CORPORATION OF THE
CITY OF SAULT STE. MARIE

SAULT STE. MARIE
STORMWATER INVESTIGATIVE STUDY
FINAL REPORT

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STORMWATER INVESTIGATIVE STUDY

FINAL REPORT

Prepared for:

The Corporation of the City of Sault Ste. Marie

In association with

Genivar,

formerly Wm. R. Walker Engineering Inc.

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The Great Lakes Sustainability Fund is a component of the Government of Canada's Great Lakes Program. The Sustainability Fund provides resources to demonstrate and implement technologies and techniques to assist in the remediation of "Areas of Concern" and other priority areas in the Great Lakes. The report that follows was sponsored by the Great Lakes Sustainability Fund and addresses water quality issues related to stormwater in the St. Marys River Area of Concern in Sault Ste. Marie. Although the report was subject to technical review, it does not necessarily reflect the views of the Sustainability Fund or the Government of Canada.

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

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EXECUTIVE SUMMARY

In early 2009, the City of Sault Ste. Marie, with R. V. Anderson Associates Limited, and Walker Engineering, now Genivar, began a Stormwater Management Master Plan.

The City has managed stormwater effectively from a stormwater quantity perspective. New developments undertake stormwater quantity control to meet peak pre-development runoff rates. The construction of channels has helped to transport water to the St. Marys River. In addition, the Fort Creek Reservoir is in place to help prevent flooding in the area.

Aspects of stormwater management which relate to water quality, erosion, fisheries, and groundwater, in general, have not been dealt with in a detailed manner. The goals of the study are to:

- update and develop policies for the design of the City storm sewer conveyance system;
- develop policies for the design of stormwater management infrastructure; and
- develop a capital works program to implement stormwater management infrastructure.

The objectives of the Master Plan are defined as follows:

- review water sampling completed by various departments and Ministries;
- identify likely sources of contamination;
- determine the existing storm trunk sewer system capacity for defined areas and assess flood prone areas by modeling;
- obtain public and stakeholder comment on the current situation;
- develop and assess alternative stormwater management strategies;
- select and describe a preferred stormwater strategy; and
- develop an Implementation Plan and review funding opportunities.

The preferred option, as shown in Appendix I, is to implement a City Wide Stormwater Management Approach. The first stage will include the implementation of a new Stormwater Management Policy, implementing oil grit separators at key locations, improving snow disposal sites, education, implementing a point source monitoring plan, improving storm water conveyance at known problem areas and the retrofitting of existing ponds for quality control. The estimated cost for this work is $17M.

Future recommendations will be based on the results of further stormwater quality monitoring.

1.0 INTRODUCTION

R.V. Anderson Associates Limited (RVA), in association with Genivar, formerly Wm. R. Walker Engineering, were retained by the Corporation of the City of Sault Ste. Marie to conduct a Stormwater Management Master Plan to address the City of Sault Ste. Marie's stormwater quantity and quality concerns.

1.1 Background

With the evolution of stormwater guidelines and practices many municipalities are developing comprehensive Master Plans to provide a policy for the management of stormwater. These plans are intended to be utilized by engineering, planning departments and private developers to simplify the application of stormwater management practices. The need for an approved policy for the City of Sault Ste. Marie has also become apparent.

In addition to a Master Plan, actions that will improve water quality in the St. Marys River have been supported by Canadian and American governments and agencies. The St. Marys River was identified as an Area of Concern (AOC) in 1985 by the International Joint Commission (IJC) due to several environmental issues. Stormwater management strategies identified under the Canada-Ontario Agreement – Respecting the Great Lakes Basin Ecosystem and under the Remedial Action Plan Stage 2 Report will be addressed by implementation of the recommendations made in this Master Plan.

Previous studies and reports have indicated degradation in creeks and rivers within the City of Sault Ste. Marie and it has been found that stormwater is a contributor of sediment and bacteria to the St. Marys River. These findings are very typical of waterways receiving untreated or undertreated urban stormwater runoff.

1.2 Study Overview and Objectives

The project objectives consist of assessing the capacity of the drainage systems throughout the City of Sault Ste. Marie, and evaluating the adequacy of these systems with regard to the drainage of stormwater, the provision of public safety, erosion, and sedimentation control. The project objectives also include assessing existing water samples at stormwater outlets. The above assessments and evaluations were conducted for both the existing as well as the ultimate level of development, and incorporate a preliminary evaluation of possible effects of climate change (variations in the intensity of precipitation events). For system capacity deficiencies identified, remedial options, along with the associated costs are provided.

The scope of work for this project is limited to the identification of drainage infrastructure that is deemed to have inadequate capacity and the recommendation of potential solutions at a conceptual level of detail. The scope of work does not include analyses of the local drainage dynamics to a level of detail that allows the final design of remedial measures. For known quality concern areas, based on sampling results and input from City staff and the public, options are provided along with associated costs. Further, areas are ranked based upon the report findings.

This study identifies measures to capture, treat, monitor, and control stormwater runoff based upon Sault Ste. Marie Region Conservation Authority (SSMRCA), Fisheries and Oceans Canada (DFO) input and Ministry of the Environment (MOE) Guidelines. This study also identifies potential funding sources for projects. To meet these objectives the requirements for a Municipal Class Environmental Assessment Master Plan Process Approach #1 for Stormwater Management Projects has been followed. The Master Plan Approach #1 addresses Phase 1 and Phase 2 of the Municipal Class EA process and forms the basis for future detailed investigations that may be necessary to satisfy project specific requirements for Schedule B or C projects identified under the Master Plan.

To fulfill these objectives, the scope of work for this study consisted of the following five (5) components. Details regarding the scope of work associated with these specific components and the methodologies that were employed during the performance of these components are presented in the following sections.

1. **Project Initiation / Compile Data / Desk Top Review**. The intent of this study component was to gather and review relevant data needed to perform an evaluation of the drainage dynamics and stormwater management issues within the City of Sault Ste. Marie. A Glossary of Terms is shown in Appendix A, while a List of References is shown in Appendix B.

2. **Evaluate Stormwater Quantity.** This component of the study consisted of the evaluation of specific storm drainage and stormwater management systems within the City of Sault Ste. Marie (through the interpretation of the results of computer model simulations), and the identification of potential issues and subsequent remedial works.

3. **Evaluate Stormwater Quality.** This task was to review information regarding total suspended solids (TSS), total phosphorus (TP), E. Coli and other watershed characterization parameters as well as observed conditions along the waterfront.

4. **Identify Alternative Solutions / Public Consultation.** This component described the alternative solutions to the problem / opportunity. The intent of the public consultation was to make contact with appropriate agencies and stakeholders from both countries and to achieve public input regarding issues and alternative solutions.

5. **Develop Stormwater Management Strategy / Master Plan.** The alternatives were evaluated using Environmental Assessment criteria with respect to social, natural, and economic environments and technical merit, and reviewed with the City and agencies. An implementation plan was devised.

   In addition a Stormwater Management Policy was developed.

1.3 Problem and Opportunity Identification

Problem statement to address this study follows.

"Develop a Stormwater Management Plan Strategy to address stormwater quality and quantity concerns within the City of Sault Ste. Marie associated with current and future developments."

1.4 Municipal Class Environmental Assessment Process

This study was undertaken in accordance with the Municipal Engineers Association Municipal Class Environmental Assessment October 2000, as amended in 2007, for wastewater projects. A Municipal Class Environmental Assessment (EA) provides a framework, approved under the Environmental Assessment Act, for projects carried out by municipalities. This study falls under a Master Planning Process Approach #1[1] EA, which requires the City of Sault Ste. Marie to clearly define the problems to be resolved, develop and evaluate alternative solutions, and consult with the public prior to deciding upon the preferred solution.

The First Public Notification was published in the Sault Star on December 5 and again on December 12, 2009. The advertisement invited public comment and noted the timing and location of the First Public Information Centre (PIC). The First PIC was held on December 17, 2009 to discuss and obtain feedback on the range of problems to be addressed by the study. Information packages were produced for attendees (Appendix C).

The Second Public Information Centre was published in the Sault Star on Saturday, May 7th & 14th, 2011 and in Sault This Week on Wednesday, May 11th & 18th, 2011. In addition the advertisement was placed on the City of Sault Ste. Marie website. The second PIC was held on May 19, 2011 to illustrate the preferred alternatives and the Stormwater Policy document. The Second PIC information is also shown in Appendix C.

Under the Municipal Class EA, projects are classified by environmental impact. The level of assessment required in the planning stage varies for each of these classifications.

Regardless of the Schedule implemented, it is recommended that public notification, prior to construction of any planned activity, whether through meetings or leaflets explaining a site specific project, be implemented. As well, construction activities are to be timed to minimize impact on businesses and residents.

Schedule A projects are small scale and have limited environmental impact. These projects are considered pre-approved therefore the full Class EA is not needed.

The Class Environmental Assessment process has the following schedules:

Schedule A+ activities are Schedule A projects that require public notification.

Schedule B projects have potential for some negative environmental impact therefore, the public and relevant review agencies are to be contacted, and concerns are to be addressed.

Schedule C activities have potential for considerable negative environmental impact. The documentation and procedures of a Class EA must be followed in its entirety.

A Master Plan Approach #1 forms the basis for individual Schedule B or C activities identified therein. More detailed investigations are required at a project specific level. A Master Plan is not reviewed by the Ministry of Environment’s Environmental Assessment and Approvals Branch, only the projects specified within. However, the proponent is required to summarize how the Master Plan followed Class EA requirements and copy this and supporting documentation to the Environmental Assessment and Approvals Branch.

Part II Order

Under the provisions of the Environmental Assessment Act there is an opportunity under the Class Environmental Assessment process for the Minister to review the project status of

Schedule B and C undertakings. The public, interest groups and review agencies may request the Minister to require the proponent (City of Sault Ste. Marie) to comply with Part II of the EA Act before proceeding. This is known as a Part II Order, previously known as a “bump-up”. Requests for an order to comply with Part II of the EA Act would be possible only for those Schedule B or C projects identified in the Master Plan, which are subject to the Municipal Class EA, and not the Master Plan itself[2].

It is preferable that the person or party bring concerns forward to the proponent during Phase 2 of the planning process for Schedule B projects, so that the issues can be resolved through discussions with the proponent.

If concerns cannot be resolved though discussion with the proponent the objector may request the proponent elevate a Schedule B project to a Schedule C or to an individual environmental assessment. Should the proponent decline, then the person or party may request a Part II Order in writing during the 30 calendar day review period after the Notice of Completion has been issued, for Schedule B projects. The Environmental Assessment and Approvals (EAA) Branch reviews the Part II Order request within 45 days after the lapsing of the 30 calendar day period. The EAA Branch will make a recommendation to the Minister, and may require additional information from the proponent to assist in their decision. If the Part II Order is made with insufficient information or simply to delay a project, the request may be denied. The Requester will be required to withdraw the request.

The Minister has 21 calendar days from the time of receipt of the EAA Branch recommendation to render a decision. The Minister may deny the request with or without conditions, refer the matter to mediation or require the proponent to comply with Part II of the EA Act.

A Part II Order would require that the proponent prepare Terms of Reference for an individual EA and submit these to the government for review, or should the document satisfy the terms of reference requirements, the proponent can proceed to complete an Individual EA.

2.0 RELATED DOCUMENTS

2.1 Canada – Ontario Agreement

2.1.1 Canada-Ontario Agreement on Environmental Assessment Cooperation

The governments of Canada and Ontario reached a draft agreement in 2007 regarding environmental assessments. When undertakings fall under both the Canadian Environmental Assessment Act and the Ontario Environmental Assessment Act a cooperative environmental assessment that meets the legal responsibilities of both parties is conducted. The agreement outlines the framework for collaboration between Canada and Ontario.

2.1.2 Canada-Ontario Agreement Respecting the Great Lakes

The Canada-Ontario Agreement Respecting the Great Lakes came into effect on June 25, 2007 with the purpose of restoring and protecting the Great Lakes Basin. The Agreement emphasizes the need for unity in this endeavor and outlines specific goals and results to promote environmental restoration. Under Annex 1 Areas of Concern, the Agreement highlights Remedial Action Plan implementation as one of Canada's and Ontario's goals with the end result being a reduction of microbial and other contaminants by continuing to "identify and promote implementation of the priority actions to address urban stormwater."

In March 2011, the Canada-Ontario Agreement was extended until June 24, 2012 to allow time for the re-negotiation of the Canada-US Great Lakes Water Quality Agreement (GLWQA) that's currently underway. The Canada-US GLWQA was amended in 1987 by protocol, including adding a commitment to restore 43 areas of significant degradation defined as Areas of Concern (AOC). The St. Marys River was identified as one such area. The negotiations currently underway may again amend the GLWQA.

2.1.3 Canada-U.S. Great Lakes Water Quality Agreement

The Canada - U.S. Great Lakes Water Quality Agreement was originally signed in 1972, and was last amended in 2012. The International Joint Commission prepared the document with the intent of affirming the commitment each country has made to "restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem."

2.1.4 Remedial Action Plan

The Remedial Action Plan process is a three stage program aimed at delisting AOCs in the Great Lakes Basin prescribed in the Canada-Ontario Agreement and the Canada-U.S. Agreement. As of the preparation of this Master Plan, Stages 1 of the RAP has been completed. The St. Marys River Area of Concern Environmental Conditions and Problem Definitions Stage 1 Report of the Remedial Action Plan were published in 1992. This report identified contributing factors to environmental degradation of this waterway. In 2002 the St. Marys River Area of Concern Remedial Strategies for Ecosystem Restoration Stage 2 Report of the Remedial Action Plan was released. Within this plan several activities aimed at improving conditions were suggested. Among the proposed activities for point source monitoring is a proposition to design and implement a monitoring system for stormwater. The Stage 2 report identified a series of remedial actions and these actions to restore the area continue to be implemented. The Stage 3 report will cover the implementation of recommended actions and evaluate progress within the AOC. The Stage 3 report will be developed once all remedial actions are complete. The Stage 3 report intent is to confirm that the actions have been effective and that the environment has been restored.

2.2 Previous Studies and Reports

There have been a number of relevant planning and engineering studies and reports completed dealing with aspects of the St. Marys River and stormwater management in Sault Ste. Marie. These were reviewed in relation to the present study. Current data and information was considered prior to older information to minimize duplication. The documents include:

- Proctor and Redfern, Sault Ste. Marie Drainage Report, December 1965
- Proctor and Redfern, Central, East Davignon and Clark Creeks, August 1966
- Proctor and Redfern, Fort Creek Channel Second Line to Aqueduct, June 1970
- M. M. Dillon, Flood Plain Mapping Report, November 1977
- Wm. R. Walker Engineering, Root River Study, Hydrology and Hydraulic Technical Report, January 1988
- Wm. R. Walker Engineering, Clark Creek Capacity Review, January 1998

A synopsis of each of these documents is provided in Appendix D.

Other reports regarding Stormwater monitoring for the City looked at quality aspects and bacteria, most notably at Bellevue Park. The work is noted by Environment Canada as being still valid and added that it was based on substantial monitoring.

- Dutka, B.J. and J. Marsalek. Urban Impacts on Bacteriological Pollution of the St. Marys River in Sault Ste Marie. September 1992, DRAFT
- McBean, E.A., M. Sharma, and D. Brush. Migration Pathways and Remediation of Urban Runoff For PAH in Sault Ste. Marie: Phase - I. 1991,
- McBean, E.A., M. Sharma, and D. Brush. 1992. Migration Pathways and Remediation of Urban Runoff for PAH in Sault Ste. Marie: Phase II. 1992

3.0 EXISTING CONDITIONS AND CONSTRAINTS

3.1 General

The City of Sault Ste. Marie limits are generally bounded by the St. Marys River to the south, Garden River and Rankin Location Indian Reserves to the east, Aweres and Pennefather Townships to the north, and Prince Township to the west. The City contains largely undeveloped lands to the west and northwest. The City has sparsely developed lands and conservation areas to the northeast. The northeast section currently has the most development pressure. Various other areas are being developed or redeveloped. The limits of the study area and the general topography are shown in Drawing 3.1.

3.2 Socio-Economic Environment and Heritage

The City of Sault Ste. Marie is located in the Algoma District of Northern Ontario north of the St. Marys River. The study area (area within the boundaries of the City of Sault Ste. Marie) encompasses 222 square kilometers of land with a population in 2006 of 74 948[3].

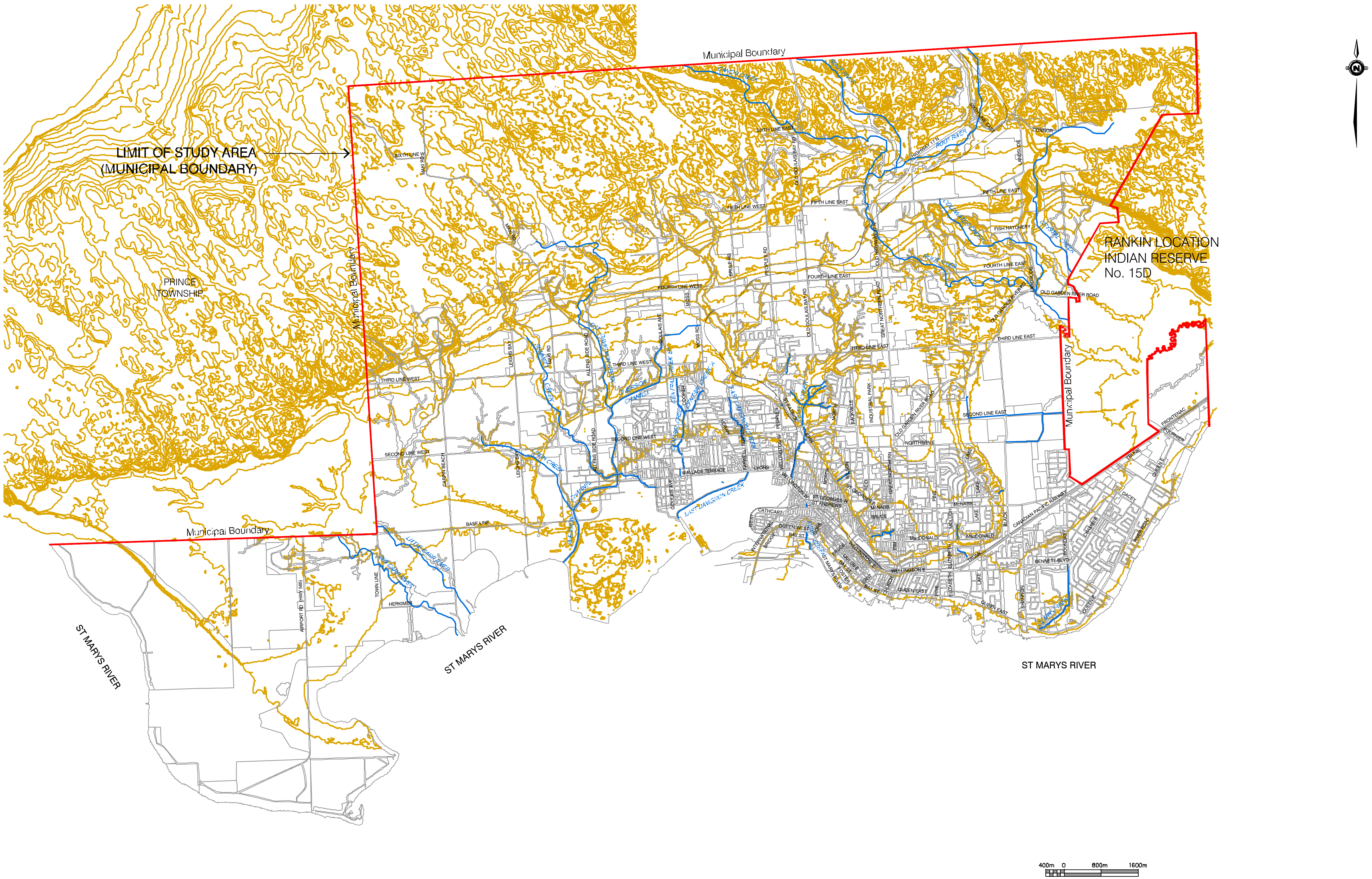
The economy in Sault Ste. Marie is based largely upon secondary resources. The St. Marys River, being the only connection between Lake Superior and the lower Great Lakes, is a prime location for shipping and the fast current provides hydroelectric power generation. Although the market for secondary resources is cyclical, the City has maintained a positive outlook and continues to see some growth.

The City of Sault Ste. Marie boasts a rich heritage. Within the City are twenty-nine designated historic sites. The Sault Ste. Marie Municipal Heritage Committee advises the City Council in decisions made under the Ontario Heritage Act. Furthermore, the St. Marys River was designated a National Heritage Waterway in 2000 by the Canadian Heritage Rivers System. This designation recognizes the significance of the waterway and establishes a strategy for caring for the river.

3.3 Natural Environment

3.3.1 Topography and Physiography

The physiography and topography of the Sault Ste. Marie area is typical of the Great Lakes basin and the Canadian Shield. Sault Ste. Marie is located on terraced lowlands along the St. Marys River as shown in Drawing 3.1. The topography along the river is gently sloping and



MASTER PLAN SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY	R.V. Anderson Associates Limited — GENIVAR DRAWING 3.1 STUDY AREA STORMWATER MANAGEMENT MASTER PLAN

predominantly consists of fine-textured soils of lacustrine and glacial origin. To the north lies a Precambrian escarpment overlain by sand and gravel deposits. The city is divided into three distinct bedrock basins - the West, Central and East Basins.[4]

A system of rivers and creeks form a key feature of the City. The catchment areas are roughly divided in half by the municipal boundary of the City extending north into Aweres and Pennefather Townships and west into Dennis and Prince Townships. Watersheds within the City can be divided into three groups (western, central and eastern) roughly delineated by the bedrock basins.

The western watersheds are comprised of the Big Carp and Little Carp Rivers that drain into Leigh's Bay west of the City. The areas to the north of this watershed are mainly undeveloped forested areas, and to the south, there is sparse development.

The central watersheds encompass Bennett Creek, West Davignon Creek, Central Creek, and East Davignon Creek that ultimately converge at an outfall to the St. Marys River at Goulais Avenue. Leigh Creek flows into Leigh's Bay; Leigh Creek receives flows from the Bennett-West Davignon Diversion Channel. Fort Creek, which lies entirely within the City limits and discharges to St. Marys River east of Whitefish Island. Bennett, West and East Davignon, Central, and Fort Creeks flow through the urban core. Upstream portions of these creeks are primarily undeveloped or sparsely developed. The SSMRCA owns and maintains 77 hectares of conservation land in the Fort Creek watershed north of Second Line West, east of Peoples Road, and west of North Street. This conservation area surrounds the Fort Creek dam completed in 1970 to control flooding in the area.

The eastern watersheds include the Root River system that discharges to the St. Marys River at Bells Point on the Garden River Indian Reserve. Within the City limits lie Black Creek, Root River, West Root River, Coldwater Creek, Crystal Creek, Canon Creek and River Creek. These watersheds are sparsely developed.

With regards to physiography many of the creeks have, over time, eroded ravines through the area.

3.3.2 Precipitation and Stream Flows

Sault Ste. Marie is located on the windward shore of Lake Superior, and is, subject to "lake effect" snow. The City experiences yearly average precipitation[5] of 888.7 mm, of which 634.3

mm falls as rain and 302.9 cm as snow. Snow is reported as the measured amount on the ground whereas the yearly average precipitation utilizes the water equivalent of snowfall as measured by a Nipher gauge. The City currently uses Atmospheric Environment Services (AES) 10-year Intensity-Duration-Frequency (IDF) curve for the Sault Ste. Marie Airport as a basis for stormwater design. Design flow estimation is conducted using the Rational Method.

Previous studies have calculated flows for several of the creeks and streams within the City. These findings are summarized in Appendix D. The precipitation experienced during the summers of 2007 and 2008, when water quality sampling was being conducted at storm sewer outfalls and various locations along the riverfront, is discussed in Appendix E.

3.3.3 Aquatic and Terrestrial Environments

The City of Sault Ste. Marie principally lies within the Great Lakes – St. Lawrence Forest Region, in the transitional zone to the Boreal Forest. Tree species found in the area include a mixture of coniferous and deciduous trees, and shrubs. Woodlands constitute approximately 40% of the land area within the City[6]. Typical wildlife found in the Boreal Forest includes black bear, white-tailed deer and woodpeckers.

There are a number of birds, fish, mammals, and insects identified on the Species at Risk in Ontario (SARO) List, including bald eagle, lake sturgeon, and eastern cougar[7]. Invasive species have been found in the St. Marys River such as the spiny water flea and the zebra mussel. Invasive plants known in the area include purple loosestrife. The emerald ash borer, an invasive insect, has also been detected in the City[8].

The lakes and rivers in the City of Sault Ste. Marie range from cool to cold. The St. Marys River and the contributing drainage courses in Sault Ste. Marie are identified as cool or cold-water fisheries. While there are a handful of small lakes within the City limits, as discussed, small rivers and creeks constitute most of the aquatic environment.

The St. Marys River has rainbow, lake, and brown trout as well as chinook, pink and coho salmon. There is also walleye, northern pike, and whitefish. The St. Marys River lies in Fisheries Management Zones 9 and 14 while the City of Sault Ste. Marie is in Zone 10[9]. The small streams that run through the City are spawning areas for many fish species. Concern from a fishery standpoint is with stream sediment, contaminants and runoff from development in general.

Wetland areas are found at the outlet of rivers such as the Big and Little Carp Rivers (165.27 ha), and along the St. Marys River shoreline such as Shore Ridges (559.30 ha). The Carp Rivers and Shore Ridges wetland areas are identified as “Provincially Significant Wetlands” (PSW) as defined by the Ministry of Natural Resources. Smaller wetland areas are located inland such as at Mary-Ann Lake (16.75 ha), which is connected to the Sault Ste. Marie Airport drainage system, and within the urban centre at McNabb Street and Shannon Road[10].

3.4 Existing Infrastructure and Operations

3.4.1 Water Supply

The main source of drinking water in the Sault Ste. Marie area is the Gros Cap intake on Lake Superior in the Township of Prince. In addition, the City of Sault Ste. Marie operates six wells at four locations; Goulais Well 1, Goulais Well 2, Steelton Well, Lorna Well 1, Lorna Well 2, and Shannon Well.

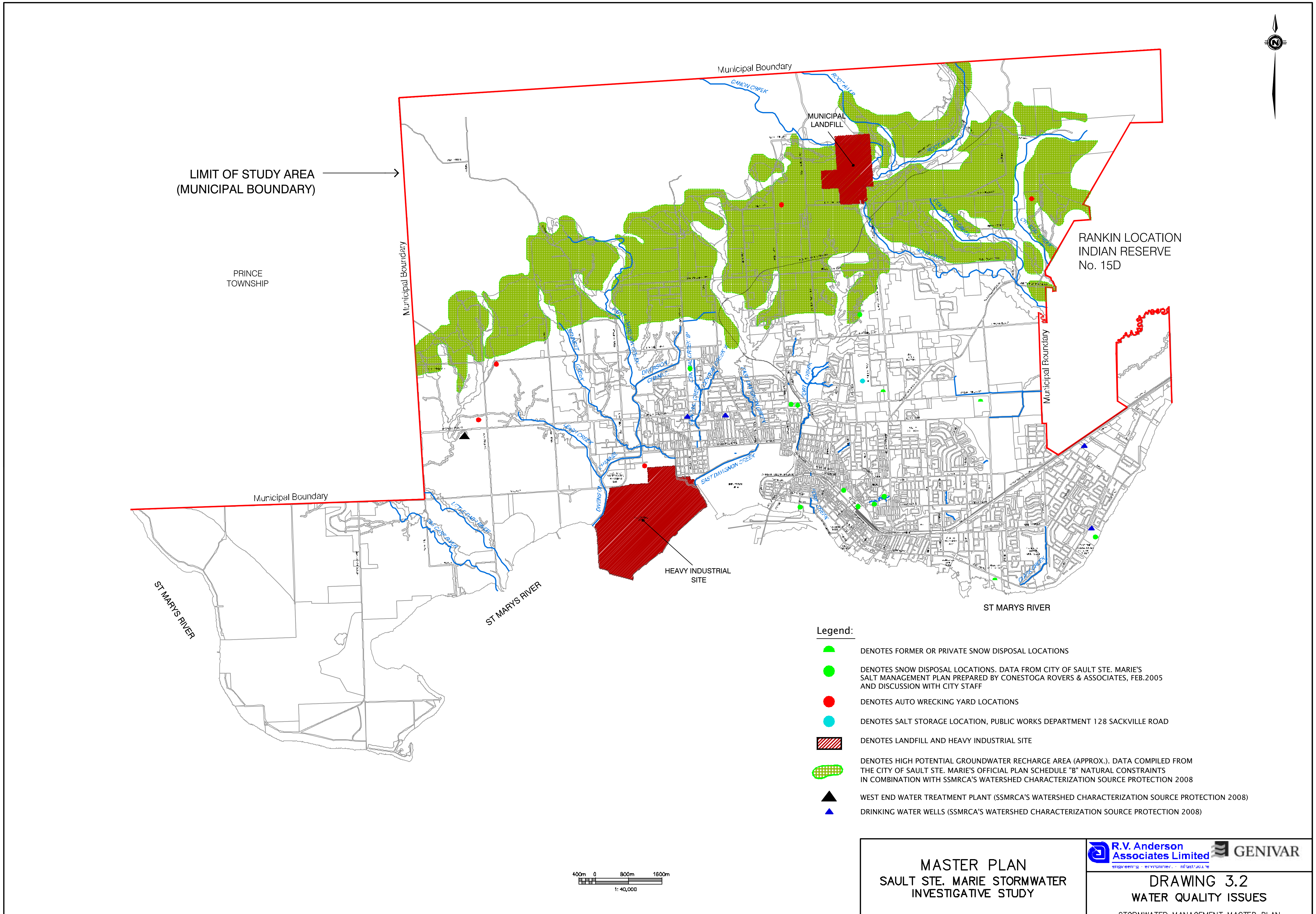
A high potential groundwater recharge area lies generally north of Third Line. The City’s Official Plan outlines measures to protect groundwater recharge areas including stormwater management practices in new development that meet groundwater goals with respect to quantity and quality. The location of the high potential groundwater recharge area and the drinking water wells is shown in Drawing 3.2.

