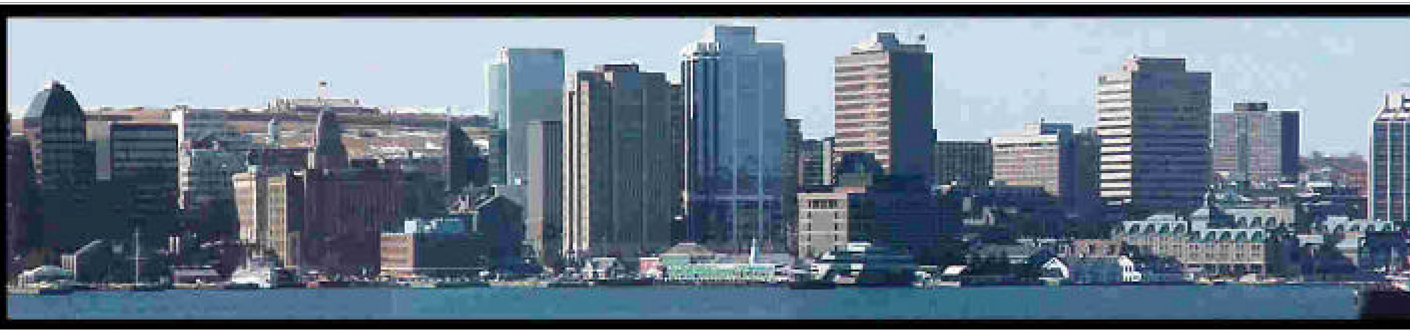
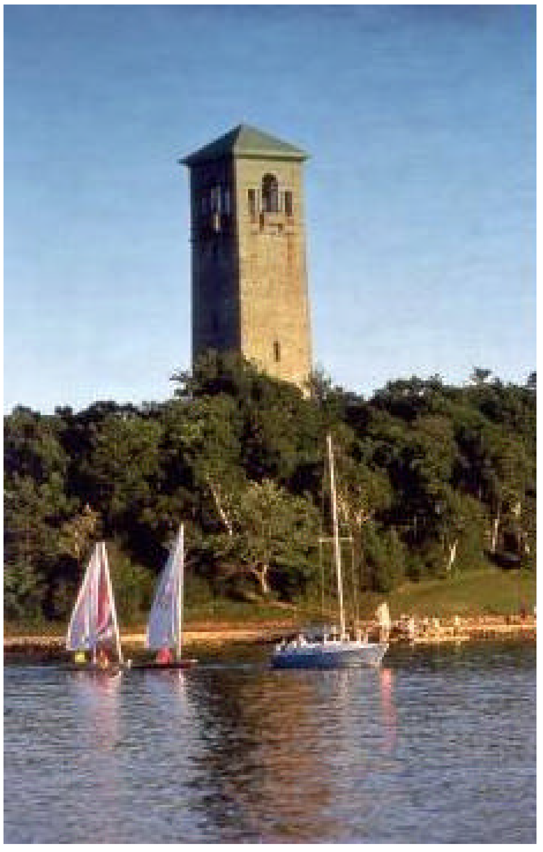


HALIFAX

REGIONAL MUNICIPALITY

HALIFAX HARBOUR SOLUTIONS PROJECT
ADDENDUM 1 ENVIRONMENTAL SCREENING



March 2002

Jacques Whitford Environment Limited

PROJECT NO. NSD13960-6027

REPORT TO

HALIFAX HARBOUR SOLUTIONS PROJECT

ON

ADDENDUM TO ENVIRONMENTAL SCREENING

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March 27, 2002

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1.0 INTRODUCTION

Subsequent to the filing of the Environmental Screening for the Halifax Harbour Solutions Project (Environmental Screening) in October, 2001, a contractor, Halifax Regional Environmental Partnership (HREP) was selected to enter into negotiations with Halifax Regional Municipality (HRM) to form the Public-Private Partnership for the construction and operation of the HHSP Project (Project). This document has been prepared as an addendum to the Environmental Screening to incorporate additional detail on various components of the Project, including the sewage sludge management system, and outfall and diffuser design. The information contained in this addendum updates sections of the Environmental Screening where indicated.

2.0 SLUDGE MANAGEMENT PROGRAM

The selection of a preferred contractor, HREP, has resulted in the availability of additional detail on the proposed sewage sludge management program which had been requested through regulatory review of the Screening. The following provides detail on the Halifax Harbour Solutions Project (HHSP) sludge management program as proposed by HREP. This information is intended to update information provided in Sections 2.7.4, 2.8.3, and 2.9.3 of the Environmental Screening as it relates to sludge management for the Project.

2.1 Process Overview

The proposed sludge management strategy uses a process currently used in Canada, the United States and other countries, that converts the sludge to a beneficial soil amendment that is free of offensive odours. The goal of the process is to maximise beneficial use of the material while maintaining environmental protection near the treatment works as well as the sludge processing facility. The treated sludge is typically used as a liming agent in production agriculture; however, it offers certain value over ordinary agricultural limestone because it retains some of the essential plant nutrients and provides organic matter to the soil.

The process stabilizes and pasteurizes wastewater sludge (harmful bacteria are destroyed and the beneficial soil bacteria, or micro flora, survive), reduces odours to acceptable levels, neutralises or immobilises heavy metals, and generates a product which has a granular appearance similar to soil, with multiple commercial uses. In the process, an alkaline admixture is added to dewatered sludge, mixed, heated (through a chemical reaction) and dried, typically by air-drying or through direct-drying in which fossil fuels may be used to expedite the drying process.

The product is approved for use and distribution by Agriculture and Agri-Food Canada under the *Fertilizers Act* and Regulations. The process meets USEPA regulations at 40 CFR Part 503 for achieving Class A pathogen reduction (essentially no detectable population of pathogenic organisms in the final product) under one of two tests. The standard process conditions required by USEPA include:

- elevating pH to greater than 12 and maintaining the pH for more than 12 hours;
- maintaining the temperature above 52°C (126°F) throughout the sludge for at least 12 hours during the period that the pH is greater than 12; and
- air drying to over 50% solids after the 72-hour period of elevated pH.

USEPA has also approved a variation on this process whereby the drying phase can be shortened through the use of a mechanical drying system. This process modification has been utilized successfully in several locations in Ontario.

The conditions are satisfied with the selected process. The basis of the process is to destroy pathogens through a combination of stresses including the following:

1. alkaline pH;
2. high temperature;
3. high interstitial ammonia;
4. accelerated drying; and
5. indigenous microflora.

The pathogen destroying stresses are produced in the sludge/alkaline admixture through the unique properties of the admixture. The high alkalinity contributes to stresses 1, 2 and 3 and extremely fine particle size and low moisture content to stress 4. Mesophilic temperatures (52 to 62°C) and a soil-like environment contribute to the growth of indigenous micro-organisms that suppress the regrowth of pathogens and putrefying organisms, stress 5.

The process can accept a variety of sludge such as: advanced primary; advanced primary/waste activated or waste activated; either digested or undigested. To minimize odours, undigested sludge is preferred because high-pH processing of undigested sludge liberates less ammonia than processing of anaerobically digested biosolids.

Process components involve three main steps: mixing; drying; and heat pulse.

Mixing

Dewatered sludge cake is mechanically mixed with alkaline admixtures. Such mixtures typically include some percentage calcium oxide (quick lime) and may include purchased quicklime and certain by-products such as cement-kiln dust, lime-kiln dust, wood ash, fly ash and/or steel-making fines. The admixtures are dosed at a rate of 20–50% of the wet-weight of sludge. The amount of the alkaline admixture varies according to the type of sludge (the higher the solids content the lower the alkaline admixture dosage), the characteristics of the alkaline admixture and the intended beneficial reuse market(s). If the admixture does not contain enough free lime (CaO, $Ca(OH)_2$ or other strong alkali) to give the necessary temperature and pH rise, CaO is added.

