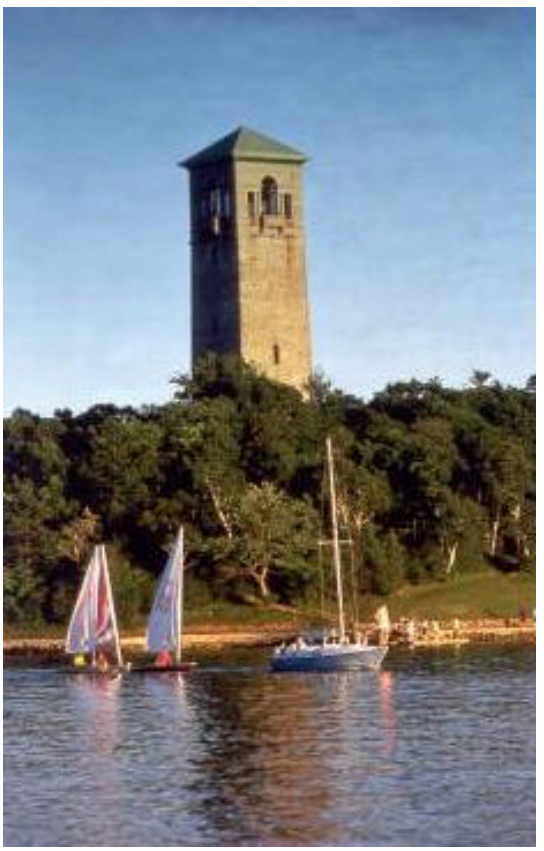
HALIFAX
REGIONAL MUNICIPALITY

HALIFAX HARBOUR SOLUTIONS PROJECT
REVISED PROJECT DESCRIPTION



October 2002

Jacques Whitford
Environment Limited

PROJECT NO. NSD13960-6027

HALIFAX HARBOUR SOLUTIONS PROJECT

REVISED PROJECT DESCRIPTION

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PREFACE

This document has been prepared to provide a summary of the current Halifax Harbour Solutions Project (HHSP) incorporating Project modifications and clarification filed (HRM 2002a, 2002b, 2002c) subsequent to the initial filing of the Environmental Screening (HRM 2001). The reader is encouraged to refer to the Environmental Screening (HRM 2001) and subsequent addenda (HRM 2002a, 2002b, 2002c) for additional detailed information on the Project and the predicted environmental effects. This document may not reflect all modifications to the project description negotiated between HRM and HREP subsequent to the filing of the Environmental Screening and addenda.

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1.0 PROJECT OVERVIEW

The regional sewage treatment Project for Halifax Harbour is proposed to include construction and operation of three Sewage Treatment Plants (STPs) (Halifax Peninsula; Dartmouth; and Herring Cove) and associated collection systems that will provide advanced primary level of treatment with UV disinfection. Initial average daily STP capacity flows for the four STPs are estimated to total 2.7 m^3/s, with peak flows totaling 7.04 m^3/s. Future (2041) average daily flows are anticipated to reach 3.31 m^3/s with peak flows totaling 8.68 m^3/s (HRM 2000). Each STP will have a marine outfall and diffuser for discharge of treated effluent. All STPs will include onsite sludge dewatering.

The STPs will be designed, built and operated by Halifax Regional Environmental Partnership (the Company) while the collection systems will be built by the Company but operated by HRM. A sludge management facility will be constructed, owned and operated by the Company. Plants and associated infrastructure would be constructed over approximately a five-year schedule, with the timing and ultimate completion based on funding availability. The primary source of funding (two-thirds of the capital costs and all of the operating costs) for the Project is a pollution control surcharge applied to HRM municipal water use charges. HRM is currently seeking the remaining one-third of capital funding required from federal and provincial levels of government.

2.0 PROJECT LOCATION AND SCOPE

Major untreated outfalls exist along both the Halifax Peninsula and Dartmouth waterfronts from the Narrows to the harbour mouth, with an additional untreated outfall outside the harbour mouth near Herring Cove carrying sewer discharge from Mainland South Halifax. The proposed concept involves: one STP to serve Dartmouth and be located on a portion of the Coast Guard base south of the downtown Dartmouth; one STP to be located south of the harbour Narrows, on Barrington and Cornwallis Streets to serve the Halifax Penninsula; and a third STP located in Herring Cove to serve Mainland South. A sludge management facility will be located at a proposed site in the Aerotech Industrial Park near Halifax Airport.

