ENGINEERING AND OPERATIONS DEPARTMENT
ENGINEERING DIVISION

Report Number: 2014-32 **Date: September 8, 2014**

SUBJECT: UPDATE REPORT ON THE STORM SEWER SYSTEM INFRASTRUCTURE NEEDS STUDY

1) PURPOSE:

This report is prepared by Jim Huppunen, Manager of Engineering Services under the direction of Chris Lee, Acting Director of Engineering and Operations to update Council on the progress and status of the Storm Sewer System Infrastructure Needs Study (SSINS).

2) HISTORY, BACKGROUND, COUNCIL POLICY, PRACTICES

The Engineering Division last revised the SSINS for the Storm Sewer System in 1978. Since then the City has completed some of the recommended capital upgrades and an updated SSINS needs to be completed in order to determine the capital upgrades required for the next 25 years.

Subsequently, a SSINS was budgeted for in the Capital Budget in 2011. This project is intended to provide a long range capital and operating plan for the City of Port Colborne's storm sewer collection system. The plan will be comprehensive and will incorporate all facets of the management, expansion, and funding of the system over a 25 year timeframe. The plan will also provide business processes and tools to allow for the refinement and augmentation of plan deliverables by City Staff over time. Project deliverables will take into account all: regulatory, risk, growth, financial and socio-economic impacts and stressors. This project will be performed in accordance with the MEA Class Environmental Assessment Process and will ensure that the recommended works are in accordance with regulatory agencies.

A SSINS will take into account the age and materials in the storm sewer system, and also examine items such as historical flooding, maintenance issues, and prioritizes storm sewer replacements based on these and other factors. A SSINS will more clearly define the estimated replacement costs, hence why it is important to have an updated SSINS.

The City's storm sewer system consists of approximately:

- 1 stormwater management pond;
- 2,700 catchbasins;
- 700 manholes;
- 95 km of main consisting of:
- 38 km of concrete pipe;
- 12 km of PVC pipe;
- 45 km of unknown pipe material

The City has recently designed Stormwater Management Plans for the following storm defined storm drainage areas:

- Clarke Street Area;
- Rosemount Avenue Area;
- Victoria Street Area;
- Kent Street Area;
- Charlotte Street Area;
- Princess Street Area;
- Steele Street Area;
- Bell Street Area

This study includes the following general tasks of work to be considered as preliminary or minimum requirements. Consultants were required to include additional study items into the scope of the project as appropriate.

- Review of Existing System Characteristics
- Storm Sewer System Modeling
- Condition Assessment
- Infrastructure Renewal/Improvements and Sustainability
- Operational/Customer Engagement
- Policy and Standards Development

As Council will recall, in December of 2012, Engineering & Operations Department, Engineering Division, Report 2012-39 was presented with the following recommendation:

A) That the Council of the City of Port Colborne award the Request for Proposal – Development of a Storm Sewer System Infrastructure Needs Study to Associated Engineering of St. Catharines, Ontario for the total proposed price of $143,952 plus applicable taxes.

B) That funding for Project #2012-09 be financed under Account 0-510-74845-3319.

3) STAFF COMMENTS AND DISCUSSIONS

Staff have been working closely with Associated Engineering for the past 2 years to prepare a comprehensive report and hydraulic model as part of the Storm Sewer System Infrastructure Needs Study.

The main objective of the project was to undertake a comprehensive analysis and review of the City's existing storm sewer network to identify existing and potential future deficiencies in the collection of storm water run-off and address storm water discharge quality. The project included order of magnitude cost estimates for recommended upgrades, repair and or replacement of the existing storm sewers and associated infrastructure. As a separate component, the project will also identify potential cost and phasing options for drainage infrastructure for those areas of the City within the urban area that are not currently serviced with storm sewers.

The project is intended to provide a long range capital and operating plan for the City of Port Colborne's storm sewer system. The plan is comprehensive and has incorporated

all facets of the management, expansion and funding of the system over a 25 year period. The plan has also provided business processes and tools to allow for the refinement and augmentation of plan deliverables by City Staff over time. Project deliverables will take into account all: regulatory, risk, growth, financial and socio economic impacts and factors. The project has been performed in accordance with the MEA Class Environmental Assessment Process and has ensured that the recommended works are planned in accordance with the Niagara Peninsula Conservation Authority (NPCA) Source Water Protection Guidelines and the Ministry of Environment (M.O.E.) Clean Water Act (2006) and both City of Port Colborne and Niagara Region standards and bylaws and all other existing and pending applicable legislation.

The attached Executive Summary details the review of the City's Storm Sewer system and includes recommendations to benefit the users of the system. These include recommendations for the following items:

- Level of Service
- Planning for Growth and Improvements
- Infrastructure Renewal and Sustainability
- Development of Revenue Sources
- Implementation of Proposed Improvements

4) OPTIONS AND FINANCIAL CONSIDERATIONS:

a) Do nothing.

This report is presented as information for Council.

b) Other Options

None.

5) COMPLIANCE WITH STRATEGIC PLAN INITIATIVES

Prepare a report for Council review detailing the issues to be considered in a Storm Sewer Master Plan for the City with recommendations on timing and funding for the study. Council was made aware of the completion of storm water drainage studies in the Rosemount, Steele, and Clarke areas. (P. 12 2011 Strategic Plan Report)

6) ATTACHMENTS

1. Storm Sewer System Infrastructure Needs Study Final Report, Executive Summary prepared by Associated Engineering – May 2014

7) RECOMMENDATION

A. That the Council of the City of Port Colborne receive the Engineering & Operations Report 2014-32 – Update Report on the Storm Sewer System Infrastructure Needs Study be received for information.