Drying

In this process, following the mixing step, the product is dried to the desirable 60-65% solids content with the use of a rotary-drum dryer. The mixer discharge goes directly to a single-pass, rotary-drum dryer. The dryer discharge then goes to a "heat-pulse" cell as described in below. A 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(s) 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.

Covered storage will provide approximately four months storage at the maximum production rate.

Heat Pulse

From the dryer, the material is discharged to a "heat-pulse" cell or bunker. The exothermic hydration reaction between the alkaline materials and the moisture in the sludge cake causes the temperature of the mixture to rise 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(s) where the temperature is monitored for a period of 12 hours. The elevated pH is maintained for a total of 72 hours, pursuant to USEPA requirements.

Odour Control

Odour control is accomplished through a number of mechanisms. First, the nature of the HREP sludge to be processed is such that odour generation during processing is minimal. Undigested sludges tend to produce less ammonia during mixing with the alkaline admixture than do digested sludges. Raw sludge odour is inhibited immediately on addition of the alkaline admixture as a result of reactions of moisture in the sludge with the alkaline admixture; this continues to improve during storage. As a result, passive ventilation of the heat-pulse and storage areas will typically be sufficient in such cases.

In the application of the mechanical drying aspect, combustion gases are tempered with make-up air collected from within the process building. The building is maintained under negative pressure such that potentially odorous air from the mixer area and the heat-pulse and product storage area (if necessary) are ducted to the combustion unit of the dryer. Air discharged from the dryer is then passed through a venturi scrubber for particulate removal followed by two-stage acid and caustic scrubbers for odour control.

The primary emissions from the mechanical drying process are particulates, ammonia, and trimethylamines that are released during the drying and heat-pulse phases. They are amenable to scrubbing, such that emissions readily meet regulatory requirements.

2.2 Sludge Handling and Loading at STP

HREP expects to routinely achieve greater than of 30% solids in the cake. At each sewage treatment plant, dewatered cake will be transferred by conveyor to a fully enclosed silo or transfer bin. These bins will be capable of holding about one-day's production of dewatered sludge. The bins will be equipped such that the dewatered cake can be quickly discharged from the bottom. The bin discharge points will be located within the truck-loading facility and thus will be subject to the odour control system for that area.

Transfer of dewatered cake to transport units (*i.e.*, trucks) will be conducted in a manner that prevents escape of odorous air to the environment. When the transport unit arrives at the wastewater treatment plant, the driver will complete a three-part manifest for the load. Upon completion of the paper work, the truck driver will back his unit into the loading area such that the entire trailer is within the confines of the area under odour control.

Once the truck is in place, the rapid-loading chutes on the bin will be activated and the dewatered cake discharged to the truck by gravity. After sludge loading is complete, the driver will check all tailgate gaskets and load covers, assure that the body of the trailer is clean and free of any sludge cake (including washing down the external portion of the truck, including tires, if necessary), and prepare to leave the plant.

Treatment plant personnel will sign the manifest, retain a copy, and the truck will leave the plant. It will be the responsibility of the plant staff to assure that all trucks arriving on-site for the removal of sludge are promptly signed in, set-up for loading, loaded and dispatched within approximately 45 minutes.

2.3 Transportation

Transport of the dewatered cake to the processing facility is a critical element of the program. It is proposed that each day's sludge production at a sewage treatment plant can be removed by one or two daily truckload(s). Additional loads will be removed as required to meet the variations in dewatered sludge production.

Sludge will be transported in a manner in full compliance with provincial regulations. HREP will provide evidence of proper licensing of drivers, insurance on vehicles and drivers, and appropriate certifications from the Province. 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. HREP will establish set procedures that will cover events where biosolids are lost from the transport container.

HREP's proposal contemplates no transfer stations, intermediate storage facilities or parking areas not incorporated into the actual sludge processing facilities. Routing to main highways from each treatment plant will be as direct as possible.

The contemplated routing from the Halifax STP will be north along Lower Water and Barrington Streets, across the MacKay Bridge and then via Routes 111 and 118 out of metro Halifax. The Hollis and Barrington Street route is already used by heavy transport vehicles to serve the container pier. The contemplated routing from the Dartmouth plant will be along the new access road and Pleasant Street to Route 111 and 118 and then out of the metro area. The forecasted routing from the Herring Cove plant will be along the Herring Cove Road to the Northwest Arm Drive and Route 102 out of the metro area.

To the greatest extent possible, sludge transport from the Halifax STP will be arranged so that periods of heavy traffic and potential conflicts with the public are minimized. In all likelihood, this will mean loading and transport will occur prior to morning peak traffic flows, or in the afternoon after peak traffic flows. Transport of sludge from the Herring Cove and/or Dartmouth plants will be similarly co-ordinated where practical.

Truck operators will be instructed to adhere strictly to speed limits and other traffic regulations. Management staff may follow trucks at random to ensure compliance with this policy. Staff will also periodically inspect the roadway and conditions on the primary and secondary haul routes for potential hazards and report any to HREP management.

All trucks will carry a fire extinguisher, a shovel, a disposable camera, and a set of hazard markers. All drivers will receive periodic safety training including the proper actions to take in the event of a spill.

Managers will take control at the site of any spill and will co-ordinate and direct the work of all employees and subcontractors in the clean-up effort. The manager will co-ordinate his efforts with those of any law enforcement officers or emergency response teams dispatched to the spill site. It will be the responsibility of HREP and in co-ordination with HRM to issue all communications regarding any spill event.

A minor spill event is defined as the unplanned discharge of a small amount of material such that the driver can effectively clean up the biosolids without the risk of additional material loss or undue hazard to traffic. In the case of a minor spill event the driver will remove his vehicle from the flow of traffic and deploy the hazard markers. The driver will notify the manager of the spill and begin clean-up immediately. The spilled material will be loaded into a service vehicle (or the original truck) for transport to the processing facility.

Occasions when a large amount of material is lost from the load or any accident accompanies the spill (especially those involving property damage, injury, or fatality) shall be termed a major spill event. In the case of a major spill event the driver will deploy the hazard markers in order to divert the flow of traffic. The driver will notify HREP managers who will notify the proper authorities and assemble the necessary equipment and personnel for containment and cleanup of the spill. Public safety is of the utmost priority and clean-up will begin only after the safety of any accident victims is assured.

Straw bales may be stockpiled at the processing facility; these may be transported to the spill site to contain the biosolids. If necessary a front-end loader and a truck can be mobilised to the spill site for clean up of the biosolids. Biosolids excavated from the spill site will be transported to the processing facility for spreading. Any biosolids that become contaminated with oil or fuel from the spill site will be disposed of in accordance with regulatory guidance.

All spill events, irrespective of their designation as major or minor, will be documented by photographing the site before, during and after the cleanup. Special note will be made of any hazards that contributed to or caused the spill event. A report will be prepared for all spill events detailing the severity of the spill, the reasons for the spill, the clean-up procedures, and any corrective measures taken to prevent reoccurrence. The report will include copies of police accident reports pertaining to spill events.

As soon as practical, and within 24 hours, designated agencies and HRM will be notified by telephone and/or facsimile of the severity and location of any major spill event. Within 48 hours a copy of the spill report will be distributed to the above parties.

Upon reaching the processing facility, trucks carrying sludge will be checked in by the plant manager who will sign the manifest and retain a copy. Trucks will be weighed on the truck scales and a loaded weight ticket will be printed. The truck will be moved into the processing building and will discharge the sludge onto the tipping floor or into a live-bottom feed hopper. All sludge discharge will be conducted in a manner that reduces the potential for odours to be emitted to the environment.

After completion of sludge discharge, the truck body and tires will be cleaned and the empty rig re-weighed. This will produce a record of the total weight of sludge delivered for processing.

2.4 Processing

The sludge processing facility will be built on a suitably-zoned site that HREP and HRM have identified. Proposed sites have been identified within the Aerotech Business Park in HRM (refer to Section 2.8 of this Addendum).

The system 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.

