PROJECT NO. 141-13379-00

MUNICIPALITY OF EAST HANTS

SEWER CAPACITY STUDY – FINAL REPORT

NOVEMBER 30, 2015

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Mr. Lew Landers, P.Eng., Engineering
Municipality of East Hants
15 Commerce Court
Elmsdale, Nova Scotia
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Subject : Municipality of East Hants
Sewer Capacity Study – Final Report

Dear Mr. Landers,

Please find enclosed 5 copies of our Final Report for the Municipality of East Hants Sewer Capacity Study.

We trust that this meets your needs at this time.

Yours truly,

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EXECUTIVE SUMMARY

The Municipality of East Hants has engaged WSP Canada Inc (WSP) to complete this Sewer Capacity Study to evaluate the hydraulic capacity of the existing wastewater infrastructure collection, transmission, and treatment systems to meet the needs of the existing and future population within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable GMA, and the Regional Commercial GMA. In addition to analyzing the hydraulic capacity of the existing system, the study also identified improvements to the existing wastewater systems necessary to service all anticipated development within the service area along with preliminary estimates of the capital costs for these improvements.

The Municipality wishes to use a uniform Sewer Infrastructure Charge to fund the portion of the future wastewater improvements that will serve future development within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable GMA, and the Regional Commercial GMA.

WSP has prepared hydraulic models of the existing wastewater collection and transmission systems within the service areas. Population growth projections within the study areas to the year 2046 include:

- Milford GMA: +0.5% per year
- Shubenacadie GMA: +0.5% per year
- Regional Serviceable Boundary GMA: 0.825% per year (Moderate Growth Scenario)
- Regional Serviceable Boundary GMA: 1.5% per year (High Growth Scenario)

These population projections to the year 2046, prepared during the Growth Management Review (WSP 2014), have been used to develop estimates of peak wet weather loading to the sanitary system hydraulic models for each of the three sanitary collection systems within the three Growth Management Areas (GMA) and the Regional Commercial Growth Management Area (GMA).

The hydraulic models have been used to analyze the capacity of the existing sanitary collection and transmission systems to meet the requirements of anticipated growth. WSP has also completed a preliminary assessment of the capacity of the three (3) existing wastewater treatment plant (WWTP) facilities to serve the future growth.

Short-term and long-term capital improvements required to service existing and future populations within the three GMA and the Regional Commercial Growth Management Area (GMA) have been identified and estimates of the capital cost for these improvements have been tabulated.

There is adequate undeveloped land within the existing boundaries of each of the three (3) GMAs and the Regional Commercial Growth Management Areas (GMA) to accommodate anticipated future population growth over the coming 32 years and beyond.

Application of a uniform Sewer Infrastructure Charge of $3,500 + HST per residential housing unit will provide adequate resources to fund the long-term improvements within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable Boundary GMA, and the Regional Commercial GMA over the coming 32 years (to 2046).

The proposed development of the larger blocks of undeveloped land within the service boundaries, (Armco Lands in Lantz and the Clayton Lands in Elmsdale) offer an opportunity for the Municipality of East Hants to develop a detailed wastewater infrastructure improvement plan that will reflect the increasing demands on the wastewater system as required to meet in an organized fashion the service requirements of each phase of these large development as they come to the table.

1 INTRODUCTION

This Sewer Capacity Study (SCS) was initiated by the Municipality of East Hants (East Hants) for the purpose of identifying the capacity of the existing sanitary sewer systems within the Municipal Growth Management Areas (GMA) to accommodate existing and future residential and commercial development within the Municipality. This study also identifies the upgrades to the existing sanitary systems required to accommodate anticipated growth over the next 30 years within the GMAs. The companion Growth Management Review (GMR) (WSP 2014) identified the population growth and development potential of the East Hants communities and reviewed the opportunities and constraints associated with sustainable, cost efficient growth within the Growth Management Areas (GMA) and Growth Reserve Areas (GRA).

This study has included the construction of a set of digital hydraulic models to simulate the hydraulic capacity of the existing wastewater collection, transmission and pumping systems within the GMAs including the existing wastewater pumping and forcemain systems, trunk gravity transmission sewers and wastewater treatment plant systems. The models have also been used to evaluate the hydraulic requirements of the future improvements required to address existing deficiencies and meet anticipated growth within these communities. This study also identifies the capital costs associated with future improvements and recommends community-wide infrastructure charges necessary to fund the expansion of the sanitary system to accommodate future development.

1.1 STUDY AREAS

This Sewer Capacity Study focuses on the hydraulic capacity of the existing sanitary collection, transmission and treatment systems within the boundaries of the Growth Management Areas (GMA) in the communities of Shubenacadie and Milford, and within the Regional Serviceable Boundary GMA and the Regional Commercial GMA.

The research conducted for this review involved the assessment of regional demographics, proposed future developments, land use patterns, and existing wastewater services provided by the Municipality of East Hants. Based on the results of these analyses WSP provides recommendations for infrastructure charges to fund improvements to the sanitary systems within the GMAs necessary to support anticipated population growth and the associated cost implications of these future improvements.

1.2 SEWER INFRASTRUCTURE CHARGE

Currently, East Hants collects a Sewer Infrastructure Charge of $3,000 for each new residential unit being serviced within the Growth Management Areas (GMA), a rate that has been in effect for nearly two decades. This Sewer Capacity Study provides a recommendation that East Hants adjust the Sewer Infrastructure Charges across the Service Areas to reflect the capital costs associated with upgrades to existing sanitary systems necessary to meet the requirements of anticipated future serviced development within the Municipality of East Hants. Due to the wide range of infrastructure costs required to meet the needs of each of the three wastewater systems and the range of growth anticipated to support those costs, the application of a single capital cost charge across the whole of the study area is recommended.

2 SERVICES AREAS AND POPULATIONS

2.1 WASTEWATER SERVICED AREAS

The Municipality of East Hants (East Hants) currently provides sanitary wastewater collection and treatment services within the service boundaries of the following communities:

- Milford GMA
- Shubenacadie GMA
- Regional Serviceable Boundary GMA
- Regional Commercial GMA

The Municipality of East Hants does not currently provide central wastewater services within the Mount Uniacke GMA, the Grand Lake Horne Settlement GRA, the Belnan GRA and the Lantz GRA.

As stated in the Growth Management Review (WSP 2014), there is sufficient available land within the four (4) existing serviced boundaries to accommodate all of the serviced residential and commercial growth anticipated within East Hants to the year 2046. Therefore, no expansion of wastewater services is recommended beyond the existing boundaries of the four (4) areas currently serviced by the Municipality of East Hants.

Sanitary sewage collected within the Milford GMA is delivered to the existing Milford Wastewater Treatment Plant (WWTP), a new sequencing batch reactor facility, located near the centre of the community and adjacent the Shubenacadie River.

Sanitary sewage collected within the Shubenacadie GMA is delivered to the existing Shubenacadie WWTP, an older oxidation ditch wastewater treatment facility, located at the eastern edge of the community adjacent the Shubenacadie River.

Sanitary sewage collected within the Regional Commercial GMA and the Regional Serviceable Boundary GMA is transmitted through a complex series of gravity trunk sewers and sewage pumping and forcemain systems to the existing Regional WWTP, an aerated lagoon treatment facility located near the Shaw Brick Plant adjacent the Shubenacadie River. For the purposes of wastewater management, the Regional Commercial GMA and the Regional Serviceable Boundary GMA are considered as a single wastewater service area.

2.2 PLANNING TIMELINE HORIZONS

The analysis and planning of wastewater systems within each of the four (4) service areas, currently provided with central wastewater services, has been considered within three (3) specific time horizons:

- <u>Existing Conditions Horizon (2014)</u> – An estimate of the existing serviced population within each of the communities has been based on a count of the number of serviced residential dwelling units multiplied by a unit density of 2.25 persons per apartment unit and 3.35 persons per single family residential unit. Where possible, for consistency, these estimates of existing serviced population have been compared with population estimates provided by East Hants and found similar.
- <u>Long-Term Growth Horizon (2046)</u> – Estimates of long-term future population growth within each of the serviced communities to the year 2046 have been based on estimates of existing population and on anticipated growth rates derived from recent historical growth within the Municipality and on population projections provided by the Municipality of East Hants. As may

be expected in a vibrant suburban community, such as the Regional Serviceable Boundary GMA, actual growth may fluctuate significantly from place to place depending on the intentions of the individual land owners or developers and on prevailing market conditions. Within the Regional Serviceable Boundary GMA, in particular, where there is plenty of room for future development, specific assumptions regarding the level of development have been made so that the analysis of wastewater system capacity could proceed in a realistic fashion.

- Ultimate Growth Horizon (beyond 2046) – In recognition that certain infrastructure system, including trunk gravity sewers and pumping station and forcemain systems, have a very long service life and where new systems are recommended to meet short-term and long-term growth requirement, we have recommended the installation of improvements designed to meet the ultimate requirements of the total development within the tributary area. When considering the construction of infrastructure upgrades that have a service life less than 30 years, we have recommended infrastructure improvements designed to meet this shorter timeline.

2.3 POPULATION SERVICED PROJECTIONS

2.3.1 SERVICED AND UNSERVICED AREAS

To regulate high density serviced and unserviced growth within the region, the Municipality of East Hants has established a number of Growth Management Areas (GMA) and Growth Reserve Areas (GRA). Development within each of the GMAs may or may not have access to central sanitary wastewater collection and treatment services and to central water distribution and fire protection services. Where central services are not currently provided, developers of lands within existing Growth Reserve Areas (GRA) will be expected to rely on on-site water and wastewater services designed to meet the regulations of the Province of Nova Scotia.

Table 2.1 provides a summary of the sanitary and water services currently available within each of the GMAs and GRAs within the Municipality of East Hants.

Table 2.1 Summary of Existing Services within East Hants GMAs and GRAs

GMAs – Serviced Growth Management Areas	Sanitary Services	Water Services
1 – Milford GMA	Yes	No
2 - Shubenacadie GMA	Yes	Yes
3 - Regional Serviceable Boundary (Enfield, Elmsdale, Lantz)	Yes	Yes
4 - Mount Uniacke GMA	No	No
5 - Regional Commercial GMA	Yes (partial)	Yes (partial)

GRAs – Growth Reserve Areas	Sanitary Services	Water Services
1 – Lantz GRA	On-site	On-site
2 - Grand Lake/Horne Settlement GRA	On-site	On-site
3 – Belnan GRA	On-site	On-site

2.3.2 REGIONAL SERVICED POPULATION PROJECTIONS

The primary purpose of this Sewer Capacity Study is to review the hydraulic capacity of existing sanitary collection, transmission and treatment systems within each of the serviced GMAs to meet the service requirements of the existing serviced population and anticipated future long-term growth within each of the area boundaries to the year 2046.

Estimates of existing serviced population within each of the four (4) serviced Growth Management Areas (GMA) have been prepared as part of the recent Growth Management Review (WSP 2014). An estimate of existing serviced population within a specific GMA boundary has been based on a count of the number of existing residential, single family and multi-unit residences multiplied by a density of

3.35 persons per R-1 (single family) home and 2.25 persons per apartment unit. These specific population densities have been adopted to support the planning of municipal wastewater infrastructure systems that must have adequate capacity to meet the requirements of the design population within the planning time horizon. It is recognized that the actual population densities within any of these GMA boundaries may be less than these planning densities, but that the municipal wastewater infrastructure systems must still have adequate hydraulic capacity to service the long-term theoretical serviced population.

Population projections have been prepared for future years in five year increments coinciding with the Census Canada anniversaries to the year 2046. A range of anticipated future population growth rates have been considered for each GMA based on the range of historical growth rates experienced in the recent past and on somewhat more optimistic growth that may potentially occur in the foreseeable future. In view of the long-term service life of municipal wastewater infrastructure and the requirement to meet the service needs of any reasonable amount of future population growth, we have adopted, where practical, a higher growth projection in the interests of conservative infrastructure planning and design.

Milford GMA

Over the past decade, the Milford GMA has experienced relatively modest population growth in the range of 0.25% per year. The recent construction of the new Milford SBR WWTP, which has plenty of excess capacity to support future development, has made it possible for the Municipality to approve significantly more development should this be proposed. Table 2.2 provides a summary of the range of population projections for the Milford GMA considered during this study.

Table 2.2 - Milford GMA - Serviced Population Growth Projections

	2014*	2016	2021	2026	2031	2036	2041	2046
High Growth (0.5% per year)	1,109	1,120	1,148	1,177	1,207	1,238	1,269	1,301
Medium Growth (0.25% per year)	1,109	1,115	1,129	1,143	1,157	1,172	1,186	1,201
No Growth (0% per year)	1,109	1,109	1,109	1,109	1,109	1,109	1,109	1,109

** 2014 population based on House Count – (number of R-1 houses x 3.35 persons per house)*

Adoption of the higher population growth rate of 0.5% per year within the Milford GMA would result in the servicing of 192 additional persons over the next 32 years, or 57 additional single family housing units (based on 3.35 persons per single family housing unit).

For the purposes of evaluating the hydraulic capacity of the sanitary collection system in this Sewer Capacity Study, it has been assumed that the Milford GMA will experience a population growth rate over the next 32 years (to 2046) of 0.5% per year. Estimates of long-term future sanitary wastewater flows within the Milford GMA have been based on a total future service population in the year 2046 of 1,301 persons, with allowance in the design flows of appropriate levels of extraneous infiltration and inflow (I/I) during wet weather conditions.

Shubenacadie GMA

Currently, the existing Shubenacadie WWTP is nearing the end of its functional service life and has no excess capacity to accommodate any future development within or beyond the boundaries of the Shubenacadie GMA. Recently, a developer has proposed the construction of a serviced 500-unit residential development on the edge of the GMA, known as the Heights at Shubenacadie. Servicing of even a small portion of this proposed development will require either significant upgrades to the existing WWTP or the construction of a new WWTP similar in size and style to the Milford SBR WWTP.

While population growth within the Community of Shubenacadie has been very slow in recent years, it is evident that the approval of even a portion of a large development, such as the Heights of Shubenacadie, will have a significant impact on the capacity of the existing sanitary collection and treatment systems. In view of the wide range of potential growth rates that may prevail within and immediately adjacent the Shubenacadie GMA, we have limited the growth projections for the Shubenacadie GMA from no growth (0% per year) to a maximum growth rate of 0.5% per year.

Table 2.3 provides a summary of the range of population projections considered during this study.

Table 2.3 - Shubenacadie GMA - Serviced Population Growth Projections

	2014*	2016	2021	2026	2031	2036	2041	2046
High Growth (0.5% per year)	874	883	905	928	951	975	1,000	1,025
Medium Growth (0.25% per year)	874	878	889	901	912	923	935	947
No Growth (0% per year)	874	874	874	874	874	874	874	874

** 2014 population estimate based on House Count – (number of houses x 3.35 persons per house)*

Adoption of the higher population growth rate of 0.5% per year within the Shubenacadie GMA would result in the servicing of 151 additional persons over the next 32 years, or 45 additional units (based on 3.35 persons per single family housing unit). Permitting and construction of the whole of the Heights of Shubenacadie development could result in the addition of 1,675 more persons or 500 homes to the GMA, which would assist significantly with the funding of the proposed new WWTP.

For the purposes of evaluating the hydraulic capacity of the sanitary collection system in the Sewer Capacity Study, it has been assumed that the Shubenacadie GMA will experience a population growth rate over the next 32 years (to 2046) of 0.5% per year. Estimates of long-term future sanitary wastewater flows within the Shubenacadie GMA have been based on a total serviced population of 1,025 persons, with allowance for appropriate levels of extraneous infiltration and inflow (I/I) during wet weather conditions. Since the addition of the whole of the Heights at Shubenacadie development to the existing sanitary system is not approved at this time and would have such a significant impact on the reconfiguration of the existing sanitary system, we have not included this in our analysis of capital costs. Should the Municipality approve the servicing of all or part of the proposed Heights of Shubenacadie development, the hydraulic capacity of the existing wastewater transmission system and WWTP must be revisited.

It is noted that even this modest level of growth (151 additional persons) will require the construction of a new WWTP to replace the existing facility. Should the development of a larger serviced subdivision become a reality, a new and larger WWTP would be required along with expansion of the collection and transmission system to accommodate the significantly higher average and peak wastewater flow rates.

Regional Serviceable Boundary GMA

Historically, residential development and subsequent population growth within the Regional Serviceable Boundary GMA has been among the highest in Atlantic Canada. Over the past two (2) decades, the population within the GMA has averaged 1.25% per year. Recently, applications for building permits have indicated that future growth may exceed this historical rate provided that municipal services are able to support the wastewater transmission and treatment requirements of the new developments.

Table 2.4 - Regional Serviceable Boundary GMA - Population Growth Projections

	2014*	2016	2021	2026	2031	2036	2041	2046	Increase between 2014 to 2046
Population Projects - High Historic Growth (1.25%/yr)	6,593	6,759	7,191	7,651	8,141	8,662	9,217	9,806	3,213
Population Projects - Low Growth (0.4%/yr)	6,593	6,646	6,780	6,917	7,057	7,199	7,345	7,493	900
Average of two (2) methods– Moderate Growth (0.825%/yr)	6,593	6,702	6,986	7,284	7,599	7,931	8,281	8,650	2,057

**2014 population estimate based on House count – (number of house x 3.35 persons per house)*

Use of the average of the two growth rates (0.825% per year), which is considered a conservative assumption, results in a projection to the year 2046 of an additional 2,057 persons over a 32 year period, or an average of 19 new single family residential units per year (based on 3.35 persons/unit) within the Regional Serviceable Boundary GMA.

If we accept that the higher growth rate of 1.25% per year is more likely, then a total 3,213 additional persons may be added to the system by the year 2046 or an average of 100 persons more per year.