HRM currently owns or is in the process of acquiring land for the three STP sites. Outfall and diffuser locations are based on: sufficient depth and current to achieve adequate mixing of treated effluent; proximity to the STPs; and avoidance of conflicts with navigation and anchoring. The Company will develop the final site plan for the outfalls and diffusers and obtain pertinent approvals such as those required by the *Navigable Waters Protection Act*, *Fisheries Act*, *Canadian Environmental Protection Act* (Disposal at Sea).

The collection infrastructure is proposed to consist of a combination of limited tunnelling, with the remainder of the sewage collection pipes installed in surface trenches. Some pumping with forcemains will be required, but gravity mains will be used whenever possible.

At a minimum, the STPs will provide advanced primary treatment. This level of treatment includes mechanical solids separation augmented by chemical treatment to enhance removal of suspended solids. Effluent will be disinfected with ultraviolet (UV) light prior to discharge. The proposed plant design and sites will provide for the possible future addition of secondary treatment processes should this become necessary, as well as future capacity expansion if this is required.

The STPs will be designed to restrict odour and noise. They will also be designed and landscaped to be compatible with surrounding land uses.

3.0 PROJECT SCHEDULE

Construction of the STPs and associated collector systems and outfalls will be phased over approximately five years, starting with Halifax and ending with Herring Cove. Site preparation work in Halifax is proposed to commence in late 2002, with construction beginning in 2003. Construction would begin in Dartmouth in 2005, and in Herring Cove in 2006. It is anticipated that each STP, related collection systems, and outfalls / diffusers will require approximately 18 to 24 months to construct.

The sewage collection systems will have a minimum design life of 60 years. The STPs, outfalls, and diffusers will be designed, constructed, and commissioned with a design life for structural components of at least 60 years, mechanical components of at least 25 years, and electrical instrumentation components of at least 15 years.

4.0 PROJECT DESIGN AND CONSTRUCTION

Construction activities will be conducted in accordance with industry standards and practices and will conform to or improve upon requirements of all applicable legislation, codes, standards, specifications, and guidelines.

4.1 Sewage Collection Systems

A new sewage collection system is required to intercept and collect sewage from the existing sewer system, and deliver it to the STPs. Some of the existing outfalls will be consolidated in this process; others will remain as combined sewer overflows (CSOs). The normal design flow will be 4 x average dry weather flow (ADWF) estimated by HRM for the year 2041 from the sewersheds of Halifax, Dartmouth, and Mainland South/Herring Cove. Excess flows will either be stored for treatment or will outfall to the Harbour through CSOs. CSOs will be equipped with screens or underflow baffles to remove floatables.

The collection systems will include sections of conventional gravity collector sewers, pumping stations with back-up generators, dual forcemains, and tunnel sections. The collection systems will be designed and constructed with specific entry (pick-up) points both for HRM's existing sewers and other sewers where feasible (*e.g.*, DND). Tunnels will have excess capacity which will serve to reduce overflow events. Where pumping stations and forcemains are constructed in lieu of tunnels, the system will be designed for 5 x ADWF to further reduce overflow events. Options for further reducing overflow events will be evaluated depending on the frequency and volume of the events and the system design options.

The principal interception point for the Northwest Arm combined sewer will be at the Atlantic School of Theology (AST). A pumping station will be located on AST property, with a forcemain running up to Pine Hill Drive and thence along city streets to Young Avenue, Atlantic Street, South Bland Street and Inglis Street to Barrington Street and on to Sackville Street. To collect inflows to the Northwest Arm sewer south of the AST property, a small pumping station is proposed near the northern limit of Point Pleasant Park on park property. This small pumping station will be primarily underground. In the north end of Halifax, the proposed collection system follows DND property to the STP site. In Dartmouth the proposed collection system north of the MacDonald Bridge follows CN lands.

Sewage trenching and installation will generally proceed along established rights-of-way (*e.g.*, roads). Work will generally include: excavation (*i.e.*, digging, ripping, blasting); sewer installation; backfilling; and repair of roads. Sewer installation or repair may cause noise, traffic delays, and restriction in access to some properties. These inconveniences will be temporary as the sewer installation proceeds, and are generally well managed through standard traffic and construction management procedures. This type of construction activity is typical for municipal infrastructure projects (*e.g.*, roads, water lines, sewers) and is generally well tolerated by the public as necessary to maintain or improve vital components of municipal services.