Overall, the processing facility will include approximately 10,000 square feet (929 m^2) of enclosed building and an addition 35,000 square feet (3,252 m^2) of covered and/or paved working area (including parking lot and loading areas). The following provides information related to the specific processing components.

Alkaline Admixture Storage

Two alkaline admixture storage silos will be provided, with a combined capacity of approximately 5,500 cubic feet (156 m^3). Each will be equipped with a high-efficiency, rectangular baghouse to remove dust during loading. The removal efficiency for dust is 99.9%. The admixture(s) will be transported from the silos to the mixer by 6-inch (15 cm) diameter screw augers to two day bins mounted on the mixer.

Dewatered Sludge

The processing equipment is designed on the basis of an average sludge solids content of 30%. However, the equipment will be able to accommodate the range of 25-35% solids and occasional values outside that range. Alkaline admixture dosages and mixer energy and retention times can be adjusted quickly to accommodate fluctuations in sludge solids.

Mixing

The mixer/proportioner (the mixer) will be capable of processing about 10 wet tonnes per hour of mixed solids (sludge and admixture). Sludge cake from the sludge receiving area will be discharged directly to a sludge day bin on the mixer. A hydraulically driven screw-auger mounted in the bottom of the bin feeds a volumetrically controlled amount of sludge from the bin to a screw-mixer. A screw-auger in the bottom of each alkaline admixture day bin automatically feeds the desired amount of admixture to a screw mixer. The mixture is discharged to a belt conveyor to the heat-pulse cells. Alkaline admixture will be dosed at an estimated 30% of the wet-weight sludge. The resultant mixed solids will be approximately 50% solids leaving the mixer.

Drying

This system will evaporate up to 2,700 kg of water per hour. Drying will require on the order of 670 kJ/kilogram of water (1,400 BTU/pound) evaporated. It is intended that locating the sludge processing facility at the site indicated in Section 2.8 will allow use of natural gas as fuel for the dryer. Another option would consist of using fuel oil. All process air will be ducted to odour control systems described below. Product will discharge from the dryer at approximately 60-65% solids.

Heat Pulse

The product from the mixer will be conveyed to one of two heat-pulse cells located in the product-storage and load-out area immediately adjacent to the processing area. Each cell will have concrete walls on three sides and be approximately 15 feet by 20 feet (28 m^2). The product is held in the cells for a minimum of 12 hours at the 52-62°C temperature range. Product is then moved to the storage area.

Product Storage

Covered storage will be provided which will have a storage area of 20,000 square feet (1,858 m^2). The storage facility will provide about four months storage at the maximum production rate.

2.5 Product End Use and Marketing

2.5.1 Product Use

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 product is low in odour because the alkaline admixture helps controls odour by:

- adsorption of odorous compounds to the very fine particles;
- destruction of putrefying organisms;
- drying; and
- stabilization of the sludge organics.

The heavy metals present in the sludge are converted to insoluble forms so the use of the product does not create any adverse conditions associated with metals leaching. No hazardous compounds are produced during the process.

The end product meets the criteria of Agriculture and Agri Food Canada for distribution as a soil amendment. Typically, the product will possess about 30% calcium carbonate equivalence, making it a product of value to the agricultural community.

The product can also be blended with composts to produce a material that can be used in horticulture and commercial landscaping. This product would combine the liming benefits of the product with the high humus content of the compost to produce a product that is well suited for such applications.

The product can be blended with soils and soil-like materials (*e.g.*, dredge spoils) to produce manufactured topsoil. This product has a broad range of applications including use in land restoration, landfill cover, and as fill materials.

2.5.2 Product Marketing

HREP or its contractor will retain a staff member whose responsibilities will focus on the development and servicing of markets for the product in Nova Scotia. The process is very flexible and can be tailored to meet a variety of end-use markets by altering the source of admixture(s) or varying the amount of each admixture.

The primary market for the product is as a replacement for ground limestone used as a soil conditioner in production agriculture. Therefore, the application rate for the product is a function of the replacement value of the liming potential as expressed in calcium carbonate equivalents (CCE). Ground agricultural limestone ($CaCO_3$) has a CCE of 100. The product will typically exhibit about 30% CCE meaning that approximately 3 tonnes of product will replace each tonne of agricultural lime.

To assess the marketability of the product in Nova Scotia, an analysis of Province-wide agricultural usage of liming agents was conducted. Nova Scotia Department of Agriculture and Marketing Records data for the past nine years were consulted. These records indicate an average annual use of 44,330 tonnes of agricultural lime throughout the Province. The majority of the lime use has been in Kings, Colchester, Cumberland, Hants, and Annapolis Counties.

Sludge production is projected to be about 15,000 tonnes per annum. At the 30% CCE value, this would represent about 4,500 tonnes of agricultural limestone. Thus, the annual production will need to replace just over 10% of the average annual agricultural lime market. Clearly during the early years of operations, much market development work will be necessary to generate any revenue from the product.

In order to market any sludge-derived product in Canada, approvals must be obtained from Agriculture and Agri-Food Canada under the *Fertilizers Act* and Regulations. Among the requirements of the regulations is compliance with the Trade Memorandum T-4-93, Standards for Metals in Fertilizers and Supplements. This regulates the concentration of nine metals within all fertilizers and soil amendments sold in Canada. The estimated concentration of these nine metals in HREP product is compliant with the T-4-93 standards.

The product will be a somewhat granular product exhibiting about 35% moisture. Typically, its transportation and application will be accomplished using routinely available equipment found in agricultural programmes. Transport vehicles (tractor trailers, field application equipment) will be loaded at the HREP facility with a front-end loader. Both tare and loaded weights will be obtained. In all cases, any over-the-road transportation unit will be required to be tarped or similarly covered so as to prevent loss of product. HREP will implement and enforce the Spill Plan described above for product transportation as appropriate.

Once in the field, the product will either be immediately spread or discharged to a designated area within the field. In the latter event, the spreader (which may be the farm operator) will load the product into a spreader and apply according to approved application rates. Rates will be determined either in terms of liming requirement or plant nutrients (N, P, or K).

In addition to agricultural application, the product could be utilised in restoration of disturbed lands (*e.g.*, mines, sand and gravel pits), as a replacement or amendment to daily, intermediate and final cover for landfills, and in the production of manufactured topsoils. HREP intends to explore all these market possibilities in the region and will place product into those applications as warranted and approved.

2.6 Control Mechanisms and Contingency Planning

2.6.1 Ventilation and Odour Control

HREP will provide premium systems to control potential odour emissions. The air will be cleansed of odours by two stage wet scrubbing. The odour control systems will treat all air that is exhausted from the building. The facility will be under a slight vacuum as a result of these systems, and untreated odorous air will not escape the building, even through open doors or windows.

HREP will design the facility such that odours, as predicted by dispersion modelling, will not be detected by neighbours of the processing facility. HREP will determine odour impacts by stack sampling, dilution olfactometry, and dispersion modelling as requested/required by the NSDEL.

The process increases the pH of the biosolids and generates heat that releases ammonia and some other amines. In order to treat ammonia, packed bed acid scrubbers will be incorporated to reduce odour contaminants to non-detectable levels off the site. The air treatment system will have the following unit operations:

- Condenser / Venturi - The dryer air will be cooled in the condenser to improve performance in the scrubbers. Water will be circulated through an ambient air cooler back to the condenser. A Venturi creates a pressure drop to remove particulates and water is circulated to the Venturi throat. A solids separator is used to clarify the water being recirculated to the Venturi.

- Acid Scrubber – The second stage is a packed bed acid scrubber. Water treated with acid is circulated over a 10-ft (3 m) depth of packing that will absorb ammonia and amines from the air stream.
- Caustic / Hypochlorite Scrubber – The third stage scrubber uses caustic to increase the pH and remove hydrogen sulfide that would be in the air pulled from the biosolids storage area or other odorous compounds in the exhaust air. A scrubber could be provided for the product storage area if this is deemed necessary. It would be designed to treat ammonia with a packed-bed acid scrubber.