Under the Clean Water Act, 2006 the Sault Ste. Marie Source Protection Committee (SPC) has an approved Assessment Report. The SPC has submitted a Proposed Source Protection Plan to the Ministry of the Environment for approval.

When reviewing snow and salt management, and stormwater management controls, care must be taken to protect these water resources.

3.4.2 Sanitary Sewage Collection and Treatment

The City of Sault Ste. Marie owns two Wastewater Treatment Plants. The east end of the City consists of three sanitary catchments that contribute to pumping stations at Pim Street, Clark Creek, and River Road contributing flow to the East End Plant. The west end sanitary system is serviced by three main lift stations located at John Street, Young Street and Allen Side Road, which directs flow into the West End WPCP.



LIMIT OF STUDY AREA
(MUNICIPAL BOUNDARY)
Municipal Boundary
Municipal Boundary
Municipal Boundary
Municipal Boundary
PRINCE
TOWNSHIP
MUNICIPAL
LANDFILL
RANKIN LOCATION
INDIAN RESERVE
No. 15D
HEAVY INDUSTRIAL
SITE
ST MARYS RIVER
ST MARYS RIVER
ST MARYS RIVER
CANON CREEK
EAST DAVIGNON CREEK
Legend:
DENOTES FORMER OR PRIVATE SNOW DISPOSAL LOCATIONS
DENOTES SNOW DISPOSAL LOCATIONS. DATA FROM CITY OF SAULT STE. MARIE'S SALT MANAGEMENT PLAN PREPARED BY CONESTOGA ROVERS & ASSOCIATES, FEB.2005 AND DISCUSSION WITH CITY STAFF
DENOTES AUTO WRECKING YARD LOCATIONS
DENOTES SALT STORAGE LOCATION, PUBLIC WORKS DEPARTMENT 128 SACKVILLE ROAD
DENOTES LANDFILL AND HEAVY INDUSTRIAL SITE
DENOTES HIGH POTENTIAL GROUNDWATER RECHARGE AREA (APPROX.). DATA COMPILED FROM THE CITY OF SAULT STE. MARIE'S OFFICIAL PLAN SCHEDULE "B" NATURAL CONSTRAINTS IN COMBINATION WITH SSMRCA'S WATERSHED CHARACTERIZATION SOURCE PROTECTION 2008
WEST END WATER TREATMENT PLANT (SSMRCA'S WATERSHED CHARACTERIZATION SOURCE PROTECTION 2008)
DRINKING WATER WELLS (SSMRCA'S WATERSHED CHARACTERIZATION SOURCE PROTECTION 2008)
400m 0 800m 1600m
1: 40,000
MASTER PLAN
SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY
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GENIVAR
DRAWING 3.2
WATER QUALITY ISSUES
STORMWATER MANAGEMENT MASTER PLAN

The East End Plant treats approximately two-thirds of the City's sanitary sewage and is located on Queen Street East next to Barber Boulevard. The West End Plant treats the remaining one-third of the City's sanitary sewage; it is located at Allen's Side Road and Baseline Road West. The East End Plant was upgraded to secondary treatment in 2006 and is the first large sewage treatment plant in Ontario using a Biological Nutrient Removal process that reduces nitrogen and phosphorus without using additional chemicals; effluent is disinfected by UV treatment. Effluent quality discharged from the East End Plant has improved significantly as a result of these upgrades. The West End Plant provides secondary treatment using conventional activated sludge treatment, alum dosing for phosphorus removal, and chlorination of the effluent for final disinfection. Both WWTP's are labeled on Drawing 3.2.

Over the past ten years the City of Sault Ste. Marie has undertaken a number of sanitary sewer collection system upgrades including pumping station upgrades, such as increased wet well sizes (Pim Street), and separation of combined sewers.

The sanitary sewer system has emergency overflows connected to the storm sewer system. Improvements have been made by the City in relation to sanitary sewer overflows. SCADA has been recently completed at the overflows and the City is now able to obtain improved data in relation to overflows.

Sanitary overflows limit surcharging in the sanitary system during wet weather events. Inflow and infiltration, into the sanitary sewer system from wet weather events can be significant and costly to manage.

3.4.3 Storm Sewer System

All stormwater runoff is generally conveyed southerly and ultimately discharges to the St. Marys River. The river systems and drainage courses flowing through the city result in a number of stormwater outfalls. The stormwater piping system (the minor stormwater system) falls under the jurisdiction of the City while the streams and channels (the major stormwater system) fall under the Sault Ste. Marie Region Conservation Authority. The streams and channels within the City are shown on Drawing 3.2, while the storm system is shown on Drawing 6.1 and in greater detail on the drawings contained in Appendix F.

The City requires rear lot swales serviced by rear yard catchbasins for drainage on private property.

Foundation drains are connected to the storm drainage system by a number of methods including pumping directly to the road ditch line, pumping to a 100 mm lateral connected to the storm system and direct connection of a sump pit to the 100 mm storm lateral, with a backwater valve. It is also acceptable to direct sump water to a concrete splash pad at surface.

The City determines design flow estimation using the Rational Method. Inlet time is estimated to be 10 minutes or determined using the Bransby-Williams or Airport formula. The minimum pipe size for storm sewers is 300 mm diameter with a hydraulic roughness Manning's (n) of 0.013. Storm pipes are generally PVC when 600 mm diameter or smaller and reinforced concrete when greater than 600 mm diameter. Storm sewers are designed to have a minimum velocity of 0.76 m/s in order to be self cleaning.

3.4.4 Flood Management

To alleviate flooding throughout the City, flood control diversions and structures have been implemented over time by the Sault Ste. Marie Region Conservation Authority has completed flood control projects for many of the major drainage systems. Totaling over 12 kilometers, the Bennett-West Davignon Creek, Clark Creek, Central Creek, East Davignon Creek, and Fort Creek Flood Control Channels have been constructed to convey drainage and help protect the City from flooding. In addition, the Fort Creek Dam was constructed to protect a portion of the west end of the City from flooding.

3.4.5 Stormwater Management

Stormwater management for new development is dealt with on a case-by-case basis. In recent private construction, dry ponds have been used to attenuate peak flows. This is currently the favoured mechanism for attenuation of stormwater flows in the City. Oversized pipes have also been used for stormwater storage.

Quality control of stormwater runoff in new development has been addressed by the SSMRCA and the DFO. The accepted level of protection, based upon MOE Guidelines, has generally been Normal at 70% suspended solids removal, although it is also based on the receiving water body.

SWM for existing development generally does not have controls in place beyond the conveyance of stormwater flows. (see 3.4.3)

3.4.6 Transportation Infrastructure

The Trans-Canada Highway (Highway 17) branches into two routes through the city with the main branch bypassing the downtown core and the secondary branch (Highway 17B) continuing through the downtown core to the International Bridge to the United States.

All roads in Sault Ste. Marie are maintained by the Department of Public Works and Transportation. The Highway Connecting Links throughout the City, including numbered highways, are maintained by the City.

The rail yard located near the downtown core is operated by Canadian Pacific Railway (CPR) and utilized by the CN, Huron Central Railway, and Algoma Central Railway lines. CPR has an environmental program in place for addressing and monitoring stormwater quality at its operations[11]. The CPR website notes that the rails travel through environments, such as wetlands, lakes and rivers. CPR adds that they manage industrial wastewater in rail yards generated from maintenance activities.

The Sault Ste. Marie Airport is an international airport located in the west end of the City. The airport is operated by the Sault Ste. Marie Airport Development Corporation (SSMADC). Planning and development at the airport recognizes goals for the environment outlined in the City's Official Plan.

3.4.7 Topsoil Stripping

The City addresses topsoil stripping within Zoning By-Law 2005-150 (February 23, 2009). Subsection 4.7.2 of the By-Law states that removal of topsoil is prohibited in all Zones subject to an approval agreement entered into with the City according to Section 142 of the Municipal Act.

3.4.8 Snow Disposal and Deicing

Winter road maintenance is the responsibility of the Department of Public Works and Transportation (PWT) of the City of Sault Ste. Marie. Snow removal and disposal and salt and sand application is managed in accordance with the Salt Management Plan (Conestoga Rovers Associates, 2005)[12].

Snow disposal sites are located throughout the City. The City currently has access to approximately nine sites, and has used other sites in the past. The locations of snow disposal sites and the salt storage facility are shown in Drawing 3.2.

PWT often places hay bales and berms within drainage outlets at the snow dumps to attempt to prevent the leaching/runoff of salt and suspended solids.

3.4.9 Construction Management

The Conservation Authority, through their permitting process requires silt control to be employed at new construction sites.

4.0 PROBLEM DEVELOPMENT

The results of analyses performed as part of the data collection and review as well as the drainage mapping and understanding are presented in the following sections.

4.1 Quality and Sampling

Non-point sources of pollution are characterized as sources that cannot be attributed to a specific location. Point sources of pollution are generally collected by a pipe network and conveyed to a single point of discharge. Stormwater can be considered to be a potential non-point source and a point source (location specific) of pollution.

Typical urban runoff from rain events and snowmelt contain suspended solids, hydrocarbons, nutrients, and bacteria. Most storm sewer outfalls discharge untreated urban runoff to drainage channels and creeks or directly to the St. Marys River. Storm sewer outfalls within the City of Sault Ste. Marie, monitored by the MOE and Algoma Public Health (APH) during the summer months of 2007 and 2008, appear to indicate that storm sewer outfalls are a source of bacteria, which is an expected result of urban runoff.

The SSMRCA conducts surface water general chemistry sampling at five sites within the City as part of the Provincial Water Quality Monitoring Network (PWQMN). The locations sampled and the results of the sampling program are summarized in Appendix E.

The sampling results reviewed as part of this study are representative of urban runoff. Urban outfalls are capable of discharging elevated concentrations of E. coli, Total Phosphorus, and Suspended Solids at any time. A review of quality issues is provided in Appendix E.

4.2 Snow Disposal

The MOE completed a sampling program of five snow disposal sites within the City in October 2009 (Appendix E). The results of the sampling program are generally typical of snow disposal sites. Concerns regarding these sites are largely influenced by site location. Runoff from snow disposal sites can enter the stormwater conveyance system, open channels, or the St. Marys River.

4.3 Storm Sewer Capacity

The drainage basins within the project area were delineated and physiographic information for each of these basins was compiled. The St. Marys River Drive catchment which outlets near the Roberta Bondar Pavilion, Pine Street, Churchill Boulevard, and Clark Creek catchments were evaluated in detail for storm water conveyance capacity.

Sand and sediment discharged to the stormwater conveyance system may cause the cross-sectional flow area of the conveyance system to decrease, which in turn may increase the probability of quantity issues such as erosion and flooding. Sand and sediment may accumulate in a sewer /channel over time and impede flow.

Older piped sections of the City were designed based on design parameters and conditions at that time. Since the older pipes were constructed, urbanization without storm water quantity control, may impact the older pipe systems.

4.4 Environmental Degradation and Potential Problem Areas

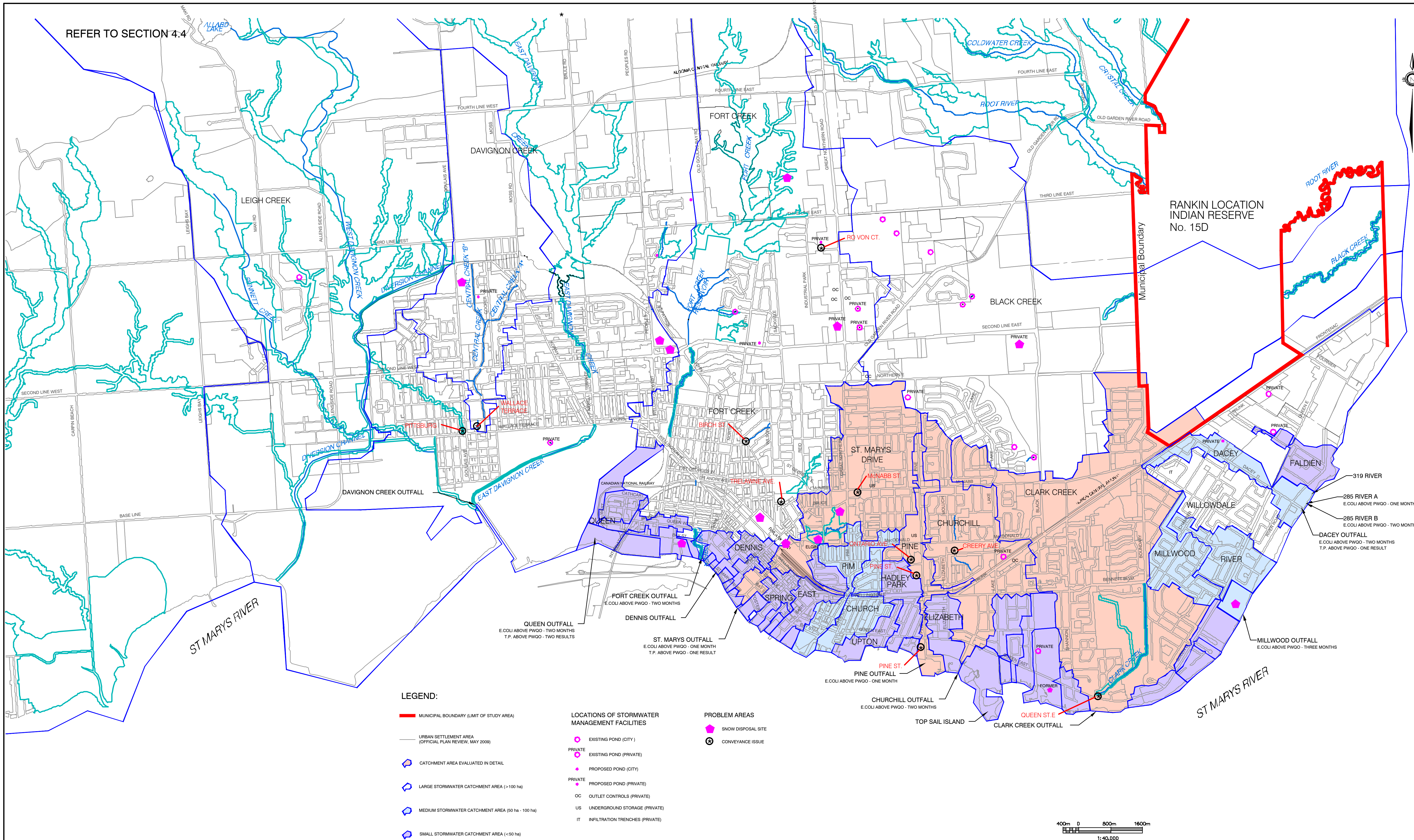
Areas requiring detailed review were identified by the City of Sault Ste. Marie and the SSMRCA. These areas were acknowledged to exhibit various issues including localized or conveyance issues. Subsections 4.4.1 to 4.4.4 summarize these areas. Additional areas were reviewed at a lesser level of detail. These areas are summarized in Subsections 4.4.5 to 4.4.7. Details regarding drainage characteristics are presented in Chapter 5 Development of Computer Model and Appendix F. The location of these areas is presented on Drawing 4.1.

4.4.1 St. Marys River Drive

The St. Marys River Drive storm outfall adjacent to the Roberta Bondar Pavilion has been identified as an area of degradation. There are snow disposal sites contributing snow melt in this area in the spring. Upstream, the ravine in the Bruce Street and Pim Street area has been subject to erosion and sedimentation, which is a possible source of solids to the storm outfall. The area has required dredging to remove sediment from the River. Conveyance issues have been noted at McNabb Street and Great Northern Road / Pim Street. Computer modeling indicates that there may be undersized pipes.

4.4.2 Clark Creek

Clark Creek is located in the southeast section of the City. The Creek receives runoff from a large area where the land use is primarily commercial and residential. Highway 17 is located



MASTER PLAN
SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

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DRAWING 4.1
ENVIRONMENTAL DEGRADATION AND POTENTIAL PROBLEM AREAS
STORMWATER MANAGEMENT MASTER PLAN

along the northern boundary of this catchment. Clark Creek has been a concern of late because of heavy siltation and overgrowth. A definitive source of the sediment is unknown. There are conveyance capacity issues noted near the downstream end of the Creek at Drake Street and Queen Street. Water quality monitoring has not been conducted at this site in recent years. Clark Creek has been improved in the Golf Course Area.

4.4.3 Churchill Boulevard

Within the catchment area contributing to the storm sewer on Churchill Boulevard, conveyance issues were noted by City staff in the Creery Avenue and Breton Road Area in the area of the escarpment. The presence of E. coli at the storm outfall to the River was confirmed during 2007 and 2008 sampling.

Bellevue Park has been identified as an area of significant sedimentation and overgrowth. Waterfowl guano has been noted to be a concern in the Park, which is a likely source of E. coli.

4.4.4 Pine Street

The Pine Street storm outfall is upstream of the Churchill Boulevard storm outfall and may contribute to the sedimentation experienced at Bellevue Park. Conveyance issues along Pine Street were identified by the City and confirmed through the modeling process.

4.4.5 West Davignon, Central, and East Davignon Creeks

The Davignon Creek watershed encompasses the Central and East Davignon Creeks and the southernmost parts of the natural channels from Bennett Creek and West Davignon Creek. The watershed begins north of the Municipal Boundary and terminates at its confluence with the St. Marys River south of Goulais Avenue.

The Central Creek subwatershed begins midway between Fourth Line East and Fifth Line East and generally follows Old Goulais Bay Road south to the Wallace Terrace area where it converges with the Davignon Creeks. Central Creek has a number of problem areas upstream of the storm sewer system prior to outletting at Davignon Creek. Areas between Pittsburg Avenue and Goulais Avenue where the creek crosses Wallace Terrace and Wallace Terrace through to Douglas Street have been flooded in the past. Conveyance issues identified during model development and analysis include a build-up of sediment and silt in the structures and channels impeding flow. These structures have been noted by City staff as being difficult to clean. Sampling conducted in 2007-2008 at the outlet has not indicated unusually high pollutant loads.

4.4.6 Queen Street

The Queen Street storm outfall is located west of the International Bridge. The trunk storm sewer from the terminus of Queen Street West discharges at this point. This location was noted to have levels of E. coli and total Phosphorus present.

4.4.7 Fort Creek

Fort Creek has been identified by City staff and SSMRCA as an area of poor aquatic health and poor aesthetics. Sedimentation has been an issue above and below the dam structure. Erosion caused by stormwater appears to be one of the main contributing factors to sedimentation and high turbidity. Fort Creek is contained in a storm structure for much of its length through the southerly urban area. Solids deposition has been a significant issue within the storm structure and in the channel. Gully erosion and sediment plumes have been reported. In 2009 a sediment removal program was undertaken by the City and SSMRCA. Sampling taken at the mouth of the Creek during 2007 and 2008 has shown that levels of E.coli are present.

Conveyance issues have been noted at Ro-von Court and around the north end of Birch Street.

4.4.8 Millwood Street

This location exhibited E.coli occurrences throughout the 2008 sampling program. This storm outfall serves a relatively small catchment area and is located downstream of the East End WPCP and near a snow disposal site. There are no known conveyance issues noted in this area.

4.4.9 Dacey Road

Monitoring during 2008 at the storm sewer outfall from Dacey Road as well as locations downstream on River Road within the Dacey watershed also showed E. coli. There are no conveyance issues noted in this area.

4.4.10 Shoreline Catchment Areas

Several small catchment areas along the Sault Ste. Marie waterfront were reviewed with a minimum level of detail. The City is recently aware of one stormwater conveyance issue in the Willowdale catchment at Gibb / Robin Street with respect to storm sewer outlet capacity.

4.5 Beneficial Use Impairments in the St. Marys River

As part of the designation process of the St. Marys River as an Area of Concern, several beneficial use impairments were identified. These impairments included restrictions on fish and wildlife consumption, beach closings, and restrictions on dredging activities. A more detailed discussion of some of the beneficial use impairments affecting the St. Marys River is included in Appendix E.

4.6 Development Pressures

The Official Plan (1996) states "all future residential growth within the City can be accommodated on lands already committed to development within the existing settlement area." Growth projections at the time estimate that 75 to 150 new residential units can be expected annually.

The Official Plan was reviewed in 2008; and the projected land requirement for new development between 2006 and 2021 is 169 ha[13]. This land requirement considers the projected number of four dwelling unit types along with associated density. Housing starts were projected to be 115 per year for the period from 2006 to 2011 and to increase steadily to 230 per year for the period 2021 to 2026. City and SSMRCA staffs have noted that there is concentrated development planned for the Second Line to Third Line area east of Great Northern Road.

Residential growth was also reviewed based on housing starts recorded from 1998 to 2010. Residential growth in Sault Ste. Marie has averaged 110 units per year between 1998 and 2010 according to the Canada Mortgage and Housing Corporation.

Table 4.1 - Housing Starts: Sault Ste. Marie[14]

Year	Housing Starts
1998	162
1999	90
2000	90
2001	74
2002	86
2003	99

2004	**119**
2005	**128**
2006	**105**
2007	**117**
2008	**173**
2009	**85**
2010	**99**

Based on the average housing starts of 110 / year and an approximate housing density of 12 units per hectare the Sault Ste. Marie's residential development industry increases the urban area by an estimated 9 hectares per year.

Institutional, commercial, and industrial development is difficult to predict over the long term. The Official Plan identifies specific corridors within the City having these zonings.

Stormwater management quantity control is currently a condition of new development under subdivision or site plan control. The Black Creek drainage area has required and will continue to require full storm water management quantity controls.

4.7 Summary

Stormwater quality and quantity issues at catchment outlets are generally evident. Areas of the City have received attention as being problematic and require maintenance. Stormwater generally flows to the St. Marys River which, because of several identified beneficial use impairments, has been recognized as an AOC.

There is a need for a plan for developers and the City to follow through with the intent that stormwater issues will be addressed during development and ongoing infrastructure maintenance. A stormwater management strategy will streamline the stormwater planning, design, and review for new development and help ensure that stormwater management is considered during any undertaking within the City.

5.0 DEVELOPMENT OF COMPUTER MODEL

The quantity of stormwater discharged is related to land use. In order to estimate the run-off quantity a computer generated model was created to provide estimates of peak flow rates. The model and modeling parameters are presented in Appendix F, Hydrologic and Hydraulic Modeling.

5.1 Modeling Software

The storm sewer model was created using PCSWMM.NET version 2.06.211, utilizing SWMM version 5.0.011, a comprehensive modeling software capable of creating a fully dynamic simulation of the area of interest and allowing the user to run trials of stormwater management Best Management Practices. The model was used to determine adequacy of the conveyance system and to confirm identified deficiencies.

5.2 Watershed and Storm Sewer Model

The City of Sault Ste. Marie was divided into a number of subwatersheds and the characteristics within each watershed was determined.

The watershed characteristics were inputted to PCSWMM. The Horton infiltration method was used to simulate infiltration into the top layers of soil. A kinematic wave routing method was used to simulate flows through the drainage system.

5.3 Detailed Model

The City requested detailed modeling at the Pine Street, Clark Creek, St. Marys River Drive, Churchill Boulevard, and Central Creek watershed areas. The modeling has generally confirmed the City’s suspected problem areas. Some obvious deficiencies have been identified.

5.4 Simplified Model

In addition to the above detailed models, a simplified model has been developed for the remaining watersheds. Imperviousness has been calculated and an estimate of flows has been determined.

6.0 ALTERNATIVE SOLUTIONS

6.1 Evaluation of Alternatives

The review of alternative solutions was based on existing developed areas and future development areas.

Analysis focused on the approach that future development requires stormwater management as part of the approvals process through review by the SSMRCA, DFO and the City. A separate stormwater policy guideline was produced as part of this project.

In the case of existing development the review was based on known problem areas through water sampling results to achieve a logical planned approach. Further point source monitoring is part of the program to identify other potential problem areas, and to confirm remedial works. Land availability was also considered. All alternatives were reviewed with regard to the positive and negative effects on the following:

- Effectiveness at resolving the stated problem;
- Technical merit, design and construction feasibility, time constraints and duration of implementation;
- Land availability and the ability of the available land to provide benefits for quantity and quality;
- Operation and maintenance requirements and costs;
- Economic environment and capital costs;
- Natural environment; and
- Social environment.

6.2 Alternatives

The following Alternatives were developed to address stormwater management in Sault Ste. Marie:

1. Do Nothing (This option is included in order to verify the need for action)
2. New Development Stormwater Management Approach
    a. Large Scale Stormwater Management Facilities

b. Small Scale Stormwater Management Facilities

3. Existing Development Stormwater Management Approach

4. City Wide Stormwater Management Approach

Additional Recommendations

- Point Source Stormwater Monitoring Plan
- Review of Snow and Salt Management
- Remediation of Erosion and Sedimentation
- Operation and Maintenance
- Community Involvement and Education

6.2.1 Do Nothing

This option requires no change in the way stormwater is currently approached within the City. Generally, dry ponds would continue to be utilized within new development for quantity control. Stormwater runoff quality concerns expressed by review agencies would not be addressed. Stormwater runoff from the City would continue to be a contributor of bacteria and solids to the St. Marys River, and erosion and sedimentation would continue to be problematic and require ongoing maintenance.

6.2.2 New Development Stormwater Management Approach

This proposed strategy would address stormwater runoff from new development under the Planning Act in conformity with the new Stormwater Management Policy. This approach can follow two avenues as described in the following clauses.

6.2.2.1 New Development Large Scale Stormwater Management Facilities

This option includes building one large facility (pond) on future City owned property as part of the development process. The intent would be to locate facilities near the outlet of a catchment area, situated in such a way that stormwater runoff generated within various new developments would be successfully treated and discharged. In areas where this is a possibility, the City should review an overall concept for the area produced by the Developers. The development community should have an understanding of the net benefits of this concept such as less development lands transferred for ponds; one larger pond constructed as opposed to many smaller ponds. In order for this concept to be successful for all parties involved, stormwater conveyance to a centralized treatment facility must be feasible. The size of a facility designed to treat stormwater runoff from a large area may be substantial. Availability of appropriate land would also dictate the viability of this option. Where such an initiative is completed, capital costs should be shared and agreements reached where one developer's land is affected, while others are not, and also where existing lands, without stormwater management, feed into the new facility. The objective of this model is to minimize the overall number of ponds while maximizing the stormwater management level of service.

The developers with interests in a given area should be encouraged by the City to bring forward their development plans so that a viable single pond option can be reviewed. It should be noted that a simpler approach is that each development includes its own stand alone stormwater management. This avoids front end agreements and issues that may arise when land may not be developed for a number of years, whether due to economics, accessibility or desire to develop.

6.2.2.2 New Development Small Scale Stormwater Management Facilities

This option includes developing stormwater management controls on a subdivision basis. Stormwater runoff generated on development sites would be attenuated and treated for quality prior to discharge to the natural environment or existing stormwater infrastructure. This option places planning and implementation responsibility on the developer. Ownership and long-term maintenance for public systems such as new subdivisions would be transferred to the City once the Contract maintenance period expires. This option would also be required for site plans, and in this case ownership and maintenance could be by the land owner.

6.2.3 Existing Development Stormwater Management Approach

A combination of control measures applied to existing development in a watershed is a logical approach to mitigating stormwater concerns. Addressing runoff from established areas using several devices allows the proponent to spread out capital spending over a much longer period as opposed to developing a large scale project all at once. This approach also allows the proponent to implement methods that work best for the Public Works and Transportation Department, regarding operation and maintenance.

In existing development, stormwater management can be initiated by applying a three step approach to each subwatershed.

Step 1 is to define the source of pollutants, typically sand, silt, garbage, and petroleum products from urban surfaces. If there are known sanitary sewer overflows to the storm sewer or areas of bank erosion, this should be addressed by flow monitoring and erosion controls. The City has begun a monitoring regimen of monitoring the sanitary sewer overflows. The findings of monitoring activities will determine the nature of remedial actions and may trigger additional investigations such as inflow and infiltration studies. It is noted that City Staff have some certainty that there are no unknown sanitary overflows into the stormwater drainage system.

Step 2 involves low impact controls such as rain barrels and greening that can be retrofitted by residents and business owners on private property. This may also include an Eco-industrial approach where industrial sites are made greener, or buildings may be retrofitted for such items as rain water harvesting. The implementation of these items would be of benefit to the land owners and those interested should be encouraged through rain barrel purchases or the completion of Eco-industrial strategies.

Step 3 concerns establishment of end-of-pipe controls such as oil and grit separators.

6.2.4 City Wide Stormwater Management Approach

This involves undertaking stormwater management approaches for both new and existing levels of development as stated in the previous subsections. Stormwater management in areas of new development will be as per the Stormwater Management Policy and, in areas of existing development, will be a series of retrofits and educational initiatives.

6.3 Additional Recommendations

Further to the alternatives outlined in the previous section, the following items can be considered in conjunction with the preferred alternative.

6.3.1 Point Source Stormwater Monitoring Plan

As part of this stormwater investigation, the City has requested a Point Source Monitoring Plan for Stormwater. The purpose of the Point Source Stormwater Monitoring Plan is to identify and document sources of contamination within the watershed. Elements of the plan include water quality sampling at storm outfalls and visual observation of key locations. The findings of the Monitoring Plan will be used to prioritize future activities and confirm improvements. The Stormwater Monitoring Plan is presented in Appendix G. It is noted that the cost of this work is significant and the City should investigate funding opportunities where available. The success of any of the above alternatives is that the results are measurable.

6.3.2 Review of Snow and Salt Management

Snow disposal sites have been noted by the City to be of concern due to the potential as a source of pollutants. A review of the Salt Management Plan to meet the City's goals for stormwater is recommended. The city requires approximately 15 to 20 hectares of snow storage based upon the snow disposal usage for 2003-2004[13]. Snow disposal site selection should be based on Guideline B-4 - Snow Disposal and Deicing Operations in Ontario (1994). To properly service the urban area, snow disposal sites should be located in the northeast and west of the City. Care should be taken when selecting snow disposal areas to avoid wellhead protection areas and vulnerable aquifers. Availability of appropriate land will dictate future locations of snow disposal sites.