8) SIGNATURES

Prepared on August 28, 2014 by:

29/08/2014

X Jim Huppunen

Jim Huppunen, A.Sc.T.
Manager of Engineering Services
Signed by: Jim Huppunen

Reviewed by:

9/02/14

X

Chris Lee
Acting Director of Engineering & Operations
Signed by: Janice Peyton

Reviewed and Respectfully Submitted:

9/02/14

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Robert J. Heil
Chief Administrative Officer
Signed by: Carrie McIntosh

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

The City of Port Colborne

Storm Sewer System Infrastructure Needs Study

Prepared by Associated Engineering (Ont.) Ltd.
In conjunction with:
GeoAdvice Engineering Inc. and
M. Fortin Associates

May 2014

CANADA'S BEST MANAGED COMPANIES

Executive Summary

1 INTRODUCTION

1.1 Background

The City of Port Colborne covers an area of approximately 12,380 ha with an urban area of approximately 2,380 ha and a population of approximately 19,200. The City's storm water collection system is a mix of urban and semi urban design comprised of approximately 96km of storm sewers plus a series of roadside ditches and swales. The City's drainage system has evolved and expanded from the earliest storm pipe installations dating back to 1929. Over the years, many roadside ditches were informally replaced with local storm pipes that were not necessarily deigned to any prevailing standard.

In some areas where basements were susceptible to high water tables and seepage, private sump pumps were installed and directed to the sanitary sewer system. To relieve the pressure on the sanitary collection system and the wastewater treatment plant, it is desirable to redirect these sump pump discharges to the storm water collection system, assuming adequate capacity exists.

The City's previous storm sewer master plan was completed in 1978. The City now requires an up to date assessment of storm sewer servicing needs, and a sustainable means of financing the needed capital investments and maintenance works.

1.2 Study Objectives

The objectives of this study are to:

- undertake a comprehensive analysis of the City's existing storm sewer network to identify existing and potential future deficiencies in the collection of storm water runoff,
- address applicable storm water discharge quality regulations,
- define and prioritize maintenance works and capital upgrades that are required to service existing and future land use for the next 25 years, and
- develop a suitable financing strategy to support the recommended capital and maintenance program.

1.3 Study Area

The Study Area is defined as the urban area boundary of the City of Port Colborne, as illustrated by Figure ES-1.