The primary discharge will be from the odour control scrubbers, which require a minimum blowdown rate to remove impurities captured from the air stream. The blowdown will also include condensed water from the exhaust air, which is cooled for more effective odour control in the chemical scrubbers. The discharges will be returned to a wastewater treatment plant.

2.6.2 Control of Noise

HREP will specify quiet equipment wherever possible. Interior building noise and noise at the property limit will comply with applicable noise regulations. In general, the building, since the building encloses all noisy equipment, and the facility walls will provide significant noise attenuation.

Noise produced by the dryer fan may also propagate through ducts and flues to the outside of the building. The facility will include measures to assure that such noise will not escape. Depending upon the particular application, measures that may be undertaken include:

- Specify quality fans. For the same flow and pressure service, fans from different manufacturers can have dramatically different noise characteristics.
- Use of variable speed fans instead of inlet throttles to vary the flow. Throttling fan intakes results in turbulence and noise.
- Use of forced draft fans instead of induced draft fans, whenever practical. Forced draft fans push air through downstream equipment, and the equipment itself muffles sounds. If induced draft fans are unavoidable, mufflers may be installed.

The ultimate selection of fan noise control measures will be evaluated during detailed design. The HREP's commitment is that the facility will produce no objectionable noise beyond the fence line of the processing facility.

2.6.3 Dust Control

Dust control is a multi-faceted task. Dust can be a problem to workers, and a general housekeeping problem within the plant. Dust also has the potential to be a nuisance outside, and can affect neighbours. The facility will have a full suite of dust controls.

The facility will incorporate dust tight equipment, and will include chutes, transition pieces and gaskets to deter the release of dust inside the building. Each silo has its own dust collection system including a baghouse to collect dust during loading of admixture. Particulate in the air stream will be removed via the scrubber.

Dust will not be a problem outside the plant. Enclosed storage of the final product will limit the potential that nuisance dust conditions will occur. If product is stockpiled outside, it will be covered with tarps or otherwise managed so as to limit potential dust issues.

2.6.4 Response to Odour, Noise or Dust Issues

HREP will develop a monitoring plan specific to the facility site and in accordance with discussions with NSDEL. The plan may provide for the monitoring of ammonia or other odorous compounds, dilution-to-threshold, and meteorological conditions. Odour monitoring can be accomplished using a Draeger tube or comparable-type system.

Where permits or approvals mandate specific levels of air pollutants, odours, or noise, HREP will conduct periodic monitoring to confirm ongoing compliance. The results of this monitoring will be compared to baseline monitoring of the same parameters conducted during facility design and permitting activities. The goal of such monitoring would be to confirm that potential impacts to the facility's neighbours are adequately mitigated. Monitoring can be conducted on a schedule to be developed by HREP and regulatory agencies.

HREP will establish a response plan for addressing the investigation and mitigation of all odours, noise or dust complaints related to the facility. If a complaint occurs during working hours, the complainant will be contacted within one hour of the complaint and visited as soon as possible. The location and characteristics of the odour will be logged, as appropriate. If odours are related to the processing facility, appropriate mitigation actions will be taken. Documentation of complaints will be summarised monthly and provided to HRM for review.

2.6.5 Occupational Health and Safety

The HREP sludge processing facility will be designed with an emphasis on the health and safety of personnel involved with the facility's operations and maintenance.

The HREP safety program is geared toward the protection of people and equipment. The health and safety program would incorporate site-specific requirements into the overall program including:

- Nova Scotia's *Occupational Health and Safety Act* requirements;
- HREP's Health and Safety Program;
- Fire and Explosion Prevention and Control Plan;
- Facility Housekeeping Program;
- Employee Hygiene Program (Infection Control Plan);
- Respiratory Protection Plan;
- Confined Space Entry Plan;
- Emergency Response Plan;
- Equipment Safety Observation Plan; and
- Materials Safety Data Sheets and Workplace Hazardous Materials Information System.

2.6.6 Redundancy, Reliability and Contingency Plan

HREP will develop and implement a maintenance management system that will consist of a strong preventive maintenance program and record keeping for all equipment. As a result, it is anticipated that the sludge processing facility will experience limited downtime due to process equipment failure.

HREP has selected two alkaline admixture silos to provide for different sources of alkaline admixture and redundancy, if one silo is out of service. The mixer has proven to have a very high on-line time, and HREP will maintain a complete spare mixer assembly and other important spare parts on-site. It is anticipated that any repairs, if necessary, can be undertaken within 24-48 hours because of the inventory and support of the supplier.

Due to the capacity of the system, there will be two days per week where downtime can be scheduled to allow service and maintenance on the equipment. In summary, the reliability and redundancy of the system includes the following elements:

- spare parts inventory;
- proven technology and equipment;
- downtime of facility allows maintenance and repairs; and
- simple process with reliable equipment.

2.6.7 Processing Contingency Plan

For short-term (one day or less) shutdowns or interruptions in processing, there will be several areas within the HREP programmes where sludge can be temporarily held. For example, the wastewater treatment plants will have the ability to retain some sludge production in treatment components such as clarifiers. The dewatered cake storage bins within the treatment plant are sized such that they may be able to hold some excess sludge production, especially at Dartmouth and Herring Cove. In any case, however, storage of sludge at any of the wastewater treatment plants for more than 48 hours will not be permitted.

Ultimately, HREP is responsible for the timely removal of all sludge produced. Therefore, weekend operations of the dewatering devices and the sludge processing facility may be required to handle the sludge load.

The flexibility of the process is such that, if the system were off-line for an extended period of time, processing could continue. This process would require addition of more alkaline admixture; however, because of the relative availability of this material, additional supplies of the admixture would not be a problem. For longer-term shutdowns or interruptions, the dewatered sludge would be taken directly to approved sites for other processing or disposal.

2.7 Monitoring and Reporting

Monitoring, record keeping, and reporting are cornerstones to the success of the process. Because Nova Scotia guidelines do not specify analytical methodologies, the basis for the sampling and analyses programmes is the USEPA's 503 rule. There are several key areas where monitoring will occur. These include:

- the wastewater treatment plants where average dewatered cake solids concentrations will be developed daily and samples of the raw sludge obtained for analyses for regulated parameters;
- monitoring of the process utilising HREP's QA/QC criteria;
- analyses of the admixture and the final products to assure compliance with regulatory issues; and
- other sampling and analyses as necessary to determine application rates for the final product.

2.7.1 Sampling at the Wastewater Treatment Plants

HREP staff will periodically collect a sample of dewatered cake and will perform solids concentration determinations on those samples. The results of these samples, along with truck weight data, will be used to calculate the total dry tonnes of solids removed for processing.

In accordance with the requirements of NSDEL, at least quarterly HREP treatment plant staff will arrange for a representative sample of sludge to be obtained and delivered to a laboratory capable of performing required physical and chemical analyses. Generally, these will include the analytical requirements under 40 CFR Part 503 plus any additional parameters required. These analyses will be used solely for the purposes of confirming the relative quality (vis a vis the regulated pollutants) of the raw sludge. Actual analyses of the final product will be used to assure compliance with product quality standards.

2.7.2 Controls and Monitoring of the Process

The process will be controlled and monitored in order to maintain the following important operating parameters.

- Alkaline admixture dosage rate on a wet weight basis. Adjustments made with Programmable Logic Controller (PLC) on the mixer panel.
- Biosolids feed rate to the dryer. Biosolids are added to the mixer hopper based on level detectors in the hopper. Biosolids are metered at pre-set rates from the mixer to the dryer to optimise dryer performance based on throughput, moisture content of the biosolids and product solids content.
- Dryer performance is adjusted automatically based on dyer outlet air temperature which modulates the dryer burner depending on how much moisture is fed to the dryer.

- HREP will control the process to maintain pH greater than 12 and heat pulse temperature (52°C - 62°C) for 12 hours.
- The scrubber performance will be monitored in accordance with permit conditions but will include system pressure drops, scrubber sump pH, air temperature, recirculation flow rates and chemical storage inventory.