To properly treat runoff from snowmelt, snow disposal sites should be designed to protect groundwater in sensitive areas and be drained to a stormwater management control structure to remove solids and attenuate flows resulting from rainfall on the impervious area. Once snowmelt is complete, the disposal site should be cleaned.

The selection of new snow disposal sites may require an EA. Further review of snow disposal preferences within the City, and consultation with the MOE, is required to determine the appropriate Schedule.

For the interim, it is recommended that snow disposal sites slated for use to have stormwater quality controls installed, subject to available funding and budget constraints. Berms, hay bales, and silt fences should continue to be used or be installed at each site.

6.3.3 Remediation of Erosion and Sedimentation

The SSMRCA is generally responsible for open channels within the City. It is recommended that SSMRCA continue to include erosion and sediment control in its mandate.

6.3.4 Operation and Maintenance Initiatives

In the spring, the City completes street sweeping, catch basin sediment removal, and remedial works at known problem areas. This practice should be continued.

In addition, it is important to include storm sewer and stormwater management maintenance protocols in Site Plan Control Agreements.

6.3.5 Community Involvement and Education

Several activities can be undertaken in the community to help reduce pollutants that enter the stormwater system. Pollution prevention through Education and/or stewardship programs are an important component to stormwater management strategies.

The City should educate homeowners on how and why stormwater drainage is their responsibility on their property and what they can do to reduce stormwater runoff effects. The City should encourage residents to use “green” alternatives such as rainwater collection barrels and/or review the implementation of porous pavement as opposed to asphalt for driveways.

The City should educate the public about potential impacts on the quality of storm runoff. Education is an important method to reduce non point source pollution. Non point source pollution from human activity is a key contributor to stormwater pollution. Keeping yards clean and free of debris, and awareness of local by-laws pertaining to sewer use and pets (By-Law No. 2009-50 and By-Law No. 87-125 respectively) will all help to reduce pollutants in stormwater discharge.

Several initiatives have been undertaken by the City or other agencies including but not limited to: promoting green alternatives like phosphate free or biodegradable soaps; vegetation planting in riparian zones; monitoring urban wetlands for signs of degradation of species and habitat quality; coordinating the Yellow Fish Storm Drain Marking Program; and water conservation awareness to reduce occurrences of sanitary sewer overflows. These activities should continue to see support and to be promoted by the City. Animal and human sources both play a role in contributing to stormwater pollutants. Public education as well as beach management and source controls (i.e. geese control through less mowing, appropriate types of plantings, beach raking, etc.) should be emphasized.

One PIC attendee photographed erosion areas and problem areas in general and presented them at the meeting. This local effort should be encouraged.

Stewardship opportunities to create lineal trails along creeks and waterways help to develop awareness. The City could create lineal parks along the streams to bring people into natural areas. This activity should be further discussed with the Community Services Department.

In addition, the Sault Ste. Marie's Zoning By-law 2005-150 deals with topsoil stripping of lands and affords the City control over this type of operation.

6.4 Stormwater Management Practices

Several options are available for managing stormwater quantity and quality. It is recommended that these controls be selected on a site by site basis following the recommendations made in the MOE's document "Stormwater Management Planning and Design Manual" (March 2003). It should be noted that each type of control has specific physical constraints. Best Management Practice (BMP) is a methodology that establishes criteria for the selection of solutions that will best meet the proponent's goals for the environment. In the case of stormwater management, a BMP is stormwater control, or combination of controls, that is the most economical, effective, and sustainable. Further discussion on current BMPs is included in Appendix H.

The SSMRCA and DFO have requested that a Normal Level of Protection (70% removal of solids) is the minimum level of protection required in most built up areas of the City while the rest of the City may require an Enhanced Level of Protection (80% removal of solids)[15]. These areas include outlying areas such as the aquifer area and the Root River catchment. Details regarding Levels of Protection are included in the separate Stormwater Management Policy.

6.4.1 Lot Level and Conveyance Controls

Primarily small scale works; lot level and conveyance controls can be an economical approach to stormwater management and are generally divided into two categories; namely, infiltration and storage. These controls maintain the natural hydrologic cycle as closely as possible and are best suited to relatively clean stormwater.

Infiltration alternatives include but are not limited to reduced lot grading, grassed swales, vegetated filter strips, and pervious pipes. The applicability of infiltration controls is largely dependent upon the characteristics of the surficial soils and location of groundwater.

6.4.2 End-of-Pipe Controls

End-of-pipe controls are implemented to treat stormwater prior to discharge to a receiving water course or downstream system. These controls can be designed for stormwater management purposes and are dependent on available area to implement.

6.4.3 Retrofit Opportunities

Within existing infrastructure, the opportunity exists to retrofit the stormwater conveyance system with inline or offline controls. Several stormwater control options are well suited to retrofit and many products are available in today's market such as oil grit separators. As well, existing ponds have the potential to be redesigned and retrofitted to provide a higher level of protection.

6.4.4 Low Impact Development

Low Impact Development (LID) is a method of mitigating stormwater runoff by maintaining the local hydrologic balance. This method focuses on stormwater as a resource. Several lot level and conveyance and end-of-pipe controls meet, or can be designed to meet, the criteria for LIDs. Examples of LIDs are rain gardens, rain barrels, green roofs, pervious pavement and bioswales.

6.4.5 Treatment Train

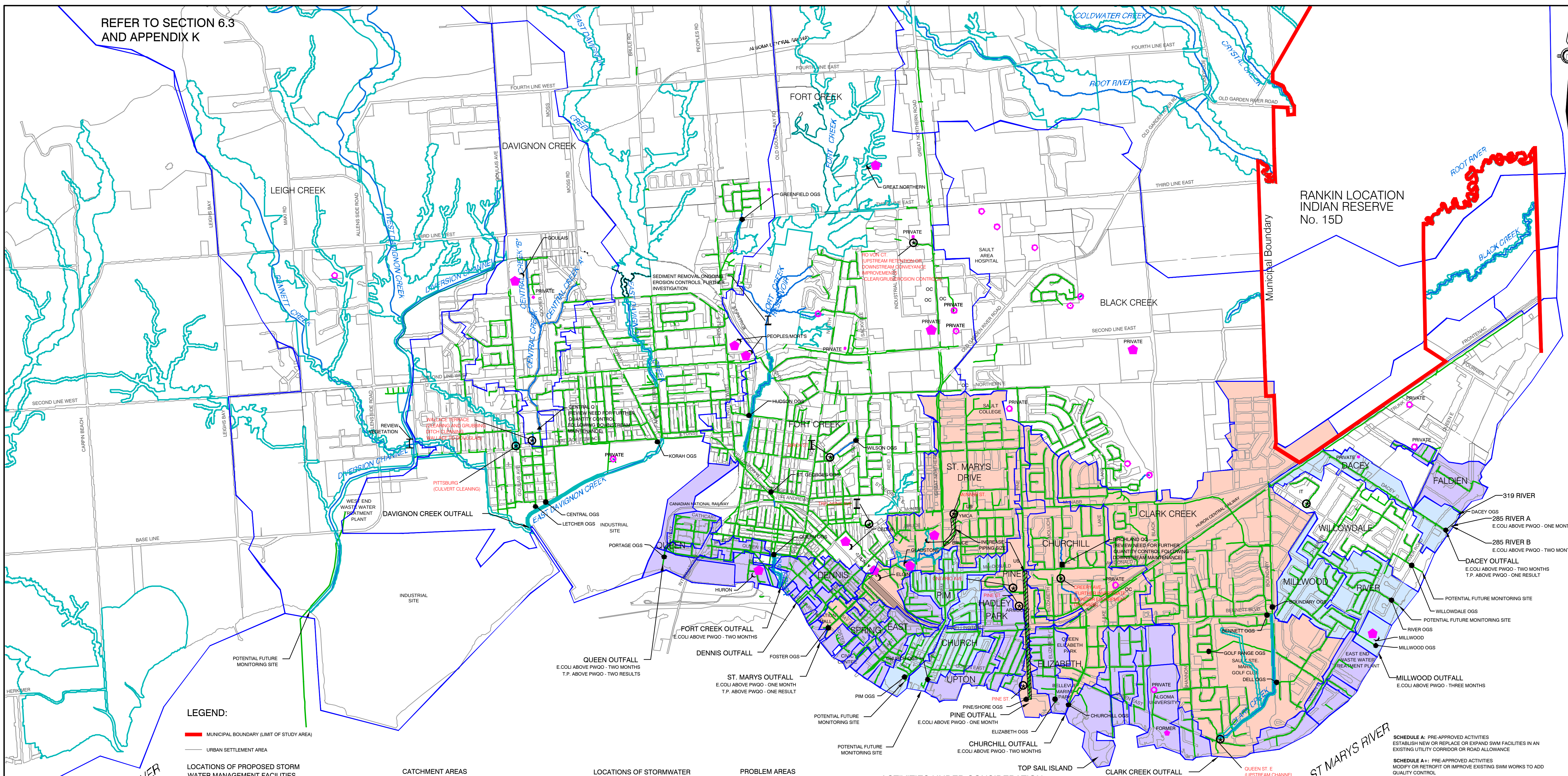
A "treatment train" is a method that applies a series of stormwater treatment practices to control stormwater runoff. This combines lot level and conveyance controls with end-of-pipe treatment to maximize attenuation of stormwater quantity and removal of solids.

6.5 Proposed Remedial Projects

As noted previously, priority watersheds within the City were identified for further modeling. As well, areas experiencing localized conveyance issues, as described by City staff, were investigated. The Master Plan activities that are recommended for each subwatershed require detailed design before implementation. General locations of remedial actions are shown on Drawing 6.1. Furthermore, it is recommended that the City and SSMRCA initiate watershed development plans as outlined in the RAP Stage 2.

Review of snow disposal is an integral part of improving downstream conditions in each affected subwatershed. Activities related to snow disposal and erosion are reviewed separately under Section 6.3 Additional Recommendations.

The recommendations below deal with the installation, in a number of locations, of oil and grit separators (OGS). It is the intent that the City proceed methodically, as funding becomes available or as specific projects are undertaken.



LEGEND:

MUNICIPAL BOUNDARY (LIMIT OF STUDY AREA)

URBAN SETTLEMENT AREA

LOCATIONS OF PROPOSED STORM WATER MANAGEMENT FACILITIES

- POTENTIAL QUALITY CONTROL OIL GRIT SEPARATOR (OGS)
- ▲ POTENTIAL QUANTITY CONTROL
- ■ POTENTIAL QUANTITY AND QUALITY CONTROL
- SPRING — CATCHMENT AREA ID

CATCHMENT AREAS

- CATCHMENT AREA EVALUATED IN DETAIL
- LARGE STORM WATER CATCHMENT AREA (>100 ha)
- MEDIUM STORM WATER CATCHMENT AREA (50 ha - 100 ha)
- SMALL STORM WATER CATCHMENT AREA (<50 ha)

LOCATIONS OF STORMWATER MANAGEMENT FACILITIES

- EXISTING POND (CITY)
- PRIVATE — EXISTING POND (PRIVATE)
- PROPOSED POND (CITY)
- PRIVATE — PROPOSED POND (PRIVATE)
- OC — OUTLET CONTROLS (PRIVATE)
- US — UNDERGROUND STORAGE (PRIVATE)
- IT — INFILTRATION TRENCHES (PRIVATE)

PROBLEM AREAS

- SNOW DISPOSAL SITE
- CONVEYANCE ISSUE

DEFINITIONS

ESCHERICHIA COLI (E.COLI) - A BACTERIA COMMONLY USED AS AN INDICATOR OF FECAL CONTAMINATION, NORMALLY HARMLESS BACTERIA IN THE INTESTINES OF HUMANS AND ANIMALS

TOTAL PHOSPHORUS (TP) - A MEASURE OF ALL DISSOLVED AND PARTICULATE FORMS OF PHOSPHOROUS, IT IS THE NUTRIENT RESPONSIBLE FOR THE UNNATURAL ENHANCEMENET OF ALGAL PRODUCTIVITY

TOTAL SUSPENDED SOLIDS (TSS) - A WATER QUALITY MEASUREMENT OF SOLID MATERIAL SUSPENDED IN WATER AND RETAINED BY A FILTER, IT IS A POLLUTANT, MEASUREMENT BY DRY-WEIGHT OF PARTICLES TRAPPED BY A FILTER OF A SPECIFIED PORE SIZE

WATER QUALITY PARAMETERS

SOURCE: WATER MANAGEMENT - POLICIES, GUIDELINES, PROVINCIAL WATER QUALITY OBJECTIVES (PWQO) OF THE MINISTRY OF THE ENVIRONMENT (JULY 1994, REPRINTED FEBRUARY 1999)

ESCHERICHIA COLI (E.COLI): 100 E.COLI PER 100 mL (BASED ON A GEOMETRIC MEAN OF AT LEAST FIVE SAMPLES)

TOTAL PHOSPHORUS (T.P.): 0.03 mg/L (BASED ON ELIMINATING EXCESSIVE PLANT GROWTH IN RIVERS AND STREAMS)

ACTIVITIES UNDER CONSIDERATION:
(FURTHER STUDIES, SCHEDULE A AND SCHEDULE A+ ACTIVITIES)

FURTHER INVESTIGATION:
FORT CREEK RESERVOIR
BIRCH ST.
BENNETT CHANNEL
TRELAWNE AVE.
BIRCH ST.

QUALITY/QUANTITY (QQ)
BIRCHLAND

QUANTITY (Q)
CENTRAL

QUALITY CONTROL
BENNETT OGS
BOUNDARY OGS
CENTRAL OGS
CHURCH OGS
CHURCHILL OGS
DACEY OGS
DELL OGS
ELIZABETH OGS
FOSTER OGS
GOLF RANGE OGS
GREENFIELD OGS
HUDSON OGS
KORAH OGS
LETCHER OGS MILLWOOD OGS
PIM OGS
PINE/SHORE OGS
PORTAGE OGS
QUEEN OGS
RIVER OGS
ST. GEORGES OGS
WILSON OGS

SNOW DISPOSAL SITES
DELINEATE, MITIGATE, AND MONITOR*

BRUCE
ELGIN
GLADSTONE
GREAT NORTHERN
GOULAIS
HURON
MILLWOOD
PEOPLES/MORT'S
CEDAR

*SALT MANAGEMENT PLAN, CRA FEB. 2005
"ASSESS SNOW DISPOSAL SITES AND DETERMINE REQUIRED IMPROVEMENTS"

SCHEDULE A: PRE-APPROVED ACTIVITIES
ESTABLISH NEW OR REPLACE OR EXPAND SWM FACILITIES IN AN EXISTING UTILITY CORRIDOR OR ROAD ALLOWANCE

SCHEDULE A+: PRE-APPROVED ACTIVITIES
MODIFY OR RETROFIT OR IMPROVE EXISTING SWM WORKS TO ADD QUALITY CONTROL

FUTURE WORKS
SCHEDULE A
CONSTRUCTION OF STORMWATER MANAGEMENT FACILITIES UNDER THE PLANNING ACT:
-CONSENT -PLAN OF SUBDIVISION
-SITE PLAN -CONDOMINIUM

SCHEDULE A+
EXISTING PONDS
- REVIEW RETROFIT OPPORTUNITIES

400m 0 800m 1600m
1:40,000

MASTER PLAN
SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

R.V. Anderson Associates Limited
engineering · environment · infrastructure
GENIVAR

DRAWING 6.1
LOCATIONS OF POSSIBLE REMEDIAL ACTIVITIES
STORMWATER MANAGEMENT MASTER PLAN

Where OGS suppliers declare high total suspended solids removals the City should ask for a written guarantee. Particle size, as well as TSS removal should be part of the guarantee.

6.5.1 St Marys River Drive

It is recommended to install oil and grit separator near the terminus of the drainage area.

The McNabb Street / YMCA area has been noted as having localized conveyance issues. Preliminary analysis of the upstream storm sewer pipes on Willow Avenue shows 900 mm diameter and 1050 mm diameter concrete storm sewers entering into a 1050 mm diameter concrete pipe south of 35 Willow Avenue. Further downstream the piping is noted as being both 1050 mm diameter CMP and 1050 mm diameter steel. At McNabb Street, the piping constricts to a 900 mm diameter by the YMCA building. It is recommended that the City investigate whether this storm sewer should be replaced or twinned southerly to the storm outfall on Pim Street. Based on as-built drawings supplied by the City, it appears that a section of the 900 mm diameter sewer was installed in 1960-1961. The drainage area north of McNabb Street is a large impervious area and appears to have been constructed more recently. There appear to be easements south of McNabb Street along the storm sewer. Construction in this area will affect parking for at least one business; alternate parking should be provided. A Geotechnical Report will be required to review pipe bedding and backfill, soil stability, and possible effects and mitigation measures for adjacent structures. The walkways and trails should be rerouted during construction.

6.5.2 Clark Creek

A stormwater sampling protocol for this area should be set up and dependant on the sampling results, the City should install oil and grit separators at points entering Clark Creek. This area is noted as having a sediment problem. The City should review the need for additional maintenance.

The City should review the need for upstream dry ponds north of South Market Street and Cambridge Place intersection, and to the west of homes on Heath Road to mitigate flows.

The southerly portion of Clark Creek, upstream of Drake Street should be reviewed for grade. The grade should be gradual entering the Drake / Queen East culvert. The City should remove trees and debris from the creek on an ongoing basis.

6.5.3 West Davignon, Central, and East Davignon Creeks

The City should install oil and grit separators at locations south of Bonney Street and near the terminus of the trunk sewer on Korah Road. Similar controls should be considered where drainage areas contribute to open channels and the land layout permits such as north of Third Line East near Peoples Road and Greenfield Drive.

Drainage courses in this area should be cleared of debris and trees and then evaluated to determine the need for upstream quantity controls.

6.5.4 Churchill Boulevard

The City should install an oil and grit separator near the terminus of the drainage area.

In the Creery Avenue and Breton Road area, no problems were evident in the pipe capacity from MacDonald Avenue to Creery Avenue. Further investigations are required in this area including CCTV camera pipe inspection. As Creery Avenue and Breton Road receive runoff from the escarpment running parallel on the north side of Creery Avenue, side yard and rear yard catchbasins should be considered for localized problem areas. Following investigations, there may be an opportunity for upstream quantity and quality control.

6.5.5 Pine Street

The City should install an oil and grit separator near the terminus of the drainage area based upon available sampling.

Construct a new sewer on Pine Street downstream of MacDonald to the outlet to alleviate the 1050 mm – 450 mm downsizing and various grade issues south of MacDonald.

6.5.6 Fort Creek

Oil and grit separators should be installed at all new storm outfalls and at known problem areas such as the outfalls to Fort Creek.

Birch Street accepts stormwater from the Wilson Street area. Currently, there is a 750 mm diameter and a 300 mm diameter pipe conveying stormwater to a +/-600 mm diameter stormwater inlet on Birch Street. The Schematic Storm Plan provided by the City shows the stormwater inlet as being 600 mm, but having an unknown grade. It is recommended that CCTV camera pipe inspection, and further, given the heavily treed upstream area, an inlet condition investigation be conducted. CCTV camera inspection should extend from this area to North Street. There is a possibility that downstream pipe upsizing may be required subject to a detailed review of pipes and conditions.

The Ro-von Court area near Third Line East and Great Northern Road would benefit from upstream quantity control or downstream ditching and erosion protection.

Fort Creek in general has been noted as having silt problems upstream and downstream of the reservoir. Recently the channel has been cleaned and rip rap placed. Ongoing monitoring and investigation of further erosion controls should be undertaken.

6.5.7 Various Locations

The installation of oil and grit separators in several smaller catchment areas was considered pending further monitoring. This type of control may be a viable option at the following sites:

Portage OGS – Located on the trunk sewer servicing the western most drainage area on Queen Street West near Portage Lane.

Pim OGS – Situated on the trunk storm sewer on Pim Street near the outfall to the River.

Church OGS – Situated on the trunk storm sewer on Church Street near the outfall to the River.

Elizabeth OGS – Located on the trunk storm sewer from Elizabeth Street, this unit would be located in Bellevue Park.

Millwood OGS – Located near the storm outfall to the River on the trunk sewer servicing Millwood Street and surrounding residential streets as far as the Chambers Avenue area.

River Road OGS – Situated near the storm outfall to the River on the trunk sewer servicing River Road northwest of Queen Street East to the Chambers Avenue area.

Willowdale OGS – Located on the storm trunk sewer servicing lands in the vicinity of Willowdale Street northwest to Highway 17.

Dacey OGS – Situated on the trunk storm sewer near the outfall to the River servicing Dacey Road and surrounding area northwest to Highway 17.

6.5.8 Third Line West and Creek Road

Preliminary review indicates that there is the possibly of an undersized culvert in this location. The City has cleaned this culvert recently.

A summary of recommended works, additional studies / pilot programs and cost estimates is carried in Appendix I. See Chapter 8 for further discussion.

7.0 PUBLIC CONSULTATION

A critical part of the Municipal Class EA is to solicit input from the public and review agencies. The following section summarizes the consultation that has taken place as part of this study.

7.1 Stakeholder and Agency Meetings

Several meetings were held with the proponent and review agencies throughout the course of the study.

The first meeting was held January 15, 2009 in the Biggings Room at the Sault Ste. Marie Civic Centre. Representatives from the City's Engineering and Public Works and Transportation Departments as well as representatives of the Sault Ste. Marie Region Conservation Authority were in attendance. Terms of reference were discussed and agreed upon and locations of particular concern were noted by the proponent.

The second meeting was held June 2, 2009. The purpose of this meeting was to review early findings of the study with the City's Engineering Department. City staff were able to fill some data gaps during the meeting.

The third meeting was held at the Public Information Centre, prior to public attendance, on December 17, 2009 at the Russ Ramsay Room in the Sault Ste. Marie Civic Centre. The PIC materials were reviewed with representatives from the City, SSMRCA, and DFO. Discussion included areas of environmental degradation within the City and discussions regarding the assignment of preferred levels of protection throughout the watershed.

7.2 Public Information Centre #1 – December 17, 2009

Public Information Centre (PIC) #1 was held in the Russ Ramsay Room at the Sault Ste. Marie Civic Centre on December 17, 2009 from 3 to 7pm. The purpose of this PIC was to present an overview of the watershed along with findings to date regarding stormwater quality and quantity. The materials presented at the PIC along with the attendance record and comments received from attendees are included in Appendix C.

The meeting was advertised in the Sault Star and letters and e-mails were sent out to agencies and organizations with background information and a questionnaire.

The Public Information Centre was attended by members of the City of Sault Ste. Marie, the Conservation Authority, local Engineering consultants, Ministry of the Environment, Algoma Public Health, the media and St. Marys BPAC as well as interested people.

7.3 Public Information Centre #2 – May 19, 2011

PIC #2 was also held in the Russ Ramsay Room at the Sault Ste. Marie Civic Centre on May 19, 2011 from 3 to 7pm. The purpose of the PIC was to present the alternative solutions reviewed, the preferred solution and to receive comments. The materials presented at the second PIC along with the attendance record and comments received from attendees are included in Appendix C.

The proposed Draft Stormwater Management Policy and the Draft Stormwater Management Master Plan were both made available for review.

The Boards presented at the second PIC included the EA Process, Drawings 3.1, 3.2, 4.1, 6.1 and the City Study Limits.

The meeting was advertised in the Sault Star and letters were sent out to agencies and organizations with background information and a questionnaire.

The Public Information Centre was attended by members of the City of Sault Ste. Marie, the Conservation Authority, local Engineering consultants, Ministry of the Environment and St. Marys BPAC as well as interested people.

8.0 RECOMMENDATIONS AND IMPLEMENTATION

As stated in Section 1.3, the intent of this study is to address stormwater quantity and quality concerns from current and future developments within the City of Sault Ste. Marie. As noted in the aforementioned Section 1.3, the Problem Statement is to: "Develop a Stormwater Management Plan Strategy to address stormwater quality and quantity concerns within the City of Sault Ste. Marie associated with current and future developments."

8.1 Preferred Alternative

The City of Sault Ste. Marie has clearly defined the problems to be resolved, developed and evaluated alternative solutions, and consulted with the public prior to deciding upon the preferred solution, following the Municipal Class Environmental Assessment process. To address stormwater related concerns inclusively as possible it is recommended that stormwater management be implemented for both existing and future development areas. As such the preferred alternative is the City Wide Stormwater Management Approach as outlined in Subsection 6.2.4.

8.2 Basis of Selection

The City Wide Stormwater Management approach is considered to be most effective as it establishes goals to remediate existing problem areas, especially in the urbanized area of the City, and provide standardized and innovative stormwater management for new development.

The implementation of low impact development controls and relatively compact devices such as oil and grit separators in urban areas will help to minimize social and natural environment impacts associated with larger construction projects. Following installation of oil and grit separators, the units would be buried and sites restored. In urbanized areas, the natural environment is generally not adversely affected. The economic impact is generally short term as implementation of these stormwater management controls is relatively less invasive with regards to installation and maintenance. Maintenance for an oil and grit separator is simpler than removing a sediment plume or cleaning a pond that requires dewatering.

New development will be required to implement stormwater management controls as per the separate Stormwater Management Policy, once adopted. The capital cost would be included in as a developer cost for new developments. Once the maintenance period is complete maintenance would be taken over by the City.

The City Wide Stormwater Management Approach does not preclude the implementation of other controls that would fall under a Schedule A Activity according to the MEA Class EA.

8.3 Project Costs and Prioritization

Order of magnitude project costs are provided to give a general perspective for budgetary allocations. Costs and prioritization of conveyance and / or water quality improvement projects, as well as costs related to supplementary activities such as snow disposal and salt management review or detailed investigations, are presented in Appendix I.

8.4 Scheduling

Generally, stormwater management controls can be advanced in existing developed areas at any time provided the project is defined as a Schedule A activity under the EA process. At all times it is recommended that residents be made aware of the project prior to design and implementation even if contact is not required under the Municipal Class EA. Projects should be started and completed during a calendar year, and scheduled to minimize disruptions during winter months.

Traffic and pedestrian rerouting should be completed prior to the start of construction.

Scheduling is dependent on municipal budgets and available funding. It may be prudent, in the case of budget and funding constraints to install oil and grit separators at localized sites in areas of road or stormwater infrastructure reconstruction.

Implementation of the recommended solutions may require further consideration by the City regarding funding methodology, financing, resource requirements and phasing.

In addition project designs will need to be accepted by the City and reviewed and approved by the MOE as evidenced by the issuance of an Environmental Compliance Approval under the Ontario Water Resources Act (OWRA), as applicable. See Appendix K – Page 1-1.

8.5 Funding Opportunities

Environmental issues are at the forefront of major budgetary announcements. The 2010 Federal Budget included provisions for protecting and enhancing the Great Lakes, specifically addressing environmental restoration issues in the Areas of Concern[16].

The City has the option of imposing fees under the Municipal Act to balance capital investment where future development would benefit. In addition, the Development Charges Act allows the City to recover expenditures attributable to growth by means of a by-law requiring fees to be paid on residential and / or non-residential lands upon issuance of a building permit. There is currently a Development Charges study underway in Sault Ste. Marie.

Implementing any of the above recommendations would be up to the discretion of council. Some of the recommendations may not be attributable to growth and may not fall under Development Charges.

Details regarding these funding opportunities are included in Appendix J.

8.6 Master Plan Reviews

A Master Plan is a dynamic document. The Municipal Engineers Association recommends that the Master Plan be reviewed by the City every five years to determine the need for a detailed review and update. Updates are to be tracked and summarized in the preface of each amended document.

As part of the Municipal Class EA process Notices are to be sent to the Ministry of the Environment's Northern Region EA Coordinator (currently in the Thunder Bay office).

9.0 CLOSURE

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[1] Municipal Engineers Association, Municipal Class Environmental Assessment, 2007, Pages A-33 – A-35

[2] Municipal Engineers Association, Municipal Class Environmental Assessment, 2007, Page 4-1

[3] Statistics Canada 2006 Census

[4] R.J. Burnside, Sault Ste. Marie Area Groundwater Management and Protection Study, Volume 1 – Main Report, June, 2003

[5] Sault Ste. Marie, National Climate Data and Information Archive, Environment Canada

[6] Official Plan (Office Consolidation) Sault Ste. Marie, Sault Ste. Marie Planning Division, 1996, Amended 2003

[7] Endangered Species Act 2007, Ontario Regulation 230/08, Last Amendment 332/09

[8] Invading Species Awareness Program, Ontario Federation of Anglers and Hunters

[9] Ministry of Natural Resources, Recreational Fishing Regulations Summary 2010

[10] Proposed Assessment Report, Sault Ste. Marie Region Source Protection Authority, April 2010

[11] http://www8.cpr.ca/cms/English/General+Public/Environment/WaterInitiatives.htm

[12] Salt Management Plan, Public Works and Transportation Department, The Corporation of the City of Sault Ste. Marie, Conestoga-Rovers and Associates, February 2005

[13] Sault Ste. Marie Planning Division, Official Plan Review – Part 2 Residential Land Inventory and Rural Area Severance Policies, May 2009

[14] Canada Mortgage and Housing Corporation (CMHC)

[15] Sault Ste. Marie Region Conservation Authority, Letter to Susan Hamilton-Beach and Alex Sorensen, January 14, 2010

[16] Canada's Economic Action Plan, Budget 2010, March 4, 2010

APPENDIX A

Glossary

GLOSSARY

Aquifer:	A formation of permeable rock or unconsolidated gravel, sand or silt where all voids are full of groundwater and which water can be extracted through a well.
Approval:	The approval of the Director of Engineering and Planning, whose decisions will be final and binding in matters of design and construction.
Assimilative Capacity:	The capacity of a natural water body to receive wastewaters or toxic materials without negative effects and without damage to aquatic life or humans who consume the water.
Attenuation Pond:	A stormwater management pond that is designed to reduce the peak rate of stormwater flow by temporary storage of runoff (also known as a detention pond or retention pond).
Bacterial Water Contamination:	The pollution of water with unwanted bacteria. The most common cause of bacterial water contamination is E. coli.
BMP:	"Best Management Practice" activities, projects or management approaches that achieve environmental objectives. Includes structural and non-structural stormwater management controls.
Base Flows:	Flow remaining in a channel once runoff has stopped.
Branch Sewer:	A sewer that receives stormwater from a relatively small area and which discharges into a main sewer serving more than one area served by branch sewers.
Channel Morphology:	The physical make-up of a channel (e.g. slope, depth, width, bed and bank material, alignment).
Contractor:	The firm that performs the construction work under a construction agreement with the developer and in accordance with plans, specifications, and other documents as may be prepared by the Engineer and approved by the Engineer.
Developer:	The owner proposed land for development, or their designated representative.