In recognition of the dynamic nature of the housing market within this area of East Hants, we have carried forward both of these two assumptions of potential growth within the Regional Serviceable Boundary GMA, including a moderate growth rate of 0.825% per year and a high growth rate of 1.25% per year.

It is noted that in recent years the actual rate of building permit applications within the Regional Serviceable Boundary GMA is significantly higher than these more moderate growth estimates, even exceeding the historic growth rates of 1.25% per year experience lately. For the purposes of the current study, we have accepted these moderate growth rates for the most conservative long-term analysis of the sanitary system. We have also examined the two largest blocks of undeveloped land within the Regional Serviceable Boundary GMA, the Armco Lands in Lantz (Area A) and the Clayton/Shaw Lands near the Nine Mile River (Area C) with regard to their potential long-term and ultimate impact on the hydraulics of the existing sanitary collection and transmission systems.

2.3.3 POPULATION GROWTH PROJECTION SUMMARY

Table 2.5 provides a summary of the population projections within the three GMAs under a moderate growth scenario to the year 2046. The total increase in serviced population across the three GMAs to the year 2046 is estimated at 2,222 additional persons for an increase in serviced population of 20.6% expressed as a percentage of projected future serviced population. This moderate growth projection scenario is considered the lower limit of combined population growth anticipated within the three Growth Management Areas.

Table 2.5 Summary of Population Growth Projections – Moderate Growth

Serviced GMAs	Total Serviced Population		Increase as Percentage of Future Population (%)
	2014	2046	
Milford GMA	1,109	1,201	7.7%
Shubenacadie GMA	874	947	7.7%
Regional Serviceable Boundary GMA	6,593	8,650	23.8%
Total Population – Moderate Growth	8,576	10,798	20.6%

Table 2.6 provides a summary of the population projections within the three GMAs under a high growth scenario to the year 2046. The total increase in serviced population across the three GMAs to the year 2046 is estimated at 3,556 additional persons for an increase in serviced population of

29.3% expressed as a percentage of future projected serviced population. This high growth projection scenario is considered the upper limit of combined population growth anticipated within the three Growth Management Areas. Should one of both of the larger undeveloped blocks of land within the Regional Serviceable Boundary GMA come forward for development at a rate beyond that anticipated in the High Growth Scenario, then the Municipality will be required to negotiate capital cost sharing for additional infrastructure improvements required to service the additional population on a case by case basis.

Table 2.6 Summary of Population Growth Projections – High Growth

Serviced GMAs	Total Serviced Population		Increase as Percentage of Future Population (%)
	2014	2046	
Milford GMA	1,109	1,301	14.8%
Shubenacadie GMA	874	1,025	14.7%
Regional Serviceable Boundary GMA	6,593	9,806	32.8%
Total Population – High Growth	8,576	12,132	29.3%

From information presented in Table 2.5 and Table 2.6, it is evident that the actual growth in total serviced population will likely fall somewhere between the moderate growth scenario and the high growth scenario. For the purposes of capital cost recovery, it has been assumed that the future growth in total serviced population within the three GMAs will be approximately 30% of the total future serviced population over the period from 2014 to 2046.

3 COLLECTION SYSTEM CONFIGURATION AND HYDRAULIC MODELLING

3.1 WASTEWATER SYSTEM HYDRAULIC MODELS

The Municipality of East Hants owns and operates sanitary collection, transmission and treatment systems within the Milford GMA and the Shubenacadie GMA, and within the Regional Serviceable Boundary GMA, which includes the communities of Enfield, Elmsdale and Lantz, as well as within the Elmsdale Business Park, which is within the Regional Commercial GMA.

As part of the current study, WSP has prepared a set of digital hydraulic models of the existing sanitary collection and transmission systems, which include all of the existing gravity collection sewers, wastewater pumping stations and forcemain systems, and trunk gravity transmission sewers currently managing sanitary sewage from existing development within the service boundaries.

These hydraulic models of the existing wastewater collection and transmission systems have been constructed in Sewer GEMS modeling environment, using information assembled from as-built drawings and schematic information provided by the Municipality of East Hants. Generally, the sewer system models include all of the gravity sewers within the wastewater collection systems, as well as the pump curves and forcemain system dimensions for wastewater pumping stations currently serving to deliver the sewage into the headworks of the wastewater treatment plants (WWTP). No attempt has been made to include the hydraulics through the wastewater treatment plants in the hydraulic models of the sewer network, but simply to deliver the wastewater into the headworks of the WWTPs.

While the configuration and layout of the collection and forcemain piping systems are consistent with the information provided in the record drawings, the actual friction factors within the pipes are unknown, and therefore we have used estimates of the pipe condition taken from industry references. We have also used pump curves provided by the pump suppliers to simulate the performance of the existing pumping stations, bearing in mind that the actual condition and hydraulic capacity of the existing pumps may be less than originally provided, due to wear and tear on the pump impellors and volutes since they were originally installed.

Nevertheless, the piping and pumping information included in the existing hydraulic models is considered adequate for the hydraulic analysis within this study of the hydraulic capacity of the existing sanitary systems. The hydraulic models, which will be delivered to the Municipality at the conclusion of the project, can be updated with more detailed information on the actual condition of the infrastructure as it becomes available and they can serve as the basis of future more detailed analysis as required.

Each GMA hydraulic model has been configured as an Existing Conditions Model simulating current peak wet weather loading to the system and as a Long-Term Future Conditions Model simulating the peak wet weather loading to the system in the year 2046. The analysis has focused on the identification of short-term improvements that must be implemented immediately to address current hydraulic limitations in the existing sanitary system and on the identification of long-term improvements necessary to provide adequate hydraulic capacity to accommodate anticipated future peak wet weather flows associated with long-term growth.

Table 3-1 provides a summary of the number and type of components included in each of the Wastewater Hydraulic Models for the three Serviced Communities. It is evident that the model of the wastewater system serving the communities of Enfield, Elmsdale and Lantz is the most elaborate and complex as it handles sanitary sewage collected within both the Regional Serviceable Boundary GMA and the Regional Commercial GMA and delivers the wastewater to the Regional WWTP.

Table 3-1 Hydraulic Model Statistics

No.	Model Component	Milford GMA	Shubenacadie GMA	Regional Serviceable Boundary GMA
1	Gravity Pipes (pipe reaches)	124	94	669
2	Manholes	121	92	662
3	Junctions	3	1	45
4	Pumps	2	5	46
5	Pumping Station Wetwells	1	3	24
6	Pressure Pipes (units)	5	14	162
7	Pressure Junctions	1	3	123
8	Outfalls	1	1	3

3.2 WASTEWATER SYSTEMS CONFIGURATION AND ANALYSIS

Three independent digital hydraulic models have been prepared for use during the analytical component of the Study. The general configuration of each of the existing sanitary collection and transmission systems is presented in the following sections, with particular emphasis on the areas of the existing wastewater transmission systems that will require upgrade in the short-term or in the long-term to meet the requirement of growth within the Study Areas.

3.2.1 MILFORD GMA

Sanitary sewage generated within the Milford GMA is collected in a conventional gravity sewer system and delivered to the headworks of the newly constructed Milford WWTP, located near the southern limit of the service area and adjacent the Shubenacadie River. Map 1 (in pouch) illustrates the service boundary of the Milford GMA, individual property boundaries, tributary sewershed boundaries, sanitary collection piping, sanitary pumping and forcemains system and the location of the Milford WWTP, which serves the Milford wastewater system.

While the majority of the sewage generated in Milford is delivered by gravity directly to the WWTP, a small portion of the system located at the north end of the GMA drains to the Main Office Sanitary Pumping Station (SLS-21), from which is it pumped through a single 200mm diameter forcemain located in Highway 2, a distance of approximately 730 metres to the top of the divide, where it discharges into a manhole on the existing 200mm diameter gravity sewer.

Based on the results of the short-term hydraulic analysis, the Milford sanitary system has adequate capacity to accommodate peak wet weather flows from the existing serviced population. Table 3.2 provides a summary of the hydraulic capacity of the Main Office Sanitary Pumping Station (SLS-21) to meet the existing and future wet weather flows within its tributary area.

Short-Term Improvements

The peak pumping capacity of SLS-21 exceeds the hydraulic capacity of a 760 metre long segment of the existing 200mm diameter trunk gravity sewer into which it discharges. In the short term, the Municipality may wish to investigate the throttling of the pumping system in SLS-21 to reduce the potential for surcharging the trunk sewer system. There is currently no short-term requirement for upgrading the receiving sewer system unless additional development tributary to SLS-21 or directly to the trunk gravity sewer system is approved for the North End of the Milford GMA.

Table 3-2 Available Pumping Station Wet Weather Hydraulic Capacity – Milford GMA

Tributary Area	Lift Station Number	Peak Wet Weather Flow[1]	Peak Lift Station Capacity[2]	Available Excess Wet Weather Capacity[3]	
		(L/s)	(L/s)	(L/s)	(%)
Milford GMA - North End	SLS-21	14.5	21	6.5	31%

The new Milford Sequencing Batch reactor (SBR) WWTP has plenty of capacity to accommodate any amount anticipated growth within the Milford GMA. Nevertheless, the WWTP requires some short-term upgrades that should be considered in the very near future including replacement of the SBR Feed Pumps, installation of a safety railing system around the top of the SBR tanks, and installation of a flow meter on the influent supply line.

Long-Term Improvements

The peak pumping capacity of the existing pumps in SLS-21 (21 L/s) and the existing forcemain system is sufficient to handle the anticipated long-term wet weather flows in the North End of the Milford GMA system to the year 2046. The capacity of the existing 200mm diameter gravity trunk sewer in Highway 2 is marginal however, and it must be replaced when and if there is a requirement for additional development within the tributary area. It is also recommended that a magnetic flow meter be installed on the forcemain at SLS-21 to monitoring wastewater flows discharging from that facility. It has been assumed that the replacement of the trunk gravity sewer will form part of the long-term improvements to the system.

The process equipment within the new Milford SBR WWTP has significant remaining service life that could extend for more than 30 years. It is recommended that the Municipality prepare and implement an Asset Renewal Plan for the Milford WWTP that will include the development of a schedule for the long-term replacement of these important process mechanical and electrical systems in a coordinated fashion, as they reach the end of their serviceable life.

3.2.2 SHUBENACADIE GMA

Sanitary sewage generated within the Shubenacadie GMA is collected in a conventional gravity sewer system and delivered to the headworks of the Shubenacadie WWTP, located near the north-eastern limit of the service area and adjacent the Shubenacadie River. Map 2 (in pouch) illustrates the boundary of the Shubenacadie GMA, individual property boundaries, tributary sewershed boundaries, sanitary collection piping, sanitary pumping station and forcemains system and the location of the Shubenacadie WWTP within the collection system.

The majority of the sewage generated in Shubenacadie is delivered by gravity directly to the existing Maitland Road Sanitary Lift Station (SLS-23), from which is it pumped through a single 150mm diameter forcemain located in Highway 2, to a sanitary gravity manhole located at the bottom of Conley Road, from which it flows by gravity to the wetwell of the Burgess Road Sanitary Lift Station (SLS-24), from which it is pumped through a 150mm diameter forcemain into the headworks of the WWTP.

Based on the results of the short-term hydraulic analysis, the Shubenacadie sanitary collection system has adequate capacity to accommodate peak wet weather flows from the existing serviced population within the Shubenacadie GMA. Table 3.3 provides a summary of the normal hydraulic capacity of the Shubenacadie Sanitary Lift Stations (SLS-23 and SLS-24) with one duty pump working and the peak hydraulic capacity with both pumps working simultaneously into their single forcemains. The existing pumps are adequate to meet the hydraulic requirements of the existing and future wet weather flows within its tributary area. It is noted that the normal hydraulic capacities of SLS-23 and SLS-24, with only one duty pump working, are adequate to accommodate the future peak wet weather flows anticipated from their tributary sewersheds and that the hydraulic capacity of each of the stations with both pumps working is significantly greater than anticipated future peak wet weather flows from the tributary sewershed areas.

Based on hydraulic analysis of the receiving sewer system using the hydraulic model, the hydraulic capacity of approximately 620m of the existing 200mm diameter receiving sewer system is inadequate to handle future extreme peak wet weather flows with both pumps discharging simultaneously. Bearing in mind that one of the existing duty pumps in the pumping station has adequate capacity to accommodate anticipated peak wet weather flows from its tributary sewershed, this sewer pipe should be adequate to handle future peak wet weather flows unless future population growth should require both duty pumps to work simultaneously, when the 620m of the existing 200mm diameter receiving sewer should be replaced with a new 300mm diameter gravity sewer in Highway 2 and the Burgess Road.

Table 3-3 Available Lift Station Wet Weather Capacity – Shubenacadie GMA

Tributary Area	Lift Station Number	Peak Wet Weather Flow[1]	Normal Station Capacity[2]	Peak Station Capacity[3]	Available Excess Wet Weather Capacity[4]	
		(L/s)	(L/s)	(L/s)	(L/s)	(%)
Burgess Road SLS	SLS-24	30	38	50	8	21%
Maitland Road SLS	SLS-23	26	70	100	44	63%

Notes: 1. Peak Wet Weather Flow based on the existing theoretical wet weather flow including sanitary sewage and infiltration and inflow (I/I) based on the Municipality of East Hants formula.

2. Normal Wet Weather Pumping Capacity assumes that only one duty pumping is operating during a wet weather event and the pump is working at its design duty point.

3. Peak Wet Weather Pumping Capacity assumes that all pumping stations are operating simultaneously during a major wet weather event with all pumps working.

4. Available Excess Wet Weather Capacity represents the theoretical additional pumping system capacity at each pumping station available to accommodate future development with only one pump working.

Short-Term Improvements

The normal pumping capacity of the Maitland Road SLS (SLS-23) with one duty pump working approaches the hydraulic capacity of the 620 metre long segment of the existing 200mm diameter trunk gravity sewer in Hwy 2 and Burgess Road, into which it discharges. It is understood that only one duty pump is required to handle peak wet weather flows from the tributary sewershed. In the short term, the Municipality may wish to investigate the throttling of this pumping system to reduce the potential for surcharging the trunk sewer system under wet weather conditions.

There is currently no excess capacity at the Shubenacadie WWTP to accommodate any additional development within the service area, even though there have been some recent efforts to reduce I/I entering the collection system. Before there is any more development within the Shubenacadie GMA, the Municipality should decide whether a new SBR WWTP will be constructed to meet the wastewater treatment requirements of future development within the GMA.

Long-Term Improvements

Currently, there is a proposal from a private sector developer to construct a large suburban residential development on the west edge of the Shubenacadie GMA, known as the Heights of Shubenacadie. The existing Shubenacadie WWTP has reached the end of its service life and cannot accommodate any additional growth. In the long-term, the Municipality should consider the construction of a new WWTP to be located either at the site of the existing WWTP or at an alternative location adjacent the Shubenacadie River, yet to be determined. The capacity of this new WWTP should be capable of accommodating the anticipated long-term growth within the Shubenacadie GMA as well as any additional growth proposed on adjacent undeveloped property, such as the Heights of Shubenacadie development.

In recognition of the limited residential growth anticipated within the core of the Shubenacadie GMA, the capital cost of a new SBR WWTP must be shared across all future growth within the GMA boundary and in the vicinity of the GMA, including that within the Heights of Shubenacadie Development, when and if it occurs. Until the outcome of this major development has been determined, it is recommended that the existing Shubenacadie WWTP be maintained in operation. The long-term requirements of the new CCME Wastewater Strategy may also result in a need to replace the existing WWTP with a modern secondary wastewater treatment facility, which could precipitate the replacement of the existing plant in the near-term, at which point the long-term capacity requirements of the new WWTP would be determined.

3.2.3 REGIONAL SERVICEABLE BOUNDARY GMA

All sanitary wastewater from residential, commercial, and industrial development within the Regional Serviceable Boundary GMA and the Regional Commercial GMA is collected and transmitted by the regional sanitary collection and transmission system, which delivers sanitary sewage to the headworks of the Regional WWTP, located near the Shaw Brick Plant in Lantz. Map 3 and Map 4 (in pouches) illustrate the serviceable boundaries of the Regional Serviceable Boundary GMA and the Regional Commercial GMA, as well as the components of existing Regional Wastewater System. In addition to the wastewater from the residential development within the service areas, the Regional Wastewater System handles the sanitary flow from 3 elementary schools and the Irving Big Stop in Enfield.

The regional sanitary collection system is structured in five (5) separate collection systems that service the following areas and operate relatively independently of each other:

- Area A – North End and Armco Lands
- Area B – Lantz/Logan Drive Area
- Area C – Nine Mile River/Shaw Lands
- Area D – Regional Commercial GMA / Highway 214 Corridor
- Area E – South Highway 2

Currently, every one of these five (5) sanitary collection and transmission systems has limited capacity to service significant additional growth within the tributary area. The following sections describe in detail the limitations of these systems and make recommendations for short-term and long-term improvements to meet the anticipated short-term and long-term growth within the individual sewersheds.

3.2.4 PUMPING STATION AVAILABLE CAPACITY – REGIONAL SYSTEM

The Regional Wastewater Transmission System that delivers wastewater to the Regional WWTP in Lantz comprises a number of sanitary lift station and forcemain systems linked together by gravity trunk sewers. Table 3-4 provides a summary of the long-term peak wet weather flows tributary to each of the wastewater Lift stations as derived from the wastewater hydraulic model of the sanitary collection system within the Regional Serviceable Boundary GMA and the Regional Commercial GMA.

While the majority of the sewage pumping stations within the Regional Wastewater Transmission System have adequate capacity to meet the long-term requirements of long-term growth within their tributary areas, several of the larger, more prominent lift station and forcemain systems are reaching or have reached the limit of their design capacity and must be upgraded in the near future. Generally, lift stations that have available less than 10% of their total wet weather capacity or are likely to receive significant new development have been flagged for upgrade in the short-term or long-term.