The heat pulse pile will be continuously monitored with a thermocouple temperature probe and strip chart recorder. This will enable HREP operators to track and record this critical temperature phase of the process.

Periodically during the operations day, samples of the product in processing will be obtained and analysed at the facility for pH. All pH measurements will be made at or adjusted to 25°C as required under 40 CFR Part 503. The pH measurements will be recorded so that HREP can warrant to the regulatory authorities that the material is in compliance with the criteria for pathogen and vector attraction reduction.

2.7.3 Monitoring of Product Quality

HREP will develop a sampling and analysis protocol for the operation to establish the baseline, and monitor ongoing bacteriological, physical and chemical parameters. This protocol will be applied to the incoming alkaline admixture component(s) and the final product.

While a specific schedule of sampling times and dates will be subject to discussions with NSDEL, the samples of the admixture and the product must be obtained at a frequency that will provide representative data while assuring regulatory compliance. Sampling frequency will be established in order to ascertain if there are daily, seasonal, or other temporal variations in the biosolids quality that may impact marketability. The results of these analyses will enable HREP to project end product classification as an exceptional quality product, as well as to establish an estimate of the plant nutrient value of the dried biosolids.

HREP plans to composite alkaline admixture samples on delivery and finished product samples daily. Composites of these samples will be prepared on a monthly basis and shipped to a commercial laboratory for metal and nutrient analysis. To meet sample method holding time requirements, samples for fecal coliform and other analyses for micro-organisms will be collected and composited over a four-hour period, chilled and immediately shipped to a laboratory. Fecal coliform samples will be obtained monthly.

Records of all analyses will be reviewed to ensure that the finished product meets the requirements of NSDEL, Agriculture and Agri-Food Canada and generally, 40 CFR Part 503. Records will be stored electronically in spreadsheet format and summary monitoring reports submitted to satisfy individual biosolids and *Fertilizers Act* and Regulations.

The Plant Manager will have continuous responsibility to ensure that sampling and analyses of the materials are conducted in a proper and timely manner. In addition to maintenance of records necessary to comply with the requirements of various regulatory agencies, the Plant Manager will be responsible for submitting all reports required by federal and provincial approval agencies.

An important support document that must be developed is a Materials Safety Data Sheet or MSDS. The MSDS describes the appropriate ways to handle and manage the product. HREP will develop this document.

2.7.4 Regulatory and Other Reports

Based on the requirements of the NSDEL and Agriculture and Agri-Food Canada, reports will be compiled and submitted to the several interested parties. Generally, the following reports will be prepared.

Monthly Operations Report

HREP will prepare and provide to HRM at each calendar month a monthly status report on sludge operations. Copies of these reports may also be provided to NSDEL. In addition to any specific information required by the HRM, the report will provide at a minimum:

- the dry weight of sludge received at the sludge handling facility;
- results of all testing of the sludge, admixture, and the product including analytical reports provided to HREP by others, as required by NSDEL and/or Agriculture and Agri-Food Canada;
- written reports related to any spills of sludge or product, actions taken to clean up the spill as well as any modifications of transportation procedures necessary to prevent future spills;
- written reports related to any sludge management-related complaints, the resolution/mitigation of the complaints, and any procedural or operational modifications aimed at limiting the potential for further complaints;
- copies of all newspaper articles related to the HREP facility and its programmes; and
- synopses/descriptions of all sludge-related actions, notices, or correspondence between regulatory agencies and HREP.

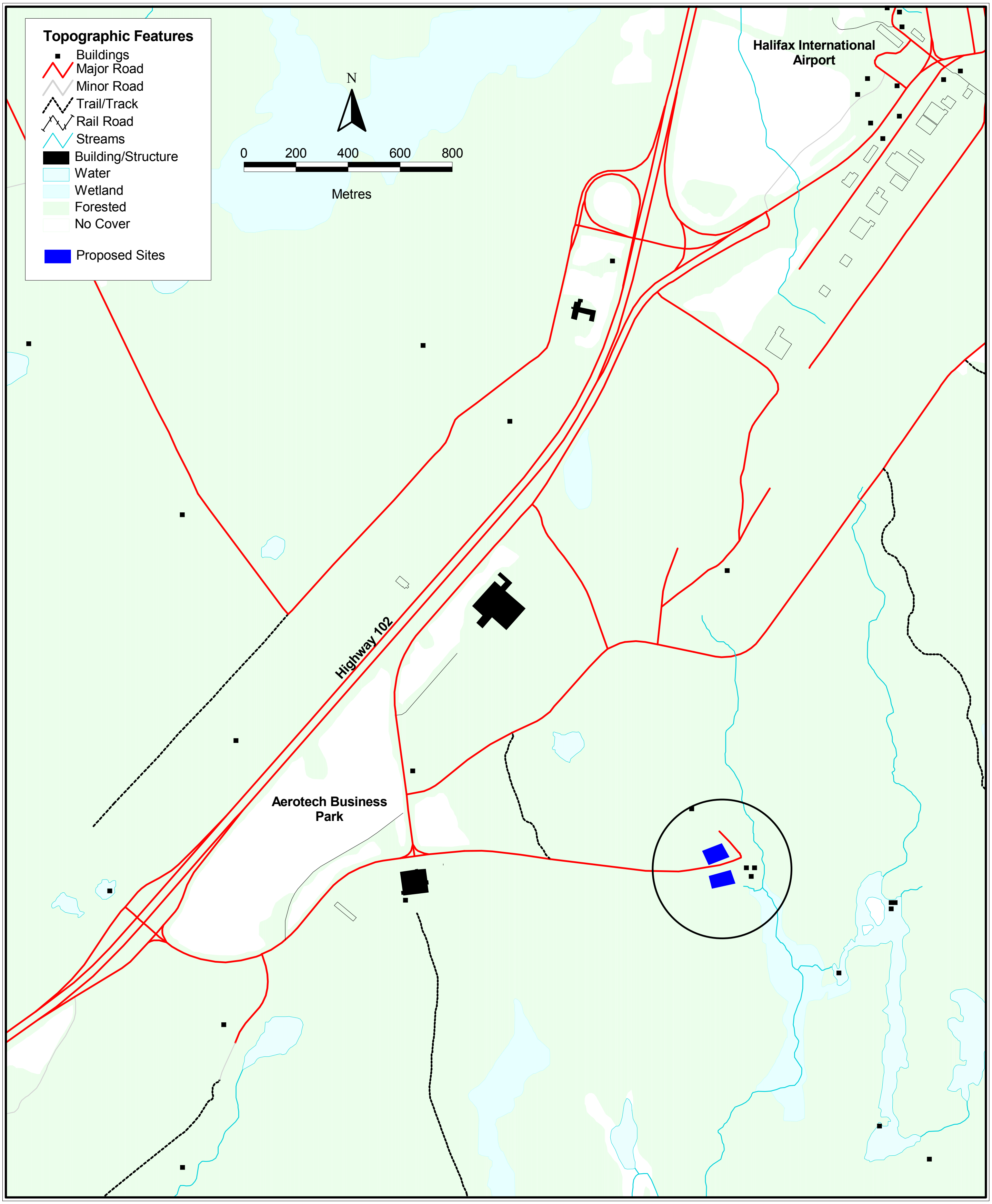
Annual Report on Operations

Each year, HREP will prepare a report summarizing the data and information contained in the monthly reports. HREP will also compile necessary information for inclusion into annual reports to regulatory agencies submitted by HREP and/or HRM.

2.8 Processing Facility Siting

The sludge processing facility will be constructed on a suitably-zoned site that HREP and HRM have identified and agreed upon. The preferred site location for the facility is in the Aerotech Business Park in HRM which provides excellent road access from the sludge source (Halifax area) and the alkaline admixture provider through Route 102 (refer to Figure 2.1). Potential sites within the Aerotech Business Park have been identified in proximity to the existing lagoon and wastewater treatment plant.