Development:	Development includes any erection, construction, addition, alteration, replacement, or relocation of or to any building or structure and any change or alteration in land use.
Design Storm:	The magnitude of precipitation from a storm event measured in probability of occurrence (e.g., 50 year storm) and duration (e.g., 24 hours), and used in design of stormwater management systems.
Engineer:	The professional engineer who performs the planning and design of the stormwater system. The professional engineer must be a member of Professional Engineers Ontario (PEO).
Detention Basin:	A basin designed to attenuate / detain stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. This basin is designed to drain completely after a storm event.
Detention Storage:	Precipitation detained on the surface during a storm, and which does not become runoff until sometime after the storm has ended.
Director of Engineering Services:	The person appointed by Council to oversee all public works of the City of Sault Ste. Marie Engineering and Planning Department, or their designated representative.
Drainage Area:	(1) The area tributary to a single drainage basin, expressed in units of area. The drainage area may also be referred to as the catchment area, watershed, sub watershed, drainage basin, or drainage sub basin. (2) The area served by a drainage system receiving storm sewer discharge and surface water runoff. (3) The area tributary to a watercourse.
Drainage Master Plan:	The compilation of data and mapping that delineates watersheds, indicates routes of the major and minor drainage systems, defines floodplains, indicates constraints associated with water quality and quantity; indicates erosion and bank stability problems, and indicates specific flood control and environmental objectives in the watershed.
Evapotranspiration:	The loss of moisture due to transpiration from vegetation and evaporation.

Flood Plain:	The relatively flat or low-lying area adjacent to a watercourse which has been, or may be, temporarily covered with floodwater during heavy rain and/or snow melt.
Grassed Swales:	Natural depressions or engineered shallow ditches that convey and can infiltrate stormwater runoff. The grass or emergent vegetation in the swale acts to reduce flow velocities, prevent erosion, and filter stormwater contaminants.
Groundwater:	Water within the earth that supplies wells and springs; water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.
Groundwater Hydrology:	The branch of hydrology that deals with groundwater.
Hydraulics:	The determination of water flow characteristics in the channels, pipes, streams, ponds, and rivers which convey stormwater.
Hydrograph:	A graph showing the rate of flow of water with respect to time for a given point within a watershed.
Hydrotechnical:	Term encompassing both engineering hydrology and hydraulics. Hydrotechnical engineering is a general term for fields of civil engineering related to the investigation, development, protection, and management of water bodies and water resources.
Hyetograph:	A graph showing rainfall depth with respect to time within a watershed.
Impervious:	A term applied to a material through which water cannot pass, or through which water passes at a slow rate.
Infiltration:	(1) The migration of water through a soil or other porous medium. (2) The quantity of groundwater which enters into a sewerage system through cracks and defective joints. (3) The entrance of water from the ground into a sewer or drain through breaks, defective joints, or porous walls. (4) Absorption of liquid water by the soil, either as it falls as precipitation, or from a stream flowing over the surface.
Infiltration Trench:	A shallow, excavated trench that has been backfilled with stone to create a narrow underground storage reservoir from which water drains into the subsoil

	and eventually to the water table. Enhanced infiltration trenches also include pre-treatment systems to remove sediment and oil.
Intensity:	The rate of precipitation expressed as a depth of precipitation per unit of time.
Interflow:	The flow of water through near-surface soils.
Lag Time:	The time from a unit storm (or hyetograph) to the peak discharge or volume of the corresponding unit hydrograph.
Lateral Sewer:	A sewer that discharges into a branch or other sewer and has no other common sewer tributary to it.
Main Sewer:	In small urban drainage systems, the main sewer refers to the sewer with one or more tributary branch sewers.
Major Storm:	A storm used for design purposes – the runoff from which is used for design and sizing the major stormwater drainage system. The frequency of such a storm is 1 in 100 years (1% probability of being equaled or exceeded in any year).
Major Storm Drainage System:	The stormwater drainage system which will discharge stormwater during a major storm when the capacity of the minor system is exceeded. The major system usually includes features such as streets, swales, and major drainage channels. Minor stormwater drainage systems may reduce the flow in many parts of the major stormwater drainage system by storing and conveying water underground. Design of a major system is typically based on a storm frequency of 1 in 100 years.
Minor Storm:	A storm used for design purposes – the runoff from which is used for design and sizing the minor stormwater drainage system. The frequency of such a storm is 1 in 10 years (10% probability of being equaled or exceeded in any year).
Minor Storm Drainage System:	The stormwater drainage system which is designed to eliminate or minimize inconveniences or disruption of activity resulting from runoff produced by more frequent, less intense storms. The minor stormwater drainage system is sometimes termed the “convenience system”, or “initial system”. The minor system may include features such as curbs and gutters, storm sewer pipes and

	open drainage channels. Design of a minor system is typically based on a storm frequency of 1 in 10 years.
MOE:	The Ontario Ministry of the Environment.
MTO:	The Ontario Ministry of Transportation.
Municipal Service Systems:	Municipal service systems include all sanitary sewerage systems, stormwater drainage systems, water distribution systems, streets, sidewalks and miscellaneous appurtenances within the City which are owned, operated, and maintained by the City.
Oil and Grit Separator (OGS):	Engineered stormwater treatment structure that removes oil and sediment from storm runoff. They consist of one or more chambers that remove sediment, screen debris, and separate oil from stormwater. Also referred to as oil and water separators, water quality inlets, and oil and sediment separators (OSS).
Non-point Source:	Source of pollution from which wastes are not released at one specific, identifiable point but from an area, making this source of pollution difficult to isolate and control. Non-point source pollutants commonly carried in stormwater runoff include solids, nutrients, and pesticides.
Open Channels:	Natural streams and their flood plains, and artificial channels used to convey stormwater.
Outfall Sewer:	A sewer that receives water from the drainage system and discharges it to a treatment area or to a receiving water body.
Overland Flow:	The concentration and conveyance of stormwater runoff over the ground surface.
Peak Discharge:	The maximum rate of flow of water at a given point and time resulting from a predetermined storm.
Pervious:	A term applied to a material through which water passes relatively freely over a short duration of time.
Point Source:	A source of pollution collected and conveyed in pipe works or other well defined path that is discharged at one location.

Precipitation: Any moisture that falls from the atmosphere, including snow, sleet, rain, and hail.

Retention Basin: A basin or pond containing a permanent pool of water and designed to attenuate stormwater runoff by temporarily storing the runoff off and releasing it at a predetermined rate.

Runoff (Direct): The total amount of stormwater that reaches stream channels.

Runoff Characteristics: The surface components on any watershed which, either individually or in any combination thereof, directly affect the rate, amount and direction of stormwater runoff. These may include, but are not limited to, vegetation, soils, slopes and any type of man-made landscape alterations.

SCS: (Soil Conservation Service), Stormwater management systems for urban development have been traditionally designed and analyzed with the aid of computer models employing design storm events [such as the Soil Conservation Service (SCS) temporal distribution.

Sewer: A pipe or conduit that carries wastewater or stormwater.

Stream: A general term for a body of water flowing in a clearly defined natural channel.

Storm Inlet: An entrance into the underground stormwater pipe system.

Stormwater Drainage System: A system receiving, conveying, and controlling discharges in response to precipitation and snowmelt. Such systems consist of ditches, culverts, swales, subsurface interceptor drains, roadways, curb and gutters, catch basins, maintenance holes, pipes, and sewers.

Stormwater Runoff: That part of the precipitation which is conveyed as overland flow.

Stormwater Runoff Depression Storage: Precipitation retained in small depressions and surface irregularities that does not become part of the stormwater runoff.

Storm Service Lateral: A pipe that conveys foundation drain water from the outer side of the wall through which the pipe exits the building to the storm sewer.

Storm Sewer:	A sewer that carries only surface runoff, street wash, and snow melt from the land. In a separated sewer system, storm sewers are completely separate and isolated from sewers that carry domestic and commercial wastewater (sanitary sewers).
Subdivision:	The division of an area of land into parcels under the Planning Act.
Surcharge:	The flow condition occurring in closed conduits when the hydraulic grade line (or water surface) is above the conduit crown, or the transition from open channel flow to pressurized flow.
Surface Water:	All water naturally open to the atmosphere, including rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries and wetlands.
Time of Concentration:	The time required for stormwater runoff to concentrate and flow from the hydraulically most remote point of a watershed to reach the point in question.
Timmins Storm:	A storm that occurred over Timmins, Ontario between August 31 and September 1, 1961. It is a 12 hour storm with a total rainfall of 193 mm that was selected to be used for regulatory purposes in North and Central Ontario.
Total Suspended Solids:	A water quality measurement usually abbreviated TSS of solid material suspended in water and retained by a filter. Measurement is by a dry-weight of particles trapped by a filter, of a specified pore size.
Trench Drainage Relief System:	A pipe system designed to collect groundwater from trenches and lower the hydraulic grade line of the groundwater.
Watershed:	A land area from which water drains to a particular water body.
Wetland:	Land that either periodically or permanently, has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions.

APPENDIX B

References

REFERENCES

Proctor and Redfern, City of Sault Ste. Marie Drainage Report, December 1965

Province of Ontario, Development Charges Act, 1997

Kresin Engineering Corporation, St. Marys River Remedial Action Plan Implementation Review Project, March 31, 2004

Conestoga-Rovers and Associates, Salt Management Plan, Public Works and Transportation Department, Corporation of the City of Sault Ste. Marie, February 2005

Canada-Ontario Agreement Respecting the Great Lakes Basin Eco-System, June 25, 2007

Sault Ste. Marie Region Conservation Authority, Watershed Characterization Draft Report, (Source Water Protection), March 2008

Stormwater Pollution Prevention Handbook PIBS 4224e December 2001

Alberta Environmental Protection. 1999. Stormwater Management Guidelines for the Province of Alberta. Municipal Program Development Branch. Pub T/378. ISBN: 0-7732-5149.

City of Calgary, Alberta, 2000. Stormwater Management and Design Manual.

City of Cambridge, Ontario. 1997. Stormwater Management Policies and Guidelines. Online: http://www.city.cambridge.on.ca/relatedDocs/Stormwater%20Mngt.pdf

City of Chilliwack, British Columbia. 2002. Policy and Design Criteria Manual for Surface Water Management. Final Draft. Prepared by: CH2MHill. 48 p.

City of Greater Sudbury, Ontario. 2005. Engineering Design Manual

City of Greater Sudbury. 2006. Official Plan Stormwater Background Study

City of Nanaimo, British Columbia. 2003. Manual of Engineering Standards and Specifications. Section 7: Storm Sewer System. Online: http://www.city.nanaimo.bc.ca/a_engineering/engineering_standards.asp

Environment Canada. 1974. New Brunswick Flood, April-May 1973. Technical Bulletin No. 81, Inland Waters Directorate, Atlantic Region, Halifax, Nova Scotia, 1974

Environment Australia (2002). Introduction to Urban Stormwater Management in Australia. Prepared Under The Urban Stormwater Initiative of the Living Cities Program 2002. Department of the Environment and Heritage © Commonwealth of Australia, 2002

National Research Council, Canada and Federation of Canadian Municipalities. 2003. Source and On-Site Controls for Municipal Drainage Systems. A Best Practice by the National Guide to Sustainable Municipal Infrastructure. © Copyright National Guide to Sustainable Infrastructure. Issue No. 1

Ontario Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Queen's Printer for Ontario. ISBN 0-7794-2969-9

Ontario Ministry of Transportation. 1997. Drainage Management Manual

Ontario Ministry of Transportation and Communication. 1986. MTC Drainage Manual

Roads & Transportation Association of Canada. 1987. *Drainage Manual*

Trow Group, The. 1977. Geotechnical Study City of Sault Ste. Marie

Publication 709. Technical Bulletin 30, pp. 51. Canada: Department of Agriculture

Chow, V.T. 1959. Open-Channel Hydraulics. McGraw-Hill Book Company. ISBN 07-010776-9

APPENDIX C

Public Information Centres

DENNIS CONSULTANTS
CIVIL ENGINEERS
a division of R.V. Anderson Associates Limited

436 Westmount Avenue Unit #6
Sudbury Ontario P3A 5Z8
Tel (705) 560 5555
Fax (705) 560 5822
Web www.rvanderson.com

"INITIAL AGENCY CONTACT"

June 22, 2009

DC File 091800

Great Lakes Area of Concern Unit
Strategic Integration and Partnerships Division
Burlington
L7R 4A6

Attention: Sandra Kok

Dear Sandra Kok

Re: City of Sault Ste. Marie
Storm Water Management Master Plan Strategy
Environmental Assessment

The City of Sault Ste. Marie is undertaking a Municipal Class Environmental Assessment to develop a Storm Water Management Master Plan Strategy, to address storm water quality and quantity concerns.

Background

Urban storm water and snow disposal site runoff generated within the City of Sault Ste. Marie, Ontario is ultimately discharged to the St. Mary's River. Contaminants in urban runoff have been identified as one of the factors affecting the quality of the St. Mary's River.

The St. Mary's River has been identified as an Area of Concern and proposed activities have been identified in the Remedial Action Plan Stage 2 report, as administered by Environment Canada.

Fisheries and Oceans Canada (DFO) and the Ministry of the Environment (MOE) have requested the addition of quality treatment of storm water runoff to the City's current quantity SWM approach.

To understand the level of protection requirements within the City (i.e. 60% to 80% total suspended solids removal) and to help address the Remedial Action Plan Stage 2 requirements the City of Sault Ste. Marie has initiated this Master Planning strategy.

The purpose of this study is to create guidelines and manage the quality and quantity of urban drainage for the existing and expected future development within the City of Sault Ste. Marie. A Storm Water Management Planning Strategy that is effective and straightforward to implement has been identified as a key step to meet the overall objectives for the river.

This study will follow the requirements of the Municipal Class Environmental Assessment Master Plan Process Approach #1 for Storm Water Management Projects. This planning document addresses Phase 1 and Phase 2 of the Municipal Class EA process and forms the basis for future detailed investigations that may be necessary to satisfy project specific requirements for Schedule B or C type projects identified under the Master Plan.

Problem Statement

Develop a Storm Water Management Master Plan Strategy to address storm water quality and quantity concerns within the City of Sault Ste. Marie from current and future developments.

At this time we ask for your written input regarding the above project. Please complete the attached form to confirm your agency's level of involvement and provide any additional information that would have bearing on this study or that you or your Ministry / Agency feel is important.

Your input is greatly appreciated.

Project Contacts:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580,
99 Foster Drive,
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, C.E.T.
Project Manager
Dennis Consultants, a division of
R.V. Anderson Associates Limited
436 Westmount Avenue,
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555
asorensen@rvanderson.com

June 22/09 LETTER SENT ~~TO~~ - INITIAL AGENCY CONTACT

Great Lakes Area of Concern Unit
Strategic Integration and Partnerships Division
867 Lakeshore Road
Burlington, Ontario
L7R 4A6
Attention: Sandra Kok
sandra.kok@ec.gc.ca

Great Lakes Areas of Concern Unit
Environment Canada
4905 Dufferin Street
Toronto, Ontario
M3H 5T4
Attention: Kate Taillon, MSc.
kate.taillon@ec.gc.ca

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Rod Stewart
rod.stewart@ontario.ca
Lilian Keen, Environmental Officer, 705-942-6309, lilian.keen@ontario.ca
Kirk Crosson, Environmental Officer, 705-942-6392, kirk.crossan@ontario.ca

Northern Ontario District
Ontario-Great Lakes Area Fisheries & Oceans
1219 Queen Street East
Sault Ste. Marie
P6A 2E5
Attention: Jennifer Hallett
jennifer.hallet@dfo-mpo.gc.ca
Jennifer on leave for 1 year beginning fall 2009, Kelly Withers interim contact
kelly.withers@dfo-mpo.gc.ca

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Rhonda Bateman
rbatemen@ssmrca.ca

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Christine Ropeter
cropeter@ssmrca.ca

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Linda Whalen
lwhalen@ssmrca.ca

Christine Ropeter and Linda Whalen NEW LETTER

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Anjim Amin
aamin@ssmrca.ca

Sault Ste.Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Frank Tesolin
frank.tesolin@sympatico.ca

Algoma Public Health
99 Foster Drive
Sault Ste. Marie
P6A 5X6
Attention: Sherri Cleaves CPHI (C), BASc (EH)
scleaves@algomapublichealth.com

Ministry of Natural Resources
64 Church Street
Sault Ste. Marie
P6A 3H3
Attention: Janice Christian
janice.christian@ontario.ca

Lake Superior Advisory Committee
69 Broadview Drive
Sault Ste. Marie
P6C 5Z4
Attention: Don Marles
donald.marles@sympatico.ca

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MEMORANDUM

TO: Amelia Thompson **DC:** 091800
FROM: Alex Sorensen
DATE: July 20, 2009 – 2 pm.
SUBJECT: Sault SWM

Spoke with Jennifer Hallett at DFO.

Jennifer notes that the big issue in the small rivers in the Sault is with sedimentation and salt. Most of the sedimentation is with winter sand. She also has concerns with associated contaminants.

She notes that development had very little runoff control, and only recently has inputted sediment control during construction.

Fort Creek is a problem as it is almost entirely urbanized. Erosion occurs.

She noted that the first clean up of Fort Creek has recently occurred with the SSMRCA getting funding to get this work going. There is also a sediment study being done by the CA with DFO assistance.

PIC #1

NOTICE OF STUDY COMMENCEMENT
STORM WATER MANAGEMENT CLASS EA MASTER PLAN
PUBLIC INFORMATION CENTRE

The City of Sault Ste. Marie is in the process of developing a long-term Storm Water Management Master Plan which will include a review and analysis of the City's watersheds and propose alternatives to manage current and future storm water runoff generated within the City.

The Master Plan study will follow Approach #1 (which addresses Phases 1 and 2) as outlined in the Municipal Class Environmental Assessment (Municipal Engineers Association, June 2000, as amended in 2007) and will form the basis for project specific Class EA requirements of the preferred alternative(s). Comments received through consultations with the public and relevant agencies will be considered in the development of this Master Plan.

Public input is an important part of this study. Interested residents and other stakeholders are invited to attend the public information centre where the problem statement and the alternative solutions will be discussed.

The public information centre will be held on **Thursday, December 17, 2009** from 3 to 7 p.m. in the Russ Ramsay Room, Level 3, Civic Centre.

Storm water quantity has been effectively controlled throughout the City of Sault Ste. Marie through a series of drainage channels and a reservoir. Recent development projects have incorporated storm water quantity control measures into subdivision plans. Approval agencies have been emphasizing the need for quality control measures. Furthermore, storm water runoff generated throughout the City is primarily discharged southerly toward the St. Marys River, which was identified as an "Area of Concern" by the International Joint Commission in 1985.

The Storm Water Master Plan study involves a review of various storm water management alternatives in order to develop and implement a long term Storm Water Management Master Plan strategy for addressing both quantity and quality of storm water runoff in existing developed areas and new areas of development.

If you cannot attend but would like to provide comments, or for further information, please contact either:

Alex Sorensen, LEL, C.E.T.,
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Telephone: 705-560-5555
e-mail: asorensen@rvanderson.com

Susan Hamilton Beach, P. Eng.
Land Development and
Environmental Engineer
City of Sault Ste. Marie
Telephone: 705-759-5385
e-mail: s.hamiltonbeach@cityssm.on.ca

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www.cityssm.on.ca

63943964

Sault Star - Dec 5, 2009

City of Sault Ste. Marie
Stormwater Management
Master Plan

Public Information Centre

December 17, 2009

R.V. Anderson Associates Limited

GENIVAR

DISPLAY BOARDS

Have Something to Say?
Want to Know a Little More?

We welcome your input!

Please complete a comment sheet,
or phone, mail, fax, or email the
contacts provided on the handout.

Please submit comments by January 14, 2010 (four weeks)

R.V. Anderson Associates Limited

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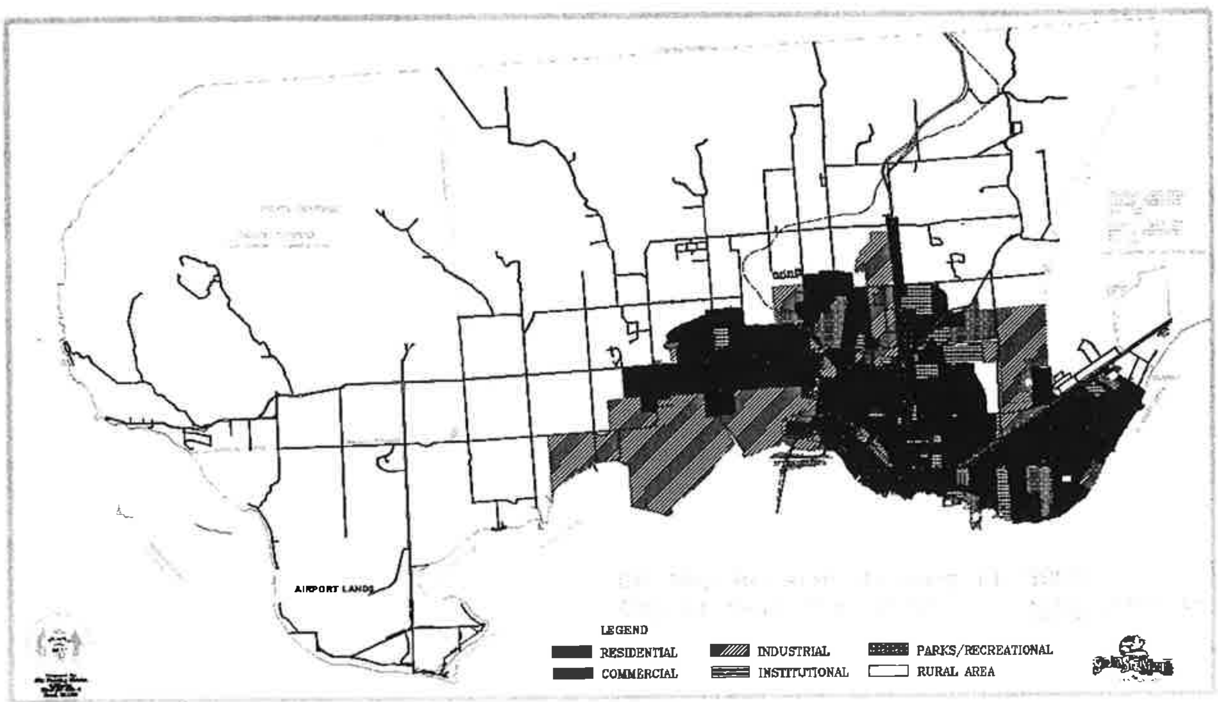
Background

- The St. Marys River is one of 42 Areas of Concern (AOC) as defined by the International Joint Commission. The St. Marys River Remedial Action Plan, aimed at delisting the River as an AOC, has made several recommendations related to storm-water. Sampling at stormwater outfalls along the St. Marys River has indicated that stormwater is a contributor of bacteria and other pollutants to the River.

- The City of Sault Ste. Marie is undertaking a City-wide Stormwater Management Master Plan to develop strategies for managing storm drainage infrastructure related to flooding and stormwater quality.

Study Limits



Land use is directly related to the amount and quality of storm-water discharged to the stormwater conveyance system.

St. Marys River
Area of Concern

The River was listed as an Area of Concern in 1985. Changes in chemical, physical, or biological integrity of this water body have been sufficient to cause beneficial use impairments:

- Restrictions on fish and wildlife consumption and unhealthy populations
- Fish tumours and other deformities
- Unhealthy populations of bottom-dwelling organisms
- Restrictions on dredging
- Undesirable algae due to excess nutrients in the water
- Beach closures
- Poor aesthetics
- Loss of fish and wildlife habitat

Remedial Action Plan

The Remedial Action Plan (RAP) Program was created in 1987 as part of the Great Lakes Water Quality Agreement between Canada and the United States as a way to guide restoration of Areas of Concern.

Stage 1 of the RAP (1992) outlines environmental conditions and beneficial use impairments.

Stage 2 of the RAP (2002) describes a strategy to remediate beneficial use impairments and defines criteria by which to measure improvement in the waterway. Actions related to stormwater are:

- Identification and remediation of disposal sites transferring contaminants into waterways
- Monitoring non-point sources of pollution
- Implementing Watershed Development Plans

Goal 2 of the 2007 Canada-Ontario Agreement is to, "Make significant progress towards Remedial Action Plan implementation" specifically reducing microbial and other contaminants and excessive nutrients from urban stormwater and continuing to identify and promote implementation of priority actions.

The Corporation of the City of

R.V. Anderson Associates Limited

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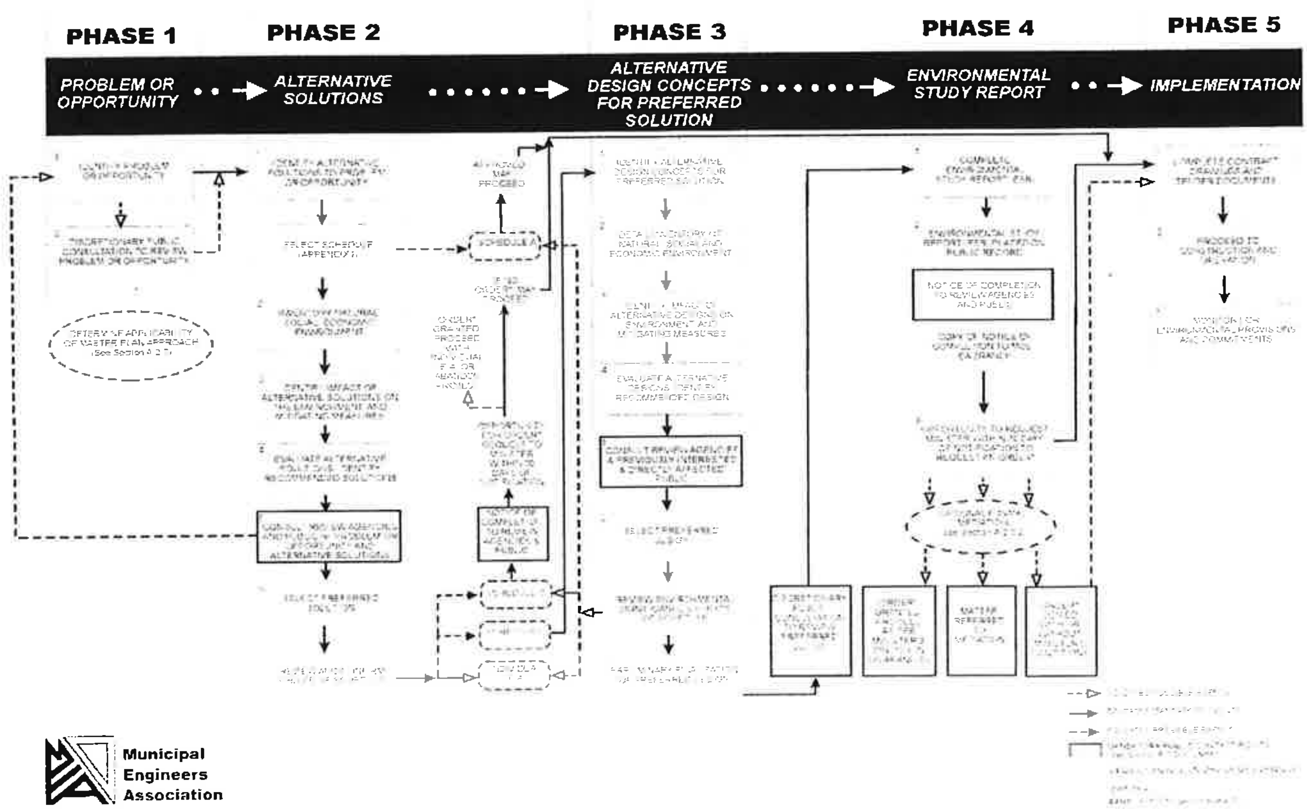
Municipal Class EA Process

Master Plans

- Integrate infrastructure requirements for existing and future land use with environmental assessment planning principles.
- Outline a framework for planning for subsequent projects and/or developments.
- Address Phase 1 and Phase 2 of the Municipal Class EA Process.

This Master Plan follows Approach #1 of the Master Planning Process where it becomes the basis for future investigations for specific Schedule B and C projects.