Table 3-4 Available Pumping Station Wet Weather Capacity – Regional Wastewater System

Sub-Area No.	Lift Station Number	Peak Wet Weather Flow[1]	Peak Pumping Station Capacity[2]	Available Excess Wet Weather Capacity[3]	
		(L/s)	(L/s)	(L/s)	(%)
A – North End and Armco Lands	SLS-20	7	25.2 (1 pump working)	18.2	72%
	SLS-19	2.4	18	15.6	87%
	SLS-18	24.4	39.5	15.1	38%
B – Lantz/Logan Drive	SLS-15	13	27.5	14.5	53%
	SLS-16	6.0	12.5	6.5	52%
	SLS-17	95	101	6	5.9%
C – Nine Mile River / Shaw Lands	SLS-12	3.8	8.8	5	57%
	SLS-13	15.5	68	52.5	77%
	SLS-14	79	170	91	54%
D – Regional Commercial GMA / Highway 214 Corridor	SLS-11B	10.4	35	24.6	70%
	SLS-11C	8 (approx.)	32	24	75%
	SLS-11A	23.2	25	1.8	7.2%
	SLS-11	7.8	15	7.2	48%
	SLS-10A	4	7	3	43%

Sub-Area No.	Lift Station Number	Peak Wet Weather Flow[1]	Peak Pumping Station Capacity[2]	Available Excess Wet Weather Capacity[3]	
E – South Highway 2					
	SLS-2	6	10	4	40%
	SLS-5	1.8	15	13.2	88%
	SLS-1	12	38	16	42%
	SLS-3	7.2	7.2	nil	nil
	SLS-4	61	67.5	6.5	9.6%
	SLS-6	n/a	n/a	n/a	n/a
	SLS-7	114	105	nil	nil
	SLS-8	45	45	nil	nil
	SLS-9	5.5	14	8.5	61%
	SLS-10	48	36	nil	nil

Notes: 1. Peak Wet Weather Flow based on the existing theoretical wet weather flow including sanitary sewage and infiltration and inflow (I/I) based on the Municipality of East Hants formula.

2. Except where noted, Peak Wet Weather Pumping Capacity assumes that all pumping stations are operating simultaneously during a major wet weather event with all pumps working. For SLS-20, where the duty pumps are not of similar capacity, we have assumed that only the smaller pump is working and the second, larger pump is out of service.

3. Available Excess Wet Weather Capacity represents the theoretical additional pumping system capacity at each pumping station available to accommodate future development.

3.2.5 SHORT-TERM AND LONG-TERM CONSTRAINTS AND IMPROVEMENTS

Area A – North End and Armco Lands

Currently, sanitary sewage collected within the developments at the northern end of the Community of Lantz, in the vicinity of Robert Scott Dr. and Isenor Rd. is delivered by pumping (SLS-20 and SLS-19) to the wetwell of SLS-18, from which it is delivered to the existing gravity sewer located in Mader St. and Green Rd., which deliver the wastewater to SLS-17. The Armco lands, located at the extreme north end of the community of Lantz, represent one of the largest single blocks of developable property in the Study Area. This large undeveloped property is a strong candidate for development in the near future.

Short-Term Improvements

The existing 100mm diameter, single forcemain system serving SLS-18 is too small in diameter and must be replaced immediately with dual 150mm diameter forcemains with sufficient capacity to handle all future development in the Armco lands, when this will occur. The dual forcemain system will provide redundancy to handle ultimate average day flows, as well as providing sufficient capacity to handle peak wet weather flows and serving the ultimate development potential in the sewershed.

Long-Term Improvements

In the longer-term, when the future of the Armco lands has been determined, the new pumps, wetwell and other equipment associated with SLS-18 will require replacement. The exact capacity of the new pumps will depend on the ultimate configuration of the new development within the Armco Lands and adjacent properties. Due to the age of the existing equipment at SLS-18, it is anticipated that the station will require a major overhaul including installation of an external valve chamber. In the ultimate (long-term) condition, there may be a requirement for the complete replacement of SLS-18 with sufficient capacity to meet the needs of the fully-developed sewershed.

The 976 m of existing 200mm diameter sewer system in Mader and Green is also near capacity and will need to be replaced with a new 300mm diameter gravity sewer before any new development can be approved in the Armco lands. For the purposes of the current study, it has been estimated that a portion of the Armco lands sufficient to accommodate 763 persons will be developed before SLS-18 must be replaced entirely.

Ultimately, sewage from Area A is delivered into the wetwell at SLS-17, from which the flow is pumped through a single 300mm diameter forcemain into the headworks of the Regional WWTP. Currently, SLS-17 has limited excess capacity to accommodate short-term development within the tributary sewershed. In the long-term, the pumps at SLS-17 will require replacement to meet the long-term needs of the area.

Area B – Lantz / Logan Drive

Sanitary Sewage generated within the existing residential subdivisions in the vicinity of Logan Drive, Oakmount Drive, and adjacent area is collected and delivered by gravity to SLS-17, from which it is pumped into the headworks of the Regional WWTP. Based on the hydraulic analysis, local pumping stations (SLS-15 and SLS-16) have sufficient capacity to meet all of the long-term requirements of remaining developable lands within Area B.

Short-Term Improvements

With the exception of the short-term requirement for upgrade of the pumps at SLS-17, there are no other wastewater collection or transmission system upgrades associated with the development of Area B.

Area C – Nine Mile River/Shaw Lands

The Shaw Lands, located to the west of Highway 2 and to the north of the Nine Mile River, represent one of the largest single blocks of undeveloped privately-owned property within the Regional Serviceable Boundary GMA. Residential development of this property has been anticipated for the past three decades and the existing sanitary transmission system has plenty of capacity to accommodate the peak wet weather flows from the ultimate development of these lands.

The three major sanitary pumping stations (SLS-12, SLS-13 and SLS-14) and their single forcemain systems have more than 50% of their design capacity available to serve future long-term development within and adjacent Area C. No specific short-term or long-term improvements are required within Area C to accommodate the long-term development of this block of undeveloped property.

Area D – Regional Commercial GMA / Highway 214 Corridor

The existing wastewater transmission system serving the Regional Commercial GMA and lands within and immediately adjacent the Highway 214 Corridor functions as a single integrated wastewater system. Sanitary sewage collected within the Regional Commercial GMA is delivered by pumping from SLS-11A in the Business Park, located north of Highway 102 and discharged into the gravity trunk sewer located in Highway 214, which carries the flow down to the wetwell at SLS-10. The minor local sanitary pumping stations in the area, including SLS-11B. SLS-11C, SLS-11 and SLS-10A, have adequate excess capacity to meet the short-term and long-term needs of their tributary service areas.

Sewage collected, within the Regional Serviceable Boundary GMA in the tributary sewersheds along Highway 214 also discharges into the gravity trunk sewer in Highway 214, which discharges into SLS-10 located south of Highway 2. Based on the results of the hydraulic modeling, it has been determined that 625m of the existing gravity trunk sewer in Highway 214 has no available excess capacity to accommodate any future growth and must be upgraded immediately.

Short-Term Improvements

The capacity of a 625m long portion of the gravity trunk sewer in Highway 214 is inadequate to accommodate the peak wet weather flows from the tributary area and must be replaced with a new 450mm diameter gravity sewer and manhole system, which will have sufficient capacity to meet the long-term needs of the tributary areas.

Long-Term Improvements

In the long-term, the main sewage pumping station serving the Elmsdale Business Park (SLS-11A) will require new sewage pumps capable of increasing the station capacity to 15 L/s at a TDH of 27.2m, which will be able to handle the long-term peak wet weather flows associated with anticipated development.

With the long-term increase in sanitary flows in the Highway 214 trunk gravity sewer, there will be a requirement to upgrade the pumping capacity in SLS-10. The exact long-term future capacity of this station will be determined at a future date when the nature and extent of commercial developments in the Regional Commercial GMA has been better defined. However, a conceptual capital cost allowance for this upgrade has been included in the capital cost estimates as a place holder.

In the near-term to long-term, approximately 182 m of the existing gravity trunk sewer from MH10 to MH7 in Highway 214 must be replaced by a 450mm diameter gravity pipe and manhole system to meet the long-term requirements of growth within the sewershed. The exact timing of this major upgrade to the Highway 214 trunk gravity sewer will depend on future plans to widen and upgrade the streetscape and transportation system in Highway 214.

Regional WWTP

Long-Term upgrades to the existing Regional WWTP may include further upgrades to the aeration and blower system to bring the plant capacity to 13,800 m^3/day. With the future implementation of more stringent effluent standards associated with the new CCME Wastewater Strategy, there is also a potential for an increased requirement for nitrogen removal from the treated effluent stream.

Currently, lagoon WWTPs in other jurisdictions across Canada are being upgraded with the installation of a SAGR treatment module located at the end of the treatment process, however this sort of technology will require additional space that is not currently available outside the floodplain boundary. The Municipality may wish to seek to acquire permission from NSE to extend the footprint of the plant further into the existing floodplain.

Area E – South Highway 2

Sanitary sewage generated within the older, southern half of the Regional Serviceable Boundary GMA (Enfield) is collected and transmitted through a series of sanitary pumping station and forcemains systems and gravity trunk sewers located in the Highway 2 Corridor to the headworks of the Regional WWTP at Lantz. This chain of wastewater pumping station and forcemain systems, which includes SLS-4, SLS-7, SLS-8, SLS-9, and SLS-10 operating in series, delivers the wastewater to the headworks through a single common forcemain system to the headworks of the Regional WWTP.

The new Donaldson Sanitary Lift Station (SLS-4), which was replaced in 2008, has adequate capacity to meet the long-term requirements of its tributary area. In general, all of the rest of these major wastewater transmission pumping stations are nearing the limit of their hydraulic capacity during wet weather conditions, increasing the risk of sanitary sewer overflows (SSO) to the environment. The pumping equipment and control systems within these stations are also reaching the end of their service life and should be considered for upgraded or replaced. All of these stations discharge into a single common forcemain system that delivers the wastewater to the Regional WWTP.

Because there is very little undeveloped land within the sewersheds tributary to this integrated wastewater transmission system, it is understood that future maintenance of this system will be funded out of general revenue. Any infrastructure charges collected for future development within Area E will be applied to the expansion of system capacity as and when required.

Long-Term Improvements

While the individual pumping and forcemain systems along the trunk transmission system in the Highway 2 Corridor have sufficient capacity to meet dry weather flow conditions, it is during the peak wet weather conditions that the system reaches its maximum hydraulic capacity and sanitary sewage overflows (SSO) may occur. When the weather is very wet and all of the main pumping stations are discharging simultaneous into the single common forcemain system, many of the existing stations are most highly stressed as they compete for capacity.

It is noted that all of the existing wastewater pumping stations (SLS-7, SLS-8, SLS-9, and SLS-10) discharge into a single common forcemain system during dry and wet weather conditions. During dry weather conditions the lift stations discharge individually and simultaneously as required into the common forcemain without any sanitary sewage overflows. During wet weather conditions, however, the discharge from all of these stations operating continuously and simultaneously exceeds the maximum hydraulic capacity of the forcemain system, increasing the risk of sanitary sewer overflow (SSO) to the environment. Due to the current lack of redundancy in the single common forcemain system, there is a significant potential for breakage of the forcemain piping and major sanitary sewage overflow to the environment during wet weather conditions.

Hydraulic modeling of the existing common pumping and forcemain system has indicated that any significant upgrading of the hydraulic capacity of the pumps in SLS-10, required to handle increased wastewater flows from the Regional Serviceable Boundary GMA and the Regional Commercial GMA will also increase the hydraulic grade line in the balance of the existing common forcemain system resulting in less pumping capacity available from the rest of the wastewater lift stations connected to the common forcemain system.

Table 3-5 provides a summary of the existing hydraulic capacity available at each of tributary wastewater lift stations, when all of the stations are working individually and also when all of the stations are working simultaneously during extreme wet weather conditions. It is evident that the existing pumps are at the limit of their hydraulic capacity during peak wet weather conditions and that any future growth within the service area will require some significant improvements to the common wastewater transmission system as a whole.

Table 3-5 Comparison of Trunk Pumping Station Capacity with Existing Pumps

Pumping Station Number	Peak Wet Weather Tributary Flow	Existing Station Capacity (all stations working simultaneously into F/M)	Existing Station Capacity (two pumps working independently into F/M)
	(L/s)	(L/s)	(L/s)
SLS-7	114	100	145
SLS-8	45	44	137
SLS-9	5.5	4	116
SLS-10	57	58	79

If all of the pumps in SLS-10 are replaced by higher capacity pumps (30 L/s at 43 m TDH) to handle peak tributary wet weather flows, then the other stations connected to the common forcemain will suffer a simultaneous reduction in their own peak capacity due to the competition for hydraulic capacity in the common forcemain. An increase in the hydraulic capacity of one station will cause the pumps at the other stations connected to the common forcemain to exhibit a reduced peak hydraulic capacity.

Preliminary analysis of the options for expanding the capacity of this trunk transmission system has included consideration of the following alternative concept. To reduce the potential for sanitary sewer overflow to the environment and to increase overall hydraulic capacity of the common forcemain system, the Municipality of East Hants may wish to consider the twinning of the existing 2271 m long 350mm diameter forcemain system from Highway 214 to the headworks of the Regional WWTP. This will significantly increase the hydraulic capacity of the common forcemain system by reducing the dynamic pressure and velocity within the forcemain system and allowing the pumps to work to the right on their curves. This installation of a second common forcemain would provide redundancy for this important forcemain system in the event of a pipe break. It would also allow the Municipality to operate some or all of the other pumping stations (SLS-4, SLS-7, and SLS-8) to have access to their own common forcemain, while SLS-10 could work directly into its own dedicated forcemain without competition from the other stations.

Short-Term Regional WWTP Upgrades

While the existing Regional WWTP is currently able to handle existing loading, there is a requirement in the near future to upgrade the aeration equipment and blowers systems to increase the capacity of the plant to 8,900 m^3/day. It is also recommended that a sludge blanket survey and influent sampling program be completed to support an assessment of the need for de-sludging of the lagoons in the near future to optimize the performance of the existing process.

A technical memorandum describing the results of the WWTP Assessment Program completed by WSP and presenting recommendations for upgrades to the facility is presented in Appendix A of this report.

3.2.6 MOUNT UNIACKE GMA

All existing residential, institutional and industrial development within the Mount Uniacke GMA is serviced using on-site sanitary treatment and dispersal services. Currently, the Municipality has no specific plans to establish central sanitary wastewater collection, transmission, and treatment services to existing or future development within the Mt. Uniacke GMA.

4 PRELIMINARY CAPITAL COST ESTIMATES

4.1 APPORTIONMENT OF INFRASTRUCTURE COSTS

Proposed upgrades to the existing wastewater transmission and treatment systems may be required to address existing short-term deficiencies, as well as long-term requirements associated with the servicing of additional customers associated with the ultimate development of lands within the tributary area. Currently, costs attributable to the ongoing rehabilitation and renewal of components of the existing transmission systems necessary to maintain the existing hydraulic and treatment capacity of the system are paid from operating budgets of the Municipality. On the other hand, capital costs for upgrades to the wastewater system required to expand the hydraulic and treatment capacity of system to provide service to new developments within the tributary service area are considered as "Infrastructure Costs" that must be recovered by the Municipality directly from the Developer at the time of construction and/or indirectly from the future homeowner within the development at the time of purchase of the building lot.

Short-term wastewater infrastructure improvements recommended in this Sewer Capacity Study are typically required to address current deficiencies in the hydraulic capacity of existing wastewater transmission systems and deficiencies in the maintenance of design of the existing wastewater treatment plant (WWTP) facilities. While the requirements for the majority of the short-term improvements may be warranted by existing deficiencies within the wastewater system, the decision to implement a particular short-term improvement may be triggered by a requirement to service a specific new development within the service area. The ultimate capacity of the proposed short-term upgrade may be increased significantly to provide service for the long-term needs of new developments within the service area. Therefore, in this circumstance the capital cost of the proposed upgrade will be divided between the Municipality (normal maintenance costs) and the Developer (Infrastructure Charge) on the basis of the relative number of customers that will be serviced by the improvement.

In this Sewer Capacity Study, long-term wastewater improvements have been configured to meet the expected service life of the particular infrastructure system, which is typically 75 years for gravity sanitary sewers, and forcemain systems and 30 years for pumping stations and wastewater treatment plant systems. Apportionment of the capital costs between normal municipal maintenance costs and development-driven Infrastructure Charges required to service future development has been based on the proportion of the total long-term service population that is currently serviced and the proportion that will be resident in the new developments within the service boundary.

Where a new WWTP is required, such as in the Shubenacadie GMA, the portion of the capital cost attributed to future new development has been allocated based on the proportion of the long-term serviced population within the new developments compared with the long-term serviced population. For example, since the anticipated long-term population growth within the service area is 30% of the total long-term serviced population within the Shubenacadie GMA for which the infrastructure has been designed, then the portion of the total capital cost for that infrastructure system that is incorporated into the Infrastructure Charge will also be 30%. In an effort to establish a uniform unit Infrastructure Charge across the whole of the serviced GMAs, it is recommended that 30% of all future infrastructure costs be recovered in the Sewer Infrastructure Charge.

4.2 PRELIMINARY CAPITAL COST ESTIMATE – MILFORD GMA

Due to the relatively small population growth anticipated within the Milford GMA, the majority of capital cost improvements to the wastewater system over the next 32 years are attributed to regular maintenance with 30% attributable to anticipated future population growth.

Table 4-1 provides a summary of Preliminary Capital Cost Estimates of the short-term and long-term improvements recommended for the sanitary system within the Milford GMA, with approximately 30% of the long-term capital costs designated as Infrastructure charges to be recovered from future development. A more detailed breakdown of these cost estimates is presented in Appendix A of this report.