NSDEL has confirmed that the proposed sludge management system is not considered a composting process by their definition; therefore reference to the sludge facility in the Environmental Screening as a "sludge composting facility" (Sections 2.7.4, 4.5, and 2.5.5.2) is not applicable. Reference to the Composting Facility Guidelines (NSDOE 1998) published by NSDEL may also therefore no longer be applicable (Sections 2.5, 2.7.4, and 2.5.5.2).



HALIFAX REGIONAL MUNICIPALITY

Jacques Whitford
Consulting Engineers
Environmental Scientists
Risk Consultants

Figure 2.1

Proposed Location for Sludge Processing Facility

Map Parameters
Projection: UTM
Projection: NAD83
Zone: 20
Scale: 1:20000

Project:
NSD13960-6027

3.0 OUTFALL AND DIFFUSER DESIGN AND CONSTRUCTION

The purpose of this section is to update information contained in the Environmental Screening regarding outfall construction, diffuser design, and initial dilution rates. The following provides more specific information to enhance existing text in the relevant sections of the Environmental Screening, and also provides updates, where noted, regarding the revised initial dilution rates.

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. No trenching, as indicated in Section 2.7.3 and elsewhere of the Environmental Screening, will be undertaken during construction of the outfalls. The outfall at Herring Cove will be laid on the bottom and secured with anchors; no underwater blasting or tunneling will therefore be required as described in Sections 2.7.3, 4.3.5.1, 4.4.5.1, 5.1.5.1, and 5.4.5.1. Diffusers may not necessarily be constructed of concrete as indicated in Sections 2.7.3 and 5.4.5.1 of the Environmental Screening.

Figures 3.1-3.3 show the location and length of outfalls and diffusers. Table 3.1 provides additional information from HREP on diffuser design and resulting dilution rates, intending to update text contained in Sections 2.1, 2.7.3, 4.2.2, and 4.2.5.2 of the Environmental Screening. In general, the 50:1 initial dilution noted in the Environmental Screening has been reduced in the case of the two inner harbour outfalls due to proposed changes in diffuser design. HREP modelling has indicated no appreciable difference in the receiving water quality with the modified diffuser design. Other important changes include the proposed shortening and relocation of the Dartmouth outfall with the diffuser into slightly shallower waters (approximately 17 m) (Figure 3.2) compared with that shown in Figure F.2 of the Environmental Screening. The outfall at Herring Cove is also proposed to be shortened with the diffuser closer to shore (Figure 3.3) compared with Figure F.3 in the Environmental Screening. In general, these proposed modifications to dilution rates and outfall/diffuser locations have been made to reduce overall Project costs where it was believed that these reductions could be achieved without significantly compromising environmental performance. Shorter outfalls and diffusers will also reduce disturbance to the benthic environment during the construction phase.

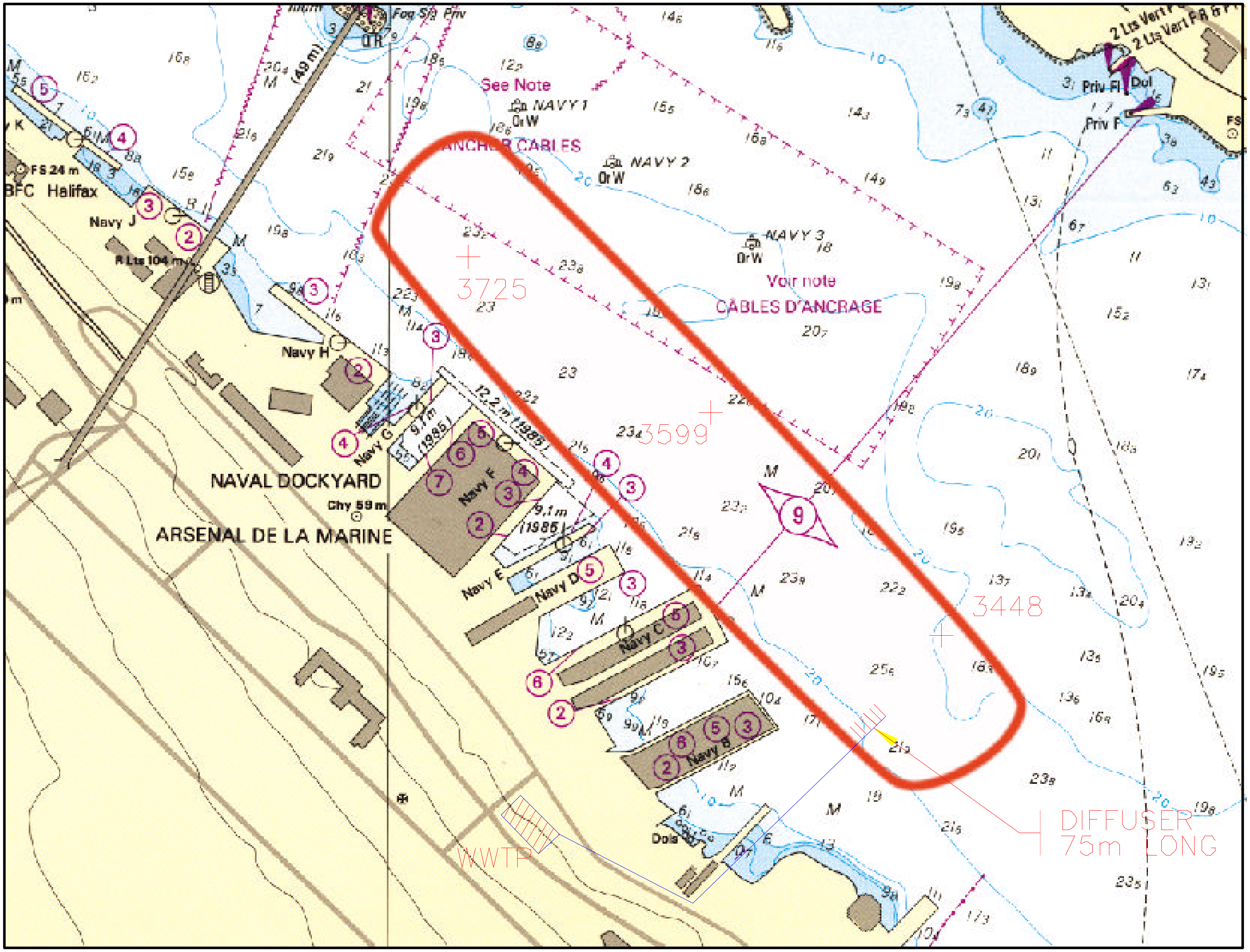
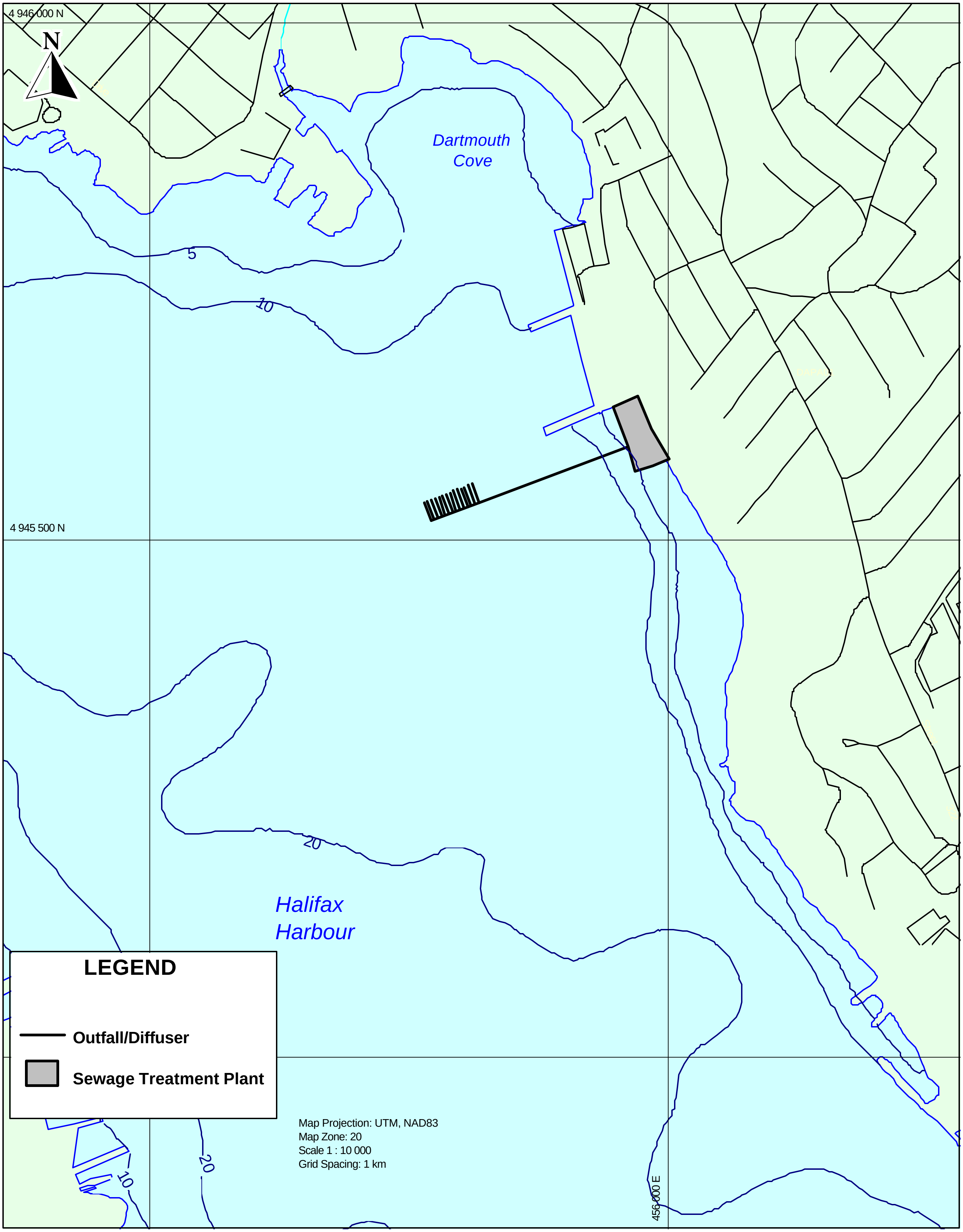


