs for additional mechanical equipment. Increase in labour costs for complex STP O&M. Chemical costs. Eliminates O&M of spray fields.
	No Change	Minor Increase	Increase	Increase	Minor Increase	Minor Increase	Increase

The following summarizes the conclusions of the assessment of alternative solutions:

- Continuing the operation of the existing spray irrigation fields, with or without modifications to the spraying frequency (Alt. 1 and 2), is not a viable solution as it cannot provide sufficient effluent disposal capacity to enable the operation of the spray irrigation system without potential runoff and associated impacts.

- Establishing additional spray irrigation fields (Alt. 3A and 3B) can provide the spare effluent disposal capacity to give the required operating flexibility, if sufficient adjacent land with reasonable soil conditions can be acquired. However, there remains the concerns that spray irrigation of the lagoon content during the May to October period without potential environmental impacts, is contingent on favourable weather. This is a significant risk factor as the soils in the area do not allow a high infiltration rate, which would have mitigated the concerns with the limited number of suitable spray irrigation days.

- Constructing a large communal effluent disposal bed, as a stand-alone solution (Alt. 5), or in conjunction with maintaining one spray field (Alt. 4), can also provide the required effluent disposal capacity, and reduce the potential impacts of the current spray irrigation operation. Operation and maintenance work would be reduced, and potential impacts on the adjacent residents would be lessened. However, the cost of a large disposal bed is high as it would be a raised bed constructed of imported fill due to the low permeability of the native soils and high groundwater table.

- Adding a tertiary treatment facility for the removal of phosphorus from the lagoon effluent, with continuous discharge of the treated and disinfected effluent to Wainman's Creek (Alt. 6) can provide the required effluent disposal capacity and eliminate the operational concerns of the spray irrigation system. As the effluent would be treated to a very high level, impacts on the water quality of the receiving water and Lake Simcoe will be minimized. Implementation of this alternative is not currently allowed under the policies of the LSPP and therefore it will be difficult to obtain an approval from the MOECC.

5.3 Preferred Solutions

Upon review of all alternatives considered and extensive discussions with the Township as well as consultation with the public and review agencies, as presented in Chapter 6, the preferred solution to address the problem statement is Alternative 6, Discontinue Spray Irrigation, Upgrade the Sewage Treatment Plant and Discharge Effluent to Wainman's Creek.

The direct discharge of tertiary treated effluent provides a well-controlled and monitored means of effluent disposal that is more appropriate than subsurface disposal at this location. It can be designed with the highest level of treatment technology to minimize the amount of phosphorus discharged to Wainman's Creek. The design could incorporate a wetland discharge to attenuate any potential impact on Lake Simcoe from the residual nutrients in the effluent. This solution also provides the opportunity for future improvements to sanitary servicing of adjacent lakefront communities that are currently relying on individual tile beds.

However, the preferred solution is considered a long-term solution because obtaining approval for the construction of a tertiary treatment facility with a direct discharge is contingent on: further discussions with the MOECC regarding the policies of the LSPP; revisions to these policies to acknowledge Bayshore Village as an existing municipal sewage treatment plant in the Lake Simcoe watershed; and further studies as may be required by the MOECC. It is acknowledged that further analysis may be required to demonstrate the acceptability of the impacts of a direct effluent discharge when compared with the existing conditions, to identify the opportunities for future benefits when considering servicing of adjacent lakefront communities and to consider Township-wide means of reducing phosphorus loads to the lake.

In the shorter-term, until a tertiary effluent surface discharge can be implemented, to address the immediate concerns and operational issues with the effluent spray irrigation operation, establishing an additional spray irrigation field (Alt. 3A) is recommended. This alternative will require the purchase, expropriation or lease of approximately 16 ha of adjacent land and the purchase of spray irrigation equipment. Increasing the available spray irrigation land will enable a significant reduction in the overall effluent application rate, and the rotation of the spray irrigation over three fields will allow the operators to increase the drying time between spray days.