Table 4-1 Capital Cost Improvements – Milford GMA

Item	Description	Year Required	Capital Cost ($2014) (excluding HST)	For Future Development
Short-Term Improvements				
1	Throttle Existing Pumps (SLS-21)	2015	Nil	Nil
2	Magnetic Flowmeter	2015	$10,000	Nil
3	WWTP Upgrades – Short-Term (see Appendix A)	2015	$60,000	Nil
	Total Capital Cost (excl Engin. and Cont.)		$70,000	Nil
	Engineering and Contingency (25%)		$17,500	Nil
	Total Short-Term Capital Cost (excl.		$87,500	Nil
Long-Term Improvements				
4	Install 760m of 300mm dia. Gravity Sewer	Not known	$497,800	30%
5	Install 10 Gravity Manholes	Not known	$55,000	30%
	Total Capital Cost (excl. Engin. & Cont.)		$552,800	$165,840
	Engineering and Contingency (25%)		$138,200	$41,460
	Total Long-Term Capital Cost (excl. HST)		$691,000	$207,300

It is noted that the majority of the long-term capital improvements within the Milford GMA are related to the replacement of the 200 mm diameter gravity sewer in Highway 2 with a new 300mm diameter gravity system. The exact timing of this improvement is not known at this time and will depend on the rate of population growth within the GMA.

4.3 PRELIMINARY CAPITAL COST ESTIMATE – SHUBENACADIE GMA

The magnitude of the potential long-term population growth within the Shubenacadie GMA will depend largely on the fate of the proposed Heights of Shubenacadie residential development, which has the potential to add approximately 500 additional R-1 lots to the wastewater system. Should the Heights of Shubenacadie development be realized, it would represent approximately 68% of the total long-term serviced population within the GMA and will therefore be responsible for 68% of the long-term capital costs as Infrastructure Charges necessary for wastewater system improvements.

For the purposes of this study, we have assumed that all future population growth over the next 32 years will be responsible for 30% of the long-term capital costs as Infrastructure Charges to support anticipated wastewater system improvements. Should the Heights of Shubenacadie development proceed, then the Municipality should revisit the requirements for long-term wastewater system improvements and deal with the appropriate Infrastructure Charges within the GMA on a case by case basis.

Due to the relatively small population growth anticipated within the Shubenacadie GMA in the long-term, the majority (70%) of capital cost improvements to the wastewater system over the next 32 years are attributed to regular maintenance with only 30% attributable to anticipated future population growth. Should the full concept of the Heights of Shubenacadie development be realized then approximately 68% of the total long-term capital costs will be attributable to that development as Infrastructure Charges, which will significantly reduce the unit charge per residential lot.

Table 4-2 provides a summary of Preliminary Capital Cost Estimates of the short-term and long-term improvements recommended for the sanitary system within the Shubenacadie GMA. A more detailed breakdown of these cost estimates is presented in Appendix B of this report.

Table 4-2 Capital Cost Improvements – Shubenacadie GMA

Item	Description	Year Required	Capital Cost ($2014) (excluding HST)	For Future Development
Short-Term Improvements				
1	Throttle Existing Pumps (SLS-1 – Maitland PS)	2015	Nil	Nil
	Total Capital Cost (excl. Eng & Cont.)		Nil	Nil
	Engineering and Contingency (25%)		Nil	Nil
	Total Short-Term Capital Cost (excl. HST)		Nil	Nil

Long-Term Improvements				
4	WWTP Upgrades – Long-Term (see Appendix A) (Development Dependent)	Not known	$3,500,000	30%
	Total Capital Cost (excl. Engineering & Contingency)		$3,500,000	$1,050,000
	Engineering and Contingency (25%)		$875,000	$262,500
	Total Long-Term Capital Cost (excl. HST)		$4,375,000	$1,312,500

The timing of the replacement of the existing WWTP will depend largely on the willingness of the Developer of the proposed Heights of Shubenacadie residential development to cost share the facility.

4.4 PRELIMINARY CAPITAL COST ESTIMATE – REGIONAL SERVICABLE BOUNDARY GMA & REGIONAL COMMERCIAL GMA

The magnitude of the potential long-term population growth within the Regional Serviceable Boundary GMA and the Regional Commercial GMA will depend largely on the rate of development within the proposed Armco Lands in north Lantz, which has the potential to add a significant number of R-1 lots to the wastewater system.

4.4.1 MODERATE GROWTH SCENARIO (0.825% PER YEAR)

Under the moderate growth scenario of 0.825% per year it has been assumed that approximately 2057 persons or 614 R-1 building lots will be added to the serviced population over the next 32 years, an increase of approximately 30% over current population. Should the total serviced population within the Armco Lands, the Clayton Lands, and other development exceed this rate, then the percentage of the total long-term capital costs for wastewater improvements would be raised accordingly.

For the purposes of this study, we have assumed that all future population growth (30%) over the next 32 years will be responsible for 30% of the long-term capital costs as Infrastructure Charges to support anticipated wastewater system improvements devoted to future population growth. Due to the relatively large population growth (0.825% per year) anticipated within the Regional Serviceable Boundary GMA and the Regional Commercial GMA in the long-term, the majority (70%) of capital cost improvements to the wastewater system over the next 32 years are attributed to regular maintenance with 30% of future capital costs attributable to anticipated future population growth (30%).

Table 4-3 provides a summary of Preliminary Capital Cost Estimates of the short-term and long-term improvements recommended for the sanitary system within the Regional Serviceable Boundary GMA and the Regional Commercial GMA, which are both serviced by the Regional Sanitary Collection and transmission system and the Regional WWTP at Lantz. Table 4-3 also provides an estimate of the proportion (30%) of the capital costs that may be attributed to the additional population that may be anticipated under the moderate growth scenario. A more detailed breakdown of these cost estimates is presented in Appendix B of this report.

Table 4-3 Capital Cost Improvements Moderate Growth at 0.825% – Regional Serviceable Boundary GMA & Regional Commercial GMA

Item	Description	Year Required	Capital Cost ($2014) (excl. HST)	For Future Development
Short-Term Improvements				
1	New twin 150mm dia. Forcemains at SLS-18 (620m)	2015	$310,000	30%
2	625 m of new 450mm dia. Gravity Trunk Sewer (Hwy 214/Elmsdale Rd.)	2015	$504,000	30%
3	Install 9 Gravity Manholes on Gravity Trunk Sewer	2015	$49,500	30%
4	WWTP Upgrades – Short-Term (see Appendix A)	2015	$1,285,000	30%
	Total Capital Cost (excl. Engin. & Cont.)		$2,148,500	$644,550
	Engineering and Contingency (25%)		$537,125	$161,138
	Total Short-Term Capital Cost (excl. HST)		$2,685,625	$805,688
Long-Term Improvements				
5	Upgrade Duty Pumps and Station at SLS-18 (twin 15-hp units)	Armco Related	$300,000	30%
6	975 m of new 300mm dia. Gravity Trunk Sewer (Green Rd. /Mader Rd.)	Armco Related	$639,280	30%
7	Install 14 Gravity Manholes (Green Rd./Mader Rd.)	Armco Related	$77,000	30%
8	Upgrade Duty Pumps and Station at SLS-11A (Regional Commercial GMA)	Comm. Related	$300,000	30%
9	182 m of new 450mm dia. Gravity Trunk Sewer (Hwy 214/Elmsdale Rd.)	Comm. Related	$135,200	30%
10	Install 3 Gravity Manholes (Hwy 214/Elmsdale Rd.)	Armco Related	$16,500	30%
11	Upgrade Duty Pumps and Station at SLS-17	2021	$200,000	30%
12	PS10 – New Pumps (2 at 29L/s at 43mTDH)	Comm. Related	$100,000	30%
	Total Capital Cost (excl. Engin. & Cont.)		$1,767,980	$530,395
	Engineering and Contingency (25%)		$441,995	$132,600
	Total Long-Term Capital Cost (excl. HST)		$2,209,975	$662,995

4.4.2 HIGH GROWTH SCENARIO (1.25% PER YEAR)

Under the high growth scenario of 1.25% per year it has been assumed that approximately 3,213 persons or 959 R-1 building lots will be added to the serviced population over the next 32 years, an increase of approximately 30% over current population. Should the total serviced population within the Armco Lands, the Clayton Lands and other development exceed this rate, then the percentage of the total long-term capital costs for wastewater improvements would be raised accordingly.

For the purposes of this study, we have assumed that all future population growth (30%) under the high growth scenario over the next 32 years will be responsible for 30% of the long-term capital costs as Infrastructure Charges to support anticipated wastewater system improvements devoted to future population growth. Due to the relatively large population growth (1.25% per year) under the high growth scenario anticipated within the Regional Serviceable Boundary GMA and the Regional Commercial GMA in the long-term, the majority (70%) of capital cost improvements to the wastewater system over the next 32 years are attributed to regular maintenance with 30% of future capital costs attributable to anticipated future population growth.

Table 4-4 provides a summary of Preliminary Capital Cost Estimates of the short-term and long-term improvements recommended under the high growth scenario for the sanitary system within the Regional Serviceable Boundary GMA and the Regional Commercial GMA, which are both serviced by the Regional Sanitary Collection and transmission system and the Regional WWTP at Lantz. Table 4-4 also provides an estimate of the proportion (30%) of the capital costs that may be attributed to the additional population that may be anticipated under the high growth scenario. A more detailed breakdown of these cost estimates is presented in Appendix B of this report.

Table 4-4 Capital Cost Improvements High Growth at 1.25% – Regional Serviceable Boundary GMA & Regional Commercial GMA

Item	Description	Year Required	Capital Cost ($2014) (excl. HST)	For Future Development
Short-Term Improvements				
1	New twin 150mm dia. Forcemains at SLS-18 (620m)	2015	$310,000	30%
2	625 m of new 450mm dia. Gravity Trunk Sewer (Hwy 214/Elmsdale Rd.)	2015	$504,000	30%
3	Install 9 Gravity Manholes on Gravity Trunk Sewer	2015	$49,500	30%
4	WWTP Upgrades – Short-Term (see Appendix A)	2015	$1,285,000	30%
	Total Capital Cost (excl. Engin. & Cont.)		$2,148,500	$644,550
	Engineering and Contingency (25%)		$537,125	$161,138
	Total Short-Term Capital Cost (excl. HST)		$2,685,625	$805,688

Long-Term Improvements				
5	Upgrade Duty Pumps and Station at SLS-18 (twin 15-hp units)	Armco Related	$300,000	30%
6	975 m of new 300mm dia. Gravity Trunk Sewer (Green Rd./Mader Rd.)	Armco Related	$639,280	30%
7	Install 14 Gravity Manholes (Green Rd./Mader Rd.)	Armco Related	$77,000	30%
8	Upgrade Duty Pumps and Station at SLS-11A (Regional Commercial GMA)	Comm. Related	$300,000	30%
9	182 m of new 450mm dia. Gravity Trunk Sewer (Hwy 214/Elmsdale Rd.)	Comm. Related	$135,200	30%
10	Install 3 Gravity Manholes (Hwy 214/Elmsdale Rd.)	Armco Related	$16,500	30%
11	Upgrade Duty Pumps and Station at SLS-17	2021	$200,000	30%
12	PS10 – New Pumps (2 at 29L/s at 43mTDH)	Comm. Related	$100,000	30%
	Total Capital Cost (excl. Engin. & Cont.)		$1,767,980	$530,395
	Engineering and Contingency (25%)		$441,995	$132,600
	Total Long-Term Capital Cost (excl. HST)		$2,209,975	$662,995

4.5 PRELIMINARY CAPITAL COST SUMMARY BY GMA

For the purposes of this Sewer Capacity Study, it has been assumed that the residential growth within the three service areas over the next 32 years will be as follows:

- Milford GMA – 0.5% per year
- Shubenacadie GMA (without Heights of Shubenacadie) – 0.5% per year
- Shubenacadie GMA (with Heights of Shubenacadie) – 0.5% per year plus 500 R-1 lots
- Regional Serviceable Boundary GMA and Regional Commercial GMA – Moderate Growth of 0.825% per year
- Regional Serviceable Boundary GMA and Regional Commercial GMA – High Growth of 1.25% per year

4.5.1 MODERATE GROWTH SCENARIO (0.825% PER YEAR)

Table 4-5 provides a summary of Preliminary Capital Cost Estimates for the short-term improvements recommended for each of the three (3) wastewater systems, under the moderate growth scenario, including allowance of 25% for engineering and contingency but excluding HST.

Table 4-5 Summary of Preliminary Short-Term Capital Costs – Moderate Growth – By GMA

Item	Description	Year Required	Capital Cost ($2014) (excluding HST)	Charge For Future Development
Short-Term Improvements				
1	Milford GMA	2015	$70,000	Nil
2	Shubenacadie GMA	2015	Nil	Nil
3	Regional Serviceable Boundary GMA & Regional Commercial GMA (Moderate Growth)	2015	$2,148,500	$644,550
	Total Capital Cost (excl. Engin. & Cont.)		$2,218,500	$644,550
	Engineering and Contingency (25%)		$554,625	$161,138
	Total Short-Term Capital Cost (excl. HST)		$2,773,125	$805,688

Table 4-6 provides a summary of Preliminary Capital Cost Estimates for the long-term improvements recommended for each of the three (3) sanitary systems, under the moderate growth scenario, including allowance of 25% for engineering and contingency.

Table 4-6 Summary of Preliminary Long-Term Capital Costs – Moderate Growth - By GMA

Item	Description	Year Required	Capital Cost ($2014) (excluding HST)	Charge For Future Development
Long-Term Improvements				
1	Milford GMA	Unknown	$552,800	$165,840
2	Shubenacadie GMA	Unknown	$3,500,000	$1,050,000
3	Regional Serviceable Boundary GMA & Regional Commercial GMA (Moderate Growth)	Unknown	$1,767,980	$530,395
	Total Capital Cost (excl. Engineering & Contingency)		$5,820,780	$1,746,235
	Engineering and Contingency (25%)		$1,455,195	$436,560
	Total Short-Term Capital Cost (excl. HST)		$7,275,975	$2,182,795

4.5.2 HIGH GROWTH SCENARIO (1.25% PER YEAR)

Table 4-7 provides a summary of Preliminary Capital Cost Estimates for the short-term improvements recommended for each of the three (3) wastewater systems, under the high growth scenario of 30% over 32 years, including allowance of 25% for engineering and contingency but excluding HST.

Table 4-7 Summary of Preliminary Short-Term Capital Costs – High Growth - By GMA

Item	Description	Year Required	Capital Cost ($2014) (excluding HST)	Charge For Future Development
Short-Term Improvements				
1	Milford GMA	2015	$70,000	Nil
2	Shubenacadie GMA	2015	Nil	Nil
3	Regional Serviceable Boundary GMA & Regional Commercial GMA (High Growth)	2015	$2,148,500	$644,550
	Total Capital Cost (excl. Engin. & Cont.)		$2,218,500	$644,550
	Engineering and Contingency (25%)		$554,625	$116,138
	Total Short-Term Capital Cost (excl. HST)		$2,773,125	$805,688

Table 4-8 provides a summary of Preliminary Capital Cost Estimates for the long-term improvements recommended for each of the three (3) sanitary systems, under the high growth scenario totaling 30% over the coming 32 years, including allowance of 25% for engineering and contingency.

Table 4-8 Summary of Preliminary Long-Term Capital Costs – High Growth - By GMA

Item	Description	Year Required	Capital Cost ($2014) (excluding HST)	Charge For Future Development
Long-Term Improvements				
1	Milford GMA	Unknown	$552,800	$165,840
2	Shubenacadie GMA	Unknown	$3,500,000	$1,050,000
3	Regional Serviceable Boundary GMA & Regional Commercial GMA (High Growth)	Unknown	$1,767,980	$530,395
	Total Capital Cost (excl. Engineering & Contingency)		$5,820,780	$1,746,235
	Engineering and Contingency (25%)		$1,455,195	$436,559
	Total Short-Term Capital Cost (excl. HST)		$7,275,975	$2,182,794

4.6 INFRASTRUCTURE CHARGE BY GMA

Table 4-9 provides a summary of the capital cost estimates and unit Infrastructure Charges associated with the short-term and long-term capital improvements required within each of the three (3) wastewater service areas to meet the requirements of anticipated population growth to the year 2046. As noted in the Growth Management Review (WSP 2014), each of the three (3) Growth Management Areas (GMA) has sufficient undeveloped area to accommodate all of the anticipated growth to the year 2046 and beyond.

Table 4-9 Unit Infrastructure Charge by GMA

Service Area	**Total Capital Cost ($2014) (incl. HST)**[1]	**Capital Cost For Future Development**[1]	**Projected Population Increase (2014-2046)**	**Additional Building Lots (2014-2046)**	**Unit Infrastructure Charge**[2]
	($2014)	($2014)	(persons)	(R-1 lots)	($ per R-1 lot)
Milford GMA[3]	$778,500	$207,300	192	57	$3,637
Shubenacadie GMA (excl. Heights of Shubenacadie)	$4,375,000	$1,312,500	151	45	$29,167
Shubenacadie GMA (incl. Heights of Shubenacadie)	$4,375,000	$1,312,500	1826	545	$2,408
Regional Serviceable Boundary GMA (Moderate Growth)	$4,895,600	$1,468,680	2057	614	$2,392
Regional Serviceable Boundary GMA (High Growth)	$4,895,600	$1,468,680	3213	959	$1,531
Totals (all GMAs – Moderate Growth)	$10,049,100	$2,988,480	2,400	716	$4,174
Totals (all GMAs) – (High Growth incl. Shubenacadie Heights)	$10,049,100	$2,988,480	5,231	1,561	$1,914
Totals (all GMAs) – (High Growth excl. Shubenacadie Heights)	$10,049,100	$2,988,480	3,546	1,061	$2,817

Notes: 1. Capital Cost Estimates are for short-term and long-term improvements and include an allowance of 25% for engineering and contingency but exclude HST.