Figure 3.1 Halifax Diffuser Design and Location (Revised February 28, 2002)



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Halifax Harbour Solutions Project

Jacques Whitford Environment Limited

Figure 3.2
Dartmouth STP & Outfall Location (Revised December 12, 2002)

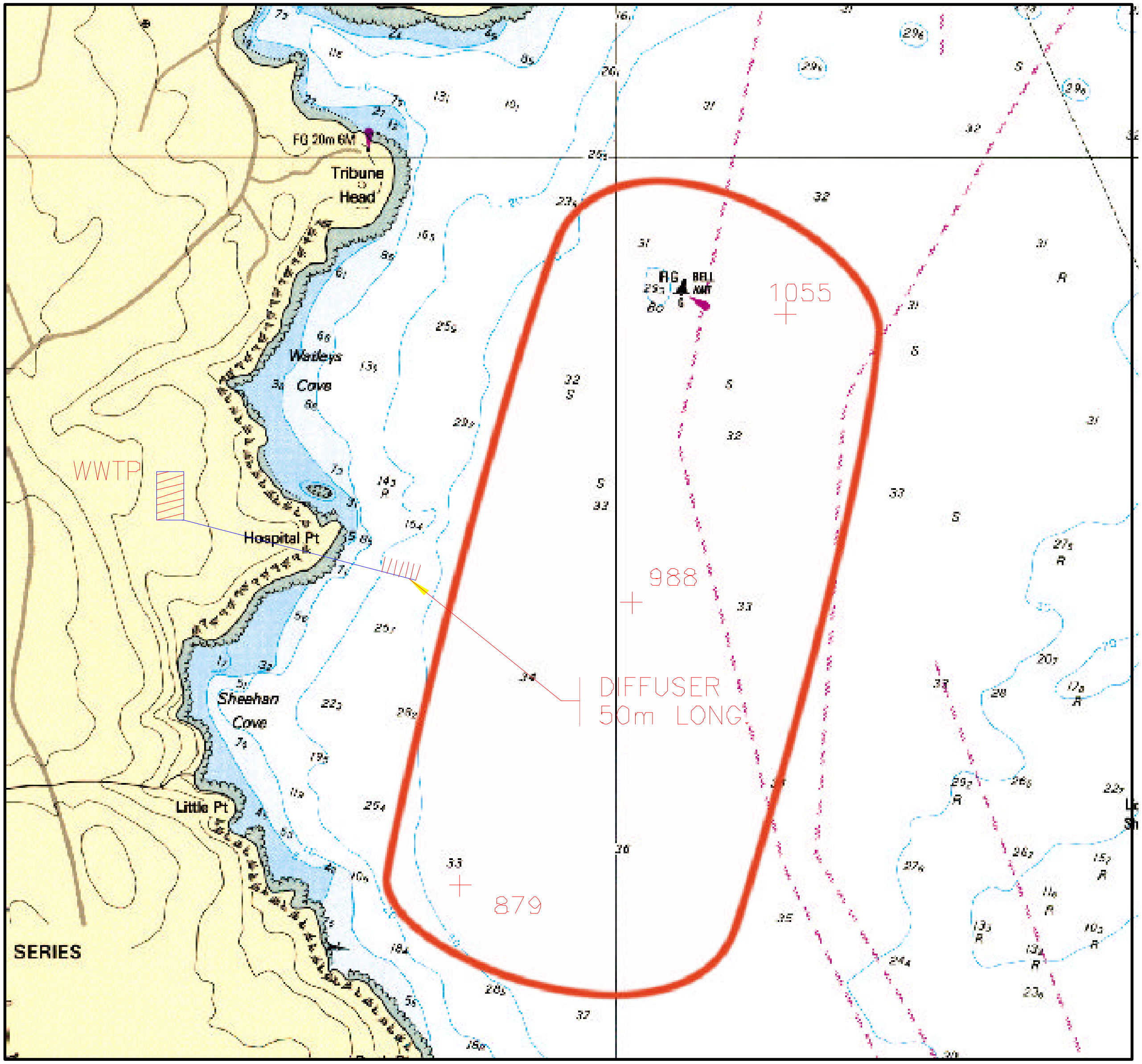

Figure 3.3 Herring Cove Diffuser Design and Location (Revised February 28, 2002)

Table 3.1 Diffuser Design and Dilution Rates			
Criteria/Results	**Halifax**	**Dartmouth**	**Herring Cove**
Length of diffuser	75 m	100 m	50 m
Minimal initial dilution rate	20:1	20:1	50:1
Average depth of diffusion zone	20 m	17 m	20 m
Density structure	Uniform	Uniform	Uniform
Assumed current speed (windless conditions)	~0.01 m/s	~0.01m/s	~0.01 m/s
Number of nozzles	20	20	15
Modelling results	• Dilution rate of 5:1 attained while plume was rising to surface ~6.2 m from nozzles • Dilution rate of 20:1 attained while plume rising ~16.7 m from nozzles	• Dilution rate of 5:1 attained while plume was rising to surface ~5.8 m from nozzles • Dilution rate of 20:1 attained while plume was rising to surface ~14.9 m from nozzles	• Dilution rate of 25:1 attained while plume was rising to surface ~13.6 m from nozzles • Dilution rate of 50:1 attained while plume was rising ~ 19.0 m from nozzles
Note: Information provided by HREP. CORMIX model was used to predict dilution rates.			