Tunnelling, where necessary, may be conducted using a tunnel boring machine. Blasting, if required, will be conducted in accordance with applicable regulations and guidelines. Blasting in or near watercourses will require approval from Fisheries and Oceans Canada, and shall be conducted in accordance with the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998). Blasting will also be conducted in accordance with the *General Blasting Regulations* made pursuant to the Nova Scotia *Occupational Health and Safety Act*. The Contractor performing the blasting will have a valid Blaster's License, obtain a blasting permit from HRM, and ensure that a pre-blast survey has been conducted as required by HRM.

4.2 Sewage Treatment Plants

Sewage treatment plants will be constructed at each of the three proposed sites. Existing STPs at Mill Cove (Bedford) and Eastern Passage will continue in operation. Sites have been or are in the process of being purchased by HRM for the purpose of STP construction.

A phased approach has been proposed for STP construction and operation with priorities for construction as listed below:

1. Halifax
2. Dartmouth
3. Herring Cove

Priorities have been determined by site availability, the need to address the most serious present outfall impacts, the need to provide treatment for both sides of the harbour, and options for consolidating outfalls. Project components will be phased in over approximately five years. HRM Council has made a commitment to move forward on a basis affordable to the community, and to raise funds for two-thirds of the total capital costs (approximately $210 million of $315 million). HRM is seeking the balance of funds from the federal and provincial governments.

The facilities will be designed and constructed with a life for structural elements of at least 60 years, mechanical components of 25 years, and electrical/instrumentation items of at least 15 years, with no major maintenance required in the first 15 years.

The minimum process requirements for the new sewage treatment plants will include:

- raw sewage pumping as required based on the hydraulic gradient, site elevation, and outfall conditions;
- screening;
- grit removal;
- chemical flocculation and settling followed by UV disinfection to produce an effluent meeting effluent standards consistently; and
- biosolids handling and management (each facility will include onsite dewatering of biosolids, with transport to offsite processing facilities).

The treatment plants located on the Halifax Peninsula and in Dartmouth will require innovative design in order to minimize land requirements (maximum 1.5 to 2 ha). Designs will be used which have been proven and successfully applied in other locations, treating municipal sewage at similar flow rates. At the treatment plant site near Herring Cove, a compact type plant or alternatively, a "conventional" advanced primary type plant may be used depending on suitability of the identified site(s). Buildings will be designed to efficiently utilize land area and as well to provide for future expansions and possible upgrades to secondary treatment. The STPs will be designed to be aesthetically attractive and visually compatible with the surrounding area and land uses. The plant facilities will be completely enclosed under negative pressure, with full odour and noise controls. Power and other municipal services (*e.g.*, potable water, sewer connection) will also be provided.

Construction activities associated with an STP will be typical for construction of a medium-sized industrial facility. This will include site preparation such as excavation and grading. A foundation will be installed and building components fabricated. Construction disturbance will include noise, dust and possible traffic delays. The construction of each STP will involve from 10 to 200 employees on site depending on the construction phase. Each site will attract from 15 to 20 (maximum 40) heavy trucks and 20 to 25 lighter vehicle trips per day. A new dedicated access road will be constructed to access the Dartmouth treatment plant construction site. The roadway will allow access to Pleasant Street without use of any local residential streets. The new access road will be used both during construction and operation of the Plant.

The level of disturbance at each site will depend on the phase of construction. These disturbances are typical for large scale construction projects in the Metro area and are routinely well managed through standard traffic and construction management practices. The total duration of construction for an STP is estimated to be from 18 to 24 months.

4.3 Outfall and Diffuser Design and Construction

Each STP will have a marine outfall to discharge treated sewage effluent terminating at an acceptable location in the Harbour. Outfalls will be designed hydraulically to meet present and future design flows. Outfalls will be equipped with diffusers engineered to achieve initial dilution of 20:1 at the Inner Harbour outfalls and 50:1 at the Herring Cove outfall.

All existing municipal outfalls will be intercepted and disconnected, except for those which will continue to function as CSOs. Private outfalls will also connect into the new collector system at the responsibility of the private owner of the outfall. Outfalls and new CSO extensions (Young St., North St., and Lyle St. in Halifax) will be constructed by laying the pipe on a granular mattress and backfilling over the pipe with granular material. The outfall at Herring Cove will be laid on the bottom and secured with anchors. Outfalls will meet all the requirements of regulatory agencies, including but not limited to: Fisheries and Oceans Canada (Habitat and Coast Guard branches); Environment Canada; and the Halifax Port Authority.