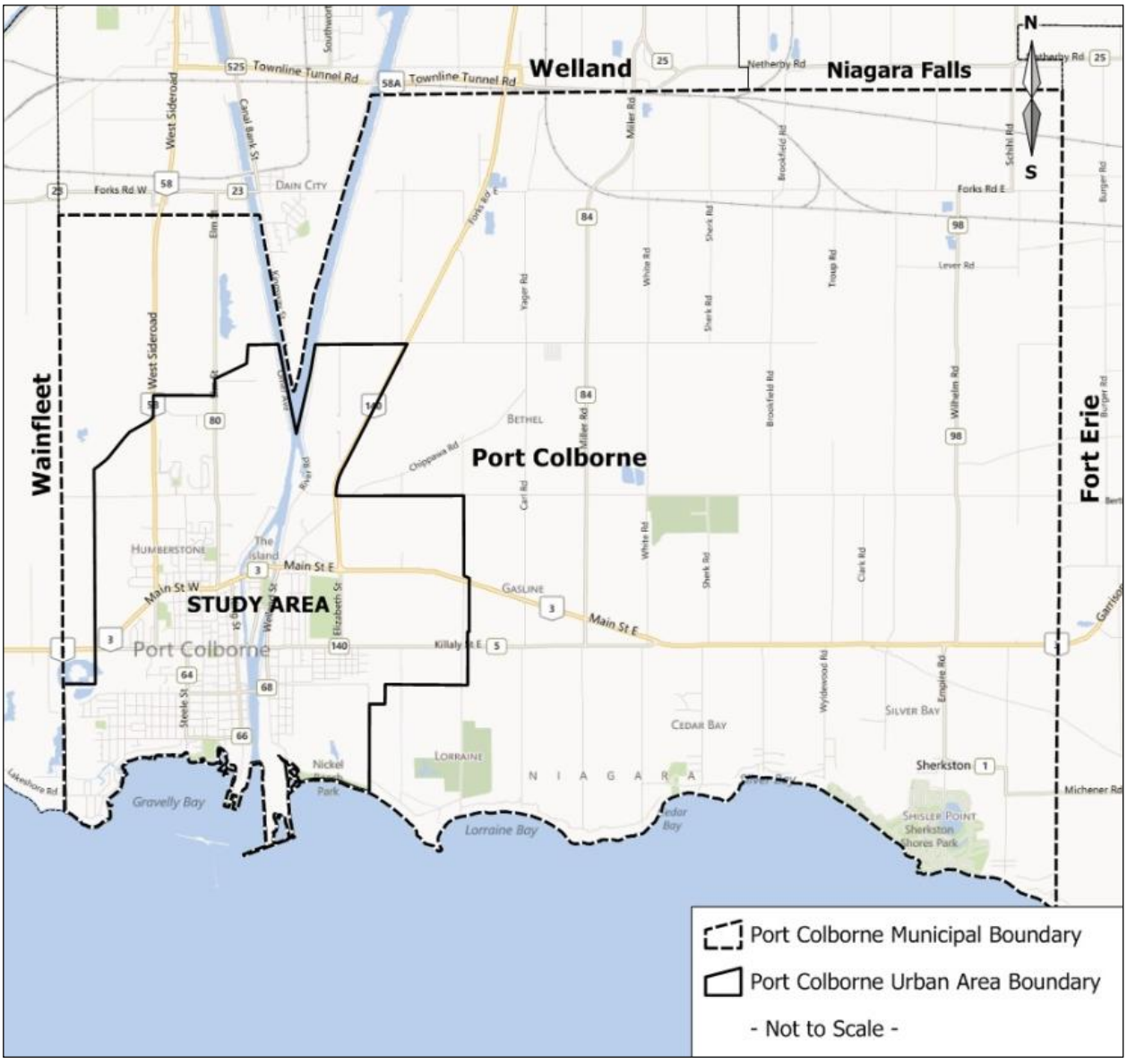

Figure ES-1
Study Area

1.4 Municipal Class Environmental Assessment Process

This study was undertaken as a Master Plan in accordance with the Municipal Engineer's Association Municipal Class Environmental Assessment (EA) Guidelines. As a Master Plan project, this study is intended to satisfy Phases 1 and 2 of the Municipal Class EA planning process. Individual projects identified by the study may be subject to additional Municipal Class EA planning and approvals prior to implementation. Additional information regarding the Municipal Class EA process is included in Appendix A.

The Problem Statement for this study is as follows:

> *The City of Port Colborne requires a comprehensive assessment of its existing storm sewer infrastructure to identify and prioritize policies, upgrades and expansion that are required to achieve the City's level of service objectives for storm drainage over the next 25 years.*

2 EXISTING SYSTEM CHARACTERISTICS

2.1 Existing Storm Sewer Drainage Areas and Outlets

The existing storm sewer network is divided into 22 drainage areas, which are generally defined by the ground surface topography as illustrated by Figure ES-2. Review of the supplied background data and information collected during field surveys concluded that the existing storm sewers primarily discharge through 23 outlets to the Welland Canal, Lake Erie, and the Eagle Marsh Municipal Drain.

It is recommended that all outfalls that are directly affected by Lake Erie water levels be equipped with flap gates to provide flood protection. It is also recommended that all flap gates be regularly inspected and maintained to ensure closure during high lake and marsh levels.