Coastal Ocean Associates reviewed these proposed modifications and have indicated that the conclusions regarding potential water quality effects in the Environmental Screening remain generally valid in that water quality objectives will be met most of the time except in the immediate vicinity of the diffusers. The harbour-wide dispersion modelling results presented in the Screening remain valid.

4.0 SEWAGE COLLECTION SYSTEMS

As detailed project design proceeds, it is anticipated that a number of refinements to the sewage collection system will be proposed compared with the system description depicted in Figure 2.2-2.4 in the Environmental Screening. These modifications will include some changes to sewer routing and pumping station configuration/location to optimize the system and/or reduce costs.

It is currently proposed that the sewer route in the south end of the Halifax Peninsula follow existing roads to downtown and Sackville Street. This updates the routing depicted in the Environmental Screening (Figure 2.2) with the route following CN lands and Lower Water Street. In the north end of Halifax, the proposed collection system follows DND property to the STP site, versus running along Barrington Street. In Dartmouth, the proposed collection system north of the MacDonald Bridge follows CN lands rather than along Wyse Road as shown in the Environmental Screening (Figure 2.3).

Dual forcemains are proposed for pumping stations that have a capacity of less than 75 L/s where the size of the forcemain would be within 15-20 cm (6-8”) making it an economically feasible option.

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 the 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 (refer to Figure 4.1). This small pumping station will be primarily underground. A forcemain will convey the intercepted flow back along the existing sewer easement to the larger pumping station on the AST property.

For construction and maintenance purposes, a vehicular access to the small pumping station would be constructed in the park from Cable Road, just north of the intersection with Tower Hill Road. The roadway would be constructed to be similar to existing roadways within the Park, and the route of the roadway would be such as to minimize tree cutting and to avoid the Chain Rock Battery. Power to the pumping station would be underground, along existing roadways, and the proposed new section of roadway. Figure 4.1 shows the proposed pumping station locations and associated collector system route.

At flows greater than 4xADWF, stormwater overflow will occur at the Chain Rock combined sewer overflow (CSO) in Point Pleasant Park. Overflow effluent at this and other CSO locations will be highly diluted by the stormwater component. While such overflow may cause occasional local deviations from the recreational water quality objectives (SB class), the overall water quality objectives for the Northwest Arm should be met on average without CSO disinfection. Contact recreational use of the Northwest Arm tends to be spatially removed from this location at the mouth of the Arm. For this reason, disinfection at this CSO has not been incorporated into the Project design as had been indicated in Sections 2.7.1 and 4.2.5.2 of the Environmental Screening. Despite predicted impacts, the water quality at this location will nevertheless be greatly improved on average, even without CSO disinfection, compared with current untreated flows entering the Northwest Arm on a continuous basis. This assessment of impacts related to overflows at the Northwest Arm modifies the discussion in the Executive Summary, and Section 4.2.5.2, 4.2.7 and 11 of the Environmental Screening.

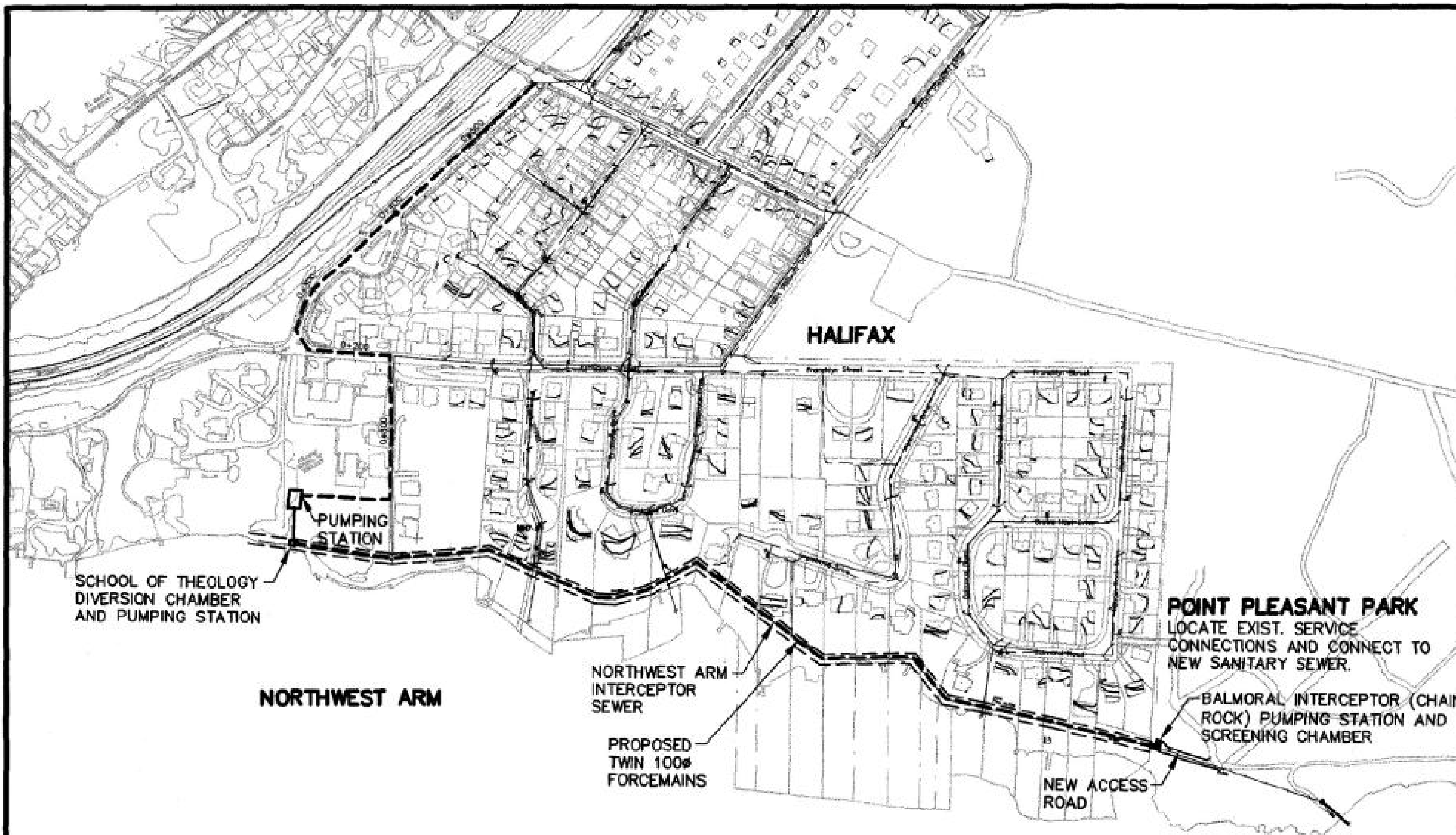

Figure 4.1 Collector System - South End Halifax

5.0 MISCELLANEOUS CLARIFICATIONS AND UPDATES

Table 5.1 presents additional miscellaneous clarifications and updates to the Environmental Screening to be considered.

Table 5.1 Additional Miscellaneous Clarifications and Updates to Environmental Screening

Disposition of Change	Reference	Clarification
Clarification	Section 2.7.3. "Private outfalls will also connect into the new collector system".	HRM states that the associated cost of connecting private outfalls to the new collector system will be the responsibility of the private owner of the outfall, not HRM.
Correction	Section 6.0 (Transportation Accidents)	Reference to four STPs should read three STPs.
Update	Section 2.4	Construction schedule has been delayed; construction of the Halifax STP did not commence in late 2001.
Update	Sections 2.4, 3.4.2, 4.2.5.2	Environmental Screening references phased construction schedule, although construction schedule may be compressed.
Update	Sections 2.3, 2.6.3, 5.2.2, 5.2.5.1, 5.3.2, 5.3.4, 5.3.5.1, 5.3.5.2, 5.4.2, 5.4.4, 5.4.5.1, 5.4.5.2, 6.0, 11.0, Figures 2.2, 5.2	Council recently approved Cornwallis/Barrington site for Halifax STP; references to alternate site are therefore no longer applicable.