Diffusers, constructed of reinforced concrete, will likely be fabricated onshore, then taken to location by barge and placed in position on a previously prepared bed of granular material. The outfall pipe would then be covered with clean granular material.

4.4 Sludge Management Facility

A central sludge processing facility will be constructed within the Aerotech Business Park in HRM. Potential sites have been identified in proximity to the existing lagoon and wastewater treatment plant.

5.0 OPERATION AND MAINTENANCE

5.1 Commissioning

Initial testing of the STP will be carried out using clean water from the municipal water system. Only after meeting initial testing requirements will sewage be introduced to the system. Following a period of initial operation using raw sewage (approximately four weeks), the Company will conduct performance testing, with any deficiencies identified and corrective action taken immediately as necessary.

5.2 Sewage Treatment

The STPs will meet or exceed Effluent Quality Requirements while treating not less than the flow rates for "Initial Construction" as shown in Table 1.

Table 1 Sewage Treatment Plant Capacity Flows (m^3/s)

Plant Location	Initial Construction (Based on projections to 2021)			Ultimate Flows	
				Ultimate Capacity (2041)	Ultimate Peak Flows (2041)
	Avg. Daily Flow	Peak Flow	Min. Flow	Avg. Daily Flow	Peak Flow
Halifax	1.55	3.97	0.29	1.7	4.37
Dartmouth	0.97	2.58	0.19	1.15	3.06
Herring Cove	0.33	0.88	0.06	0.61	1.64
Total	2.85	7.43	0.54	3.46	9.07

Source: HRM (2000)
Notes:
1. Peak flow is equal to 4 x Average Dry Weather Flow (ADWF)
2. Average Daily Flow is 1.5 x ADWF
3. The ultimate capacity represents the ADWF that is expected when development of the applicable sewersheds is complete.

The HHSP plan assumes advanced primary treatment of sewage with UV disinfection. Operation of an advanced primary treatment facility usually includes the following processes:

1. **Screening** of raw sewage through 6 mm openings or slots produces a highly putrescible, segregated material including paper, fabric, plastic, and wood, all contaminated by human waste. The screenings will be washed to remove contaminants, prior to a sanitary landfill site for disposal.

2. **Grit removal** is accomplished in a chamber or channel in which the velocity of flow is controlled so that materials with a high specific gravity (1.2 or greater) are allowed to settle and are collected. These settled materials are sands and gravels which occur in the collection system as a consequence of street inlets, open joints, etc. The grit is collected and often washed to remove organic contamination. Grit is typically disposed of at a landfill.

3. **Settling** of the wastewater in a tank or chamber allows all remaining settleable solids to collect at the bottom of the tank and floatable materials (vegetable materials, oils and grease, small bits of plastic or wood) to collect as a scum on the top surface. The settled material drawn from the tank is a putrescible substance containing 60 percent to 80 percent organic materials, and is known as raw sludge. The floating scum material is skimmed from the surface of the tank and is generally disposed of separately or sometimes combined with the raw sludge for processing and disposal (refer to Section 2.8.3).

4. **Addition of flocculating agents** is the specific step that "advances" the process beyond conventional primary treatment (Steps 1 to 3). These agents enhance settling and also combine chemically to precipitate most of the phosphorus present in the soluble form. Advanced primary treatment also involves lower hydraulic loading rates to increase the hydraulic retention periods. The result is that in addition to a fairly high degree of phosphorus removal, fine solids and colloidal matter not removed in simple gravity settling (conventional primary treatment) are removed. Approximate removal efficiencies for conventional primary treatment of 65 percent for suspended solids (SS) and 35 percent for biochemical oxygen demand (BOD) are increased in advanced primary treatment to 75 percent SS and 50 percent BOD removal.

5. **UV Disinfection** is the final step for the proposed HHSP advanced primary treatment plants. This involves exposure to ultraviolet radiation (UV) for disinfection of human pathogens. With UV there is no potentially harmful residual product added to the effluent as with chlorine disinfection, and no hazard from accidental releases of chlorine due to a spill or fire. UV radiation has been used successfully as a disinfection method at several primary sewage treatment facilities to meet a regulatory faecal coliform limit of 200/ml (B. Topp, pers. comm, 2001). Its proposed application following advanced primary treatment (*i.e.*, increased removal of suspended solids) will produce similarly successful results. Various advanced primary treatment plants in Quebec are currently using UV disinfection including STPs in: Laval; Beloiel; Fabreaville; La Malbaie; Beaupre; Boischatel; and Gaspe.