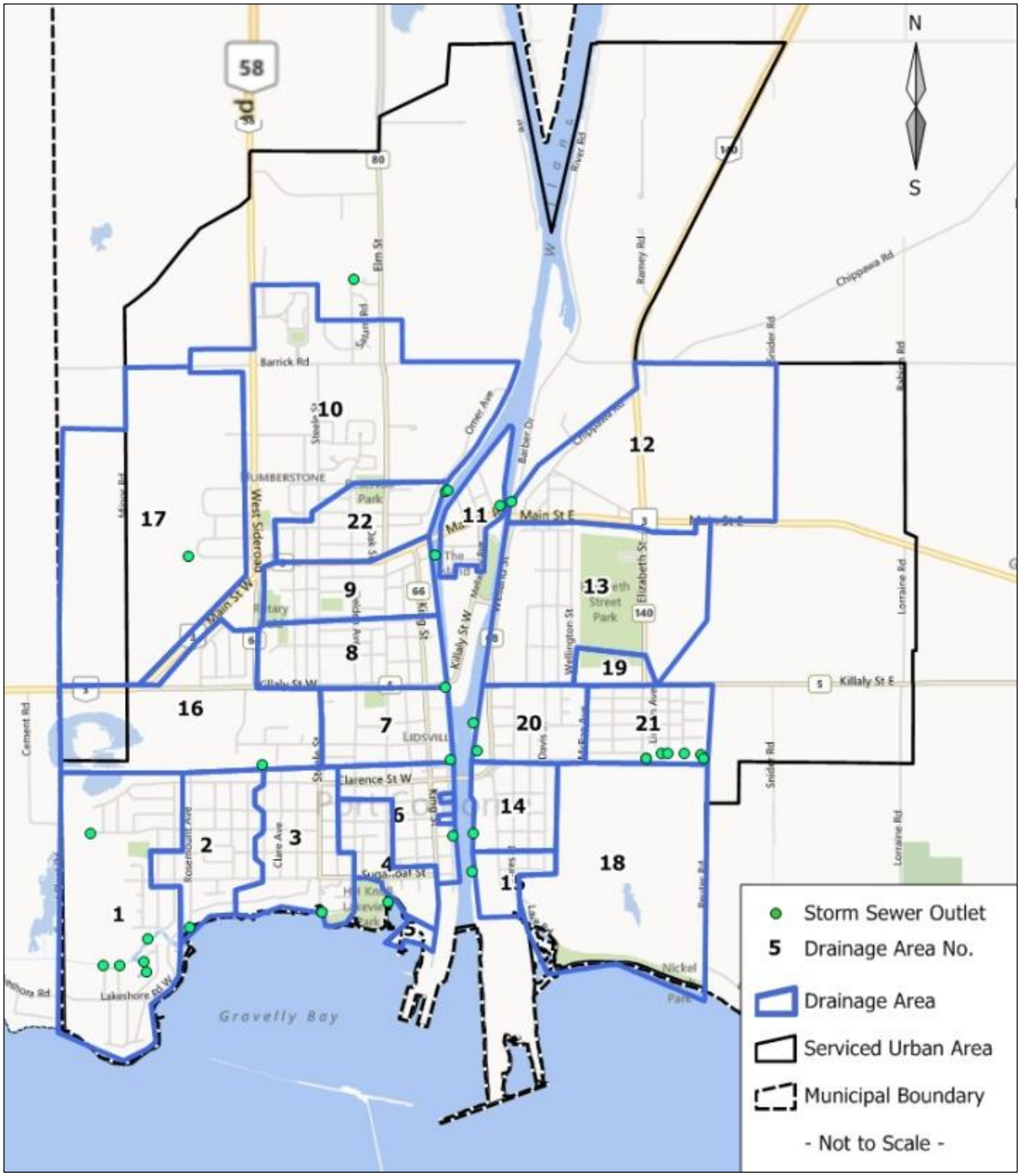

Figure ES-2
Storm Sewer Drainage Areas

2.2 Existing Storm Sewer Condition

As part of the City's Inflow and Infiltration (I&I) Reduction Program, AE conducted a detailed review of the storm sewers in the Nickel Area (Storm Drainage Areas 14 and 15), and a portion of the Omer Area (Storm Drainage Area 22). As part of the current study, AE also reviewed a number of storm sewer inspection reports for Storm Drainage Areas 2, 3 and 4.

In general, the sewers reviewed by AE were in poor condition, with several exhibiting significant defects and early stages of collapse. Based on the available information, the sewers reviewed appear to be classified as "non-designed" or "semi-designed". Presumably, the more recently constructed "designed" sewers are in better condition than the sewers reviewed by AE, however this can only be verified by inspection.

It is recommended that the City initiate a regularly scheduled program of flushing and inspection to monitor the condition of its storm sewers, and identify repair/upgrade needs on a proactive, rather than reactive, basis. Such a program will require careful planning to ensure that the resulting reports accurately identify the exact location of the subject sewers, which will require improvement of the City's storm sewer GIS to create unique identifiers for each asset, particularly manholes.

2.3 Existing Level of Service

The level of service provided by the existing storm sewer network varies throughout the City based on factors such as the design and construction methodologies that have been employed over the duration of the network's development, and the age of the various portions of the network.

In order to characterize the existing level of service, AE conducted a cursory review of drainage issues recorded in the City's "Lotus Notes" customer service/work order database. Review of the issue descriptions indicated that, other than those related to debris and tall grass in ditches, many of the issues were related to surface ponding due to poor grading. Issues were found to be evenly distributed across the City, with no one area identified as particularly problematic.

3 HYDRAULIC MODEL DEVELOPMENT

A model of the City's existing storm sewer system was developed on behalf of Associated Engineering by GeoAdvice Engineering, using the InfoSWMM hydraulic modeling software application.

The model's network topology was built primarily using the City's existing storm sewer infrastructure GIS data sets. The supplied GIS data was used as much as possible; however a number of connectivity issues and data gaps remained. As well, a substantial amount of the storm water data was found to be missing either diameter or invert elevation data. In order to fill the data gaps, AE relied on field surveys, existing engineering drawings and interviews with City Staff. Remaining data gaps were filled by interpolating data from neighbouring pipes and from ground elevations.

The hydraulic model was calibrated using storm sewer flow and rainfall data collected between April 8, 2013 and June 17, 2013. Rainfall data collected at the Region of Niagara's Seaway wastewater treatment plant was provided by the Region of Niagara. Storm sewer flow data was collected at the Princess St. and Killaly St. storm sewer outlets.

4 HYDRAULIC MODELLING - EXISTING CONDITIONS

4.1 System Performance Criteria

The evaluation criteria used to assess the City of Port Colborne drainage system are summarized below.

Table ES-1
System Performance Criteria

Criteria For	Criteria
Upgrading existing pipes	
Deficient	if d/D > 1.0 and q/Q > 1.0 and surcharged > 15min
Not Deficient	if d/D > 1.0 and q/Q > 1.0 and surcharged < 15min
	if d/D > 1.0 and q/Q < 1.0
	if d/D < 1.0 and q/Q < 1.0
Replacing existing frontage tiles	All replaced with pipe(s) or ditch, scenario based
Upgrading existing channels & swales	Upgrade if HGL > GE
New pipe design	At peak flow rate d/D =< 0.8 and q/Q < 1.0
New channel design	At peak flow rate HGL < GE

Notes:

- Criteria is based on the 5-year return period Chicago design storm
- HGL: Hydraulic Grade Line
- GE: Ground Elevation
- d: depth of flow
- D: pipe diameter
- q: peak flow rate
- Q: full pipe capacity flow rate

4.2 Existing System Capacity – 2 Year Storm

Hydraulic model simulation of the 1:2 year storm was used to assess the existing system capacity under relatively frequent rainfall events. This simulation used existing land use conditions and assumed that private sump pumps were not contributing to the storm sewer network.

The results of this simulation indicate that approximately 11km of the City's existing storm sewers are considered deficient under the 1:2 year storm, and therefore do not meet the City's current 1:5 year design storm standard.

4.3 Existing System Capacity – 5 Year Storm with Sump Pump Discharges

Hydraulic model simulation of the 1:5 year storm was used to assess the existing system capacity relative to the City's design storm event, and to assess the impact of redirecting private sump pumps to the storm sewers in the Nickel and Omer Inflow and Infiltration Reduction Program study areas.