Municipal Class Environmental Assessment Process



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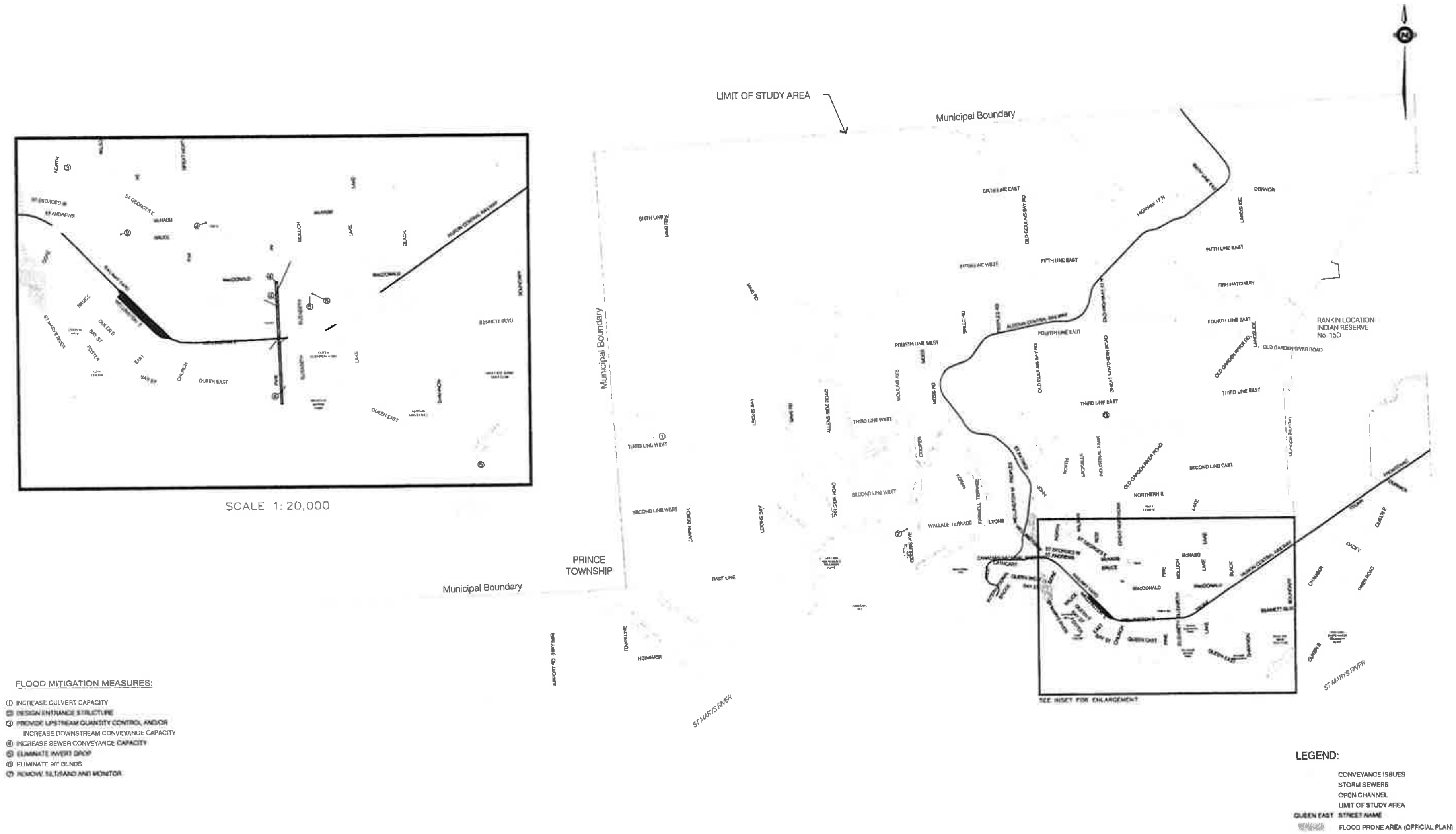

FIGURE 1

EXISTING STORM WATER CONVEYANCE ISSUES, FLOOD AREAS AND DRAFT MITIGATION SOLUTIONS

PRELIMINARY

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Total Suspended Solids (mg/L)

Agency	Location	June 4, 2008	June 11, 2008	June 18, 2008	June 25, 2008	July 2, 2008	July 9, 2008	July 16, 2008	July 23, 2008
Ministry of the Environment	Davignon Creek	3.5	3.6	3.3	5.9	7.6	11.1	3.3	7.3
Ministry of the Environment	Queen	-	4.7	2.3	2.1	36.7	12.1	1.2	2.4
Ministry of the Environment	Fort Creek	-	4.7	5	2.2	43.9	14.8	3.2	22.1
Ministry of the Environment	Dennis	-	1.8	1.6	1.9	1.9	1.9	1.5	2.6
Ministry of the Environment	St. Marys River	-	3.2	2.5	2.4	62.9	13.9	1.9	3
Ministry of the Environment	Pine	-	2.1	0.9	1.9	15.3	4.1	2.4	4.5
Ministry of the Environment	Churchill	-	2.1	1.6	2.2	20.8	4.6	1.2	9
Ministry of the Environment	Millwood	-	5.3	3.6	11.8	9.9	4.4	3	1.9
Ministry of the Environment	Dacey	-	2	2	14.3	28.1	5	5.9	6.6

Total Phosphorus (mg/L)

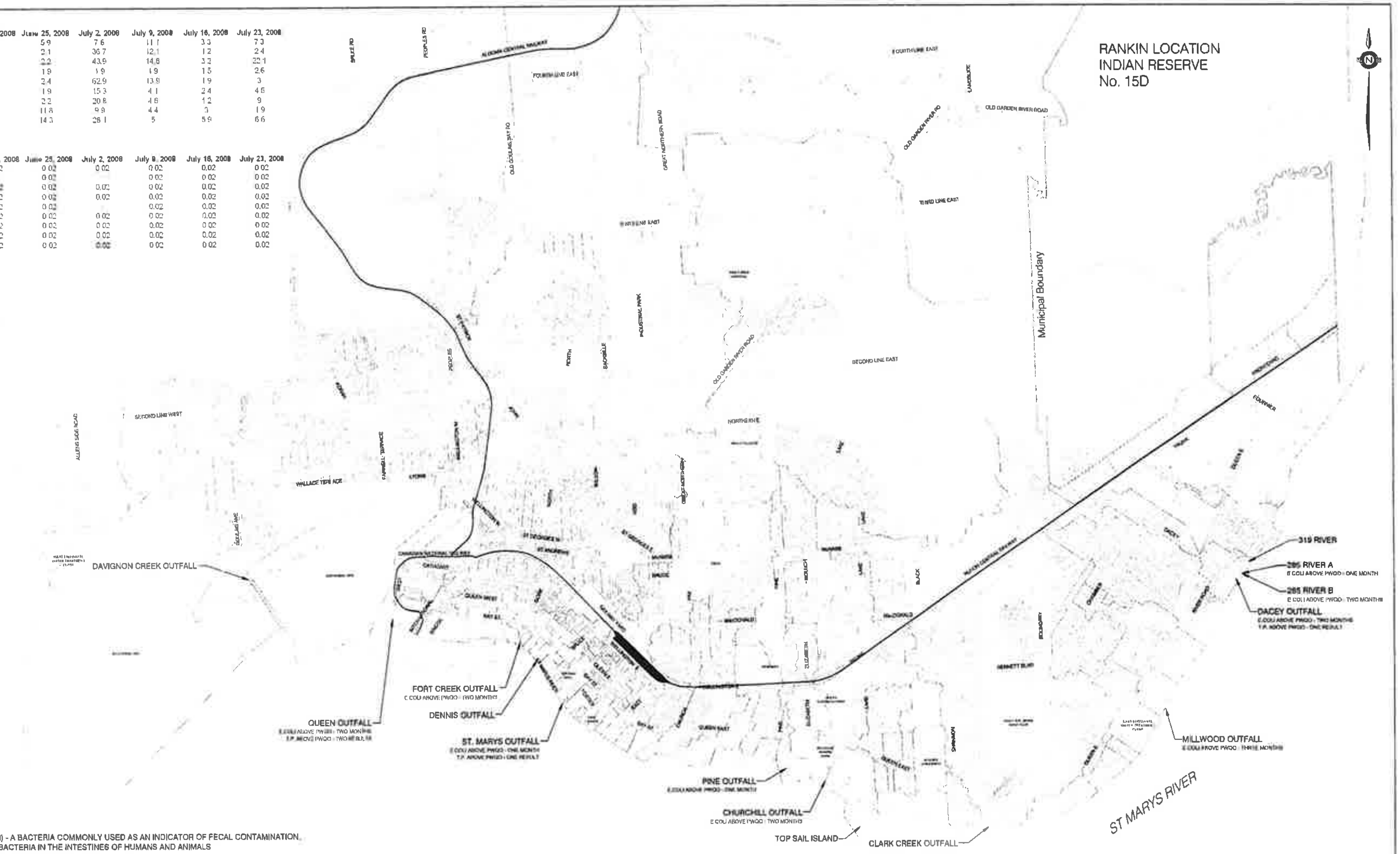
Agency	Location	June 4, 2008	June 11, 2008	June 18, 2008	June 25, 2008	July 2, 2008	July 9, 2008	July 16, 2008	July 23, 2008
Ministry of the Environment	Davignon Creek	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Queen	0.02	0.02		0.02		0.02	0.02	0.02
Ministry of the Environment	Fort Creek	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Dennis	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	St. Marys River	0.02	0.02	0.02	0.02		0.02	0.02	0.02
Ministry of the Environment	Pine	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Churchill	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Millwood	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Dacey		0.02	0.02	0.02	0.02	0.02	0.02	0.02

Notes:
PWQO 0.030 mg/L

E. Coli (CFU/100mL)
(geometric mean of five samples per month)

Agency	Location	June	July	August
Ministry of the Environment	Davignon Creek	83	78	62
Ministry of the Environment	Queen			56
Ministry of the Environment	Fort Creek			69
Ministry of the Environment	Dennis	24	26	15
Ministry of the Environment	St. Marys River	34		32
Ministry of the Environment	Pine	50		31
Ministry of the Environment	Churchill			34
Algoma Public Health	Top Sail Island	73	33	13
Ministry of the Environment	Millwood			
Algoma Public Health	285 River A	19		-
Algoma Public Health	285 River B			-
Ministry of the Environment	Dacey			31
Algoma Public Health	319 River	45	29	13

Notes:
PWQO 100 E. coli per 100 mL
Values > 1000 assumed to be 1000
Values < 10 assumed to be 10



DEFINITIONS

ESCHERICHIA COLI (E.COLI) - A BACTERIA COMMONLY USED AS AN INDICATOR OF FECAL CONTAMINATION, NORMALLY HARMLESS BACTERIA IN THE INTESTINES OF HUMANS AND ANIMALS

TOTAL PHOSPHORUS (TP) - A MEASURE OF ALL DISSOLVED AND PARTICULATE FORMS OF PHOSPHOROUS, IT IS THE NUTRIENT RESPONSIBLE FOR THE UNNATURAL ENHANCEMENT OF ALGAL PRODUCTIVITY

TOTAL SUSPENDED SOLIDS (TSS) - A WATER QUALITY MEASUREMENT OF SOLID MATERIAL SUSPENDED IN WATER AND RETAINED BY A FILTER, IT IS A POLLUTANT, MEASUREMENT BY DRY-WEIGHT OF PARTICLES TRAPPED BY A FILTER OF A SPECIFIED PORE SIZE

WATER QUALITY PARAMETERS

SOURCE: WATER MANAGEMENT - POLICIES, GUIDELINES, PROVINCIAL WATER QUALITY OBJECTIVES (PWQO) OF THE MINISTRY OF THE ENVIRONMENT (JULY 1994, REPRINTED FEBRUARY 1999)

ESCHERICHIA COLI (E.COLI): 100 E.COLI PER 100 mL (BASED ON A GEOMETRIC MEAN OF AT LEAST FIVE SAMPLES)
TOTAL PHOSPHORUS (T.P.): 0.03 mg/L (BASED ON ELIMINATING EXCESSIVE PLANT GROWTH IN RIVERS AND STREAMS)

SUMMARY OF 2008 WATER QUALITY MONITORING PROGRAM
NUMBER OF TEST RESULTS FOR EACH SAMPLING SITE

MOE
- 5 RESULTS PER MONTH FOR E. COLI (JUNE TO AUGUST)
- 8 RESULTS FOR TOTAL SUSPENDED SOLIDS (JUNE AND JULY)
- 9 RESULTS FOR TOTAL PHOSPHORUS (JUNE AND JULY)

ALGOMA PUBLIC HEALTH
- 3 RESULTS, SAMPLED ONCE PER WEEK FOR E.COLI (JUNE TO AUGUST)

FIGURE 2

2008 WATER QUALITY MONITORING RESULTS

PRELIMINARY
R.V. Anderson Associates Limited
GENIVAR

Problem Statement

In response to growing recognition of stormwater from approval agencies, source water protection initiatives and the RAP, the City has initiated a Municipal Class Environmental Assessment Master Plan to,

"Develop a stormwater Management Plan Strategy to address stormwater quality and quantity concerns within the City of Sault Ste. Marie from current and future developments."

The Purpose of this Study is to:

- Develop a long-term sustainable plan to assist the City with meeting and maintaining stormwater management goals and address quality objectives.
- Address stormwater related issues identified in the St. Marys River Remedial Action Plan to the extent possible.
- Identify stormwater capacity issues and recommend remedial works for the future.
- Develop a comprehensive monitoring program.

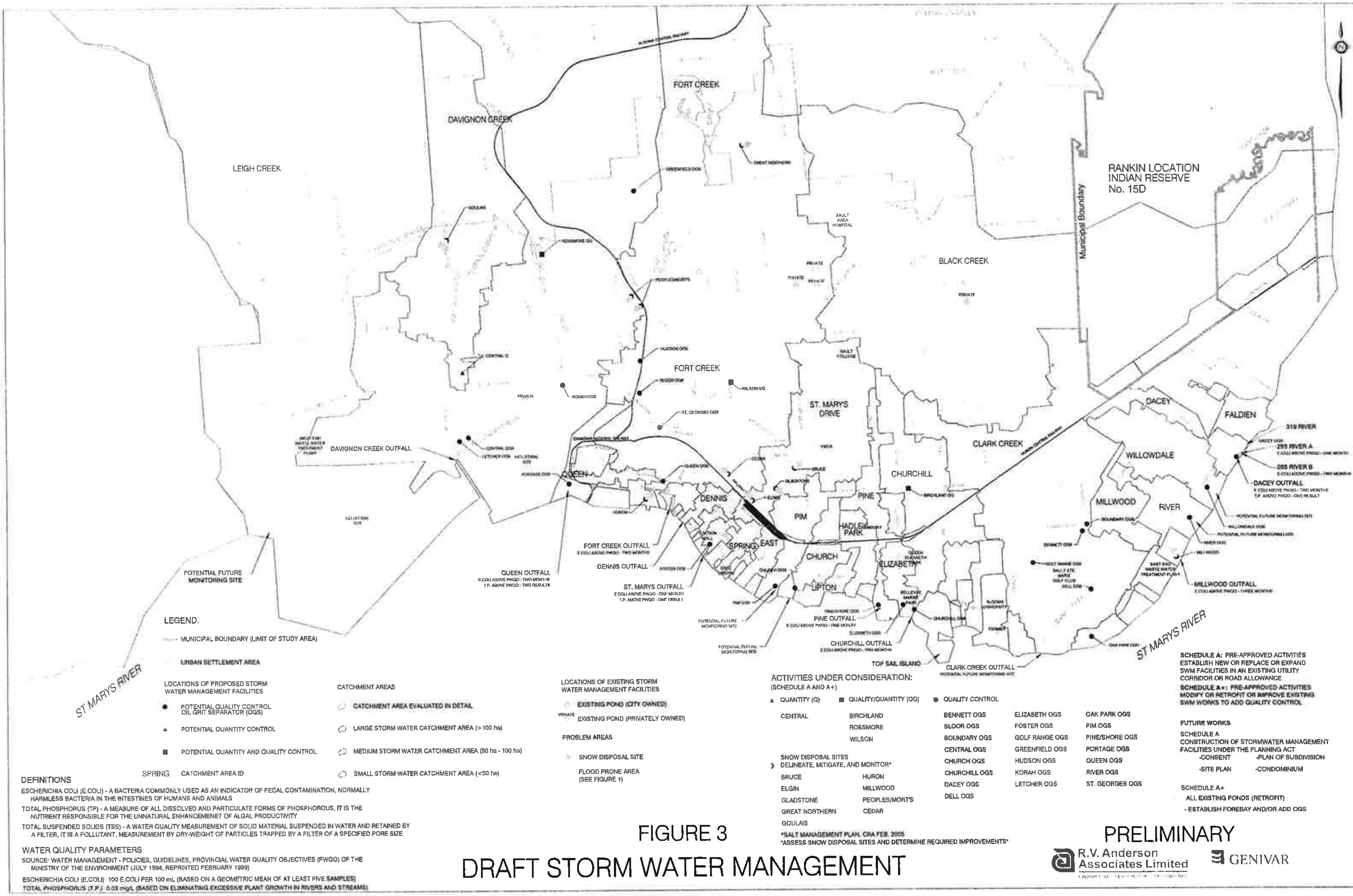


FIGURE 3

DRAFT STORM WATER MANAGEMENT

Stormwater Management Goals

- Establish a sustainable Level of Protection to:
    - Reduce environmental impact on aquatic habitat from end-of-pipe discharge
    - Be economically viable short and long-term

- Control of post-development stormwater peak flows to at or below pre-development levels in new development.

- Water Quality Monitoring Program

    - The goal of the monitoring program is to identify and track poor quality hot spots and confirm water quality improvements following remediation activities.
    - The monitoring program establishes a procedure for sampling site selection that optimizes information collected and minimizes cost.

Next Steps

- Receive public comments by January 14, 2010

- Incorporate public comments into preferred alternatives over Winter 2010

- Present Stormwater Investigative Study Report to the City and make available for public comment late Winter 2010

- City of Sault Ste. Marie approves Master Plan Spring 2010

Have Something to Say?
Want to Know a Little More?

We welcome your input!

Please complete a comment sheet,
or phone, mail, fax, or email the
contacts provided on the handout.

Please submit comments by January 14, 2010 (four weeks)

R.V. Anderson Associates Limited

BEST MANAGED COMPANIES

GENIVAR

R.V. Anderson
Associates Limited
engineering · environment · infrastructure

436 Westmount Avenue Unit 6
Sudbury Ontario P3A 5Z8 Canada
Tel 705 560 5555 Fax 705 560 5822
www.rvanderson.com

SAMPLE LETTER
PIC#1.

December 9, 2009

RVA 091800

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie, Ontario
P6A 5K7

Attention: Linda Whalen

Dear Ms Whalen:

Re: **City of Sault Ste. Marie**
Storm Water Management Investigative Study
Public Information Centre – December 17, 2009

The City of Sault Ste. Marie is undertaking a Municipal Class Environmental Assessment to develop a Storm Water Management Master Plan Strategy to address storm water quality and quantity concerns.

This study follows the requirements of the Municipal Class Environmental Assessment Master Plan Approach #1 and proposes to address Phase 1 and Phase 2 of the Municipal Class EA process. The Master Plan will form the basis for future detailed investigations that may be necessary to satisfy project specific requirements for Schedule B or C type projects identified under the Master Plan.

An integral part of the Master Planning process is public consultation. The City will be holding a Public Information Centre (PIC) to provide a forum for public input into the study. Stakeholders are invited to attend and provide comments.

The PIC has been arranged as follows:

Thursday, December 17th, 2009
3:00 pm to 7:00 pm
Russ Ramsay Room, Third Floor
Civic Centre

The PIC will present an overview of the watershed, identify quality and capacity issues, outline storm water management goals, and introduce mitigation alternatives with respect to storm water quality and quantity.

Should there be any questions or comments regarding this PIC, or if you cannot attend but would like to provide information, please do not hesitate to contact the undersigned.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Alex Sorensen, LEL, C.E.T.
Project Manager

Phone: (705) 560-5555, ext. 202
Email: asorensen@rvanderson.com

AES:act

Encls.

J:\2009\091800\PROJECT\correspondence\pic-letters\091800-20091209-l-act-pic-letter-stakeholders-ssmrca2.doc

ENCL. DEC. 9/09 LETTER

PUBIC INFORMATION CENTRE

SAULT STE. MARIE STORM WATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday December 17, 2009

COMMENT SHEET

Please Print

Name: ______________________________

Email: ______________________________

Address: ______________________________

Postal Code: ______________________________

Would you like to be added to a mailing list to receive future project information? Yes ☐ No ☐

Do you consent to having your comments included in the public record? Yes ☐ No ☐

Please indicate your interest in the study.

☐ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☐ Interest Group Representative

☐ Agency or Ministry Representative

Please specify: ______________________________

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

____

____

____

____

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Mary's River? If yes, please describe your observations.

____

____

____

____

Are there any particular issues you would like to bring to the attention of the project team?

____

____

____

____

Do you feel that this Storm Water Management Master Plan will address concerns that you have regarding storm water management in the City of Sault Ste. Marie?

____

____

____

____

Thank you very much for your participation in the Sault Ste. Marie Storm Water Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Monday, January 14, 2009 to one of the following:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Fax: (705) 541-7165
Email: s.hamitonbeach@cityssm.on.ca

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555, ext. 202
Fax: (705) 560-5822
Email: asorensen@rvanderson.com

EMCL DEC 9/09 LETTER 2 December 17, 2009

Public Information Centre

Sault Ste. Marie Storm Water Investigative Study
Master Plan

Background

- The City of Sault Ste. Marie is undertaken a City-wide comprehensive Storm Water Management Master Plan to develop strategies and plans for managing storm drainage infrastructure related to flooding and storm water quality.
- Storm water quantity has been managed in the past by installing dry ponds to match pre-development and post-development flows. Approval agencies are now requiring developers in the City to provide for quality control of storm water in new developments.
- The St. Mary's River is one of 42 Areas of Concern (AOC) as defined by the International Joint Commission. The St. Mary's River Remedial Action Plan, aimed at delisting the River as an AOC, has made several recommendations related to storm water. Sampling at storm water outfalls along the St. Mary's River has indicated that storm water is a contributor of bacteria and other pollutants to the River.

Study Purpose

- The purpose of this study is to evaluate the current drainage policies, guidelines, and existing infrastructure, to identify deficiencies and develop an implementation plan for capital improvements along with a sustainable policy and strategy applicable specifically to Sault Ste. Marie that will meet or exceed Ministry of the Environment standards.

Study Process

- This study follows the requirements of the Municipal Class Environmental Assessment Master Plan Process Approach #1, which addresses Phases 1 and 2 of the Municipal Class Environmental Assessment process as defined in the Municipal Engineers Association's *"Municipal Class Environmental Assessment,"* (October 2000, as amended 2007). The Master Plan will form the basis for future investigations for Schedule B or C projects.

Study Deliverables

Priority-based Capital Projects – Quantity and Quality Management of Storm Water
- Recommendations of projects to remediate identified system deficiencies

Design, Operation and Maintenance Standards
- A Storm Water and Drainage Standard in accordance with Ministry of the Environment guidelines, City operational needs and current climatic conditions

Study Deliverables – continued

Point Source Monitoring Plan

- A thorough plan to identify and track poor quality water entering the St. Mary's River with a mechanism in place to improve source drainage areas

How to Provide Comments:

The City of Sault Ste. Marie is looking for input from the community for the Storm Water Management Master Plan. Please take the time to fill out the comment sheet today or email, mail, or fax your comments or call the contacts listed below.

Comments are welcome until January 14, 2010 (four weeks)

Next Steps

- Receive public comments by January 14, 2010
- Incorporate public input into preferred alternatives over winter 2009/2010
- Present Storm Water Management Master Plan to the City and make available for public comment late winter 2010
- City of Sault Ste. Marie approves Master Plan Spring 2010

Contacts

You are encouraged to provide written comments and direct your input to either:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
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Phone: (705) 560-5555, ext. 202
Fax: (705) 560-5822
Email: asorensen@rvanderson.com

DEC 9/09 LETTER, QUESTIONNAIRE, TWO PAGE SYNOPSIS SENT TO:

Great Lakes Area of Concern Unit
Strategic Integration and Partnerships Division
867 Lakeshore Road
Burlington, Ontario
L7R 4A6
Attention: Sandra Kok

Great Lakes Areas of Concern Unit
Environment Canada
4905 Dufferin Street
Toronto, Ontario
M3H 5T4
Attention: Kate Taillon, MSc.

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Rod Stewart

Northern Ontario District
Ontario-Great Lakes Area Fisheries & Oceans
1219 Queen Street East
Sault Ste. Marie
P6A 2E5
Attention: Jennifer Hallett

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Rhonda Bateman

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Christine Ropeter

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Linda Whalen

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Anjim Amin

Sault Ste.Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Frank Tesolin

Algoma Public Health
99 Foster Drive
Sault Ste. Marie
P6A 5X6
Attention: Sherri Cleaves CPHI (C), BASc (EH)

Ministry of Natural Resources
64 Church Street
Sault Ste. Marie
P6A 3H3
Attention: Janice Christian

Lake Superior Advisory Committee
69 Broadview Drive
Sault Ste. Marie
P6C 5Z4
Attention: Don Marles

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Lilian Keen, Environmental Officer

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Kirk Crosson, Environmental Officer

Northern Ontario District
Ontario-Great Lakes Area Fisheries & Oceans
1219 Queen Street East
Sault Ste. Marie
P6A 2E5
Attention: Kelly Withers

City of Sault Ste. Marie
Stormwater Management Master Plan
Environmental Assessment

December 17, 2009

Sign-in Sheet:

Please sign your name and provide your contact information if you would like additional information or would like to be notified of further meetings.

	NAME (PLEASE PRINT)	PHONE No.	CONTACT INFORMATION
1	FRANK TESOLIN	705 971-0790	ftesolin@ssmrca.ca
2	Rick Talvitie	942-2612	
3	Rod Stewart	942 6384	
4	Kirk Fry	942 - 6338	
5	Kirk Crossman	942 6392	
6	Klaas Oswald	942-6618	
7	Sheri Cleaves	541-7347	scleaves@algomapublichealth.com
8	Rhonda Bateman	946-8530	rbateman@ssmrca.ca
9	ANJUM AMIN	946-8530	aamin@ssmrca.ca
10	BILL PLETSCH	759-2975	
11	Mike Ripley	(906)632-0072	mripley@sault.com
12	BILL JAKOMAIT	7593223	
13	SUSAN HAMILTON BEACH	946-1896	s.hamiltonbeach@cityssm.on.ca
14	Andre Riopel	942-3119	ariopel@shaw.ca
15	Jason Bertrim	256-6397	Jason.bertrim@ssmradio.rogers.com

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50 BEST MANAGED COMPANIES

GENIVAR

Collection and disclosure of personal information:
Please note that the City of Sault Ste. Marie and R.V. Anderson Associates Limited, are required under the Municipal Class Environmental Assessment Planning Process to attach a list of public contacted, as well as submissions, input and opinions received from the public, to the Environmental Assessment for the Stormwater Management Master Plan. The information on this form (including personal information) will become part of the public record, unless you expressly request the removal of your personal identity information.

City of Sault Ste. Marie
Stormwater Management Master Plan
Environmental Assessment

December 17, 2009

Sign-in Sheet:

Please sign your name and provide your contact information if you would like additional information or would like to be notified of further meetings.

	NAME (PLEASE PRINT)	PHONE No.	CONTACT INFORMATION
1	Bonnie & Jim Hurley	946-3067	
2			
3			
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13			
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PUBLIC INFORMATION CENTRE

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday December 17, 2009

COMMENT SHEET

Please Print

Name: André Riopel

Email: ariopel@shaw.ca.

Address: 200 Case

Postal Code: P6A 6J8

Would you like to be added to a mailing list to receive future project information? Yes ☒ No ☐

Do you consent to having your comments included in the public record? Yes ☒ No ☐

Please indicate your interest in the study.

☒ City of Sault Ste. Marie Resident or Landowner

OR

☒ Developer Representative

☒ Interest Group Representative ?

☐ Agency or Ministry Representative

Please specify: ______________________

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

____

____

____

____

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Marys River? If yes, please describe your observations.

you can't swim at Bellevue park or anywhere in St Mary's River Friend was in water cut foot on glass and developed severe infection

Are there any particular issues you would like to bring to the attention of the project team?

Address cause: too much pavement need to put real value of road use & parking on user there is no such thing as free parking

Do you feel that this Stormwater Management Master Plan will address concerns that you have regarding stormwater management in the City of Sault Ste. Marie?

Not unless parking lot bylaws changed to reduce parking lot sizes and create environment that encourage green transportation.

Thank you very much for your participation in the Sault Ste. Marie Stormwater Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Thursday, January 14, 2009 to one of the following:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
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MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday December 17, 2009

COMMENT SHEET

Please Print

Name: Klaas OSWALD

Email: khm.oswald@sympatico.ca

Address: 111 MILLCREEK DR, SSM

Postal Code: P6B 6H7

Would you like to be added to a mailing list to receive future project information? Yes ☑ No ☐

Do you consent to having your comments included in the public record? Yes ☑ No ☐

Please indicate your interest in the study.

☑ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☐ Interest Group Representative

☐ Agency or Ministry Representative

Please specify: __________

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

NO

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Marys River? If yes, please describe your observations.

AND OTHER STREAMS
YES. SILTATION IN CARP RIVER, RESULT OF AGRICULTARIAL & RESIDENTIAL PRACTICES, SOME OF THEM OUTSIDE THE CITY LIMITS. CITY SHOULD INCLUDE PRINCE TWP AND PART OF SOO NORTH IN WATER CATCHMENT AREA.

Are there any particular issues you would like to bring to the attention of the project team?

~~A~~ THIS STUDY SHOULD INCLUDE FISHERIES HABITAT SURVEY (where, is it degraded, etc) ~~AND~~. IF THE HARD-TO-MAINTAIN BENNET + E. DAVIGNON ARE TO BE REBUILT OR REMEDIATED, THEN FISH HABITAT SHOULD BE ADDRESSED.

Do you feel that this Stormwater Management Master Plan will address concerns that you have regarding stormwater management in the City of Sault Ste. Marie?

NOT ALL STORMWATER CHANNELS WERE MARKED ON THE MAPS. E.G. MILLCREEK-STRAHCLAIR RUNOFF ~~IS~~ A PERMANENT STREAM, WITH FISH, RUNNING EAST ALONG THE SECOND LINE EXTENSION. FISH HABITAT SHOULD ALSO ADDRESS WATER COMING FROM PRINCE TWP AND UNORGANIZED AREA.

Thank you very much for your participation in the Sault Ste. Marie Stormwater Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Thursday, January 14, 2009 to one of the following:

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SAULT STE. MARIE STORM WATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday December 17, 2009

COMMENT SHEET

Please Print

Name: Mike Ripley

Email: mripley@sault.com

Address: 76 Cottage Lane, SsMarie, ON

Postal Code: P6A 5K6

Would you like to be added to a mailing list to receive future project information? Yes ☒ No ☐

Do you consent to having your comments included in the public record? Yes ☒ No ☐

Please indicate your interest in the study.

☒ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☒ Interest Group Representative

☐ Agency or Ministry Representative

Please specify: St. Marys River BPAC

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

No

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Mary's River? If yes, please describe your observations.