6. **Sludge management** will be accomplished by the following processes:
   - onsite thickening or dewatering at the STPs followed by transport to the Sludge Facility;
   - mixing dewaterered sludge cake with alkaline admixtures;
   - drying the product to a 60-65% solids content;
   - heat pulse to induce exothermic hydration reaction to increase temperature and pH of the product; and
   - beneficial end use of processed sludge (*e.g.,* soil amendment for agricultural or non-agricultural uses, depending on quality).

5.3 Sludge and Residue Management and Disposal

At each STP, screenings, grit and biosolids will be produced. Plant design will include process equipment for biosolids collection, conveying, compaction, storage, mixing, pumping, thickening and dewatering as required. It is proposed that each day's sludge production at an STP can be removed by one or two daily truckload(s). Additional loads will be removed as required. Dewatered cake will be transported in dump trailers with an approximate capacity of 34 wet tonnes per load. These units will be covered and equipped with sealed and lockable end-gates to prevent leaks. The trucks will be loaded within the STP facility under controlled atmosphere and will be washed after loading and unloading. Routing to the sludge processing facility from the STP will be as direct as possible and transport will be arranged to avoid periods of heavy traffic as much as possible. All trucks will be equipped with the appropriate response materials and drivers will receive periodic spill response training.

The sludge processing facility design is capable of handling the average annual sludge production in a six-day week, operating for approximately 10 hours per day initially, increasing to about 14 hours per day in year 20. The processing facility will include approximately 929 m^2 of enclosed building and an additional 3,252 m^2 of covered and/or paved working area (including parking lot and loading areas).

Processing will involve mixing the dewatered sludge cake with alkaline admixtures. If the admixture does not contain enough free lime to give the necessary temperature and pH rise, CaO is added. Following the mixing step, the product is dried with the use of a rotary-drum dryer. The dryer discharge then goes to a "heat-pulse" cell. The combination of heat from the dryer and a chemical reaction between the alkaline materials and the moisture in the sludge cake raises the temperature to a controlled range between 52 and 62 C and the pH to slightly above 12. The material is held in the heat-pulse cell where the temperature is monitored for a period of 12 hours. The elevated pH is maintained for a total of 72 hours, after which the product is ready for distribution or storage.

Approximately 1,858m^2 of covered storage area will be provided, giving the storage facility about four month storage capacity at the maximum production rate. The final product of the process is a biologically stable, low-odour, safe, soil-like material that will have a solids content of approximately 60-65%. The quality of the finished product will be monitored to ensure that it meets the requirements of NSDEL, Agriculture and Agri-food Canada and generally, 40 CFR Part 503 US EPA Regulations. The product can be blended with composts to produce a material that can be used in horticulture and commercial landscaping. It can also be blended with soils and soil-like materials to produce manufactured topsoil which would have a broad range of applications.

5.4 Effluent Quality Monitoring

The treated wastewater effluent will be measured in accordance with the test procedures, policies and all other requirements of NSDEL at the sampling points designated by NSDEL for each STP, and shall meet or exceed the Effluent Quality Requirements (refer to Section 7.1).

5.5 Operational Traffic

The operation of the STPs will generate low volumes of traffic. Estimated vehicle movements related to each Plant's operation include:

- sludge haulers, average two tractor trailers per day;
- chemical delivery vehicle, average two per week;
- lighter delivery vehicles, two per day; and
- private vehicles for employees and visitors, 12 to 15 per day.

5.6 Maintenance

Routine maintenance includes regular operations that are required to obtain smooth and continuous operation of all aspects of the facilities including, but not limited to:

- cleaning;
- lubrication;
- calibration; and
- equipment adjustment.

Predictive maintenance is the measurement of physical properties of equipment performance and a comparison with engineering standards or limits. These measurements include, but are not limited to:

- vibration testing;
- lubricant analysis for wear particles or lubricant contamination;
- infrared thermography;
- performance monitoring;
- non-destructive testing; and
- ultrasonic testing.