The results of this simulation indicate that:

- Approximately 16km of the City's existing storm sewers are considered deficient under the 1:5 year storm.
- With the exception of those in Drainage Area 1, the majority of the "designed" sewers meet the City's design standard. While the model does indicate that some of the "designed" sewers do not have adequate capacity, surface flooding is only predicted at four locations. Many of these hydraulic deficiencies may, in fact, be due to the limited accuracy of assumed sewer inverts.
- The majority of "semi-designed" and "non-designed" sewers are deficient under both the 1:2 year and 1:5 year storm events, with surface flooding predicted at several locations. This is not surprising given that these sewers were not designed to current standards, and that many are the tiled system that resulted from infilling of ditches with little consistency in sewer sizes or grades.

5 PLANNING FOR GROWTH AND IMPROVEMENTS

Drivers for system improvements include:

- The need to address the structural condition of the existing storm sewers.
- The need to improve the level of service based on customer complaints.
- The need to provide additional capacity to accommodate potential development.
- The need to provide additional capacity to accommodate Community Improvement Plans, or to coordinate system improvements with implementation of CIP's.
- The need to address the recommendations of other City Initiatives such as the Inflow and Infiltration Reduction Program (primarily to accommodate sump pump disconnection).

Table ES-2, below, lists the drivers that were identified for each drainage area, based on the available background information. Note that the need to address the structural condition of the existing storm sewers likely applies to more areas than those listed below.

Table ES-2
Drivers for System Improvements

Area No./Outlet Name	Drivers for System Improvements
1 - Eagle Marsh Drain	• Development Capacity - Bayview Lane (0.7ha) Westwood Phase 2 (9.6ha), Westwood Park Secondary Plan (V8, 30.6ha)
2 - Rosemount Avenue	• Development Capacity - CMT Lots (1.2ha)
3 - Steele Street/Sugarloaf	• None identified
4 - Elm Street	• None identified
5 - Marina	• None identified
6 - Victoria Street/Downtown	• Downtown Central Business Area CIP
7 - Princess Street	• None identified
8 - Killaly Street West/Steele	• None identified
9 - Neff Street	• Olde Humberstone CIP
10 - Cedar Street	• Development Capacity - V6 Residential Development (1.9ha), Rosedale (V2, 12.8ha), Meadow Heights (30.5ha) • Satisfy I&I reduction initiatives (Omer Area I&I Program).
11 - Island	• Olde Humberstone Village (3.1ha)
12 - Barber Drive	• Development Capacity - Chippawa Estates (3.5ha), V5 Residential Development (0.9ha)
13 - Bell Street North (Clarke)	• Development Capacity - V1 and V7 Residential Developments (3.1ha, 31.2ha) • Address resident complaints identified by City
14 - Nickel Street	• East Waterfront CIP • Satisfy I&I reduction initiatives (Nickel Area I&I Program). Address condition of existing storm sewer identified by I&I program. Separate "Municipal" runoff from "Vale" runoff tributary to Vale's private treatment facility.
15 - Rodney Street	• East Waterfront CIP • Satisfy I&I reduction initiatives (Nickel Area I&I Program). Address condition of existing storm sewer identified by I&I program. Separate

Area No./Outlet Name	Drivers for System Improvements
	"Municipal" runoff from "Vale" runoff tributary to Vale's private treatment facility.
16 - Quarry	• Development Capacity - Rosemount Estates (38.5ha)
17 - Eagle Marsh Ext.	• Development Capacity - Northland Estates (15.8ha), V3 and V4 Residential Developments (54.2ha, 7.8ha)
18 - Vale	• Coordinate with work in Areas 14 and 15 to separate "Municipal" and "Vale" runoff.
19 - Bell Street Northeast	• None Identified
20 - Bell Street East	• None Identified
21 - Bell Street West	• None Identified
22 - Neff Street	• Satisfy I&I reduction initiatives (Omer Area I&I Program). Address condition of existing storm sewer identified by I&I program.

Potential future residential development areas identified by the City illustrated by Figure ES-3. No additional industrial, commercial, or institutional developments were identified.

It is assumed that all future developments will include provisions for the construction of storm sewers and storm water management facilities. Internal servicing costs associated with new developments will therefore be borne by the developers. It is also assumed that future storm water management facilities will meet objectives for storm water runoff quality and quantity, and will therefore mitigate impacts of post-development runoff. For some of the identified potential developments, marked * in the table above, extension or upgrades of existing storm sewers may be required in order to convey future development flows to existing outlets. In these cases, the required extension or upgrades may benefit existing users, and the costs may be shared by the developer and the City. In other cases, future developments will include provisions for new storm sewer outlets and will have no impact on the existing system.