2. Unit Capital Cost Estimates are based on the total short-term and long-term capital improvements necessary to meet the sanitary wastewater needs of anticipated population growth to the year 2046.

3. Wastewater Capital Costs exclude transmission infrastructure and treatment plant capacity to handle additional wastewater from Heights of Shubenacadie.

4.7 INFRASTRUCTURE CHARGE

The Municipality has expressed a desire to have a single Infrastructure Charge for wastewater infrastructure improvements required to support anticipated development within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable Boundary, and the Regional Commercial GMA.

The amount of the Sewer Infrastructure Charge per R-1 building lot depends on the total number additional building lots that many be serviced by improvements to the wastewater collection and treatment systems serving the GMAs. In general, the higher the actual growth rate experienced within the services areas, the lower the Regional Sewer Infrastructure Charge required to fund the construction of wastewater improvements within the service area over the next 32 years.

Based on information presented in Table 4-9, it is recommended that the Municipality of East Hants adopt a uniform Sewer Infrastructure Charge of $3,000 per R-1 building lot to support the construction of trunk wastewater transmission and treatment infrastructure necessary to meet the requirements of all future development within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable Boundary, and the Regional Commercial GMA. This uniform Sewer Infrastructure Charge of $3,000 per R-1 building lot is adequate to generate sufficient funds to cover the capital cost of all wastewater system improvements anticipated under a Moderate Growth Scenario. Should growth within the three (3) GMAs over the next 32 years exceed this Moderate Growth Scenario, then the Municipality may elect to adjust the infrastructure Charge at that time.

This Sewer Infrastructure Charge would be applied to every residential lot being approved by the Municipality over the coming 32 years. The Municipality would reserve the right to negotiate alternative Sewer Infrastructure Charges for large developments such as the Heights of Shubenacadie under a separate development agreement as necessary to fund the expansion of sewer system capacity required to service these larger developments.

5 CONCLUSIONS & RECOMMENDATIONS

5.1 CONCLUSIONS

The population projections prepared during the Growth Management Review (WSP 2014) have been used to develop estimates of peak wet weather loading to the sanitary system hydraulic models for each of the three sanitary collection systems within the three Growth Management Areas (GMA) and the Regional Commercial Growth Management Area (GMA).

The hydraulic models have been used to analyze the capacity of the existing sanitary collection and transmission systems to meet the requirements of anticipated growth. WSP has also completed a preliminary assessment of the capacity of the three (3) existing wastewater treatment plant (WWTP) facilities to serve the future growth.

Short-term and long-term capital improvements required to service existing and future populations within the three GMA and the Regional Commercial Growth Management Area (GMA) have been identified and estimates of the capital cost for these improvements have been tabulated.

There is adequate undeveloped land within the existing boundaries of each of the three (3) GMAs and the Regional Commercial Growth Management Area (GMA) to accommodate future population growth over the coming 32 years.

Application of a uniform Sewer Infrastructure Charge of $3,000 per residential housing unit will provide adequate resources to fund the short-term and long-term improvements within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable Boundary GMA, and the Regional Commercial GMA over the coming 32 years (to 2046).

The proposed development of the Armco Lands in Lantz and the Clayton Lands offer an opportunity for the Municipality of East Hants to develop a detailed wastewater infrastructure improvement plan that will reflect the increasing demands on the wastewater system as required to meet the service requirements of each phase of these large development in an organized fashion.

5.2 RECOMMENDATIONS

1. The Municipality of East Hants should adopt a uniform Sewer Infrastructure Charge of $3,000 per residential unit within the Milford GMA, the Shubenacadie GMA, the Regional Serviceable Boundary GMA, and the Regional Commercial GMA.
2. When a developer of a very large property located within one of the GMAs comes forward seeking approval to develop and there is not adequate capacity in the existing sanitary sewer system to accommodate that development, the Municipality should enter into a formal development agreement that will include a formal funding arrangement to generate sufficient capital to support the developers share of the capital improvements necessary to meet the long-term needs of the residents within that specific development.

Appendix A

Capital Cost Estimates

Milford Cost Estimates
excluding HST

1.25

Milford Capital Cost Estimates

Item	Description	Year Required	Source	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
Short-Term Improvements								
1	**Throttle the pumps (from 21L/S to 14.5L/s)**	2015		L.S	1	nil	nil	nil
2	**Magnetic Flowmeter**	2015		L.S	1	$10,000	$10,000	$12,500
3	**WWTP Upgrades - Short Term**							
	Replace SBR Feed Pumps	2015	High Level Estimates	L.S.	2	$20,000	$40,000	$50,000
	Railing Around Top of SBR	2015		m	50	$200	$10,000	$12,500
	Influent Flow Meter	2015		L.S.	1	$10,000	$10,000	$12,500
				Total Short-Term Costs (Ex. HST)			**$70,000**	**$87,500**
Long-Term Improvements								
4	**Install 760m of 300mm dia Gravity Sewer**	not known	300mm dia (PVC DR35 inlcuding reinstatement) (Source HRM 2013)	m	760	$655	$497,800	$622,250
5	**Install ten (10) Gravity Manholes**	not known	MH (1200mm dia. Pre cast with cover) (Source HRM 2013)	L.S.	10	$5,500	$55,000	$68,750
				Total Long-Term Costs (Ex. HST)			**$552,800**	**$691,000**

Shubenacadie Sewer Capital Cost Estimates
excluding HST

#	Item	Year Required	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)	Inflation
							1.25	

Shubenacadie Capital Cost Estimates

Item	Description	Year Required	Source	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
Short-Term Improvements								
1	**Throttle the pumps (PS-1 - Maitland PS)**	2015		L.S	1	nil	nil	nil
						Total	**Nil**	**Nil**
Long-Term Improvements								
2	**WWTP Upgrade - Long Term**	not known	Source - similar cost to Milford WWTP	L.S.	1	$3,500,000	$3,500,000	$4,375,000
						Total (Ex. HST)	**$3,500,000**	**$4,375,000**

Regional Cost Estimates

excluding HST

1.25

#	Item	Year Required	Description	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)	Inflation

Regional Cost Estimates

Item	Description	Year Required	Source	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
Short-Term Improvements								
1	**Twin 1500mm dia Forcemains at PS18 (620m)**	2015	dual 150mm dia DI CL 52	m	620	$500	$310,000	$387,500
2	**625m of new 450mm dia. Gravity Trunk Sewer (Hwy 214/Elmsdale Road)**	2015	450mm PVC DR35 - Source HRM 2013	m	625	$800	$504,000	$630,000
3	**Install 9 Gravity Manholes on Gravity Trunk Sewer**	2015	MH (1200mm dia) (Source HRM 2013)	L.S.	9	$5,500	$49,500	$61,875
4	**WWTP Upgrades - Short Term**							
	Estimate of Sludge	2015	Estimate to do the survey of the lagoon	L.S.	1	$100,000	$100,000	$125,000
	Removal of Sludge		Need the amount of sludge to determine cost - potential to be in the millions	tonne				
	Influent Testing	2015	150 samples to be tested	L.S	150	$50	$7,500	$9,375
	Building Mechanical Systems	2015	estimate for mechanical system upgrades	L.S.	1	$300,000	$300,000	$375,000
	Aeration Equipment (to 8,900m3/day)	2015	(based on an equipment price of $675,000 plus installation)	L.S.	1	$877,500	$877,500	$1,096,875
						Total	**$2,148,500**	**$2,685,625**
Long-Term Improvements								
5	**Upgrade Duty Pumps and Station at PS-18 (twin 15-hp units)**	Armco Related		L.S.	1	$300,000	$300,000	$375,000
6	**975m of new 300mm dia. Gravity Trunk Sewer (Green Road/Mader Road)**	Armco Related	300mm dia sewer (PVC DR35 including reinstatement) (Source HRM 2013)	m	975	$655	$639,250	$799,063
7	**Install 14 Gravity Manholes (Green Road/Mader Road)**	Armco Related	MH (1200mm dia) (Source HRM 2013)	L.S.	14	$5,500	$77,000	$96,250
8	**Upgrade Duty Pumps and Station at PS-11A (Regional Commercial GRA)**	Comm. Related	Pump Station Upgrade (Source HWIRP)	L.S.	1	$300,000	$300,000	$375,000
9	**182m of new 450mm dia. Gravity Trunk Sewer (Hwy214/Elmsdale Road)**	Comm. Related	400mm (assume 450mm PVC DR35) (Source HRM 2013)	m	182	$743	$135,200	$169,000
10	**Install 3 Gravity Manholes (Hwy 214/Elmsdale Road)**	Comm. Related	MH (1200mm dia) (Source HRM 2013)	L.S.	3	$5,500	$16,500	$20,625
11	**Upgrade Duty Pumps and Station at PS17**	2021		L.S.	1	$200,000	$200,000	$250,000
12	**PS10 - New Pumps (2 at 29L/s @ 43mTDH)**	Comm. Related		L.S.	1	$100,000	$100,000	$125,000
						Total	**$1,767,950**	**$2,209,937**

$689,625

Appendix B

Wastewater Treatment Plant Assessment Report

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TECHNICAL MEMO

To: Lew Landers
From: Meghan Woszczynski & Marco Vincelli (Cornwall Office)
Project: Sewer Capacity Study & Growth Management Review
Project No.: 141-13379-00
Date: December 13, 2014

Subject: Wastewater Treatment Plant Review and Assessment

WSP Canada Inc. (WSP) has been retained by the Infrastructure and Operations Section of the Municipality of East Hants (East Hants) to complete a Sanitary Sewer Capacity Study for the areas of the Municipality currently provided with sanitary wastewater services. The Sewer Capacity Study has included the creation of a set of up-to-date digital hydraulic models of the existing sanitary collection and transmission systems within the three (3) Growth Management Areas (GMAs) and the Commercial Growth Management Area (GMA). The digital models have been used to evaluate peak wet weather sanitary flows within each area and the available excess capacity of the existing sanitary sewer systems to service the existing customer base and to provide wastewater service to anticipated new development within the service areas.

Each of the existing serviced areas is equipped with its own wastewater treatment plant facility including the:

- Milford WWTP serving the Milford GMA,
- Shubenacadie WWTP serving the Shubenacadie GMA, and
- Regional WWTP serving the Regional Serviceable Boundary GMA and the Commercial GMA (Elmsdale).

A critical component of the Sewer Capacity Study is to assess the ability of each of the existing wastewater treatment plant systems to accommodate existing and predicted future flows tributary to the treatment facilities. As part of the Sewer Capacity Study, WSP conducted site visits to each of the three (3) wastewater treatment plant (WWTP), reviewed existing documentation, effluent and flow data from 2012 to mid-2014, and have consolidated our findings within this technical memorandum. This memo is structured as follows to provide the information collected during the site visit.

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1. Existing Wastewater Treatment Infrastructure

The Municipality of East Hants (East Hants) owns and operates three (3) sanitary wastewater treatment plants (WWTP) including the Milford WWTP serving the Milford GMA, the Shubenacadie WWTP serving the Shubenacadie GMA, and the Regional WWTP located in Lantz servicing the Regional Serviceable Boundary GMA (Enfield, Elmsdale, and Lantz) and the Commercial GMA in Elmsdale. Each of the WWTPs is located to serve the most urbanized areas of East Hants.

On June 18, 2014 a site visit was conducted to all three (3) of the WWTPs by Meghan Woszczynski, EIT (WSP Dartmouth NS Office) and Marco Vincelli, P.Eng (WSP Cornwall ON Office).

1.1 Wastewater Treatment Plant Configuration

1.1.1 Shubenacadie WWTP

The Shubenacadie Wastewater Treatment Plant (WWTP), constructed in the mid 1970's, comprises an oxidation ditch, clarifier, and chlorine contact chamber. Disinfection of the treated effluent is done using chlorine gas and the disinfected, treated effluent is discharged directly into the Shubenacadie River. Recently, the Shubenacadie WWTP has been upgraded with new compressors to include supplementary air and redundancy, an air distribution system with controls, variable speed sludge return pumps, and supervisory controls connected to the Municipality's central SCADA system (Source: Regarding Inflow & Infiltration Reduction & Sewage Treatment Plant Improvements in the Village of Shubenacadie by East Point Engineering Limited, dated May 21,2009).

The Permit for the Shubenacadie WWTP indicates the facility was originally designed to treat 378 m^3/day (83,260 imperial gallons per day). Currently, the WWTP is treating average daily flows in excess of the original design flow. The volume of the oxidation ditch is approximately 360 cubic metres (79,000 imperial gallons) at the design operating level of 1.37 m (4.5ft) (Source: Regarding Inflow & Infiltration Reduction & Sewage Treatment Plant Improvements in the Village of Shubenacadie by East Point Engineering Limited, dated May 21,2009).

1.1.2 Milford WWTP

The Milford WWTP, constructed and commissioned in 2011, is a Sequencing Batch Reactor (SBR) with an average day design flow rate of 998m^3/day (219,825 igpd), a maximum design flow rate of 2,500m^3/day (550,660 igpd), and a peak hourly design rate of 232 m^3/hr (51,100 igph) (Preliminary Evaluation Report by SNC (Jan 2008)). The design population for the Milford service area was 1,805 persons plus two (2) schools.

An SBR WWTP is designed to treat sewage in a batch flow (non-continuous) process. Raw sanitary wastewater generated within the Milford GMA flows into an aerated grit chamber before flowing by gravity into the flow equalization tanks, where the wastewater is stored and aerated until a batch process begins. The batch process includes the following steps within the SBR reactor tank(s): fill, reaction (using aeration), settlement, sludge wasting and decantation. At the start of each batch process, wastewater is pumped from the equalization tank into the SBR reactor tanks and the steps of the process proceed accordingly. Once decanted, the treated wastewater effluent is disinfected with ultraviolet light (UV) before being discharged to the Shubenacadie River.

1.1.3 Regional WWTP (Enfield, Elmsdale, and Lantz and Commercial GRA)

The Regional WWTP, located in Lantz and commissioned in the late 1980's, comprises three (3) partially mixed reactor cells in series as an aerated lagoon system. The original design appears to have been a facultative lagoon system with limited aeration added to the facility in more recent years. The aeration rate in each lagoon decreases from the first cell to the third cell. Disinfection of the treated effluent is accomplished using a chlorine (gas) contact chamber with de-chlorination achieved at a subsequent manhole using sulfur dioxide. The treated and disinfected wastewater effluent is discharged directly to the Shubenacadie River. The Regional WWTP currently treats the sanitary wastewater from the communities of Enfield, Elmsdale, and Lantz and from the Elmsdale Business Park (Commercial GMA).

1.2 APPROVALS TO OPERATE – NOVA SCOTIA ENVIRONMENT

1.2.1 TREATED EFFLUENT LIMITS

Permits

- Milford WWTP – Approval to Operate from NSE– Sewage Treatment Plant Approval No.2014-071521-R01.
- Shubenacadie WWTP – Joint Certificate of Approval for Municipal Water Sewage Services Permit, Nova Scotia Department of the Environment and Department of Public Health Approval No. 74-113.
- Regional WWTP (Lantz) – Joint Certificate of Approval for Municipal Water and Sewage Services by the Nova Scotia Department of the Environment Approval No. 88-160.

Table 1 provides a summary of the treated effluent limits required by Nova Scotia Environment (NSE) for the three (3) WWTP. It is noted that certain of the treated effluent limits for the Regional WWTP and the Shubenacadie WWTP are not stated in the existing approvals for those plants.

Table 1: Treated Effluent Limits

Parameter	Shubenacadie WWTP	Milford WWTP	Regional WWTP
Operator Classification	Level II	Level II	Level II
Approval Number	74-113	2010-071521-R01	88-160
Outfall	Shubenacadie River – in the range of tidal influence	Shubenacadie River	Shubenacadie River
Biological Oxygen Demand (BOD5) (mg/L)	Not mentioned in approval	20	20
Suspended Solids (mg/L)	Not mentioned in approval	20	20
Fecal Coliform (counts/100 mL)	Not mentioned in approval	200	Not mentioned in approval
Chlorine Residual (mg/L)	Not mentioned in approval	0	Not mentioned in approval
pH	Not mentioned in approval	6.5 to 9	Not mentioned in approval

1.2.2 Effluent Sampling Requirements

Table 2 described the effluent sampling requirements from Nova Scotia Environment (NSE) for the three (3) WWTP.

Table 2: Sampling Requirements

Sampling Requirements	Shubenacadie WWTP		Milford WWTP		Regional WWTP	
	Type	Location	Type	Location	Type	Location
BOD5	5/month	Treated	5/month	Treated	5/month	Treated
TSS	5/month	Treated	5/month	Treated	5/month	Treated
Fecal Coliform	5/month	Treated	5/month	Treated	5/month	Treated
pH	Continuous or grab	Treated	Continuous or grab	Treated	Continuous or grab	Treated
Plant Volume	Continuous	Treated	Continuous	Raw and Treated	Continuous	Treated

1.3 Reference Documents

During the Sewer Capacity Study, the following documents, provided by East Hants, have been reviewed by WSP.