6.0 ABANDONMENT AND REPLACEMENT

Provided the land serviced by the present collection system continues in residential, commercial, or industrial use, the sewage collection systems will not be abandoned. The system is normally maintained and upgraded as necessary to provide the required service. Pipes are sized for projected population and type of development in the serviced sewersheds since there will not be an opportunity to replace or enlarge tunnels after they are commissioned. Tunnels can be accessed for routine maintenance such as cleaning. Repairs which occur as a result of corrosion or material failure can also be undertaken as necessary. These might include replacement of ladders and reinstatement of concrete lining.

The STP differs from the collection system in that it is not initially designed for ultimate capacity; rather, it is designed to be expanded to ultimate capacity by addition of more treatment trains or higher levels of treatment. Sufficient land to upgrade to secondary treatment or to accommodate projected future flows will be provided at each STP site. These expansions would occur based on either hydraulic load generated in the service sewershed or by an environmental need to improve treatment level. However, once STPs are established, they are seldom abandoned because sewage is delivered to that location by the tunnels. Normal maintenance such as replacement of equipment on a periodic basis and recoating of treatment tankage will be performed. No existing STPs will be abandoned in connection with this Project.

7.0 EFFLUENTS AND EMISSIONS

7.1 Effluent and Water Quality Standards

Based on a review of the previous four STP plan and oceanographic modelling conducted by HRM (COA 2000), NSDEL concluded that the following guidelines for treated effluent will be acceptable (D. Hiltz, pers. comm. 2000):

- fecal coliforms of less than 5000/100 mls, as maxima;
- BOD_5 50 mg/L; and
- suspended solids of 40 mg/L.

HRM staff and consultants have concluded that these effluent quality criteria specified by NSDEL can be achieved on a consistent basis by advanced primary treatment in the current three STP concept. Environment Canada has also advised HRM that, based on the oceanographic modeling and assimilative capacity work carried out, the proposed system is justified and will meet the water quality objectives established by the Halifax Harbour Task Force (HHTF) if proper design, including outfall siting, and operational maintenance system takes place (J. Kozak, pers. comm. 2000). Environment Canada also states that the acceptability of the system is predicated on the successful implementation of a source control program by HRM to reduce the input of toxics into the wastewater.

In general, given the current HHSP plan and the minimum requirement for advanced primary level treatment of sewage, it is expected that the HHTF water quality objectives for harbour regions can be met with prudent design and siting of outfalls and diffusers. The final criteria and monitoring requirements will be specified as a condition of the operating permit administered by NSDEL. NSDEL has granted HRM a permit to construct the three treatment plants and collection systems.

7.2 Air Emissions/Odour/Noise

The treatment plants will be designed, constructed and operated as atmospherically controlled systems to prevent the potential occurrence of objectionable odour in the community beyond the property limits of the STP site during routine operations. Highly effective odour control systems will be used for all process areas of each plant, as well as the pumping stations. Enclosed plant design will also serve to minimize noise beyond the site boundary.

HRM has required that odour from the STPs and pumping stations will not exceed 4 ppb (over a 5 minute rolling average) at the point of air exhaust during normal operating conditions. Compliance with this limit will ensure that there are no perceptible odours at the facility property line.

HRM has required that facility generated noise levels at each STP property line will not exceed the following levels:

- 55 dBA Leq (between 2300 hours and 0700 hours);
- 60 dBA Leq(between 1900 hours and 2300 hours); and
- 65 dBA Leq (between 0700 hours and 1900 hours).

Individual noise sources which are tonal in nature will not exceed 45 dBA Leq when measured at the applicable property line.

7.3 Sewage Sludge and Residue

At each STP, screenings, grit and biosolids will be produced. Screenings and grit will be washed to remove contaminants prior to landfill disposal. Biosolids will be collected at each STP site where they will be mixed, pumped, thickened, and dewatered prior to transport for offsite treatment at a central sludge processing facility.

8.0 RELATED PROJECTS AND PROJECT ALTERNATIVES

8.1 Related Initiatives

8.1.1 Pollution Prevention Program

HRM's Pollution Prevention Program, formerly referred to as the Source Control Strategy initiated in 1996, will result in important improvements in the levels of nutrients, metals, and toxins currently entering the wastewater system, and ultimately, Halifax Harbour.

The overall objectives of the Pollution Prevention Program are:

- protect the safety of the public and the health and safety of municipal staff;
- protect the physical integrity of the collection system, pumping stations and wastewater treatment plants;
- reduce potential operational problems related to the wastewater treatment process which may be caused by industrial, commercial or institutional discharges to the municipal sewer systems;
- reduce potential bio-solids management problems cause by excessive concentrations of prohibited materials; and
- reduce pollution of freshwater or marine ecosystems (in compliance with the *Fisheries Act*).