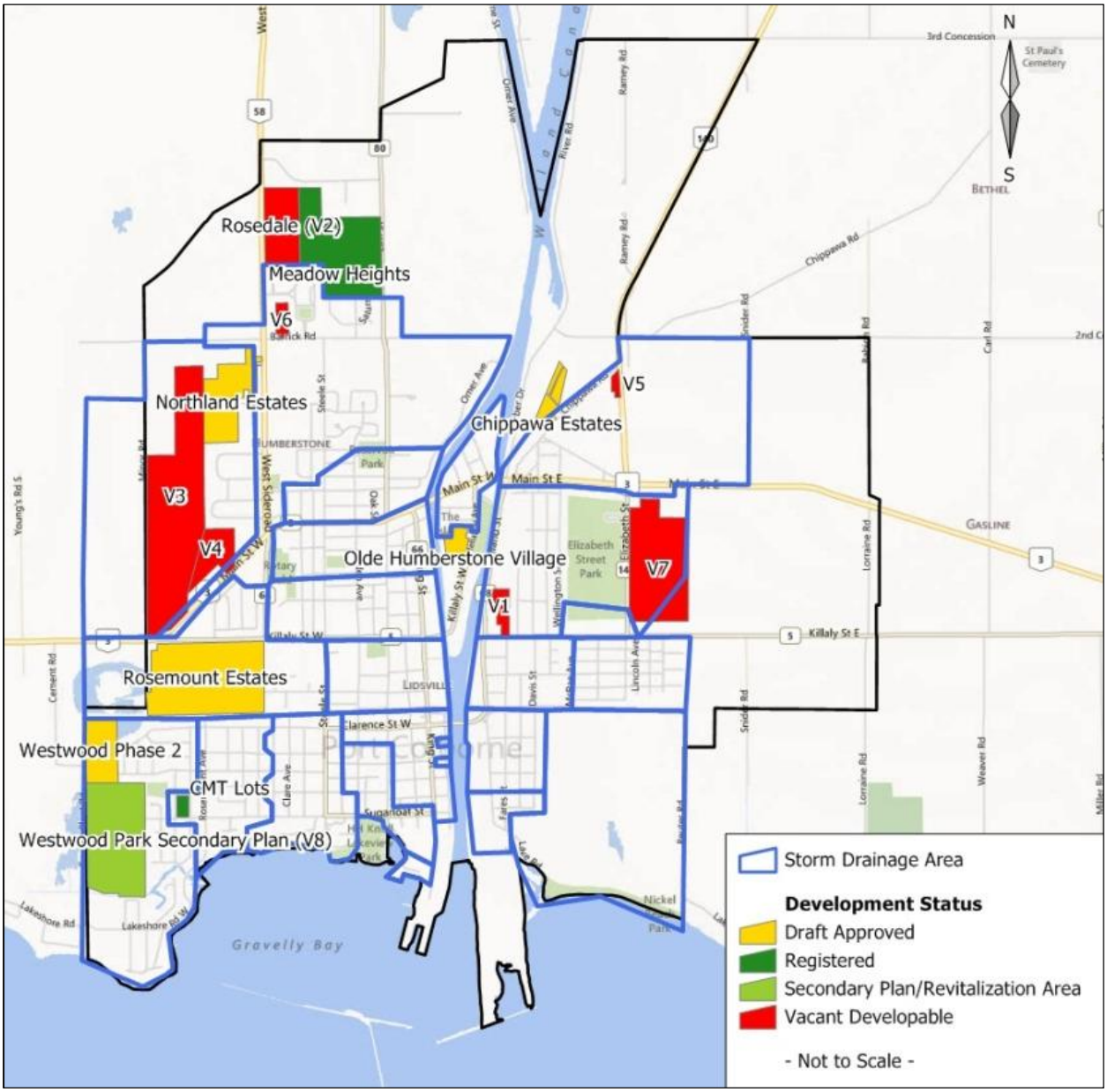

Figure ES-3
Future Residential Development Areas

6 CAPITAL PLAN

6.1 Proposed Improvements

The following system improvement categories are defined for the development of the Capital Plan:

- Upgrade Existing Sewer - Upsize existing "Designed" or "Semi-Designed" sewers to 5-year storm capacity
- Reconstruct Existing Sewer - Replace existing "Non-Designed" sewers with a conduit (ditch, single pipe, or dual pipe). Also includes "Semi-Designed" sewers in Areas 14 and 15. Cost estimate assumes single pipe.
- New Dedicated Sump Pump Drain - New storm sewers to accommodate sump pumps only in existing un-serviced areas
- Service New Developments – Construct new storm sewers required to service proposed developments

Table ES-3 summarizes the proposed improvements for each drainage area. Approximately 31km of pipe upgrades and reconstruction are recommended, in addition to the construction of approximately 4.7km of new infrastructure to service new development and accommodate sump pump disconnection in currently un-serviced areas. A complete listing of each conduit is provided in Appendix C, Table C-1 and forms the basis of the Capital Plan.

Figure ES-4 illustrates the recommended capital works by system improvement category, and indicates pipe diameters to accommodate the 5-year storm. The improvement categories and pipe diameters shown correspond to those listed in Appendix C, Table C-1.

Table ES-3
Proposed Improvement Summary

Drainage Area	Upgrade Ex. Sewer	Reconstruct Ex. Sewer	New Third Pipe	New Storm Service	Total	Estimated Cost
	Length of Upgrade (m)					
1	760	529			1,289	$1,941,560
2	970	2,157			3,127	$4,971,996
3		1,304	1,084		2,388	$3,653,896
4	329	720	308		1,357	$1,954,816
6	69	1,203	351		1,623	$2,400,308
7		1,867	75		1,942	$2,916,525
8	450	1,690			2,140	$3,153,645
9	793	2,707			3,500	$5,220,875
10	988	2,358	406	145	3,897	$5,424,044
11	421			495	916	$1,610,425
12	55	825		688	1,568	$2,262,235
13		2,545		628	3,173	$5,071,906
14-15		3,889			3,889	$6,380,462
17		778			778	$1,158,240
20	52	206	519		777	$988,041
21	45				45	$191,287
22		3,278			3,278	$4,837,708
Total	**4,932**	**26,056**	**2,743**	**1,956**	**35,687**	**$54,137,969**

A complete listing of all conduits, including length, required flow rate, and suggested pipe diameter is included in Appendix C. Details of the cost estimate are provided in Appendix D.