Yes - See attached photos and documentation. The remedial action plan (RAP) process and studies by MNR and DFO in the 1980s identified serious degradation of water quality in the lower portions of Bennett, Davignon, Fort Creek and Little Carp Creek due, in large part, to non-point source and stormwater runoff

Are there any particular issues you would like to bring to the attention of the project team?

The Stage 2 RAP for the St. Marys Area of Concern contains recommendations to improve fish habitat in the urban tributaries. Current maintenance practices in the flood channels is destroying resurgent fish habitat.

Do you feel that this Storm Water Management Master Plan will address concerns that you have regarding storm water management in the City of Sault Ste. Marie?

BPAC would be interested to see the proposals. Improvements of water quality would be welcome but the SWMMP will probably do little to improve the physical fish habitat therefore the RAP recommendations for Watershed Management Plans will need to be developed.

Thank you very much for your participation in the Sault Ste. Marie Storm Water Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Monday, January 14, 2009 to one of the following:

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Land Development and Environmental Engineer
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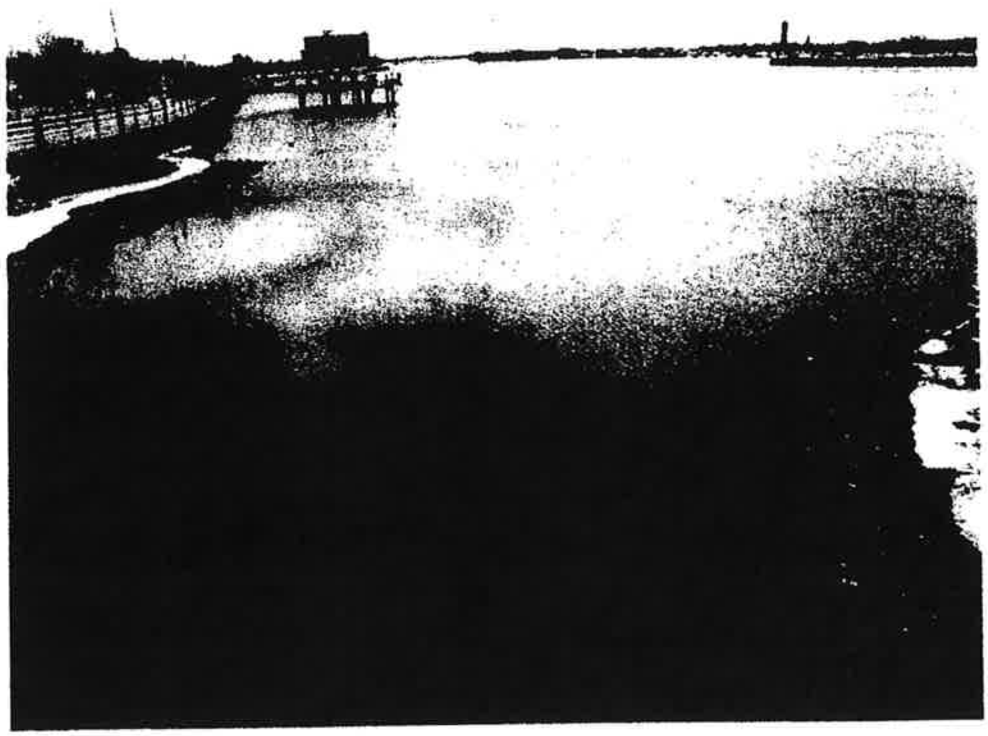
Email: asorensen@rvanderson.com

Supplemental Information

For the City of Sault Ste. Marie, ON
Public Information Centre
Storm Water Management Master Plan Strategy

Provided by the St. Marys River Binational Public Advisory Council (BPAC)



17 December 2009

(Photos by Mike Ripley, BPAC)

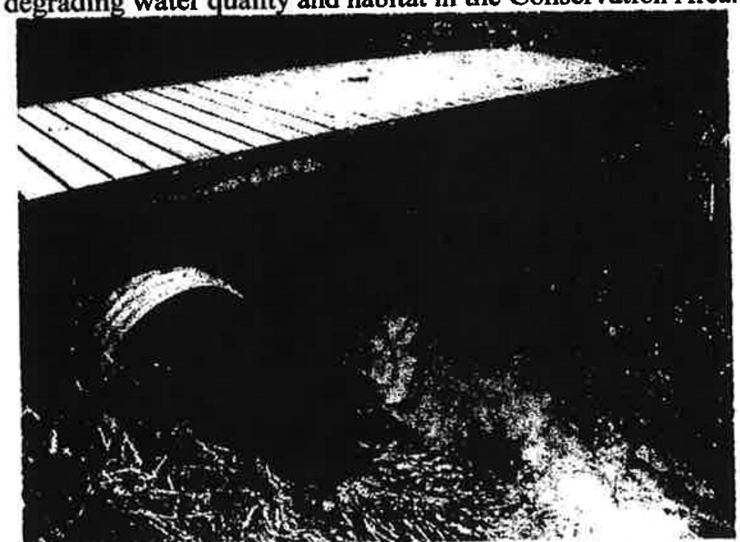
The headwaters of West Davignon Creek are undisturbed wetlands and marshes on the Canadian Shield less than 4 Km upstream from the St. Marys River.

One of the waterfalls on the West Davignon Creek.

Bennet Creek is reduced to a mostly stagnant and nearly lifeless ditch before it reaches the St. Marys River.

West Davignon Creek flows into the Essar Algoma Steel Plant before it enters the St. Marys River. Previous studies have found contamination and poor water quality in both creeks that outflow from the steel plant.

The Fort Creek reservoir is filling in with sediments from erosion upstream seriously degrading water quality and habitat in the Conservation Area.



A stream crossing in the Fort Creek Conservation Area clearly showing inputs of sediment.

Water quality in the Fort Creek is visibly degraded as it flows into the St. Marys River.

A storm sewer outfall in the St. Marys River probably originating from the snow staging site adjacent to the hydro plant.

ST. MARY'S RIVER

REMEDIAL ACTION PLAN

The St. Marys River Area of Concern

Remedial Strategies for Ecosystem Restoration

STAGE 2 REPORT

Environment Canada Environnement Canada

United States Environmental Protection Agency

Ontario Ministry of the Environment

DEQ

E. Recommendations to Eliminate Remaining Beneficial Use Impairments

Restoring beneficial uses to the St. Marys River AOC requires a cooperative effort by government, industry, and the public, aimed at reduction or cessation of impacts on the ecosystem and rehabilitation of historically degraded sites. The following table summarizes the main recommended actions for the restoration and protection of the St. Marys River. Note that the remediation and monitoring actions are grouped separately and in each case are listed in the same order in which they appear in the report. General reporting and education actions and management actions are listed at the end of the table.

Table E.2 - Summary of Recommended Actions for the St. Marys River AOC

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses* and for the Associated Monitoring Activities
Restrictions on Fish and Wildlife Consumption	——— **Remediation Actions** ——— • **Action PS-1:** Virtually eliminate all persistent and bioaccumulative contaminants from industrial and municipal discharge. ——— **Monitoring Actions** ——— • **Action NPSM-2:** Aerial Monitoring of the Cannelton Industries Site • **Action NPSM-3:** Biological Monitoring at the Cannelton Industries site to ensure protection of the ecological food chain • **Action FFM-3:** Fish Harvest Survey • **Action FFM-4:** Continue with sport fish contaminant monitoring programs in the St. Marys River and tributaries.
Degradation of Fish and Wildlife Populations	——— **Remediation Actions** ——— • **Action PS-1:** Virtually eliminate all persistent and bioaccumulative contaminants from industrial and municipal discharge. • **Action NPS-1:** Develop a multi-agency sediment management program for the river to address remedial options and implement actions for contaminated sediments, including long-term sediment contamination studies. For details on this high priority action see section 5.3 of the Stage 2 Report. • **Action NPS-4:** Identification and Control of Contaminant Inputs from the Algoma Slag Dump (including stabilization of shoreline and nearshore sediments) • **Action NPS-7:** Remediation for Contaminated Terrestrial and Aquatic Disposal Sites • **Action FF-7:** Continue with St. Marys River Fishery Task Group efforts to develop a 10 year assessment program for the river. • **Action FF-8:** Continue to support sea lamprey control efforts. ——— **Monitoring Actions** ——— • **Action PSM-6:** Monitor the receiving water every three years at St. Marys Paper Ltd. to document response of fish communities to improved effluent quality as mill

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses** and for the Associated Monitoring Activities
Degradation of Fish and Wildlife Populations (Continued)	upgrades and process improvements are implemented. • **Action PSM-8:** Monitor the Short Term Variability and Monthly Ranges of Contaminant Discharges from Water Pollution Control Plants in the AOC • **Action NPSM-2:** Aerial Monitoring of the Cannelton Industries Site • **Action NPSM-3:** Biological Monitoring at the Cannelton Industries site to ensure protection of the ecological food chain • **Action NPSM-9:** Identify Terrestrial and Aquatic Disposal Sites Transferring Contaminants into Waterways • **Action NPSM-11:** Assess the Potential Hazards Associated With Spills from Shipping Vessels • **Action FFM-5:** Complete a Canadian Wildlife Survey assessment of common tern and black tern populations for the entire St. Marys River. • **Action FFM-6:** Analyze contaminant levels in eggs from herring gull, black tern, and common tern nests in the AOC. • **Action FFM-7:** A monitoring program should be developed to assess change in fish and wildlife populations in the AOC in response to habitat enhancement efforts.
Fish Tumours and Other Deformities	**——— Remediation Actions ———** • **Action PS-1:** Virtually eliminate all persistent and bioaccumulative contaminants from industrial and municipal discharge. • **Action PS-7:** Continue with process improvements at industrial and municipal facilities. • **Action NPS-1:** Development of a Multi-Agency Sediment Management Program • **Action NPS-4:** Identification and Control of Contaminant Inputs from the Algoma Slag Dump (including stabilization of shoreline and nearshore sediments) **——— Monitoring Actions ———** • **Action NPSM-9:** Identify Terrestrial and Aquatic Disposal Sites Transferring Contaminants into Waterways • **Action FFM-1:** Identify the Causes of Fish Tumours and Other Deformities Which Originate Within the AOC
Bird and Animal Deformities or Reproductive Problems	**——— Monitoring Actions ———** • **Action FFM-8:** Reproductive assessments of herring gulls, black terns, and common terns should be done within the AOC boundary. Deformities should be assessed in common terns in the St. Marys River.
Degradation of Benthos	**——— Remediation Actions ———** • **Action NPS-1**: Develop a multi-agency sediment management program for the river to address remedial options and implement actions for contaminated sediments, including long-term sediment contamination studies. For details on this high priority action see section 5.3 of the Stage 2 Report. • **Action NPS-2**: Conduct further studies to characterize sediment quality in high priority areas (ie., adjacent to Algoma Slag Dump, portion of Little Lake George Channel downstream of East End WPCP, and the Algoma Slip). • **Action NPS-3**: Complete sediment chemistry analysis and benthic community assessment as part of the *St. Marys River Contaminated Sediment Zones Evaluation* (Kauss 1999b)

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses* and for the Associated Monitoring Activities
Degradation of Benthos (Continued)	• **Action NPS-5**: Algoma Steel Inc. has removed sediments from the slip during maintenance dredging operations. Therefore, further sediment quality and benthic community assessments should be made to determine the effectiveness of contaminant removal and to determine the need for further dredging. **——— Monitoring Actions ———** • **Action PSM-1:** Long-Term Water Monitoring at the Cannelton Industries Site • **Action PSM-6:** Monitor the receiving water every three years at St. Marys Paper Ltd. to document response of benthic communities to improved effluent quality as mill upgrades and process improvements are implemented. • **Action NPSM-1**: Monitor effluent from East End Water Pollution Control Plant for concentrations and loadings of persistent contaminants exceeding guidelines in Lake George Channel sediments. • **Action NPSM-3:** Biological Monitoring at the Cannelton Industries site to ensure protection of the ecological food chain • **Action NPSM-5**: Re-sample river sediments every five years to obtain trend with time information. • **Action NPSM-6**: Periodically conduct benthic, toxicity, and sediment chemistry studies in the Bellevue Marine Park area.
Restrictions on Dredging Activities	**——— Remediation Actions ———** • **Action NPS-1**: Develop a multi-agency sediment management program for the river to address immediate dredging needs. For details on this high priority action see section 5.3 of the Stage 2 Report. • **Action NPS-5:** Evaluate sediment quality and quantity in the Algoma Slip to determine need for further dredging. **——— Monitoring Actions ———** • **Action NPSM-3:** Biological Monitoring at the Cannelton Industries site to ensure protection of the ecological food chain
Eutrophication or Undesirable Algae	**——— Remediation Actions ———** • **Action PS-3:** Upgrade East End Water Pollution Control Plant to secondary treatment. • **Action NPS-6**: Control non point source pollution from agricultural activities. **——— Monitoring Actions ———** • **Action NPSM-8:** Monitor Non-Point Sources of Pollution in the AOC

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses and for the Associated Monitoring Activities
Ambient Water Quality	**—— Remediation Actions ——** · **Action PS-1:** Virtually eliminate all persistent and bioaccumulative contaminants from industrial and municipal discharge. · **Action PS-2:** Reduce storm water infiltration to prevent sewage bypasses. · **Action PS-3:** Upgrade East End Water Pollution Control Plant to secondary treatment. · **Action PS-5:** Address contaminants in storm water discharge system by source control, air quality control, and pollution prevention education programs. · **Action PS-6:** Continue with Clean Water Regulation (Canada) and National Pollutant Discharge Elimination System (US) Programs for industrial dischargers. · **Action PS-7:** Continue with process improvements at industrial and municipal facilities. · **Action PS-8:** Continued work on CSOs in Sault Ste. Marie Mich. · **Action NPS-1:** Development of a Multi-Agency Sediment Management Program · **Action NPS-7:** Remediation for Contaminated Terrestrial and Aquatic Disposal Sites · **Action NPS-8:** Plan and Implement Appropriate Remediation, Protection, and Enforcement Actions to Remove Any Potential Public Health Risks Identified by Action NPSM-10 **—— Monitoring Actions ——** · **Action PSM-1:** Long-Term Water Monitoring at the Cannelton Industries Site · **Action PSM-3:** Ambient Water Monitoring in the St. Marys River · **Action PSM-7:** Design and implement monitoring system for storm water. · **Action NPSM-9:** Identify Terrestrial and Aquatic Disposal Sites Transferring Contaminants into Waterways · **Action NPSM-10:** Assess Health Risks to Communities and Individuals Taking Their Water From the "Down-River" Regions of the St. Marys River System · **Action NPSM-11:** Assess the Potential Hazards Associated With Spills from Shipping Vessels
Beach Closings	**—— Remediation Actions ——** · **Action PS-2:** Reduce storm water infiltration to prevent sewage bypasses. · **Action PS-3:** Upgrade East End Water Pollution Control Plant to secondary treatment. **—— Monitoring Actions ——** · **Action NPSM-7:** Assess potential human health risks resulting from floating contaminated masses near, and downstream from, Bellevue Marine Park.

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses* and for the Associated Monitoring Activities
Degradation of Aesthetics	**——— Remediation Actions ———** · **Action PS-4:** Relocate discharge pipe from East End Water Pollution Control Plant to deeper, faster moving water in the Lake George Channel in order to improve dispersion of discharge plume. · **Action PS-9:** Algoma Steel to Limit Discharges from its Dekish Operation · **Action FF-9**: The Algoma Slag Dump shoreline is an eyesore. Shoreline stabilization and providing habitat for plant growth (eg., via soil addition) would help to soften and stabilize the landscape. **——— Monitoring Actions ———** · **Action PSM-2:** The Sault Ste. Marie, Michigan Air Quality Monitoring Project · **Action PSM-4:** The Sault Ste. Marie, Ontario Air Quality Monitoring Project · **Action PSM-5:** Monitoring of Particulate Emissions at Algoma's Dekish Operation
Loss of Fish and Wildlife Habitat	**——— Remediation Actions ———** **Action NPS-6**: Control non point source pollution from agricultural activities and road crossings on tributaries. **Action NPS-7:** Remediation for Contaminated Terrestrial and Aquatic Disposal Sites **Action FF-1:** *Walleye recovery in the Bar River:* · Mitigate the effects of land use practices upstream of historic walleye spawning grounds. · Use stabilizing structures, contour streambanks, plant trees along the shoreline, and provide exclusionary fencing to restrict livestock access to river. **Action FF-2:** *Watershed Development Plan for Bennett and West Davignon Creeks (See Table 6.1)* **(a)** Maintain headwater reaches in natural state **(b)** Restrict development within 30m of shoreline **(c)** Plant trees in riparian zone **(d)** Restrict livestock access to stream **(e)** Assist passage of migratory salmonids by enhancing migratory pathways while excluding sea lamprey passage (see **(n)**) **(f)** Create spawning and nursery habitat **(g)** Naturalize Diversion Channel **(h)** Prevent seepage of petroleum products into aquifer to protect groundwater quality **(i)** Design and implement soil remediation projects for inactive parcels of land on Algoma Steel property **(j)** Algoma to work with OMOE in addressing specific contamination issues **(k)** Increase habitat quality and migration pathways in Diversion Channel with instream modifications. **(l)** Optimize volume of flow between Diversion Channel and Bennett and West Davignon Creeks **(m)** Maintain migratory pathways **(n)** Exclude passage of sea lamprey **(o)** Adhering to buffer strip guidelines and continued restrictions on development

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses* and for the Associated Monitoring Activities
Loss of Fish and Wildlife Habitat (continued)	**(p)** Provide alternative water sources for livestock **(q)** Streambank stabilization **(r)** Construct retention ponds or man-made wetlands to reduce effects of storm water discharge **(s)** Continued wetland development to improve salmonid staging habitat and provide for waterfowl and other wildlife **(t)** Maintenance of riparian buffer zone contiguous with a forested area no less than 1000 ha **(u)** Reforestation of inactive agricultural lands **(v)** Tree planting along top of Diversion Channel **(w)** Enhance wetland forming off mouth of Diversion Channel **Action FF-3:** *Watershed Development Plan for East Davignon and Fort Creeks etc.:* A watershed plan similar to Action FF-2 should be developed for East Davignon and Fort Creeks, *Root River, Crystal Creek, and the Big and Little Carp Rivers.* **Action FF-4:** *Munuscong River/Bay: Sedimentation Reduction* Several key non point source pollution control projects to reduce sedimentation in the river and in Munuscong Bay (e.g., stabilization of eroding streambanks at Stirlingville Bridge site and at Pickford). **Action FF-5:** *Mission Creek:* Complete hydrogeological and waste characterization study to be completed, including a feasibility study for the removal of waste and restoration of the natural flow of the creek. **Action FF-6:** *Rapids Habitat:* (A number of options have been presented for the remediation of rapids habitat and associated wetlands.) **(a)** Protect remnant rapids habitat from further reduction and degradation and maximize the productive capacity of the rapids area **(b)** Enhance remnant rapids habitat by placing additional spawning substrate in rapids area - map existing substrate, identify target fish species assemblages, and note areas likely to become dewatered under differing flow conditions **(c)** Create new rapids areas elsewhere in the St. Marys River, especially in the Little Rapids area - identify areas with the hydrologic and physical characteristics to support rapids generation **(d)** Create alternative to rapids habitat such as artificial spawning substrate **(e)** Create wetlands downstream of Whitefish Island to connect wetland habitat to adjacent remnant rapids **(f)** Create new wetland/rapids complexes **(g)** Enhance habitat and water quality in tributary watersheds **Action FF-7:** *Fisheries Assessment:* **(a)** Mortality rates for walleye, northern pike, and yellow perch require further assessment. **(b)** Continue with St. Marys River Fishery Task Group efforts to develop a 10 year assessment program for the river. **Action FF-8:** Continued Support for Sea Lamprey Control Efforts **Action FF-9:** Stabilize shoreline of Algoma slag dump to provide habitat for plants

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses* and for the Associated Monitoring Activities
Loss of Fish and Wildlife Habitat (continued)	——— **Monitoring Actions** ——— **Action PSM-1:** Long-Term Water Monitoring at the Cannelton Industries Site **Action NPSM-3:** Biological Monitoring at the Cannelton Industries site to ensure protection of the ecological food chain **Action NPSM-9:** Identify Terrestrial and Aquatic Disposal Sites Transferring Contaminants into Waterways **Action NPSM-11:** Assess the Potential Hazards Associated With Spills from Shipping Vessels **Action FFM-2:** Continued support for the Marsh Monitoring Program **Action FFM-7:** A monitoring program should be developed to assess change in fish and wildlife use of the AOC in response to habitat enhancement efforts. **Action FFM-9:** Evaluate Influence of Water Levels and Flows on Spawning and Production **Action FFM-10:** Determine Minimum Water Levels and Flow Rates Necessary for Spawning **Action FFM-11:** Monitoring Water Quantity
General Actions Relating to Reporting, Education, Human Health, and Management	
General Reporting and Education Actions	**Action RE-1:** Revitalizing Public Understanding and Involvement in Remediation Activities **Action RE-2:** Communication of Any Identified Health Risks Resulting from Adverse Effects to First Nations/Native American Water Supplies or Lands **Action RE-3:** Identify, Track, and Publicize Implementation Activities Within the AOC **Action RE-4:** Raise Public Awareness of Environmental Health Concerns **Action RE-5:** Quantify the Economic Benefits of a Healthy Natural Ecosystem
Actions Relating to Human Health	**Action NPSM-10:** Assess Health Risks to Communities and Individuals Taking Their Water From the "Down-River" Regions of the St. Marys River System **Action NPSM-12:** Identify Locations Within the AOC Which are Associated With Elevated Levels of Human Health Disorders
General Management Actions	**Management Action MNG-1:** It is recommended that a workshop session, or series of sessions be convened which will produce a set of precise, objectively defined delisting criteria that are numerically quantified wherever possible, and which will provide the necessary decision framework that will govern the delisting of each impaired beneficial use and ultimately the delisting of the AOC itself.

Beneficial Use Impairment	Recommendations for the Restoration of Beneficial Uses* and for the Associated Monitoring Activities
General Management Actions (continued)	**Management Action MNG-2:** It should also be noted that monitoring activities which track progress toward delisting must, in large measure, be determined by those very same criteria which define the delisting process itself. Consequently, modifications or additions to the delisting criteria, such as those which are recommended under management action MNG-1 will likely require corresponding changes to the monitoring activities. It is recommended, therefore, that a workshop session, or series of sessions also be convened to establish the necessary coordination between the overall monitoring strategy and the revised delisting criteria resulting from Action MNG-1.

* The recommended actions are labeled as follows:

Action PS-n denotes the n-th point source (PS) recommended action (see section 4.3).
Action NPS-n denotes the n-th non-point source (NPS) recommended action (see section 5.3)
Action FF-n denotes the n-th flora and fauna (FF) recommended action (see section 6.3).
Action RE-n denotes the n-th reporting and education action (see section 7.3).
Action MNG-n denotes the n-th management recommended action.

Monitoring recommendations for point sources, non-point sources, and flora and fauna are denoted by **Action PSM-n**, **Action NPSM-n**, and **Action FFM-n**, respectively (see sections 4.4, 5.4, and 6.4 respectively).

ST. MARYS RIVER

BINATIONAL PUBLIC ADVISORY COUNCIL

22 October, 2009

Ms. Linda Whalen
General Manager
Sault Ste. Marie Regional Conservation Authority
1100 Fifth Line East
Sault Ste. Marie, ON
P6A 5K7

Re: Progress on Watershed Plans for Bennett and West Davignon Creeks.

Dear Ms. Whalen:

On behalf of the Binational Public Advisory Council (BPAC) for the St. Marys River Remedial Action Plan (RAP), I am writing to enquire as to the status of the Watershed Development Plan for Bennett and West Davignon Creeks (Watershed Plan). The Watershed Plan was submitted to your office in 1998 and now forms a key part of the St. Marys River Stage 2 RAP for restoration of flora and fauna in the St. Marys River Area of Concern.

Urban tributaries on both sides of the St. Marys River are recognized as being impaired due to stormwater runoff pollution, altered stream channels and flow regimes, destruction of fish and wildlife habitat, elevated water temperatures, and barriers to fish passage. Recently, the State of Michigan approved a comprehensive watershed plan for Sault Ste. Marie, Michigan which includes many of the same concepts recommended in the Bennett and West Davignon Creeks Watershed Plan including naturalizing of altered stream channels, stormwater management practices, improvements to water quality and the creation or enhancement of fish and wildlife habitat.

Since the St. Marys River RAP commenced in 1988, we have seen many improvements to water quality in the river especially in industrial point source pollution however many challenges still remain. BPAC is encouraging those agencies that have jurisdiction over local resources to continue working to achieve the goals of the RAP including rehabilitation of the degraded urban tributaries.

BPAC understands that much work has been done by the Conservation Authority to address flooding concerns in the Sault's urban watersheds however, there are many examples across North America of municipalities taking actions to improve water quality and fish habitat in urban watersheds while also ensuring that flooding does not take place.

BPAC would like to work with the Conservation Authority, the City of Sault Ste. Marie, Ontario Ministry of Natural Resources and other partners to address the concerns of water quality and fish habitat in the urban tributaries to the St. Marys River and to ensure that the actions recommended in the Stage 2 RAP are completed. Please keep us informed as to any progress being planned in this area.

Sincerely,

Greg Zimmerman, Chair
Binational Public Advisory Council

Cc: Mayor John Rowswell, City of Sault Ste. Marie
Andre DuPont, Ontario Ministry of Natural Resources
Doug Geiling, Department of Fisheries and Oceans Canada

Sault Ste. Marie
Watershed Project

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
SEY 1	.35 sediment eroding from river bank/yr	Stabilize 3rd Ave. Gully w/geotextile & rip rap	$5/ft^2 vegetated chute	$1000	Gully stabilized 7/2007
SEY 2	.14 sediment eroding from Seymour Creek bank/yr' Maintain >4mg/L DO Maintain peak temperature<18°c	-Install riparian buffer	$400/acre vegetation	$1000	Buffer installed 6/2008
SEY 3	1.02 sediment reaching stream at site from eroding embankments and streambanks. Lower average downstream flow velocity 50%. Maintain >4mg/L DO Maintain peak temperature<18°c	Replace cement with geotextile reinforced, vegetated riprap to stabilize d/s & u/s embankments and absorb flow. Install riparian buffer at upstream bend	$60 yd^3 stabilization w/ rip rap, geotextile fabric $400/acre vegetation $1000 excavation of cement	$3500	Embankment protection installed 8/2007 Buffer installed 5/2007
SEY 4	.7 sediment from road/shoulder and embankment reaching creek during rain events/snow melt	-Install roadside turnouts -Stabilize u/s embankment w/ geotextile, vegetative reinforced rip rap	$60 yd^3 stabilization w/ rip rap, geotextile fabric 2-$500/turnouts	$2000	Complete turnouts and embankment stabilization 9/2007
SEY 8	.7 sediment reaching creek from eroding u/s embankment; Eliminate seasonal bankful flood level events above Sey 8 culvert top.	-Stabilize u/s embankment -Improve upstream inlet capacity	-$60 yd^3 stabilization w/ rip rap, geotextile fabric -$50/ft culvert extend	$1000	Begin embankment stabilization and culvert improvement 7/2008 Complete construction 8/2008
ASH 1	>10 tons of cement riprap littering road/stream crossing embankments	-Protect Shoreline w/ Conservation Easement -Promote low impact recreation park Replace cement rip rap with smaller, geotextile and vegetation reinforced riprap	>$100,000/park development $60 yd^3 stabilization w/ rip rap, geotextile fabric	$110,000	Complete rip rap work 2007 Pursue park funding 2008
ASH 2	100' of natural streambank habitat has been destroyed to stabilize railroad crossing. Decrease average downstream discharge rates by 50%.	-Install natural stream bank structure/habitat to stabilize flow energy caused by cemented banks	$60 yd^3 stabilization w/ rip rap, geotextile fabric $25/foot installation of natural habitat	$10,000	Develop restoration plan w/railroad company 2007 Complete construction 2009
ASH 6	1.4 sediment reaching stream from eroding stream bank Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s bank with geotextile reinforced rip rap and vegetation	-$400/acre vegetation -$60 yd^3 stabilization w/ rip rap, geotextile	$2000	Complete streambank restoration 9/2007
ASH 7/8	.68 sediment reaching stream from eroding crossings	-Stabilize embankment drainage ditches along each snowmobile trail exit	-$34/yd3 aggregate/geotextile, installed	$2400	Complete r/s crossing 9/2007
ASH 10	Eliminate elevated levels of nutrients and bacteria from stormwater discharge (30% N, 50% P, 70% bacteria) Maintain<300 colony forming units bacteria mg/L stormwater	-Determine stormdrain discharge source. Redirect to wet/dry detention. Install treatment/filtration hardware	-Wet/Dry detention pond -Oil/Grit separator --Nutrient separator	$40,000/acre N/A N/A	City planning/consult 2007 Installation 2008
ASH 11	Eliminate culvert breech flows (50% average flow reduction) during spring runoff period. Maintain<300 colony forming units bacteria mg/L stormwater Maintain minimum dissolved oxygen level (>4mg/L), reduce maximum instream water temperature to 18°C. Reduce nutrient (N=30%,	-Incorporate/enforce stormwater detention all new construction (Soo township) Construct wet/dry detention ponds near current larger developments(Soo Township)	-Dependent upon development	N/A $40,000/acre ponds	City planning/consultation 2007