A new HRM by-law (July 2001) respecting discharge into public sewers (By-Law Number W-101, Wastewater Discharge By-Law) prohibits discharges of specified substances and concentrations to sanitary and combined sewers, and storm sewers. This by-law will be instrumental in the reduction of the discharge of toxic, hazardous or prohibited wastes into the municipal sewer systems.

The Pollution Prevention Program is now an on-going operational activity of the HRM. Regular reporting on a quarterly basis to HRM Council will identify the progress of monitoring and enforcement. HRM staff are currently developing a database of all industrial, commercial and institutional locations which will assist in the management of regulating contaminant levels in the municipal systems. This will permit existing and new development to be included in procedures for compliance monitoring and enforcement of prohibited discharges. The development of best management practices for industrial and commercial sectors will be developed to assist these locations in achieving compliance. Educational material will also be developed for the residential sector to permit the direct participation of the public in the reduction of contamination released to our waterways. There is estimated to be approximately 5,000 institutional, commercial and industrial sites to be evaluated under the program within approximately 3.5 years. A detailed implementation plan for this program is currently being developed.

The P2 Program has been and will continue to be promoted through a number of available media. These have included the Naturally Green Newsletter, water billing inserts, Burnside News, Enviro-Connect, Nova Scotia's Environmental News, Maritime Water and Wastewater publication, HRM's web site as well as the Canadian Centre for Pollution Control web site. Staff have made presentations to various groups and organizations including the various Watershed Advisory Boards, Nova Scotia Environmental Industry Association, Canadian Petroleum Products Association, open houses hosted by HRM.

The implementation and continued maintenance of this program is key to the success of the proposed HHSP. Although a separate entity, the P2 program (*i.e.*, source control strategy) will complement the HHSP as it will increase the effectiveness of wastewater treatment and improve quality of resulting sludge for composting.

Implementation of the P2 program will be coordinated to the extent practical with the development of the new STPs. HRM will work with dischargers in each of the STP sewersheds to ensure that they are in compliance within the timeframe for initiation of operation for the associated new treatment plant. Thus, dischargers within the Halifax sewershed will be brought into compliance with the by-law prior to the operational target for the Halifax STP, and similarly for dischargers within the Dartmouth and Mainland South STP sewersheds. All dischargers will thus be expected to be aware of the by-law provisions and in compliance within the overall STP development timeframe.

8.1.2 Inflow/Infiltration Reduction

HRM is also in the early planning stages of developing Inflow/Infiltration (I/I) reduction plans which will reduce the overall volume of wastewater entering the treatment system and reduce frequency of overflow events. This wastewater management program will complement the HHSP and increase its effectiveness.

The implementation of an I/I program is a two step process. First step includes study and investigation to determine the sources and the location of infiltration/ inflow. Second step is the implementation of corrective and remedial works. Depending on the findings from the investigation, corrective and/or remedial works may include from minor repairs to major piping works.

HRM video inspects its sewer on an ongoing basis in the range of 40,000 to 50,000 meters/year. From this inspection, sewers requiring repairs and /or replacement are identified and the remedial works are undertaken. These works have net impact on the reduction of infiltration and inflow on the overall system. HRM also has an ongoing flow monitoring program to monitor the flow during wet conditions. Flow monitoring is also intended to check the reduction in the rates of I/I and the performance of the corrective works after an area has gone through an I/I reduction phase.

8.2 Alternatives to the Project

Alternatives to the Project are defined by the CEA Agency as functionally different ways of achieving the same end (CEA Agency 1994). The major alternative to the project (*i.e.*, the alternative to provision of wastewater treatment) would be to continue with the status quo (null alternative). This is generally acknowledged by regulatory agencies, the general public, as well as by HRM, to be an unsatisfactory alternative, both environmentally as well as socially.

Poor aesthetics, high nutrient concentrations, harmful algal blooms, high levels of suspended solids, organic matter enrichment, and depressed oxygen levels in sediments and water are some examples of current sewage-related conditions in Halifax Harbour. The harbour water is unacceptable for shellfish consumption and primary contact recreation in most places in the Inner Harbour.

As the population serviced by the HRM sewershed grows, the wastewater inputs to the harbour will continue to increase in volume, with increasingly deleterious effects on the harbour, particularly in the absence of sewage treatment.