7 INFRASTRUCTURE RENEWAL AND SUSTAINABILITY

The infrastructure improvements recommended by this Master Plan represent a significant capital investment program for the City of Port Colborne. Potential revenue sources, user fees and rate structures to fund the recommended capital plan are examined and cash flow requirements are presented.

7.1 Development of Revenue Sources

Potential municipal revenue sources including property taxes, local improvement charges, development charges, and storm sewer user fees are compared against basic evaluation criteria in table ES-4. Each revenue source has merits under particular conditions. The development of storm sewer user fees, which

can be assessed based on various combinations of parcel area and parcel imperviousness, and various rate structures, is examined in detail.

Table ES-4
Comparison of Revenue Instruments

Criteria	Property Taxes	Local Improvement Charges	Development Charges	Storm Sewer User Fees
EQUITABLE – payments by customers are commensurate with the level of service required and the benefit received*	NO –based on assessed property value which has little bearing on the demand for service	Can be if costs are apportioned appropriately. Apportionment by frontage is not equitable.	NO – costs are apportioned by floor area of buildings which has little bearing on the demand for service	YES - if costs are apportioned based on contribution to runoff (some fee structures do not do this)
DEDICATED – collected revenues should be dedicated to storm water services	NO – revenues go to general fund (special area rates are dedicated)	YES – to specific growth related capital projects	YES – to specific growth related capital projects	YES – dedicated to storm water services
SUSTAINABLE – allows budgeting based on long term planning of funding requirements	NO – competing priorities can cause funding levels to vary	YES – funding for the covered project is guaranteed	YES – funding for the covered projects is guaranteed	YES – dedicated funding allows long term financial planning
AREA-WIDE – covers the total program area	YES – covers entire municipal area	NO – applies only to the local improvement area	NO – applies only to lands subject to new development or redevelopment	YES – covers entire storm water system service area
ALL COSTS – applies to all program costs	YES – revenues cover operating, maintenance and investments	NO – revenues cover only capital investments	NO – revenues cover only capital investments	YES – revenues cover operating, maintenance and investments
INCENTIVE –customers can save by reducing their demands for service**	NO – no credits for on-site storm water controls	NO – no credits for on-site storm water controls	NO – no credits for on-site storm water controls	YES – user fee program can include credits for on-site storm water controls
UNDERSTANDABLE – the customer charge is reasonably easy to understand	YES –in place long enough that most customers understand it now	YES – relatively simple charge levied on the tax bill	YES – Property owners not charged directly. Most developers understand the charge.	NO – Many will likely be confused at first since storm water systems are probably poorly understood.
IMPLEMENTATION – implementation costs should be relatively low	YES – already implemented	NO – case by case implementation with possibility of petitions to challenge projects	YES – already implemented	NO – new program costs incurred for design and public consultation and to establish customer data base, billing and collections system
ADMINISTRATION – administrative effort should be relatively low	YES – resources already committed	YES – once implemented, annual charges should be easy to levy	YES – resources already committed	NO – customer records require periodic updating, any credit program involves additional resources

* Requires that storm water service costs be allocated to customers in proportion to the contribution of their properties to storm water runoff.

** Requires that customers can reduce their service charge by controlling runoff from their property.

7.2 Financial Plan

The financial analysis indicates that the levelized annual cash requirement of the proposed capital improvements is estimated to be approximately $3.02 million at 2014 prices.

Three alternative approaches to recover the required costs are considered: two based on storm water user fees and one based on property tax. The user fee approaches include one based on total parcel size and one based on the size of the parcel's impervious area.

Table ES-5 summarizes the charge schedules to recover the required amount of $3.02 million per year.

Table ES-5
Sewer User Charges

Parcel Class	Sewer User Charge		Property tax (0.1701%**)
	By Parcel Area ($0.0268/m^2)	By Impervious Area ($1.0661/m^2)	
Not Coded	$76	$403	na
Commercial	$274	$1,275	$762
Industrial	$1,039	$1,838	$1,676
Multi-residential	$99	$1,134	$3,842
Public*	$0	$0	$0
Residential	$114	$218	$295
Farm/forest	$3,959	$995	$29
All	$346	$346	$346

* No cost recovery from public properties

**% of assessed parcel value

The following observations can be made based on the above:

- The different approaches to cost recovery allocate costs in markedly different ways but the average cost per parcel is the same across all three approaches as expected.
- The amount that individual property owners pay will differ from the amounts calculated since several parcels may be owned by single persons or companies.
- The parcel area storm water charge places a heavy burden on farm properties. This burden shifts to industrial, commercial and multi-residential properties with the two other charges.
- Charges for residential parcels vary least across the three charging approaches.
- The impervious area charge likely comes closest to a charge that allocates costs based on average parcel contributions of storm water runoff to flows in storm sewers.

8 IMPLEMENTATION OF PROPOSED IMPROVEMENTS

Implementation of the recommended improvements considers a variety of factors including condition, capacity, planned development and infill, I&I reduction, and complaints. However, improvements to the storm water system, particularly when flow is being added, should generally progress starting from the most downstream end. The recommended implementation strategy is as follows:

- Continue collection of storm sewer network data including pipe inverts, material, and diameters, manhole rim elevations, pipe connectivity, and records of houses with sump pumps. We note that the model results are only as good as the network data that was available through the various investigations completed as part of this study. We recommend an ongoing program to collect storm sewer network data so that a complete GIS database can be developed to the degree possible. The hydraulic models should be updated and re-run upon the collection of significant amounts of data.
- Inspect and maintain all outfalls and make sure flap gates are in good working order.
- Replace all failing pipes and expand inspection efforts with CCTV.
- Replace storm sewer pipes that are identified as being undersized for the 2-year storm without the addition of sump pump flows. Proceed from the most downstream location. Focus first on areas where infill development is anticipated.
- Upgrade storm sewer pipes to the specified level of service (5-year return period with sump pump flows added), proceeding from downstream to upstream. Focus first on areas where development is anticipated.
- Encourage re-direction of sump pumps from the sanitary to the storm system as the downstream storm sewers network is upgraded.
- Add new laterals to currently un-serviced areas as the downstream network is upgraded from the outfall to the point of interest. Connect sump pumps. If larger pipes are selected, add CB's and other drainage infrastructure.