- Condition and Upgrade Alternative for the Village of Shubenacadie and the Village of Milford, prepared by East Point Engineering Limited, dated November 1, 2006
- Dilution of STP Effluent in the Shubenacadie River at Lantz, Municipality of East Hants, Nova Scotia, prepared by R.H. Loucks Oceanology Ltd., dated March 8, 1995.
- East Hants Socio-Economic Study, prepared by the Planning and Development Department of the Municipality of East Hants, dated November 20, 2012.
- Expansion of Enfield Irving Big Stop Site – Assessment of Regional Wastewater Infrastructure System, prepared by CBCL Ltd., dated February 2007
- Flow Monitoring and Inflow/Infiltration Investigation – Elmwood Subdivision, East Hants, prepared by SNC Lavalin dated December 22, 2005.
- Flow Monitoring and Inflow/Infiltration Investigation – Milford, East Hants, prepared by SNC Lavalin dated November 14, 2005.
- Flow Monitoring and Inflow/Infiltration Investigation – Shubenacadie, East Hants, prepared by SNC Lavalin dated December 21, 2005.
- Infrastructure Capacity Study Final Report, prepared by Porter Dillon Limited dated October 1998
- Integrated Community Sustainability Plan Toward a Sustainable East Hants
- Municipal Climate Change Action Plan for the Municipality of East Hants Planning and Development Department, dated November 28, 2013
- MWWE Risk Levels 100826 , Letter from NSE to MEH
- Proposal to Municipality of East Hants Regarding Sanitary Sewage System Inflow and Infiltration Reduction and Sewage Treatment Plant Upgrades prepared by East Point Engineering Limited dated January 15, 2008.
- Report to Municipality of East Hants and to NSDOEL Regarding Sanitary Sewage System Inflow and Infiltration Reduction and Sewage Treatment Plant Upgrades in the Village of Shubenacadie, prepared by East Point Engineering Limited, dated May 19, 2009.
- Revised Draft Pre-Design Brief Sewage Treatment Plant Replacement, Milford Nova Scotia prepared by SNC Lavalin, dated April 2010.
- Service Extension Study, prepared by Porter Dillon Limited, dated January 2001
- Shubenacadie/Milford Infrastructure Study Draft Report, prepared by Vaughan Engineering dated April 2001
- Water and Sewerage System Improvements - Enfield, Elmsdale and Lantz, prepared by CBCL Limited, dated March 1986.
- Various record and design drawings of the sanitary wastewater collections system and wastewater treatment plants.

2. Condition of Existing Equipment

2.1 Equipment Life Cycle Planning

In the absence of a detailed equipment assessment report, the remaining service life of each component of a WWTP may be estimated based on industry averages for service life and the date of installation of the equipment. Table 3 summarizes the Industry Standards that estimate the normal service life and annual maintenance requirements for the various components of a wastewater treatment facility.

Table 3: Normal Service Life and Maintenance Budgeting[1]

Asset	Normal Service Life	Annual Maintenance
Forcemains/Sewers	100 years	1%
Lift Stations Structure	60 years	4%
Wastewater Pumps	20 years	5%
Aeration Equipment	15 years	2%
Oxidation Ditch	58 years	2%
Secondary Clarifier	52 years	3%
UV Disinfection	25 years	20%
Electrical & Mechanical Systems	25 years	2%

1. *Normal Service Life from the Ontario Ministry of Public Infrastructure Renewal, "Water and Wastewater Asset Cost Study", May 2005*

2.2 Shubenacadie WWTP Remaining Service Life

The Shubenacadie WWTP, an oxidation ditch style treatment facility was originally constructed in 1975 with some significant upgrades over the past decade. Table 4 provides a summary of the remaining service life for each of the major components in the Shubenacadie WWTP. Based on the estimated normal service life for the various components of the WWTP, all of the asset classes have some remaining service life. However, during the inspection, the concrete on the oxidation ditch was observed to be deteriorating significantly.

Table 4 : Shubenacadie WWTP - Remaining Service Life

Asset	Year Constructed	Normal Service Life	Remaining Service Life
Controls Building	1975	50 years	11 years
SCADA System	2009*	25 years	20 years
Screening Area	1975	50 years	11 years
Aeration Equipment (Compressors, air distribution, and sludge pump)	2009*	20 years	15 years
Oxidation Ditch (Structural)	1975	58 years	19 years
Secondary Clarifier	1975	52 years	13 years
Chlorination System	2005	25 years	16 years
Chlorine Contact Chamber (Structural)	1975	52 years	13 years

*From Report to Municipality of East Hants and to NSCOEL Regarding Sanitary Sewage System Inflow and Infiltration Reduction and Sewage Treatment Plant Upgrades in the Village of Shubenacadie prepared by East Point Engineering Limited dated May 19, 2009.

2.3 Milford WWTP - Remaining Service Life

The Milford WWTP, an SBR facility, was commissioned in 2011. Table 5 provides a summary of the estimated remaining service life in each of the major components of the WWTP. While the WWTP is still relatively new, it is important to establish a asset management plan for the new treatment plant to maximize the use of each component. Based on the anticipated remaining life presented in Table 5, significant renewal of the major electrical and mechanical systems will need to occur around 2036 or towards the end of the timeline for the Sewer Capacity Study.

Table 5: Milford WTP Remaining Service Life

Asset	Year Constructed	Normal Service Life	Remaining Service Life
SCADA System	2011	25 years	22 years
Grinder Pump	2011	25 years	22 years
Aeration Blowers	2011	20 years	17 years
UV Disinfection	2011	25 years	22 years
Automatic Sampler	2011	25 years	22 years
Sludge Return Pumps	2011	25 years	22 years
Sludge Holding Tanks	2011	50 years	47 years
Sludge Digester Blower	2011	25 years	22 years
Building Electrical & Mechanical Systems	2011	25 years	22 years

2.4 Regional WWTP Remaining Service Life

The Regional WWTP is an aerated lagoon facility serving the Regional Serviceable Boundary GMA and the Commercial GRA in Elmsdale. Table 6 provides a summary of the remaining service life for various components within the Regional WWTP. Since the aeration equipment and other mechanical building systems have reached the end of their normal service life, these older systems will need to be updated in the immediate future, with the chlorination system requiring upgrade soon thereafter.

Table 6: Regional Remaining Service Life for Existing Equipment

Asset	Year Constructed	Normal Service Life	Remaining Service Life
Aeration Equipment	1988	20 years	**-6** years
Chlorination System	1995	25 years	6 years
Chlorine Contact Chamber (Structural)	1988	52 years	26 years
Building Mechanical Systems	1988	25 years	**-1**years

2.5 Observations from Site Visits

On June 18, 2014, site visits were conducted at all three (3) of the WWTPs by Marco Vincelli, P.Eng, WSP's Senior Process Engineer and Meghan Woszczynski, EIT, Water Resources Engineer. The following describes observation made at each of the three (3) WWTP's

2.5.1 Shubenacadie WWTP

Observations made at the Shubenacadie WWTP include the following points:

- Concrete was wearing from the sides of the oxidation ditch.
- Slight smell of sewage at the site.
- The operator commented that the clarification tank would freeze in the winter due to the lack of insulation.
- Smell of chlorine from the chlorine contact area.

2.5.2 Milford WWTP

Observations made at the Milford WWTP include the following points:

- There was a key in the actuator valve supplied by Omintech Ltd, which may be a security issue. The operator stated that the key must remain in place for the valve to work.
- The operator commented that the SBR pumps from the equalization tank would often clog whenever a rag was sucked into the pump suction. This caused extensive maintenance issues, as the pumps had to be lifted out and cleaned each time it was clogged.
- The decant cycle at the plant does not happen on a regular schedule due to the lower flow rates entering the plant.
- Some aspects of the plant maintenance, such as the aerators and UV lights, are contracted out to the suppliers.
- The SCADA system will alert the operator if there are any problems.
- The SBR tanks are covered in concrete with no guard rail around the outside ledges, which poses a safety issue for the operators and others.
- The data provided by the flow meters at the inlet and outlet of the facility do not agree. The operator speculated that this was most likely the result of the influent meter not working correctly.
- There was algae growth in the UV chambers due to the extended time between decants. There is a lot of standing water on the floor in the UV chamber.
- There was some odour near the grinder pump installation.
- There is a portable generator on-site that had not yet been hooked up at the time of our site visit.

2.5.3 Regional WWTP

Observations made at the Regional WWTP include the following points:

- Aeration bubbles were seen in a small circle in the first lagoon indicating poor distribution of air within the cell. More diffusion of the air bubbles would be expected if the aerators were located at the bottom of the 25ft deep lagoon.
- Treated wastewater effluent flowing over the measurements weirs was observed to be clear.
- The sludge depth within each of the lagoon cells is unknown, as the sludge has never been measured or cleaned out.
- The blowers in the mechanical building are original dating from the commissioning of the WWTP (1988).

3. Treatment Capacity Assessment

3.1 Summary of Existing Performance

WSP has completed a preliminary review and assessment of the current performance of the three (3) WWTP's based on information provided by East Hants and other industry standards. Table 7 provides a summary of the flow rates and wastewater quality parameters for each of the three (3) WWTP based on information covering the period from January 2012 to mid-2014. The influent parameters to the WWTP are not measured regulatory. The parameters presented in Table 7 have been drawn from the Flow Monitoring and Inflow/Infiltration Investigation Report prepared by SNC Lavalin for the Shubenacadie and Milford, which were based on one (1) single set of grab samples.

Table 7: Summary of Flow and Wastewater Quality Parameter (2012 to mid-2014)

Performance Parameters	Shubenacadie WWTP		Milford WWTP		Regional WWTP	
	Influent[1.]	Effluent[2.]	Influent[3.]	Effluent[2.]	Influent	Effluent[2.]
Average Daily Flow (m^3/d)	*not measured*	415	1,120	370	*not measured*	4,840
95% Percentile	*not measured*	840	2,995	770	*not measured*	6,640
Max Daily Flow (m^3/d)	*not measured*	3,700	10,000	1,930	*not measured*	9,640
BOD_5 (mg/L)	$CBOD_5$=160	6.9	$CBOD_5$=120	5.5	*not measured*	4.74
TSS (mg/L)	120	9.0	140	9.5	*not measured*	6.88
Fecal Coliform[4.] (counts/100 mL)	*not measured*	53	*not measured*	10	*not measured*	10
pH	7.8	7.5	8.0	6.9	*not measured*	7.5
Un-ionized Ammonia (mg/l)	*not measured*	0.003	*not measured*	0.0005	*not measured*	0.17
Total Phosphorus (mg/L)	6.1	*not measured*	5.5	*not measured*	*not measured*	*not measured*

1. From Ch.8, Flow Monitoring and Inflow/Infiltration Investigations for Shubenacadie, NS (SNC Lavalin).
2. Based on the average from 2012 to mid-2014, data provided by the Municipality of East Hants.
3. From Ch.8, Flow Monitoring and Inflow/Infiltration Investigations for Milford, NS (SNC Lavalin).
4. Based on the median from 2012 to mid-2014 effluent data provided by the Municipality of East Hants.

It is noted that, on average, all three (3) WWTP's have met their Permit requirements for BOD, TSS, and Fecal Coliforms.

3.2 Ability to Treat Future Flows

In order that growth may be accommodated within a service area, there must be available excess treatment capacity at the exiting WWTP. Table 8 provides a summary of the average flow entering each of the facilities over the past 2.5 years and compares this average flow with the remaining excess treatment capacity in the WWTP available to meet the service requirements of future growth.

Table 8: Summary of Available Capacity to Treat Future Flows

WWTP Facility	Average Daily Flow (2012 to mid-2014)	WWTP Capacity (Avg. Day)	Remaining WWTP Capacity (Avg. Day)	Remaining Population Capacity[1]
	(m^3/day)	(m^3/day)	(m^3/day)	(persons)
Shubenacadie WWTP	415	378*	Nil (-37)	nil
Milford WWTP	370	998**	628	1,850
Regional WWTP	4,840	5,180***	340	1,000

Notes: - Sources of Information
* Shubenacadie WWTP Approval – Joint Certificate of Approval for Municipal Water Sewage Services Permit, Nova Scotia Department of the Environment and Department of Public Health Approval No. 74-113
**Revised Draft Pre-Design Brief Municipality of East Hants Sewage Treatment Plant Replacement Milford Nova Scotia Prepared by SNC-Lavalin dated April 2010
***See Appendix A for calculations

Shubenacadie WWTP

The Shubenacadie WWTP is able to meet the treatment requirements for the existing average day flow entering the facility but has issues during wet weather events due to the high levels of extraneous inflow and infiltration entering the collection system and flooding the plant. Due to the limitations of the existing treatment facility, there is currently no excess treatment capacity available at the Shubenacadie WWTP to accommodate future growth within the service area. Therefore, should the Municipality wish to approve future development within the Shubenacadie GMA, a new wastewater treatment plant will be required to allow for growth in the collections system and to meet future, more stringent CCME requirements.

The recent upgrades to the Shubenacadie WWTP, including updated SCADA, sludge pumps, and aeration system, were supported financially by a local developer, Agate Development Limited, to allow for early phases of their current development. In addition, work was carried out within the sanitary collection system on behalf of Agate Developments Ltd. to reduce the I/I entering the system at the manholes. Although the upgrades and I/I reduction was completed, none of the proposed development has been built to date.

Milford WWTP

The influent meter at the Milford WWTP is malfunctioning producing flows greater than those the effluent flow meter is reading.

Regional WWTP

The present capacity of the Regional WWTP constrains future development. According to assumptions in Appendix A of this memo, the Regional system has sufficient capacity to service an additional growth equaling 1,000 people without any aeration upgrade. That capacity is allocated first to the approximately 649 people in already approved developments: Sherwood Park, 16 Lot John Murray, and WM Fares. The remaining capacity is a serviceable population of 351. Assumptions of the influent BOD and existing capabilities of the aeration system need to be verified by East Hants.

4. Recommendations for WWTP Upgrades

4.1 Short Term Improvements

4.1.1 General Recommendations

The following are general recommendations for short term improvements at all of the three (3) WWTP's.

- Measurement of Influent BOD and TSS – Measurement of influent BOD and TSS will allow East Hants to quantify the influent wastewater coming into the treatment plants. This would confirm assumptions made for theoretical treatment calculations. If the influent cannot be directly measured such as with the Regional Lagoon, monitoring from the closest manhole could be an acceptable option.

- Measurement of Nutrients – Measurement of nutrients in the influent and effluent of the WWTP is an advantage to optimize the existing system. Although not required, nutrients such as ammonia and phosphate could become an obligation in the future. In monitoring the parameters now optimization can be worked out in each of the WWTPs to ensure that the East Hants is able to meet the new restrictions or be able to develop a plan.

4.1.2 Specific Short Term Improvements

The following describes the short term improvement recommended at each of the individual WWTP's.

Shubenacadie WWTP

The existing Shubenacadie WWTP is currently at capacity for dry weather flows and therefore there is no excess capacity available within the facility to support any future growth. Two options are available to accommodate future growth in the short term:

Option 1 - Replace the WWTP and Encourage Significant Growth, or

- Do a Pre-Design Study for WWTP options
- Encourage development applications in the area
- Continue to investigate the I/I issues in the system

Option 2 - Maintain the Existing WWTP and Eliminate I/I to Recover Capacity.

- Develop an Asset Renewal Plan to ensure that each asset in the WWTP
- Continue to investigate the I/I issues in the system.

Recommendation 1 – Due to the uncertainty associated with the size and timeline for the Agate Development, it is recommended that the Municipality continue to maintain the equipment at the Shubenacadie WWTP and continue to pursue the current I/I Reduction Program.

Milford WWTP

The existing Milford WWTP has plenty of capacity to accommodate any reasonable amount of future growth within the Milford GMA. The following are recommendations for short term improvement at the Milford WWTP based on conditions observed in the recent site visit.

- Replace SBR Influent Pumps – Replacing the existing SBR Influent Pumps with non-clog units will ensure that rags do not clog the pumps and pumps are available at all times to fill the SBR.
- Install Safety Railing on SBR tanks – Since the WWTP operators are required to look into the SBR tanks on a regular basis and the tops of the tanks are quite high, a safety railing system installed around the tops of the SBR tanks will significantly improve safety.
- UV Disinfection – During the recent site visit, algal growth was observed in the UV disinfection chambers. This algal growth is attributed to the low number of decants (once per day) during dry weather and average day flow conditions. The stagnant water in the UV disinfection chamber warms up and the algae will grow leading to an increase in total suspended solids (TSS) in the final effluent. Operations staff do clean the UV disinfection chambers regularly; however this activity takes the operator's time away from other regular duties.
- Flow Meter for Influent and Effluent Measurements - The effluent and influent daily flow totals do not agree. It is recommended that the Municipality conduct a test program to verify the correct calibration of the two flow meters. To test the reliability of each flow meter the following process is recommended to clarify measurements:

  Step 1 Bucket Test –
    - Compare the time it takes to fill a five (5) gallon bucket with the flow rate on the wall mounted display for the Greyline Area – Velocity Flow Meter
    - If the number registered by the meter is inconsistent with the bucket test continue to Step 2
    - If the two flow rates are comparable then continue to Step 3

  Step 2 Greyline Unit Installation
    - Confirm level-velocity sensor is installed as shown on page 19/20 of the Greyline Manuel.
    - Ensure that the sensor is fully engaged in the mounting bracket.
    - On the wall display, press the down arrow until it shows the level. Then verify the actual depth of flow at the inlet and outlet of the 300mm diameter pipe in which the sensor is installed. Account for an additional 3/8" for the space below the sensor.
    - Look up and down the pipe and observe if a bull nose occurs in the flow were it hits the sensor.
    - If the sensor can be removed, a functional test (as described on page 4 of the manual) can be performed.

  Step 3: Magmeter Installation
    - The mag-meter on the decant line must remain full at all times. If the decant line drains following a decant cycle or if the flow control valve has a leak, the mag-meter on the SBR decant line may not be reading properly. If the decant line drains, then the mag-meter is reading incorrectly until the line is full again.
    - Creation of a sump in the decant line will reduce the possibility of the line draining.