HRM's related pollution prevention initiatives complement the Project in that it will control discharges that cannot be effectively handled by sewage treatment systems. However, in the absence of the wastewater treatment Project, the Pollution Prevention Program and I/I initiatives cannot achieve the desired water quality objectives set by the HHTF. Source control alone cannot therefore be considered a feasible alternative to the Project.

There is, therefore, no feasible alternative to the implementation of a sewage treatment system in order to achieve the basic water quality objectives of HRM.

8.3 Alternative Means of Undertaking the Project

Alternative means of carrying out the project are defined by the CEA Agency as methods of a similar technical character or methods that are functionally the same (CEA Agency 1994). A number of important guidelines or constraints were considered in order to define the major alternative means for undertaking the project. The main guidelines were provided by:

- the General Principles from the Halifax Harbour Solutions Symposium including water use and water quality guidelines developed by the HHTF;
- recommendations of the Halifax Harbour Solutions Advisory Committee; and
- input from HRM staff and consultants (the Project Team).

Guidance from these sources was applied particularly during the selection of: treatment level and technology; potential site areas for STPs and outfalls; and the number and size of STPs. Additional information regarding the evaluation of treatment technologies was obtained from the "Review of Halifax Harbour Clean-up Program" (CBCL 1996), which included a review of wastewater treatment technologies presented at the G-7 Summit in Halifax in June 1995.

Alternatives means of carrying out the Project included consideration of:

- number and size of STPs;
- outfall siting;
- plant siting;
- level of sewage treatment (*i.e.*, primary, advanced primary, secondary and tertiary);
- collection systems (*i.e.*, separation or consolidation of stormwater and sewage; and trenching or tunneling of collection system); and
- treatment technologies (e.g., UV radiation, Solar Aquatics™).

Section 2.6.3 of the Screening Report includes a detailed description of the specific alternatives considered. Alternatives were evaluated based on various criteria, including environmental, technical, and economic considerations. The current Project contains the preferred alternatives.

9.0 REFERENCES

9.1 Literature Cited

Canadian Environmental Assessment Agency. 1994. Responsible Authority's Guide to the *Canadian Environmental Assessment Act*.

Canadian Environmental Protection Act, R.S.C. [1999] c.33.

CBCL Limited. Review of Halifax Harbour Clean-up Program. Prepared for Halifax Regional Municipality. August 1996.

Coastal Ocean Associates. 2000. Oceanographic Modelling and Assimilative Capacity Study Three Plant Scenario. Prepared for Halifax Regional Municipality.

Fisheries Act, R.S.C. [1985] c. F-14.

Halifax Regional Municipality. 2000. Request for Proposals. For a Public-Private Partnership for a Sewage Treatment System for Halifax Harbour. Prepared by Jacques Whitford Environment Ltd. May 2000.

Halifax Regional Municipality. 2001. Halifax Regional Municipality Harbour Solutions Project Environmental Screening. Prepared by Jacques Whitford Environment Ltd. October 2001.

Halifax Regional Municipality. 2002a. Halifax Regional Municipality Harbour Solutions Project Addendum to Environmental Screening. Prepared by Jacques Whitford Environment Ltd. March 2002.

Halifax Regional Municipality. 2002b. Halifax Regional Municipality Harbour Solutions Project Environmental Screening Addendum 2. Prepared by Jacques Whitford Environment Ltd. May 2002.

Halifax Regional Municipality. 2002c. Halifax Regional Municipality Harbour Solutions Project Environmental Screening Addendum 3. Prepared by Jacques Whitford Environment Ltd. September 2002.

Navigable Waters Protection Act, R.S.C. [1998] N-22.

Occupational Health and Safety Act, R.S.N.S. [1996], c.7.

Wastewater Discharge By-Law. Halifax Regional Municipality By-Law Number W-101.

Wright and Hopky. 1998. Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters. Department of Fisheries and Oceans Canada. Canadian Technical Report of Fisheries and Aquatic Sciences. 2107.

9.2 Personal Communications

Hiltz, D. Manager, Nova Scotia Department of Environment and Labour. Letter to M. Kroger, Halifax Regional Municipality. April 12, 2000.

Kozak, J.H. Manager, Toxic Management Division, Environment Canada. Letter to M. Kroger, Halifax Regional Municipality. June 1, 2000.

Topp, B. Regional Manager, Trojan Technologies, North America West. 2001.