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
	P=50%) loads in stormwater and baseflow.				
ASH 12	3.4 sediment from trail surface reaching stream Maintain >4mg/L DO Maintain peak temperature<18°c Reduce nutrient (N=30%, P=50%) loads in stormwater and baseflow.	-Stabilize snowmobile surfaces (approaches) w/ gravel and geotextile -Install trail turnouts -Protect riparian zone w/ Conservation Easement -Promote recreation	-$34/yd^3 aggregate/geotextile, installed -$500/turnout >$100,000 for easement	$110,000	Construction complete 9/2007 Promotion complete 2007-2010 Easements obtained 2010
MIS 2	1,000 linear feet of original stream channel has been comprimised. Restore flow to natural stream channel. Reduce average discharge volume (50% measured during spring thaw periods) at MIS 2 Maintain >4mg/L DO Maintain peak temperature<18°c	Restore natural drainage by blocking channelized drain, redirecting flow into original channel	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$13,300	Planning w/ City complete 2007 Channel restored 2008
MIS 3	.44 tons sediment reaches stream when road floods during spring;	Replace culvert with larger bottomless and increase road fill: Stabilize embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$5000 culvert	$5300	Evaluate site after channel restoration 2008 Construction complete 2009
MIS 4	.44 tons sediment reaches stream when road floods during spring Eliminate storm water breech at culvert	-Replace twin culverts w/ one larger culvert -Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$5000 culvert	$5300	Evaluate site after channel restoration 2008 Construction complete 2009
MIS 6	.12 tons sediment reaches stream with rains and road flooding during spring Eliminate storm water breech at culvert >1000' of original stream dewatered due to channel diversion Restore baseflow at site to 100% of contributing flow u/s of diversion Maintain >4mg/L DO Maintain peak temperature<18°c	-Replace culvert w/ one larger and longer bottomless culvert to realign original channel -Stabilize d/s & u/s embankments -Restore original hydrology; block drain -Install buffer	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$15/ft culvert replacement -$25/foot stream habitat restoration	$5000	Planning w/ City complete 2007 Channel restored 2008 Remaining construction activity complete by 2010
MIS 7	Eliminate 100% stormwater discharge at this site. Maintain >4mg/L DO Maintain peak temperature<18°c	Restore original hydrolgoy to mainstream. Block this drainage site.	-$60/yd riprap, geotextile fabric	$1000	Complete installation 2007
MIS 8	.3 sediment erodes each year from unprotected streambank along reach .5 ton garbage strewn throughout reach Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize eroded streambanks w/ vegetation -Stabilize embankments -Remove trash	-$50/hr garbage removal -$25/foot installation fascines, and bioengineering	$5000	Planning w/ City complete 2007 Channel restored 2008 Remaining construction activity complete by 2010
MIS 9	.25 sediment eroding from streambank 1 ton of junk metal at site Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize u/s eroding streambank -Remove junk	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$25/foot restoration -$50/hr clean up	$3500	Remove metal junk 2007 Stabilize streambank 2008
MIS 10	.55 sediment from eroding streambanks Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s eroding streambank -Install riparian buffer -Install/improve in-stream habitat	-$60/yd^3 stabilization w/ rip rap, geotextile fabric -$400/acre vegetation -$25/foot restoration	$5000	Stabilize streambank 2008 Install buffer/habitat 2009

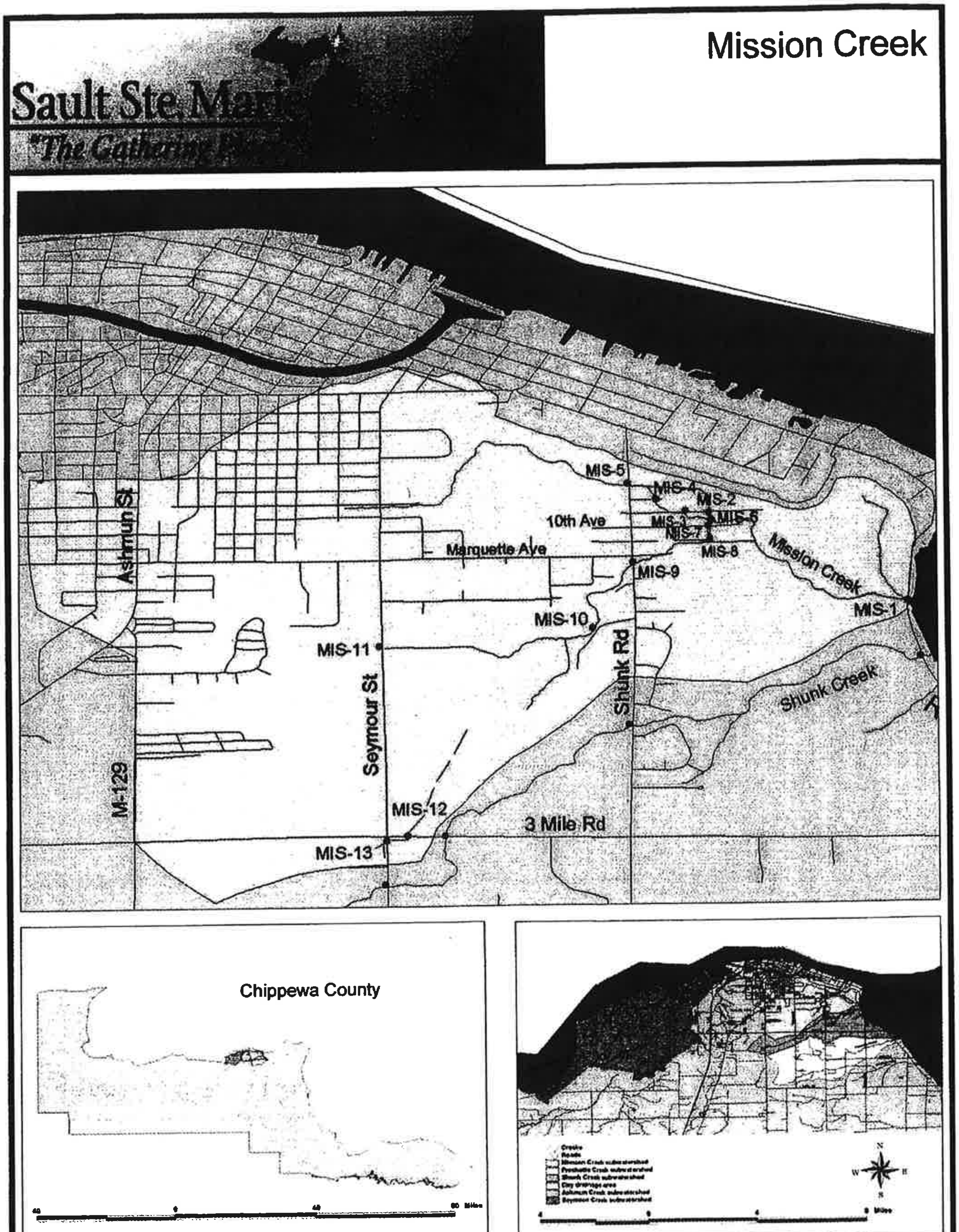
Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
MIS 11	1.4 tons sediment from eroding streambank upstream along Seymour road. >1000' of channelized streambanks Decrease peak seasonal discharge by 10% and increase baseflow by 10%. Maintain >4mg/L DO Maintain peak temperature<18°c Maintain<300 colony forming units bacteria mg/L stormwater	-Install riparian buffer -Protect remaining wetlands w/ conservation easement -Install flood plain culverts under Seymour Road -Increase streambank vegetation and instream debris to increase natural sinuosity and pool/riffle habitats. -Spread runoff from concentrating in power line ditch and west Seymour Rd. ditch into adjacent wetlands	-$400/acre vegetation -$25/linear ft. of stream restoration >$100,000 culvert insertion under Seymour Rd. >$100,000 wetland conservation easement -$60/yd^3 stabilization w/ rip rap, clay, aggregate, geotextile fabric	$240,000	Engineering complete 2008 Construction complete 2010
FR 1	2 tons sediment have eroded from 600' of stream bank; Riparian vegetation has been replaced with large concrete rip rap; Maintain >4mg/L DO Maintain peak temperature<18°c Decrease seasonal peak flows by 10% and increase baseflow by 10% Maintain<300 colony forming units bacteria mg/L stormwater	-Restore riparian buffer -Install/improve geotextile reinforced riprap at streambank toe. -Install storm water basins adjacent city property; check dams or other obstacles in approach ditches	-$400/acre vegetation -$25/linear ft. of stream restoration –$60/yd^3 stabilization w/ rip rap, geotextile fabric	$30,000	Complete rip rap by 2007 Restore buffer by 2008 Complete ditch work by 2008
FR 2	.13 sediment erodng from u/s and d/s embankments around culvert.	-Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1000	Installation complete 2008
FR 3	200' streambank channelized. Decrease seasonal peak flows by 10%, increase base flow by 10%. Maintain >4mg/L DO Maintain peak temperature<18°c	-Restore riparian habitat, including vegetation, woody debris structures, sinuosity u/s & d/s	$25/linear ft. stream restoration	$5000	Installation complete 2008
FR 5	.13 sediment eroding from u/s and d/s embankments around culvert.	-Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1000	Installation complete 2008
FR 7	.2 sediment eroding from u/s and d/s embankments around cultert and d/s streambanks Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s & u/s embankments -Stabilize d/s streambanks -Stabilize approach ditches	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1500	Installation complete 2008
FR 8	.22 sediment eroding from new culvert embankment	-Stabilize d/s & u/s embankments	-$60/yd^3 stabilization w/ rip rap, geotextile fabric	$1000	Installation complete 2008
FR 9	.22 sediment eroding from new culvert embankment Maintain >4mg/L DO Maintain peak temperature<18°c	-Stabilize d/s & u/s embankments -Install riparian buffer	-$60/yd^3 stabilization w/ rip rap, geotextile fabric $400/acre vegetation	$5000	Embankments stabilized 2008 Riparian Buffer installed 2009
CAN 1	7 acres of shoreline habitat destroyed	-Protect shoreline w/ conservation easement -Redevelop nearshore upland area for low impact recreation	>$100,000 park development >$100,000 upland conservation easement $0 shoreline easement	>$200,000	Establish conservation easement language with City by 2009 Begin immediate pursuit of development funding
CAD 1	2 suspected waste storage pits exist on site	-Locate and remove existing toxins	>$100,000 soil tests, excavation,stabilization	$100,000	Locate specific toxin locations 2007: Remove by 2009

Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
SSL 1	1 ton of sediment erodes from landfill face since construction Orange, oily leachate issuing from site	-Identify observed leachate -Improve clay layer -Install erosion control structures around landfill	$1,000 monitoring/chemical analysis $1.50 linear foot installed silt fence $400/acre vegetation	$2000	Analyze leachate 2007 Install erosion control measures 2008
CLA 1	-Facilitate DEQ compliance/clean up -Work with Landowner to develop a Water Quality Management Plan for site	Automotive based toxins on ground surface. Ditched path to surface water (Ashmun 10)	Project manager's salary	Project manager's salary	Establish water quality management/clean up plan by 2008
PET 1	-Conduct well water testing to determine potential pollutants	Potential fuel spills	$500 well test	$2500	Conduct a private well water and nearby surface water analysis by 2007 Develop site water quality management plan 2007
SPD 1	-Conduct well water testing to determine potential pollutants	Potential fuel spills	$500 well test	$2500	Conduct a private well water and nearby surface water analysis by 2007 Develop site water quality management plan 2007
UCC 1	-Facilitate successful regeneration of vegetation over site -Permanently protect adjacent wetland	>1million yds^3 toxic pollutants remain on site. Potential leaching may enter into wetland at headwaters of Mission Creek	$100,000 Conservation Easement Facilitate yearly planting of native vegetation to stabilize site	$100,000 $1000/yr	Develop conservation easement on property and adjacent properties Facilitate native vegetation planting each spring/fall
AMT 1	-Continue monitoring of test wells	Potential fuel spills	$500 well test Manager's Salary	$6000	Conduct well tests on 12 wells by 2007 Complete a site remediation plan with landowner by 2008
ALG 1	30% reduction of 190 million viral units/year per household (319)	Replace/improved OSS Extend municipal wastewater management	$10,000/household Unknown	$1,000,000 Unknown	2008-2015

Structural BMP Summary

Road/Crossings sites	# Sites Addressed	Total Pollutant Load Reduction	Total Cost
	11	5.4 Tons sediment/Year	$145,000
Stream bank sites	14	9.4 Tons sediment/Year, 3,900 linear feet stream restored (10% reduction in seasonal peak flow volume;10% increase in base flow/year, maintain minimum dissolved oxygen level (>4mg/L), reduce maximum seasonal instream water temperature to 18°C. 7 acres shoreline buffer restored Reduce nutrient enriched	$430,300

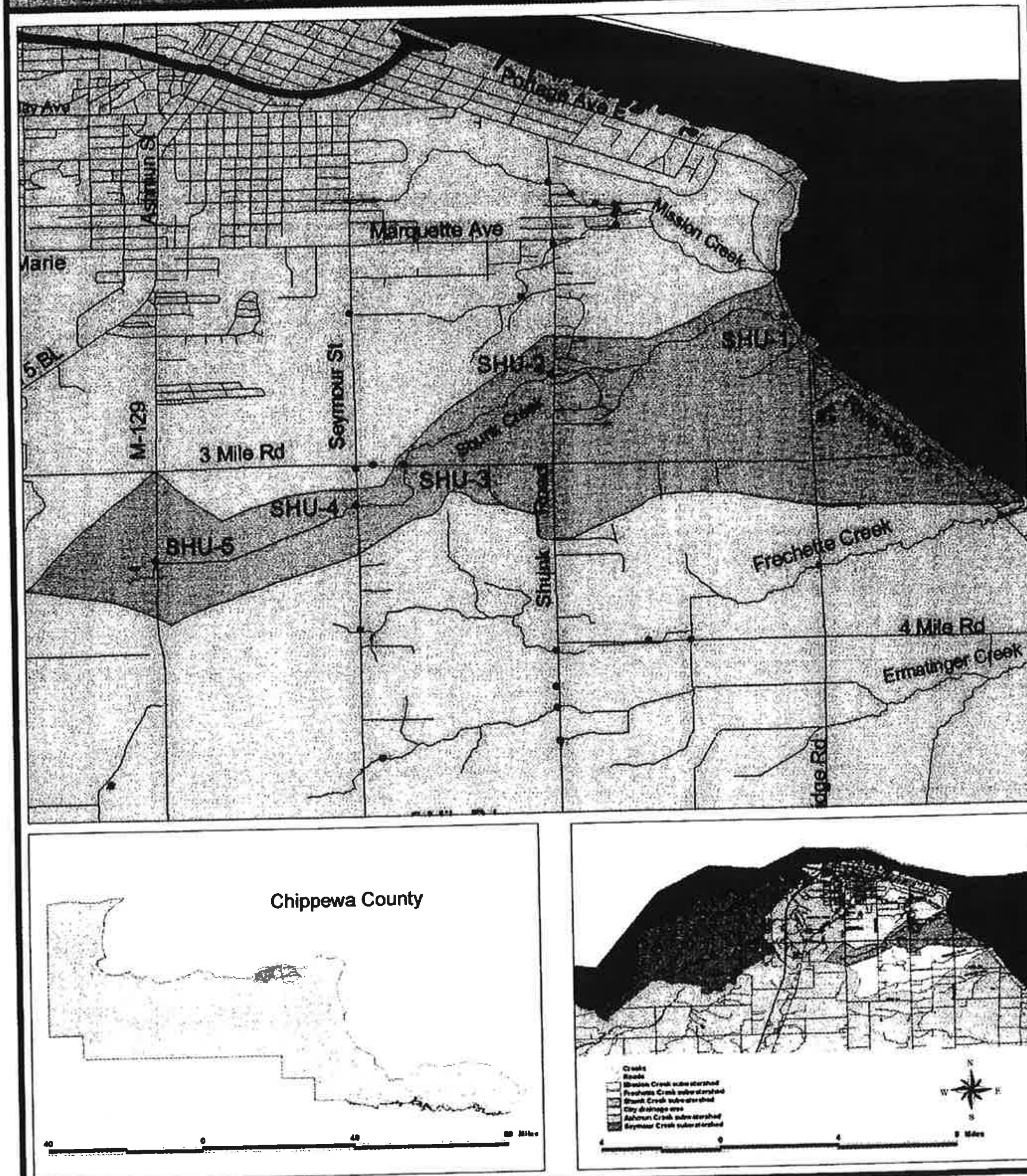
Site ID	Pollutant Reduced (Tons/year)	BMP/Partner	Unit Cost	Cost	Timeline Start/Completion
		stormwater from entering mainstream (N=30%, P=50%) Eliminate E. coli bacteria occurrence >300 colony forming units per each mg/L sample (geometric mean)			
Contamination Sites	8	Undefined, 7 sites delisted 30% reduction of 190 million viral units/year per household (319)	$1,214,000		
Stormwater Sites	6	Restored Natural Hydrology 6 sites; 10% reduction in peak flow discharge volume; 10% increase in baseflow discharge volume Eliminate E.coli bacteria occurrence >300 colony forming units (geometric mean mg/L samples(3/site) Maintain minimum dissolved oxygen level (>4mg/L), reduce maximum instream water temperature to 18°C. Reduce nutrient (N=30%, P=50%) loads in stormwater and baseflow.	$352,500		


Mission Creek
Sault Ste. Marie
"The Gathering Place"
Ashmun St
10th Ave
Marquette Ave
MIS-1
MIS-2
MIS-3
MIS-4
MIS-5
MIS-6
MIS-7
MIS-8
MIS-9
MIS-10
MIS-11
MIS-12
MIS-13
Mission Creek
Shunk Creek
Shunk Rd
Seymour St
M-129
3 Mile Rd
Chippewa County
N
W
E
S

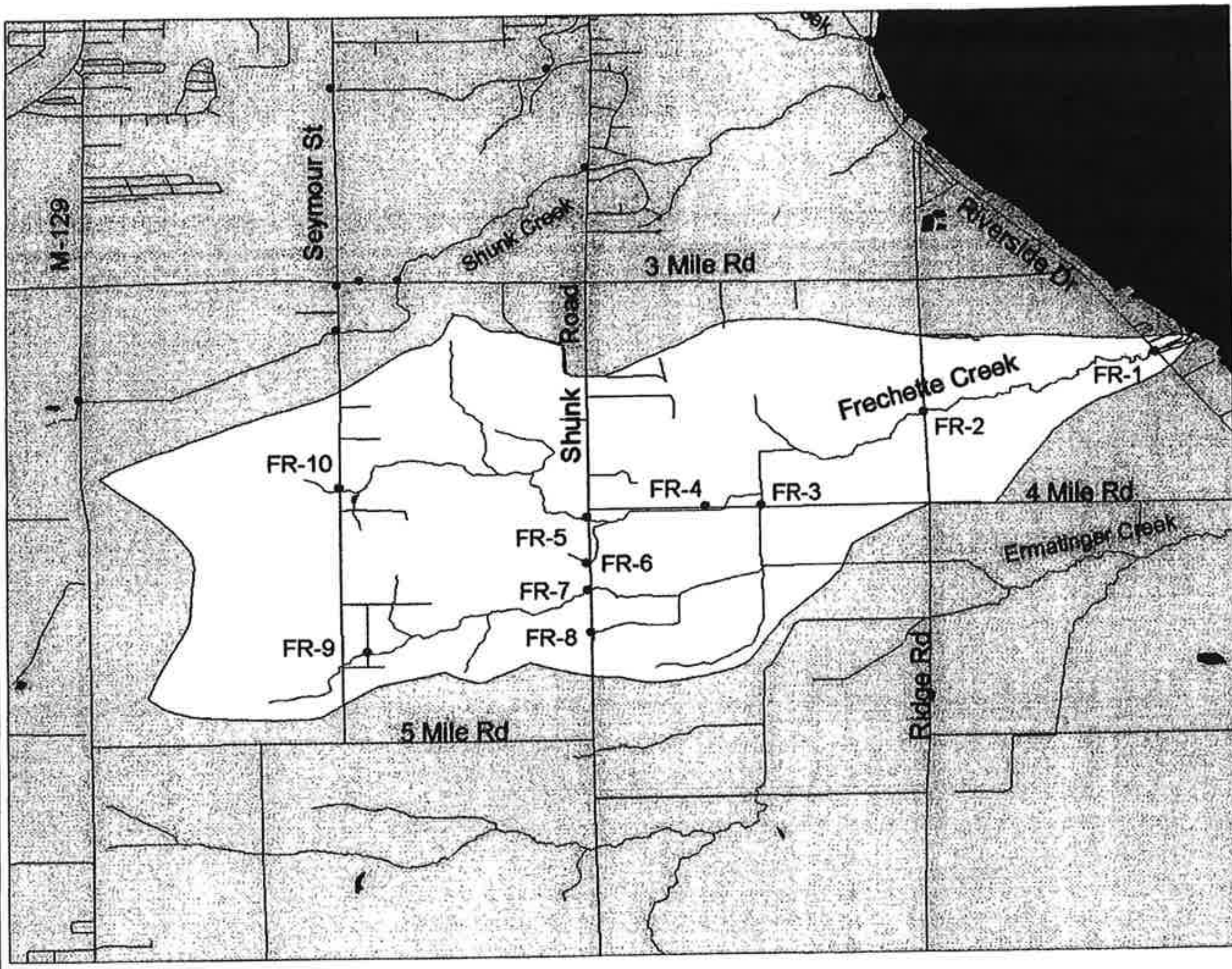
Sault Ste Marie

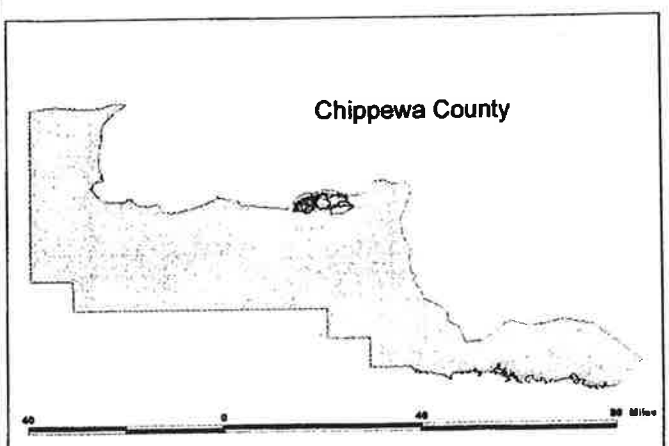
"The Gathering Place"