Regional WWTP

The following are short term improvements recommended at the Regional WWTP

- Sludge Depth – Since the volume of accumulated sludge in the lagoons at the Regional WWTP has not been measured or reduced lately, it is recommended that a survey of the sludge profile be completed within all three (3) lagoon cells. The survey of the sludge profile will involve the use of a portable sludge level detector to measure down to the sludge interface on a regular grid pattern. The procedure will require a person in a boat wearing a lifejacket, using the portable sludge level detector to document sludge depth at the intersection points along the grid. (See - http://www.sludgecontrols.com/our-products/portable-sludge-level-detector/). With this survey information, the effective volume remaining in the lagoons can be calculated. In order to generate a sludge depth trend, it is recommended that the sludge profile survey procedure be repeated yearly. The majority of the sludge accumulated at the Regional WWTP would be located in Lagoon Cell #3. Cell #1 and Cell #2 are well aerated and Cell #3 is used to settle out the solids before decanting the treated effluent to the environment. Following the completion of the sludge profile, the Municipality can prepare a look-up table of effective remaining volume in columns and BOD loading in Rows which will prove the current remaining capacity of the lagoon system.

WSP has investigated the Record Drawings for the existing treatment lagoons and it seems that in the original design, which includes very deep lagoon cells, the WWTP was not intended to be de-sludged. Cell #1 and Cell #2 are integrated lagoons that cannot by isolated due to a berm underneath the surface level. To clean the lagoons, Cell #1 and Cell #2 must be bypassed resulting in only a facultative (non-aerated) lagoon in Cell #3 to provide treatment. Cell #3 does not provide sufficient hydraulic retention time to comply with the Atlantic Canada Wastewater Guidelines. There is a great possibility that during the de-sludging operation, when the time Cell #1 and Cell #2 are bypassed to Cell #3, the treated wastewater effluent will be out of compliance. In addition, to clean Cell #3, there is no gravity transfer pipe to covey effluent from Cell #2 to the chlorine contact chamber. Therefore, temporary piping and pumping would be required to isolate Cell #3.

Alternatively, lagoons that are meant to be de-sludge are shallow, around 7ft in depth compared to the close to 30ft depth of the Lantz lagoon. Preliminary estimates to de-sludge the Lantz lagoon are around $5 to $6 Million, this will also vary depending on the cost to dispose of the waste at an appropriate facility.

4.2 Long Term Improvement Recommendations

Shubenacadie WWTP

The existing Shubenacadie WWTP does not currently have any excess capacity to accommodate future development within the Shubenacadie GMA. Two (2) options exist whereby East Hants can accommodate future development within the service area.

- *Option #1 – New WWTP* – Construction of a new WWTP designed to meet the long-term needs of an expanded community will encourage growth in the Shubenacadie GMA and improve the quality of the treated wastewater effluent being discharged to the adjacent river. It is currently understood that the Municipality would prefer an SBR style WWTP similar to what was recently constructed at the Milford WWTP. The new WWTP would be designed to accommodate any future development that has been proposed within the area.
- *Option #2 – Maintain Existing WWTP* and Reducing I/I – Maintaining the exiting WWTP will not allow any additional growth within the Shubenacadie GMA, nor will it provide any additional treatment that may be required in the future by the CCME Wastewater Regulations. During the coming 25 to 30 year timeframe, the condition of the WWTP will continue to deteriorate and an asset renewal plan will need to be put in place to replace treatment assets including the structural components of the oxidation ditch, the chlorine contact chamber etc.

Recommendation No1. – Due to the high cost of a new WWTP for the Shubenacadie GMA, the business case for construction of a new WWTP to replace the existing WWTP depends on the extent of new development proposed for the Shubenacadie Heights Residential Development. If and when the Shubenacadie Heights Development is to be constructed, the Municipality should take the opportunity to apply the infrastructure charge of $3,000 per residential unit. This infrastructure charge, when applied to the total buildout of the Shubenacadie Heights Development should be sufficient to cover the capital cost of the new WWTP required to service the whole of that development.

Milford WWTP

The relatively new Milford SBR WWTP has plenty of excess capacity to meet the long-term requirements of anticipated development within the Milford GMA. Long-term improvements recommended for implementation at the Milford WWTP include the following:

- Implement an Asset Management plan for the existing equipment. Many mechanical and instrumentation components of the SBR will need to be replaced near the end of the 30 year Sewer Capacity Report.

Regional WWTP

The existing Regional WWTP has limited capacity to accommodate some future development within the service areas. Long-term improvements recommended for implementation at the Regional WWTP include the following:

- Upgrades to Aeration System sufficient to accommodate a total sanitary flow rate for future growth of 8,900m^3/day.
- An upgrade to secondary treatment will be required once the CCME regulations are in place. Submerged Attached Growth Reactors (SAGRs), manufactured by Nelson Environmental Inc., have been used downstream of wastewater treatment lagoons to remove ammonia from the treated effluent. SAGRs are made up of a coarse gravel bed that is aerated. However, the SAGRs require significant room beyond the available space at the WWTP, which would bring the process into the adjacent wetland/flood plain.

5. Capital Cost Estimates

The following are preliminary estimates of the most probable capital costs associated with short-term and long-term improvements at each of the three (3) WWTP's.

Shubenacadie WWTP

Future Growth	Year Required		Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
New WWTP (for 700m3/day - 2000ppl)	2019-2024	Source - similar cost to Milford WWTP	L.S.	1	$3,500,000	$3,500,000	$4,375,000

Asset Renewal -	Year Required		Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
Controls Building	2025	*High Level estimates*	L.S.	1	$75,000	$75,000	$93,750
SCADA System	2034		L.S.	1	$50,000	$50,000	$62,500
Screening Area	2025		L.S.	1	$100,000	$100,000	$125,000
Aeration Equipment (Compressors, air distribution, and sludge pump)	2029		L.S.	1	$150,000	$150,000	$187,500
Oxidation Ditch (Structural)	2033		L.S.	1	$1,000,000	$1,000,000	$1,250,000
Secondary Clarifier	2027		L.S.	1	$750,000	$750,000	$937,500
Chlorination System	2030		L.S.	1	$150,000	$150,000	$187,500
Chlorine Contact Chamber (Structural)	2027		L.S.	1	$150,000	$150,000	$187,500
					Total (Ex. HST)	$2,425,000	$3,031,250

Milford WWTP

Current Recommendations	Year Required	item	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
Replace SBR Feed Pumps	2015	*High Level Estimates*	L.S.	2	$20,000	$40,000	$50,000
Railing Around Top of SBR	2015		m	50	$200	$10,000	$12,500
Influent Flow Meter	2015		L.S.	1	$10,000	$10,000	$12,500
					Total (Ex. HST)	$60,000	$75,000

Asset Renewal (long term)	Year Required	item	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
SCADA System	2036	*High level estimates*	L.S.	1	$300,000.0	$300,000.0	$375,000
Aeration Blowers	2031		L.S.	1	$100,000	$100,000	$125,000
Grinder Pump	2036		L.S.	1	$900,000	$900,000	$1,125,000
UV Disinfection	2036		L.S.				
Automatic Sampler	2036		L.S.				
Sludge Return Pumps	2036		L.S.				
Sludge Digester Blower	2036		L.S.				
Building Mechanical Systems	2036		L.S.				
					Total (Ex. HST)	$1,300,000	$1,625,000

These capital cost estimates were calculated based on the assumption that the pumping mechanical & electrical is 30% of the asset valve, and Telemetry and SCADA accounts for approximately 10% of the Total Asset Valve. The total asset value was assumed to be $3,000,000 based of the construction price to build the new Milford WWTP.

Regional WWTP

Current Recommendations	Year Required	Description	Unit	Estimated Quantity	Unit Price	Est. Total Cost	Total Including Engineering and Contingency (25%)
Estimate of Sludge	2015	Estimate to do the survey of the lagoon	L.S.	1	$100,000	$100,000	$125,000
Removal of Sludge	?	Need the amount of sludge to determine cost - potential to be in the millions	tonne				
Influent Testing	2015	150 samples to be tested	L.S	150	$50	$7,500	$9,375
Building Mechanical Systems	2015	estimate for mechncial system upgrades	L.S.	1	$300,000	$300,000	$375,000
Aeration Equipment (8,900m3/day)	2015	(based on an equipment price of $675,000 plus installation)	L.S.	1	$877,500	$877,500	$1,096,875
				TOTAL (excluding HST)		**$1,285,000**	**$1,606,250**
Asset Renewal - Future (NOT INCLUDED IN TOTALS)							
Chlorination System	2020		L.S.	1	$150,000	$150,000	$187,500
Chlorine Contact Chamber (Structural)	2040		L.S.	1	$250,000	$250,000	$312,500
						Total	**$500,000**

Upgrades for 13,800m3/day (For Information Only)							
Upgrade to Aeration System			L.S.	1	$887,900	$887,900	$1,109,875
SAGR upgrade (If needed)			L.S.	1	$5,353,250	$5,353,250	$6,691,563

APPENDIX A - Capacity of the Regional Lagoon WWTP

The lagoon in Lantz was built to treat wastewater from Elmsdale, Enfield, and Lantz. It was design by CBCL Limited in the late 1980's. Record drawings for the Sewage Treatment Plant were available, along with a Joint Certificate of Approval from the Nova Scotia Department of the Environment (now called Nova Scotia Environment). The WWTP is described as a three cell partially mixed, aerated facultative lagoon system.

The Joint Certificate of Approval No. 88-160 for the Lantz WWTP indicates that the facility was design/allowed to 9,000 persons served in the future. Which indicates based solely on population that there is enough room left for 2,407 persons. Yet, based on the WSP Sewer Model there is a theoretical additional flow (from commercial) of 1,230m^3/day. Based on a population equivalent of 340L/day/person, the theoretical additional flow equates to 3,618 persons. Therefore the current population of 6,593 persons plus the theoretical additional flow population equates of 3,618 persons equals a total 10,211 person equivalents connected to the WWTP, greater than the 9,000 persons in the permit.

The permit indicated an estimated biological load of 600 pounds/dayBOD_5 (272kg/dayBOD_5) which is high considering the inflow and infiltration coming into the system. There is no influent meter data which makes it difficult to determine the actual capacity.

The average daily flow from January 2012 to the end of May 2014 at the effluent of the WWTP is 4,840m^3/day. The data provided the average daily flow at the outlet of the treatment plant. Since the volume, and therefore the hydraulic retention time, of the lagoons is relatively high, the peaks flows measured at the lagoon outlet do not reflect peak flows coming at the inlet of the WWTP. The volume of the lagoon is able to temporality increase in response to peak flows thereby flattening out or attenuating the peaks by the time it is measured at the lagoon outlet.

At this time there is no influent data available to determine the strength of the raw sewage coming into the first cell of the lagoon. Inflow and Infiltration is most likely diluting the wastewater strength, lowering the concentration of BOD. The influent raw sewage is most likely weaker than domestic strength wastewater, BOD and TSS being less than 180mg/L. WSP assumed a BOD of 150mg/L to account for the low strength wastewater and high concentration of I/I.

Section numbers refer to the Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal (2006) (Guidelines). In addition, it is assumed that there is full capacity in the lagoon as the sludge depth is not known. Once the sludge depth is known, the calculations can be modified.

The Regional WWTP is assumed to have the following characterizes as described in the CBCL Irving Report (2007) and summarized in Table 9.

Table 9: Summary of Regional WWTP (from Expansion of Enfield Irving Big Stop Site, CBCL 2007)

	Volume (m^3)	Number of Static Tube Aerators	Aeration Capacity (standard cubic feet per minute – SCFM)
Cell #1	29,902	48	720
Cell #2	42,771	20	300
Cell #3	70,023	10	150
Total	**142,696**	**78**	**1170**

Calculation for Available Capacity

The following calculates the hydraulic retention time limitation of the existing lagoon and the theoretical capacity of the existing aeration system.

Assessment of Hydraulic Retention Time

The following section looks at the maximum daily flow at the lagoon while maintaining the existing lagoon structure. The calculations below also do not take into account the amount of volume that is loss due to the build-up of sludge in the bottom of the lagoon.

Hydraulic Retention Time

According to **Section 7.6.3.3**, aerated lagoons have a detention time ranging from 5 to 30 days. The hydraulic retention time (HRT) is calculated based on the volume of Cell #1 and Cell#2, as the first two cells are doing the majority of the treatment. Cell#3 is used for settlement. Based on a combined volume of 72,673m^3, the average daily flow possible is between 2,400m^3/day and 14,500m^3/day.

Polishing Cell

According to **Section 7.6.5.2.2.5**, a polishing cell is to have a minimum hydraulic retention of five days. For the lagoon, cell #3 at a volume of 70,023m^3, is considered the polishing cell. The maximum average flow based on the polishing cell capacity is 14,000m^3/day.

Conclusions for Hydraulic Retention Time

Based on the physical capacity of the lagoons, there is enough capacity for an average daily flow of 14,000m^3/day. Based on 340L/day/person, that is equivalent to 41,000persons. Again this is only hydraulic retention time; the capacity of the lagoon is also dependent on amount of aeration, a minimum of 1 kg of O_2 per kg of influent BOD is needed.

Theoretical Capacity of Existing Aeration System

According to the **Section 7.6.5.2.1b**, the aeration system must be able to transfer up to 1.0 kilogram of oxygen per kilogram of BOD_5.

The following assumptions were made to determine the theoretical capacity of the existing lagoon system.

- Air flow is 1020scfm for cell#1 and cell#2
- Diffuser's are submergence at a depth of 18ft
- For the Oxygen Transfer Efficiency (OTE) assume 0.75% per ft depth of diffuser
- 1 scfm of air contains 0.0173lb of O_2
- For Coarse bubble diffusers, AOR/SOR=0.5

Oxygen Transfer Efficiency (OTE) = 18ft x 0.0075 = 0.135 =**13.5% OTE**

At OTE, 1 cfm of air will transfer = 0.135 * 0.0173 lb of O_2 = **0.002336 lb O_2 per minute**

Standard Oxygen Requirement (SOR) = 1020scfm x 24hr/d x 60min/hr x 0.002336 lb O_2 per minute
= 3,430 lb O_2/day
= **1,556 kg O_2/day**

Actual Oxygen Requirement (AOR) = SOR x 0.5 = 1,556 kg O_2/day x 0.5 = **778 kg O_2/day**

AOR = Average Day Flow x BOD_5

Average Day Flow = AOR x BOD_5 = 778 kg O_2/day / (150mg/L x (0.001kg/m^3)) = **5,180 m^3/day**

Conclusion Theoretical Capacity of Existing Aeration System

The estimate theoretical capacity of the existing aeration system is 5,180m^3/day, based on the full capacity of the aeration system and a BOD of 150mg/L. The theoretical calculations were based on the full capacity of the aeration system, which after 30 years may not be working to its full capacity.

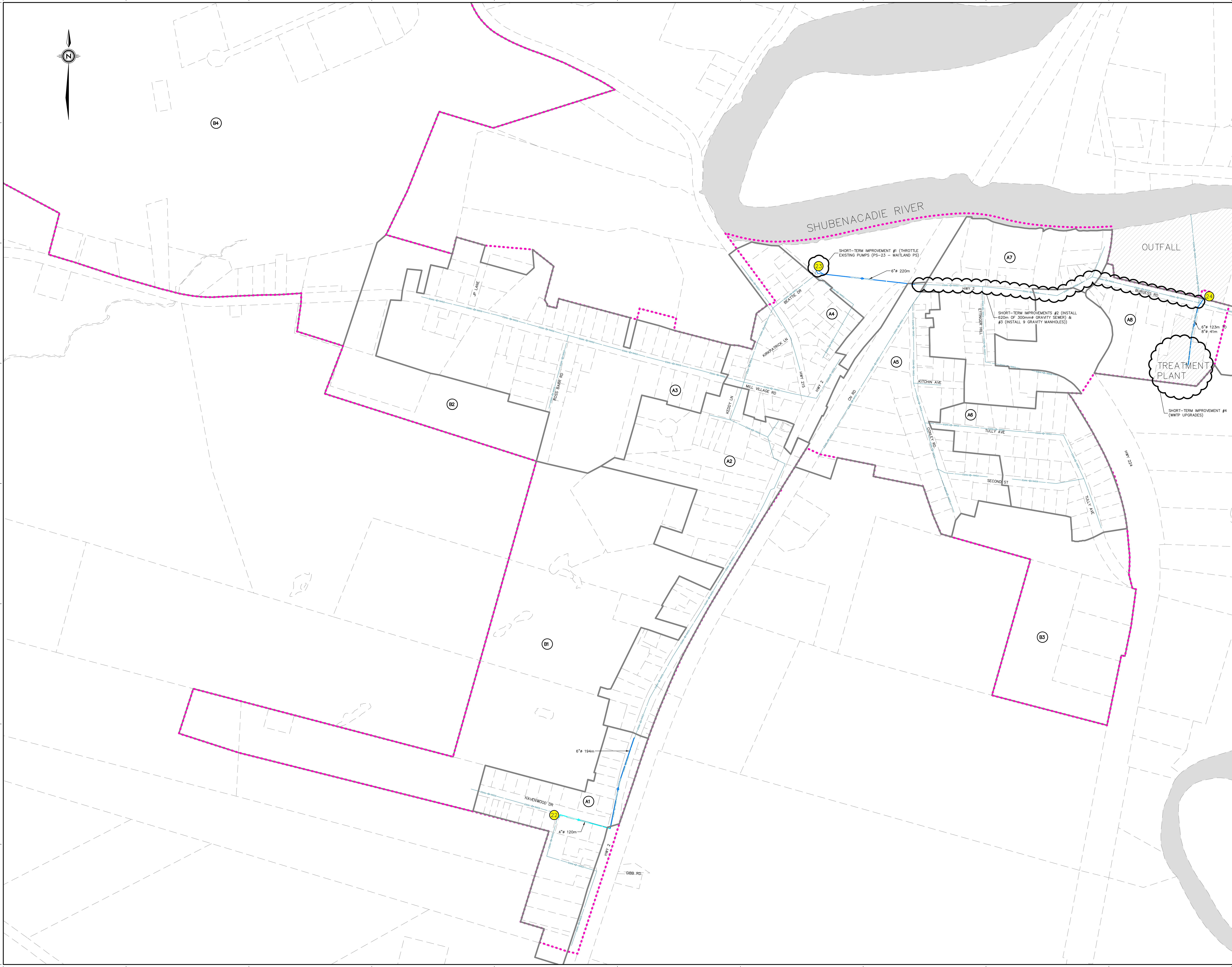
Conclusions

The limiting factor for the capacity of the exiting Regional Lagoon is the aeration system. There is enough hydraulic capacity in the existing lagoon structure to service the communities of Lantz, Enfield, and Elmsdale well beyond the Sewer Capacity Study's 30 year time frame, assuming there is no sludge build-up.