With respect to implementation of a storm water user fee, it is recommended that the City undertake the following tasks.

- Establish and maintain a geo-referenced customer data with data fields including property ID and ownership, customer classification, gross area, impervious area, status of credits, etc.
- Policies, procedures and resources for revising, validating and updating the data base
- Review system costs and determine full-costs of the storm water system including capital plans and asset management costs. Estimate any new costs associated with implementation of the new user fee including for billing software.
- Review cost reporting policies and procedures including the chart of accounts and revise as needed to facilitate future budgeting and rate setting exercises. Storm water costs should be segregated in accounting records.

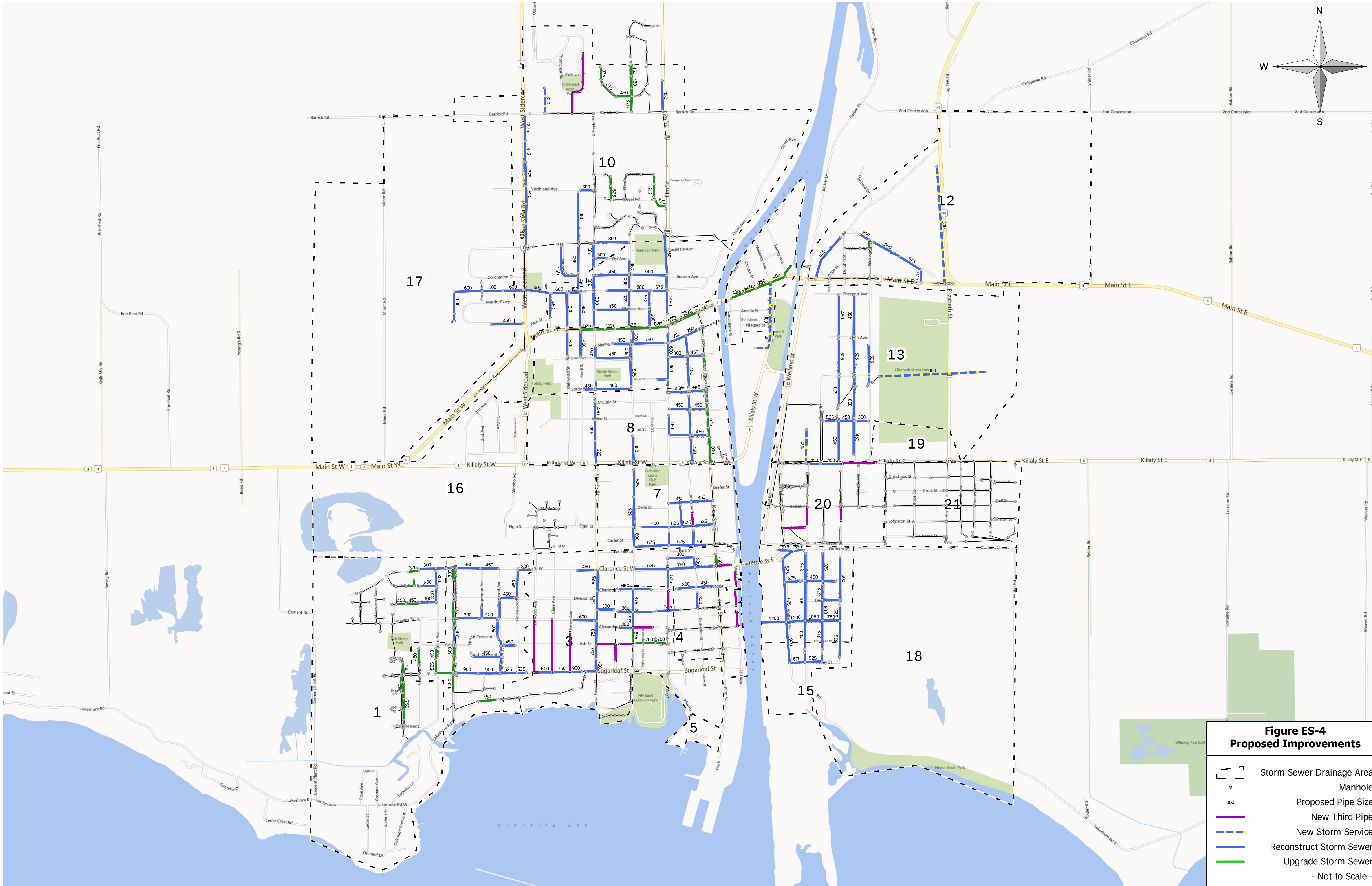
Figure ES-4
Proposed Improvements
Storm Sewer Drainage Area
Manhole
text
Proposed Pipe Size
New Third Pipe
New Storm Service
Reconstruct Storm Sewer
Upgrade Storm Sewer
- Not to Scale -
N
E
S
W