Based on an existing average day flow of 4,840m^3/day and a theatrical capacity of 5,180m^3/day, there is approximately 340m^3/day which is equivalent to 1,000 persons. The 5,150m^3/day is an estimate based on ageing aeration, an estimated BOD concentration, and full capacity of the lagoon system.

Appendix C

Maps



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SHUBENACADIE AREA
MILFORD AREA
REGIONAL AREA

SERVICE BOUNDARY		GROWTH BOUNDARY	
SEWERSHED BOUNDARY		LOT LINE	
GRAVITY SEWER		FORCEMAIN	
100YR FLOODPLAIN		20YR FLOODPLAIN	
PUMP STATION	1	SEWERSHED LABEL	A1

Color Coding Legend
Conduit: Diameter (mm)

<= 0.0
<= 101.6
<= 152.4
<= 203.2
<= 254.0
<= 304.8
<= 355.6
<= 381.0
<= 406.4
<= 457.2
<= 508.0
<= 533.4
Other

Color Coding Legend
Pressure Pipe: Diameter (mm)

<= 76.0
<= 101.6
<= 152.4
<= 203.2
<= 254.0
<= 304.8
<= 355.6
Other

SEWERSHEDS

SEWERSHED	AREA (ha)	HOUSE COUNT
A1	6.68	39
A2	11.47	38
A3	16.77	49
A4	6.89	25
A5	9.88	37
A6	6.48	41
A7	8.73	18
A8	5.52	14
VACANT OR UNCONNECTED		
B1	26.88	0
B2	7.09	0
B3	10.24	3
B4	108.40	8

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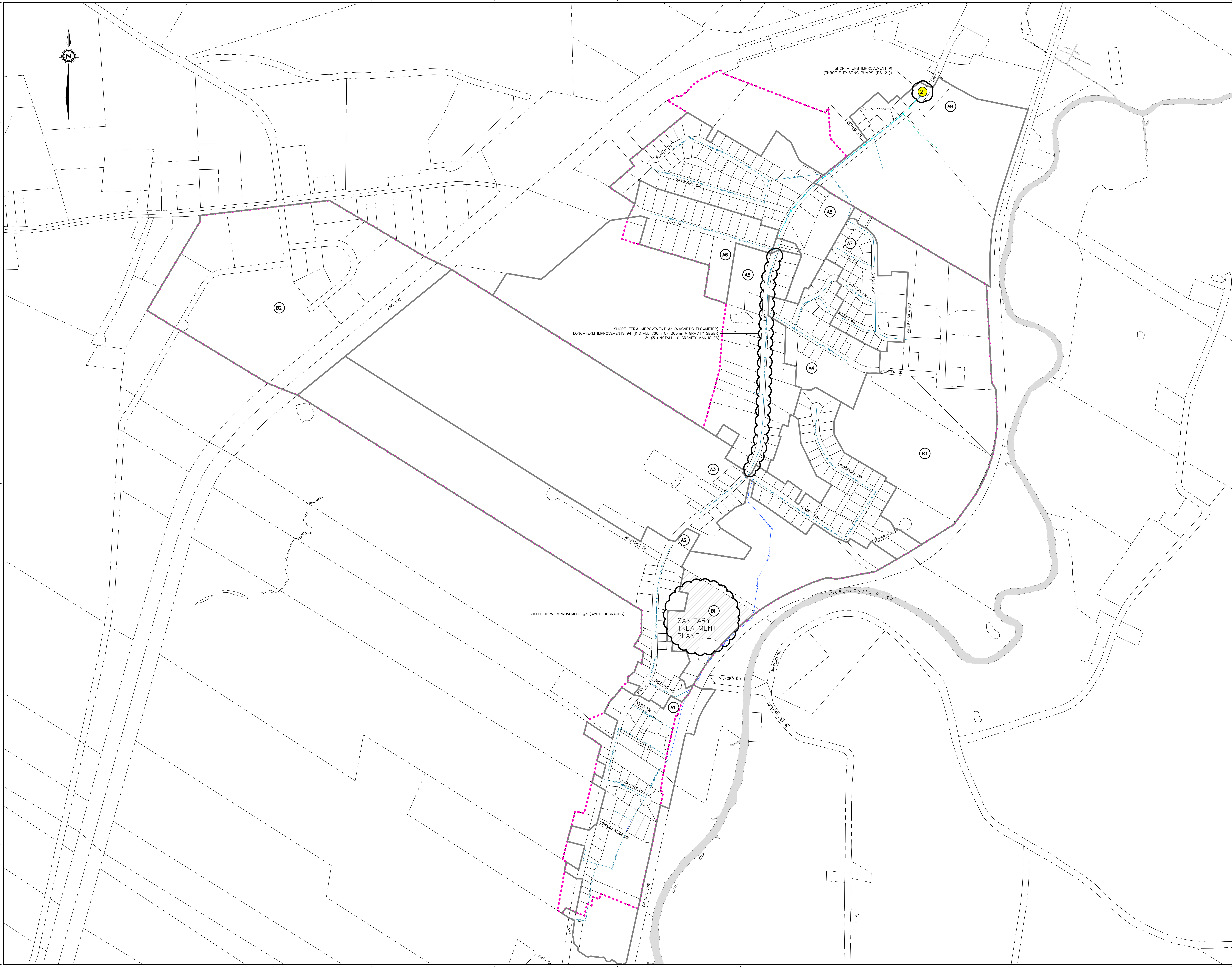

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SHUBENACADIE AREA
MILFORD AREA
REGIONAL AREA

LEGEND:

SERVICE BOUNDARY		GROWTH BOUNDARY	
SEWERSHED BOUNDARY		LOT LINE	
GRAVITY SEWER	ESAN	FORCEMAIN	EFMSAN
100YR FLOODPLAIN	100 YR	20YR FLOODPLAIN	20 YR
PUMP STATION	1	SEWERSHED LABEL	A1

Color Coding Legend
Conduit: Diameter (mm)

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<= 457.2
<= 508.0
<= 533.4
Other

Color Coding Legend
Pressure Pipe: Diameter (mm)

<= 76.0
<= 101.6
<= 152.4
<= 203.2
<= 254.0
<= 304.8
<= 355.6
Other

SEWERSHEDS

SEWERSHED	AREA (ha)	HOUSE COUNT
A1	21.01	54
A2	31.71	31
A3	65.33	70
A4	8.77	26
A5	42.63	26
A6	8.49	20
A7	7.32	30
A8	18.53	65
A9	26.55	9
VACANT OR UNCONNECTED		
B1	173.33	0
B2	38.22	0
B3	34.05	0

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SCALE: 1:4000 METRIC
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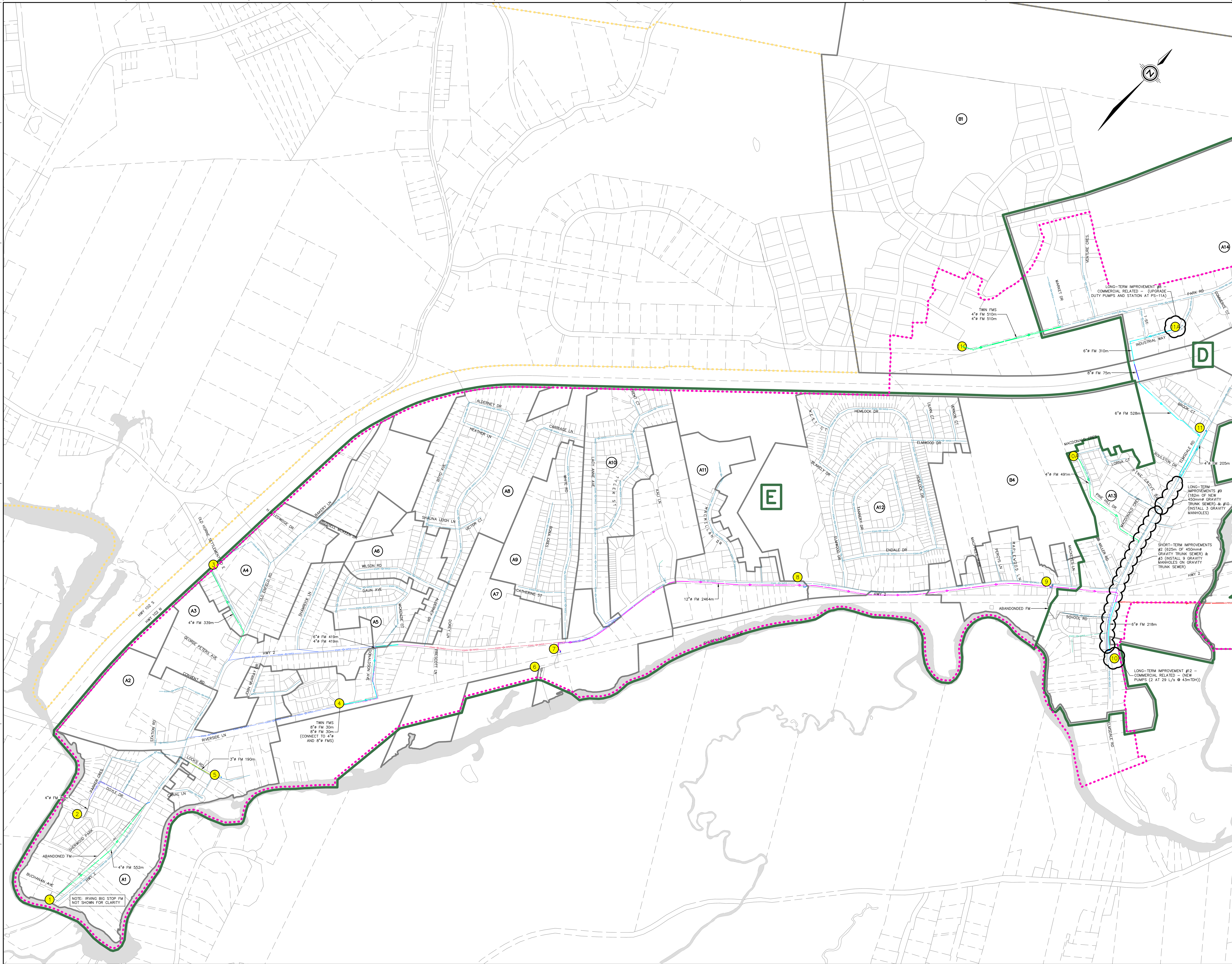

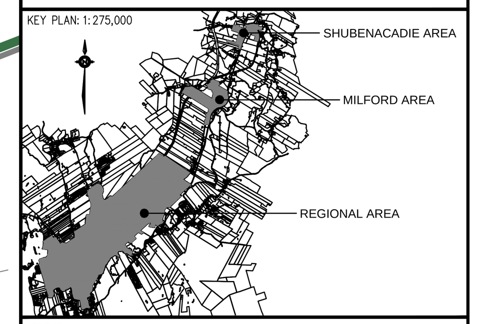

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SERVICE BOUNDARY		GROWTH BOUNDARY	
SEWERSHED BOUNDARY		LOT LINE	
GRAVITY SEWER	ESAN	FORCEMAIN	EFMSAN
100YR FLOODPLAIN	100 YR	20YR FLOODPLAIN	20 YR
PUMP STATION	1	SEWERSHED LABEL	A1

Color Coding Legend
Conduit: Diameter (mm)

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<= 152.4
<= 203.2
<= 254.0
<= 304.8
<= 355.6
<= 381.0
<= 406.4
<= 457.2
<= 508.0
<= 533.4
Other

Color Coding Legend
Pressure Pipe: Diameter (mm)

<= 76.0
<= 101.6
<= 152.4
<= 203.2
<= 254.0
<= 304.8
<= 355.6
Other

SEWERSHEDS

SEWERSHED	AREA (ha)	HOUSE COUNT
A1	31.7	79
A2	32.6	47
A3	25.9	39
A4	28.1	55
A5	8.3	49
A6	11.1	59
A7	69.1	41
A8	31.1	141
A9	16.7	82
A10	20.3	105
A11	19.7	39
A12	58.6	322
A13	97.0	183
A14	96.0	0
A15	172.6	230
A16	84.7	200
A17	63.6	146
A18	77.6	151
VACANT OR UNCONNECTED		
B1	227.5	9
B2	141.5	0
B3	371.5	2
B4	42.1	0

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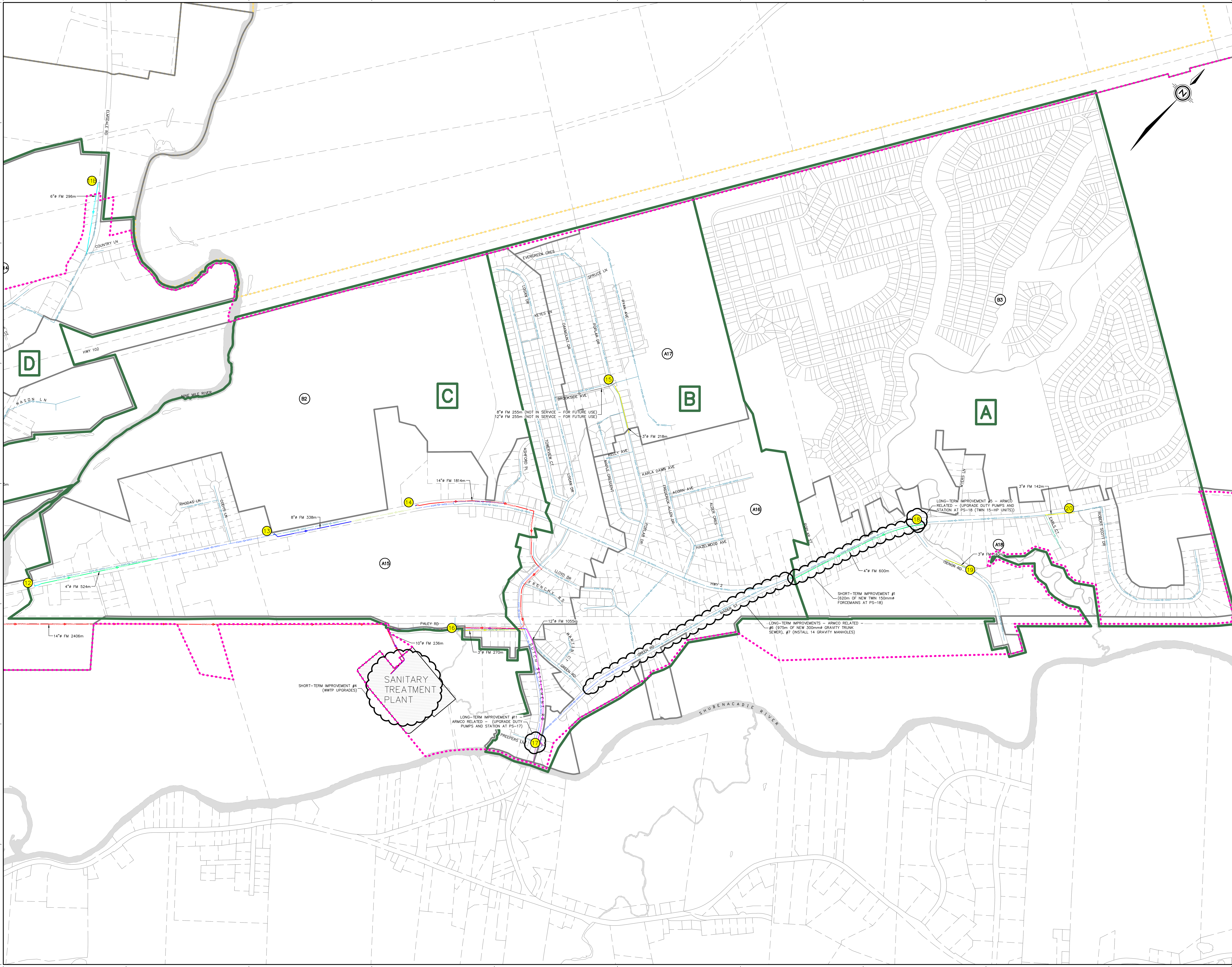

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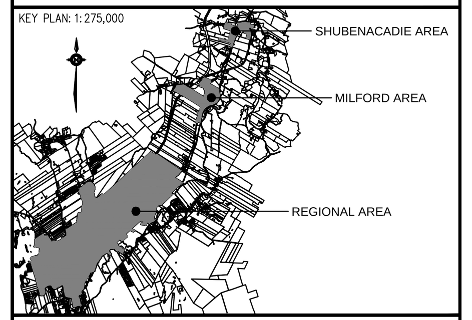

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SEWERSHED BOUNDARY		LOT LINE	
GRAVITY SEWER		FORCEMAIN	
100YR FLOODPLAIN		20YR FLOODPLAIN	
PUMP STATION	1	SEWERSHED LABEL	A1

Color Coding Legend
Conduit: Diameter (mm)

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<= 457.2
<= 508.0
<= 533.4
Other

Color Coding Legend
Pressure Pipe: Diameter (mm)

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<= 304.8
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B3	371.5	2
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