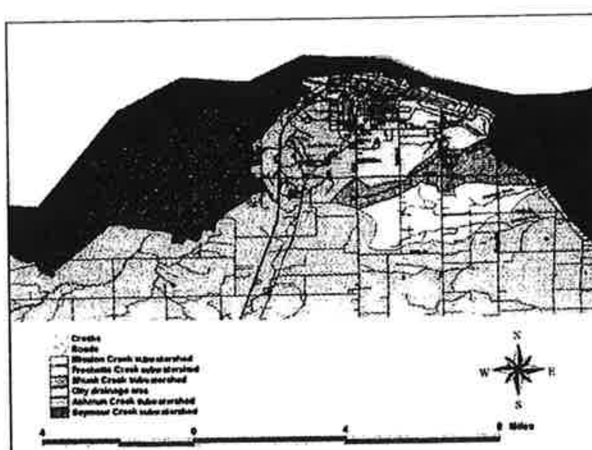
Shunk Creek



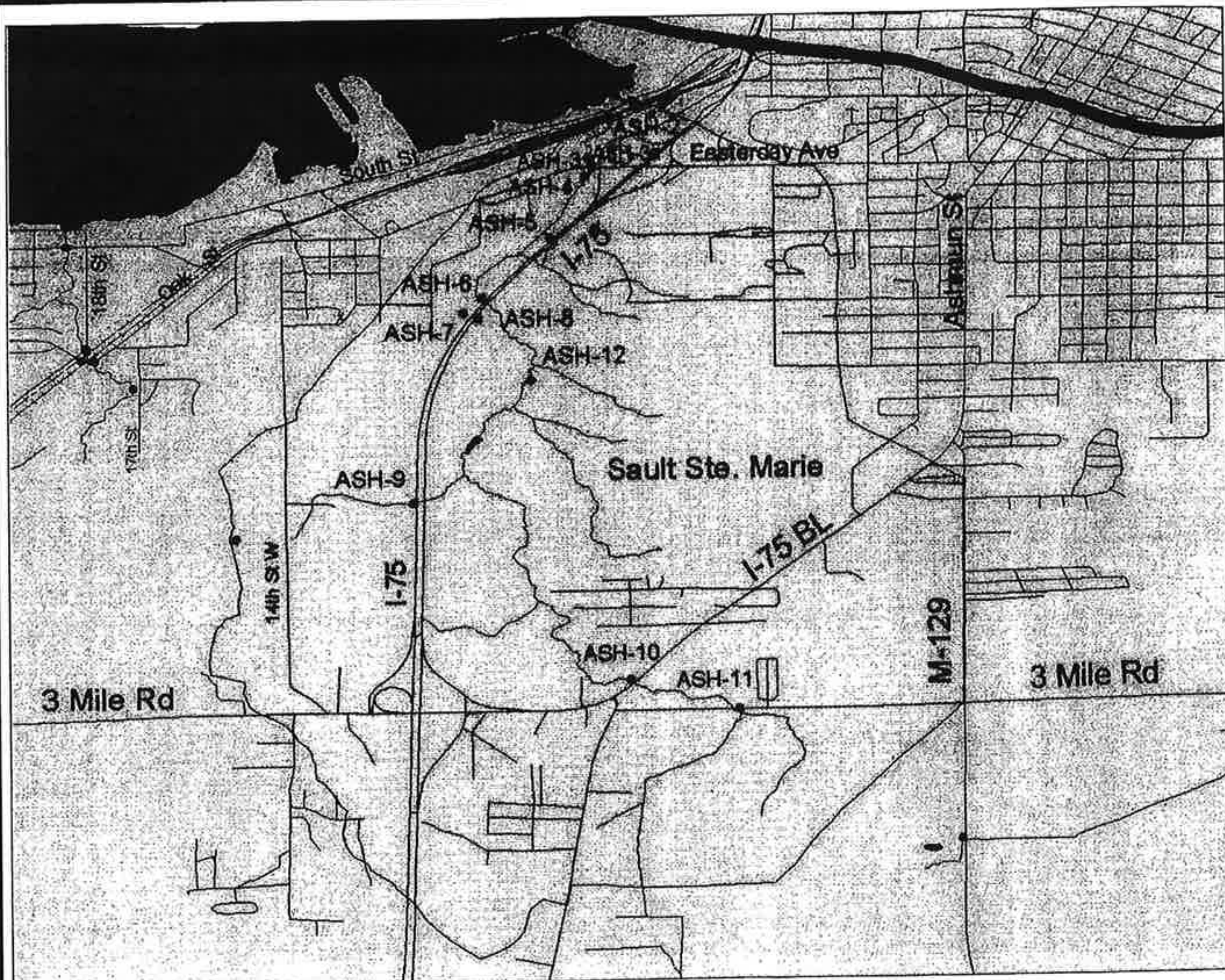
Frechette Creek

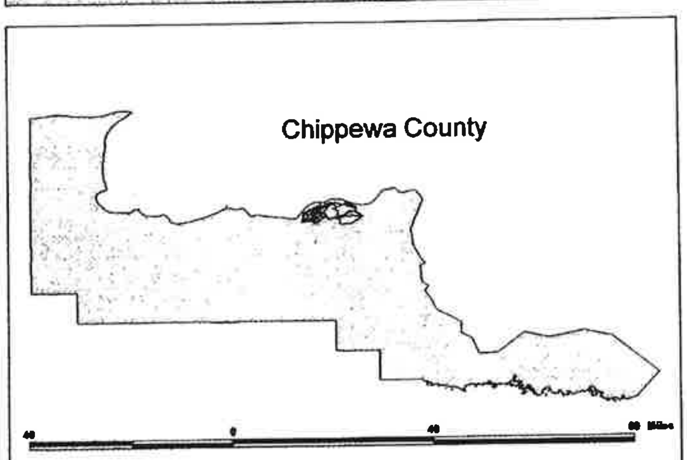


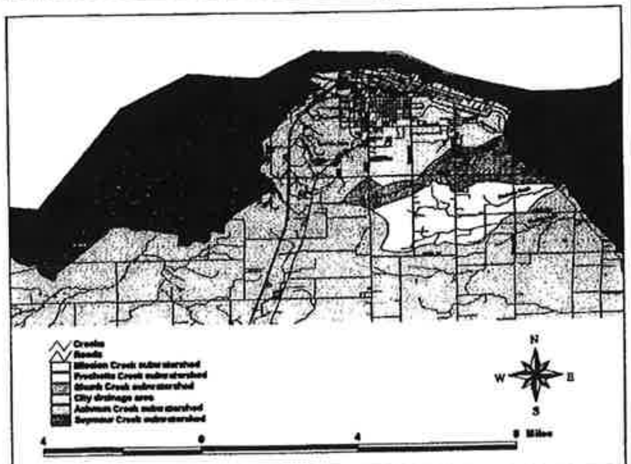




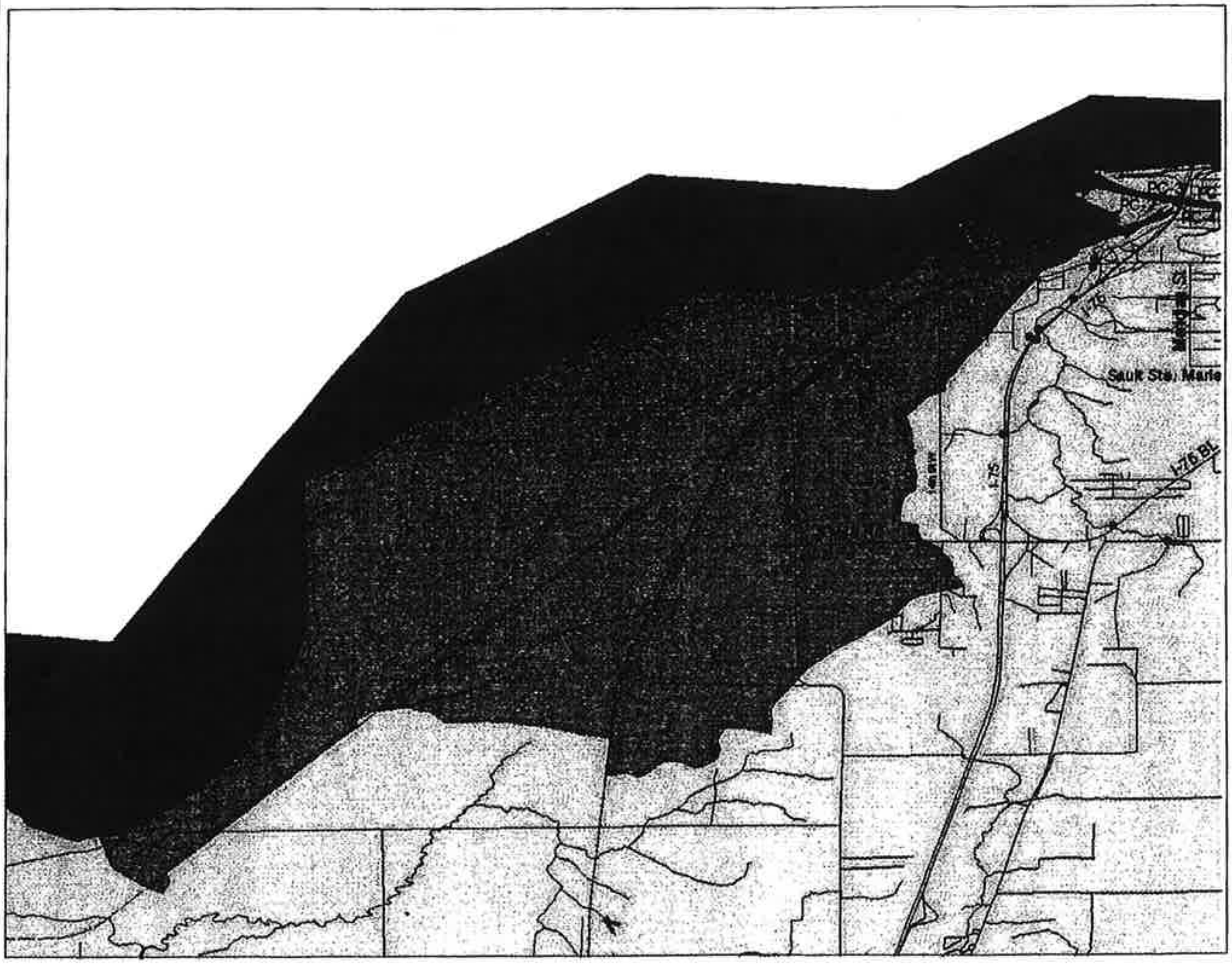
Ashmun Creek

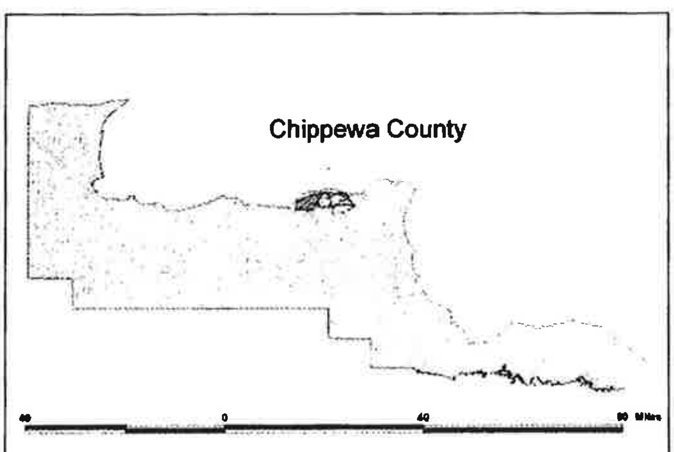


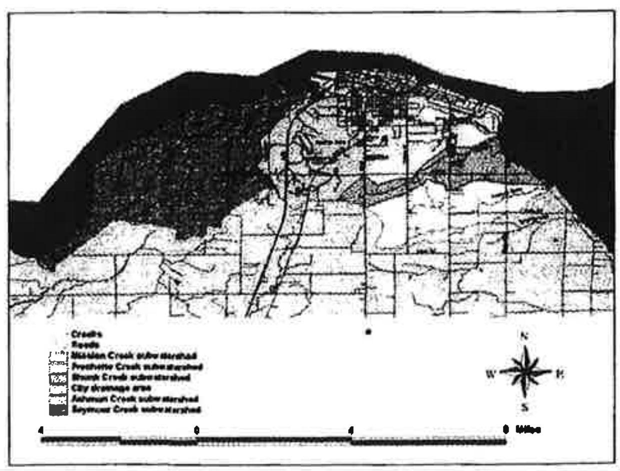




Seymour Creek And Lake Drainage Area







Sault Ste. Marie Region Conservation Authority
SSMRCA

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www.ssmrca.ca

January 14, 2010

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
Sault Ste. Marie, ON

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Ltd.
436 Westmount Ave., Unit 6
Sudbury, ON P3A5Z8

Dear Susan and Alex:

Staff members from the Sault Ste. Marie Region Conservation Authority (CA) attended the Stormwater Study Public Information Session held on December 17th, 2009. This Stormwater Study is of particular interest to the SSMRCA relative to the implementation of O. Reg. 176/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses", the SSMRCA's flood control mandate, as well as the Drinking Water Source Protection Program.

The session provided an overview of the efforts to-date of the City's consultants undertaking a stormwater assessment study to develop a Master Plan for City. The following is a compendium of staff's comments on the presentation and its initiatives as well as goals that the SSMRCA would like to see incorporated into the Plan.

The control of stormwater quantity and physical quality (related to solids content only) can have significant impacts on the CA's flood control system and maintenance requirements. The control of the amount of sedimentation in flood control channels and structures is important to the CA as these sediments limit capacity of these systems to handle flows and result in economic impact to the CA and City when those sediments must be removed to prevent flooding.

The Conservation Authority's implementation of Reg. 176/06 and flood control role often puts the CA in the position of specifying the control of stormwater quantity and quality (again related to solids content only). Decisions in regard to the acceptability and the degree of treatment required for discharges of stormwater systems to natural watercourses are made in consultation with the DFO with support as necessary from both the OMOE and OMNR. The Drinking Water Source Protection mandate works toward the maintenance and protection of the municipal supply sources both groundwater and surface water.

In general, the CA and DFO have requested that a minimum of 70% average solids removal be incorporated into the design of stormwater system discharges into the natural watersheds within the City east of the West Davignon, west of the Root River and south of the Third Line. The cold water streams including and beyond those watersheds may require 80% average solids removal upon further review/ assessment by the CA and DFO. These limits are based on the type of fish habitat present and the need to preserve or rehabilitate that habitat or any habitat which would sustain an endangered or at risk species.

The proposed Master Plan seeks to identify areas of concern within the city where stormwater has either a physical, chemical or biological adverse impact on the natural receiving watercourses. The plan is then to seek and recommend remedies to address or improve the condition.

Staff of the CA has verbally provided the consultant with a list of locations where some form of physical impact either due to erosion or solids carry-through may be creating a possible adverse situation. Locations suggested for possible inclusion in the proposed plan are:

1. Clark Creek at Bennett Avenue is sustaining a considerable amount of sediment coming from the stormwater system reporting to this location. The CA with support of the City undertook major sediment removal/ stream rehabilitation at this location in 2008. Sediments are continuing to accumulate in this watercourse.

2. Fort Creek has several locations along its path where stormwater is contributing considerable sediment/ turbidity to its waters with resultant sedimentation along its course and especially in the dam impoundment. The area above the Second Line dam impoundment is especially hard hit by stormwater inputs during all types of flow events. A report commissioned by the DFO and the SSMRCA in 2008 identified several areas and this report has been passed on to the consultant for review. The SSMRCA and the DFO have made a long term commitment towards the rehabilitation of the Fort Creek. In 2009, a major sediment removal program to address the section below the dam was undertaken with SSMRCA and City finances.

3. The stormwater system reporting to the west side of the Roberta Bondar Pavillion was identified as both an historical concern (former Bruce Street cement plant discharge) and a current concern from the ravine and stormwater system coming from the Pim Street, Bruce Street and Melrose Avenue area. This area has been identified as an area where considerable sediment contribution from landslides of fill areas and snow disposal along with sediment deposits from upper reaches of the ravine have accumulated.

4. Erosion issues along the Root River were identified within the Landslide Road, Old Garden River Road and Fourth Line East triangle where the natural meandering of the river is causing some sedimentation episodes, threatening homes and limiting development.

5. As above, the Bennett Creek was identified as having erosion issues in the Second Line to Allen's Side Road area related to its meandering nature along with areas where vegetation growths are creating flow impediments, especially along the Wallace Terrace tributary.

Ontario Regulation 176/06 bases flood controls on 100 year return storm events. The City of Sault Ste. Marie is using 10 year return storm events as the basis for stormwater design. The study should assess whether the 10 year design is acceptable or whether a 25 year or more design should be employed.

The undertaking of the stormwater study by the City was strongly supported by the CA as a result of the stormwater management and control concerns revealed to CA and DFO during staff review of several proposed subdivisions and the existing and under construction institutional facilities in the Second Line to Third Line areas east of Great Northern Road. The requirements to preserve and protect fish habitat, to control stormwater runoff quality and quantity and to ensure drinking water resources were not adversely impacted gave rise to the need to control offsite discharge of stormwater. These concerns subsequently resulted in stormwater control facilities being required for each subdivision. It was recommended to City staff that a stormwater plan for that specific area should be developed to control stormwater flows in a cooperative and efficient plan between the land users and the city.

The Conservation Authority staff request that the area of Second line to Third Line east of Great Northern Road be given special attention early on in the study in light of the proposed and imminent and concentrated development planned for this area. A collaborative plan would allow better control of development progression along with lower costs for the city and developers as a result of fewer and more effective stormwater control systems.

The groundwater recharge area located north of Third Line should be considered for a special emphasis on stormwater infiltration systems.

The Drinking Water Source Protection Planning (SPP) staff suggests Low Impact Development (LID) approaches to be adopted especially within the Wellhead Protection Areas (WHPAs), Significant Groundwater Recharge Areas (SGRAs), Intake Protection Zones (IPZs) and Highly Vulnerable Aquifer Areas (HVAs). LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, rain barrels, downspout disconnection, soakaway pits, tree clustering, filter strips, dry swales and permeable pavements. By implementing LID principles and practices, water can be managed at the source in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale and to adopt techniques for any development within vulnerable areas, LID can maintain or restore a watershed's hydrologic, ecological functions and better manage the stormwater at the source. These approaches would also helpful to reduce the negative impacts of the developments.

The SSMRCA feels that the Stormwater Management Plan will go a long way to addressing the issues facing the City of Sault Ste. Marie in regard to its stormwater issues relating to stormwater impacts, stormwater system upgrade and directing of future development.

Yours truly,

Linda Whalen
General Manager

cc Kelly Withers, DFO

THE CITY OF SAULT STE. MARIE

PUBLIC INFORMATION CENTRE #2
STORMWATER MANAGEMENT CLASS EA MASTER PLAN

The City of Sault Ste. Marie has developed a long-term Stormwater Management Master Plan. Based on the study findings to date and the comments received from review agencies and the public, a series of alternative solutions have been developed to manage stormwater runoff generated within the City.

The first Public Information Centre (PIC) was held on December 17, 2009 to introduce the study and solicit input. The study area and background information was presented along with the Problem Statement developed to address the City's goals for stormwater management.

A second PIC has been arranged to provide residents and other stakeholders an opportunity to review and comment on the alternative solutions and identification of the preferred solutions.

The PIC has been arranged as follows:

Thursday, May 19th, 2011
3:00 p.m. to 7:00 p.m.
Russ Ramsay Board Room, Third Floor
Civic Centre

If you cannot attend but would like to provide comments, or obtain further information, please contact either:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Email: s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555
Email: asorensen@rvanderson.com

Sault Ste Marie > City Hall > Latest News > Public Information Centre - Stormwater Management Class EA Master Plan

PUBLIC INFORMATION CENTRE - STORMWATER MANAGEMENT CLASS EA MASTER PLAN

The City of Sault Ste. Marie has developed a long-term Stormwater Management Master Plan. Based on the study findings to date and the comments received from review agencies and the public, a series of alternative solutions have been developed to manage stormwater runoff generated within the City.

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A second PIC has been arranged to provide residents and other stakeholders an opportunity to review and comment on the alternative solutions and identification of the preferred solutions.

The PIC will take place on Thursday, May 19, 2011 from 3 to 7 p.m. at the Russ Ramsay Board Room, Level 3, Civic Centre, 99 Foster Drive.

If you cannot attend but would like to provide comments, or obtain further information, please contact either:

Susan Hamilton Beach, Land Development and Environmental Engineer
Engineering and Planning Department
Phone: 705-759-5385
Email: s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6, Sudbury, ON P3A 5Z8
Phone: 705-560-5555
Email: asorensen@rvanderson.com

"The Corporation of the City of Sault Ste. Marie will be a leader in the provision of efficient, affordable and quality services supporting a progressive and sustainable community."

The Corporation of the City of Sault Ste. Marie
P.O. box 580 ~ 99 Foster Drive ~ Sault Ste. Marie, ON P6A 5N1
Telephone: (705) 759-2500 ~ Fax: (705) 759-2310
www.cityssm.on.ca

From: Anne Logtenberg
Sent: April 21, 2011 9:50 AM
To: corporatead
Cc: Susan Hamilton Beach
Subject: Notice for Sault Star & Sault This Week & web site - Stormwater Management Class EA Master Plan

ADVERTISING DATES.

Hi Lorie,

The following are the dates:

Sault Star - Saturday, May 7th & 14th

Sault This Week - Wednesday, May 11th & 18th

Account number 20-325-3000-9360

Thanks.

Anne J. Logtenberg (Annie)
Administrative Support Clerk
Engineering & Planning Department
Construction Division

5/6/2011

R.V. Anderson Associates Limited
engineering · environment · infrastructure

436 Westmount Avenue Unit 6
Sudbury Ontario P3A 5Z8 Canada
Tel 705 560 5555 Fax 705 560 5822
www.rvanderson.com

May 4, 2011

RVA 091800

«Company_Name»
«Address_Line_1»
«Address_Line_2»
«City», «State»
«ZIP_Code»

Attention: «Name»

Dear «Name_2»:

Re: City of Sault Ste. Marie
Stormwater Management Master Plan
Public Information Centre – May 19, 2011

The City of Sault Ste. Marie is undertaking a Municipal Class Environmental Assessment to develop a Stormwater Management Master Plan to address stormwater quality and quantity concerns.

This study follows the requirements of the Municipal Class Environmental Assessment Master Plan Approach #1 and proposes to address Phase 1 and Phase 2 of the Municipal Class EA process. The Master Plan will form the basis for future detailed investigations that may be necessary to satisfy project specific requirements for Schedule B or C type projects identified under the Master Plan.

An integral part of the Master Planning process is public consultation. The City will be holding a Public Information Centre (PIC) to provide a forum for public input regarding the alternative solutions and identification of the preferred solution. Stakeholders are invited to attend and provide comments.

The PIC has been arranged as follows:

Thursday, May 19, 2011
3:00 pm to 7:00 pm
Russ Ramsay Room, Third Floor
Civic Centre

The PIC will present an overview of the watershed, identify quality and capacity issues, and present the preferred alternative(s).

Should there be any questions or comments regarding this PIC, or if you cannot attend but would like to provide information, please do not hesitate to contact the undersigned.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Alex Sorensen, LEL, C.E.T.
Project Manager

Phone: (705) 560-5555, ext. 202
Email: asorensen@rvanderson.com

AES:ad

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May 19, 2011

Public Information Centre #2

Sault Ste. Marie Stormwater Investigative Study
Master Plan

Background

- The City of Sault Ste. Marie is nearing completion of a Stormwater Management Master Plan to develop strategies and plans for managing storm drainage infrastructure related to stormwater quantity and quality.
- Stormwater quantity has been managed in the past by installing dry ponds to match pre-development and post-development flows. Approval agencies are now requiring developers in the City to provide for quality control of stormwater in new developments.
- The St. Marys River is one of 42 Areas of Concern (AOC) as defined by the International Joint Commission. The St. Marys River Remedial Action Plan, aimed at delisting the River as an AOC, has made several recommendations related to stormwater. Sampling at stormwater outfalls along the St. Marys River has indicated that stormwater is a contributor of bacteria and other pollutants to the River.

Study Purpose

- The purpose of this study is to evaluate current drainage policies, guidelines, and existing infrastructure, identify deficiencies and develop an implementation plan for capital improvements along with a policy and strategy applicable specifically to Sault Ste. Marie that will meet current Ministry of the Environment standards based on input from the approval agencies.

Study Process

- This study follows the requirements of the Municipal Class Environmental Assessment Master Plan Process Approach #1, which addresses Phases 1 and 2 of the Municipal Class Environmental Assessment process as defined in the Municipal Engineers Association's *"Municipal Class Environmental Assessment,"* (October 2000, as amended 2007). The Master Plan will form the basis for future investigations for Schedule B or C projects.

Study Deliverables

Priority-based Capital Projects – Quantity and Quality Management of Stormwater

- Recommendations of projects to remediate identified system deficiencies

Stormwater Management Policy

- Development of a Stormwater management Policy to provide guidance to Engineers of stormwater management systems in Sault Ste. Marie, considering City operational needs and future climatic conditions.

Study Deliverables – continued

Point Source Monitoring Plan

- A thorough plan to identify and track the quality of water entering the St. Marys River with a mechanism in place to improve source drainage areas

How to Provide Comments:

The City of Sault Ste. Marie is looking for input from the community for the Stormwater Management Master Plan. Please take the time to fill out the comment sheet today or email, mail, or fax your comments or call the contacts listed below.

Comments are welcome until June 20, 2010

Next Steps

- Receive public comments by June 20, 2010
- Incorporate final public input into the preferred alternatives.
- Present Stormwater Management Master Plan to the City and make available for public comment under the 30-day review period.
- The City of Sault Ste. Marie approves the Master Plan.

Contacts

You are encouraged to provide written comments and direct your input to either:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Fax: (705) 541-7165
Email: s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555, ext. 202
Fax: (705) 560-5822
Email: asorensen@rvanderson.com

PUBLIC INFORMATION CENTRE

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday May 19, 2011

COMMENT SHEET

Please Print

Name: ______________________________

Email: ______________________________

Address: ______________________________

Postal Code: ______________________________

Would you like to be added to a mailing list to receive future project information? Yes ☐ No ☐

Do you consent to having your comments included in the public record? Yes ☐ No ☐

Please indicate your interest in the study.

☐ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☐ Interest Group Representative

☐ Agency or Ministry Representative

Please specify: ______________________________

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

____

____

____

____

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Marys River? If yes, please describe your observations.

____

____

____

____

Are there any particular issues you would like to bring to the attention of the project team?

____

____

____

____

Do you feel that this Stormwater Management Master Plan preferred alternatives will address concerns that you have regarding stormwater management in the City of Sault Ste. Marie?

____

____

____

____

Thank you very much for your participation in the Sault Ste. Marie Stormwater Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Monday, June 20, 2011 to one of the following:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Fax: (705) 541-7165
Email: s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555, ext. 202
Fax: (705) 560-5822
Email: asorensen@rvanderson.com

MAY LETTER & HANDOUTS TO:

Great Lakes Area of Concern Unit
Strategic Integration and Partnerships Division
Environment Canada 867 Lakeshore Road
Burlington, Ontario
L7R 4A6
Attention: Sandra Kok

Great Lakes Areas of Concern Unit
Environment Canada
4905 Dufferin Street
Toronto, Ontario
M3H 5T4
Attention: Kate Taillon, MSc.

Ministry of the Environment
199 Larch Street, Suite 1201
Sudbury, Ontario
P3E 5P9
Attention: Celeste Dugas, Supervisor (Acting)

Northern Ontario Disctrict, Ontario-Great Lakes Area
Fisheries & Oceans
1219 Queen Street East
Sault Ste. Marie, Ontario
P6A 2E5
Attention: Jennifer Hallett

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie, Ontario
P6A 5K7
Attention: Rhonda Bateman

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie, Ontario
P6A 5K7
Attention: Anjim Amin

Sault Ste.Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie, Ontario
P6A 5K7
Attention: Frank Tesolin

Sault Ste. Marie Conservation Authority
1100 Fifth Line East
Sault Ste Mare, Ontario
P6A 5K7
Attention: Linda Whalen

Algoma Public Health
99 Foster Drive
1st & 6th Floor
Sault Ste. Marie, Ontario
P6A 5X6
Attention: Sherri Cleaves CPHI (C), BASc (EH)

Ministry of Natural Resources
64 Church Street
Sault Ste. Marie, Ontario
P6A 3H3
Attention: Ilsa Langis, Planning and Information
Management Supervisor

Lake Superior Advisory Committee
69 Broadview Drive
Sault Ste. Marie, Ontario
P6C 5Z4
Attention: Don Marles

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Lilian Keen, Environmental Officer

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Kirk Crosson, Senior Environmental Officer

Northern Ontario District
Ontario-Great Lakes Area Fisheries & Oceans
1219 Queen Street East
Sault Ste. Marie, Ontario
P6A 2E5
Attention: Kelly Withers

Andre Riopel
200 Case
Sault Ste. Marie, Ontario
P6A 6J8

Klass Oswald
111 Millcreek Drive
Sault Ste. Marie, Ontario
P6B 6H7

Mike Ripley
76 Cottage Lane
Sault Ste. Marie, Ontario
P6A 5K6

Ministry of the Environment
Northern Region
435 South James Street, Suite 331
Thunder Bay, Ontario
P7E 6S7
Attention: Michelle McChristie

Ministry of the Environment
3rd Floor, 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Tym Garside, Area Supervisor

Environment Canada
4905 Dufferin Street
Toronto, Ontario
M3H 5T4
Attention: Mark Chambers, Program Officer, Great Lakes Area of Concern

Ministry of Aboriginal Affairs
Policy and Relationships Branch
160 Bloor Street East, Suite 400
Toronto, Ontario
M7A 2E6
Attention: Lori Sterling, Deputy Director

Ministry of the Environment - Northern Region
Technical Support Section
199 Larch Street, Suite 1201
Sudbury, Ontario
P3E 5P9
Attention: Laurie Brownlee, Environmental Planner and EA Coordinator

Indian and Northern Affairs Canada
Ontario Research Team
10 Wellington Street
Gatineau, Quebec
K1A 0H4
Attention: Doug Klassen, Senior Policy Analyst

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie, Ontario
P6A 5K7
Attention: Christine Ropeter

Batchewana First Nation
Rankin Reserve
236 Frontenac Street, R.R. # 4
Sault Ste. Marie, Ontario
P6A 5K9
Attention: Chief Dean Sayers

Ministry of Aboriginal Affairs

160 Bloor St. East, 9th Floor
Toronto, ON M7A 2E6
Tel: (416) 326-4740
Fax: (416) 325-1066
www.aboriginalaffairs.gov.on.ca

Ministère des Affaires Autochtones

160, rue Bloor Est, 9e étage
Toronto ON M7A 2E6
Tél. : (416) 326-4740
Téléc. : (416) 325-1066
www.aboriginalaffairs.gov.on.ca

Ontario

Reference : MAA3895DRC-2011-238

JUN 14 2011

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue Unit 6
Sudbury, ON
P3A 5Z8

Re: City of Sault Ste. Marie
Stormwater Management Master Plan
Public Information Centre- May 19, 2011

Dear Mr. Sorensen:

Thank you for your inquiry dated May 4, 2011 regarding the above-noted project.

As a member of the government review team, the Ministry of Aboriginal Affairs (MAA) identifies First Nation and Métis communities who may have the following interests in the area of your project:

- reserves;
- land claims or claims in litigation against Ontario;
- existing or asserted Aboriginal or treaty rights, such as harvesting rights; or
- an interest in your project's potential environmental impacts.

MAA is not the approval or regulatory authority for your project, and receives very limited information about projects in the early stages of their development. In circumstances where a Crown-approved project may negatively impact a claimed Aboriginal or treaty right, the Crown may have a duty to consult the Aboriginal community advancing the claim. The Crown often delegates procedural aspects of its duty to consult to proponents. Please note that the information in this letter should not be relied on as advice about whether the Crown owes a duty to consult in respect of your project, or what consultation may be appropriate. Should you have any questions about your consultation obligations, please contact the appropriate ministry.

You should be aware that many First Nations and Métis communities either have or assert rights to hunt and fish in their traditional territories. For First Nations, these territories typically include lands and waters outside of their reserves.

In some instances, project work may impact aboriginal archaeological resources. If any Aboriginal archaeological resources could be impacted by your project, you should contact your regulating or approving Ministry to inquire about whether any additional Aboriginal communities should be contacted. Aboriginal communities with an interest in archaeological resources may include communities who are not presently located in the vicinity of the proposed project.

With respect to your project, and based on the brief materials you have provided, we can advise that the project appears to be located in an area where First Nations may have existing or asserted rights or claims in MAA's land claims process or litigation, that could be impacted by your project. Contact information is below:

Ojibways of Batchewana 236 Frontenac Street Rankin Reserve 15D SAULT STE. MARIE, Ontario P6A 5K9	Chief Dean Sayers (705) 759-0914 (Fax) 759-9171 chiefdeansayers@batchewana.ca councilsecretary@batchewana.ca
Ojibways of Garden River 7 Shingwauk Street GARDEN RIVER, Ontario P6A 6Z8	Chief Lyle Sayers (705) 946-6300 (Fax) 945-1415 sayers@gardenriver.org

For your information, MAA is aware of Métis communities that have existing or asserted rights near your project. Contact information is below:

Historic Sault Ste Marie Métis Council 26 Queen Street East Sault Ste. Marie, ON P6A 1Y3	Kim Powley, President (705) 254-1768 (Fax) 705-254-3515 e-mail: kimmysue@shaw.ca

Please copy any correspondence to name of community council to the Métis Nation of Ontario. Contact information is below:

Métis Nation of Ontario Head Office 500 Old St. Patrick Street, Unit D Ottawa, Ontario, K1N 9G4	Métis Consultation Unit Fax: (613) 725-4225

The Government of Canada sometimes receives claims that Ontario does not receive, or with which Ontario does not become involved. For information about possible claims in the area, MAA recommends you contact the following federal contacts:

Ms. Janet Townson Claims Analyst, Ontario Team Specific Claims Branch Indian and Northern Affairs Canada 1310-10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 953-4667 Fax: (819) 997-9873	Mr. Sean Darcy Manager Assessment and Historical Research Indian and Northern Affairs Canada 10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 997-8155 Fax: (819) 997-1366

For federal information on litigation contact:

Mr. Marc-André Millaire
Litigation Team Leader for Ontario
Litigation Management and Resolutions Branch
Indian and Northern Affairs Canada
10 Wellington St.
Gatineau, QC K1A 0H4
Tel: (819) 994-1947
Fax: (819) 953-1139

Additional details about your project or changes to it that suggest impacts beyond what you have provided to date may necessitate further consideration of which Aboriginal communities may be affected by or interested in your undertaking. If you think that further consideration may be required, please bring your inquiry to whatever government body oversees the regulatory process for your project.

The information upon which the above comments are based is subject to change. First Nation or Métis communities can make claims at any time, and other developments can occur that could result in additional communities being affected by or interested in your undertaking.

Yours truly,

Heather Levecque
Manager, Consultation Unit
Aboriginal Relations and Ministry Partnerships Division

091800.

Alex Sorensen

From: Don Boswell [Don.Boswell@ainc-inac.gc.ca]

Sent: Thursday, May 19, 2011 10:07 AM

To: Alex Sorensen

Cc: Ralph Vachon

Subject: City of Sault Ste. Marie, Stormwater Management Master Plan, Public Information Centre – May 19, 2011

I am writing in response to your letter of May 4, 2011 inquiring about claims in the above noted area.

In determining your duty to consult, you may wish to contact the First Nations in the vicinity of your area of interest to advise them of your intentions. To do this you may:

find the Reserves in your area of interest by consulting a map of the region such as the Province of Ontario Ministry of Aboriginal Affairs online map at http://www.ainc-inac.gc.ca/ai/scr/on/rp/mcarte/mcarte-eng.asp ; then
search for the First Nations located on those Reserves by using the INAC Search by Reserve site at http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/SearchRV.aspx?lang=eng.

To determine the First Nations in your area of interest who have submitted claims please consult the Reporting Centre on Specific Claims at http://pse4-esd4.ainc-inac.gc.ca/SCBRI/Main/ReportingCentre/External/ExternalReporting.aspx?lang=eng.

It should be noted that the reports available on the INAC website are updated regularly and therefore, you may want to check this site often for updates. In accordance with legislative requirements, confidential information has not been disclosed.

Please rest assured that it is the policy of the Government of Canada as expressed in The Specific Claims Policy and Process Guide that:

"in any settlement of specific native claims the government will take third party interests into account. As a general rule, the government will not accept any settlement which will lead to third parties being dispossessed."

We can only speak directly to claims filed under the Specific Claims Policy in the Province of Ontario. We cannot make any comments regarding potential or future claims, or claims filed under other departmental policies. This includes claims under Canada's Comprehensive Claims Policy or legal action by a First Nation against the Crown. You may wish to contact the Assessment and Historical Research Directorate at (819) 994-6453, the Consultation and Accommodation Unit at (613) 944-9313 and Litigation Management and Resolution Branch at (819) 934-2185 directly for more information.

You may also wish to visit http://www.ainc-inac.gc.ca/ai/mr/is/acp/acp-eng.asp on the INAC website for information regarding the Federal Action Plan on Aboriginal Consultation and Accommodation.

To the best of our knowledge, the information we have provided you is current and up-to-date. However, this information may not be exhaustive with regard to your needs and you may wish to consider seeking information from other government and private sources (including Aboriginal groups). In addition, please note that Canada does not act as a representative for any Aboriginal group for the purpose of any claim or the purpose of consultation.

I hope this information will be of assistance to you. I trust that this satisfactorily addresses your concerns.

Sincerely,

Don Boswell
Senior Claims Analyst
Ontario Research Team
Specific Claims Branch

PIC2 – May 19, 2011 included the following boards as well as displays of the latest report plans, specifically, 3.1,3.2,4.1,6.1 and complete documents of the Study to date and the proposed SWM policy.

City of Sault Ste. Marie Stormwater Management Master Plan

Public Information Centre

May 19, 2011

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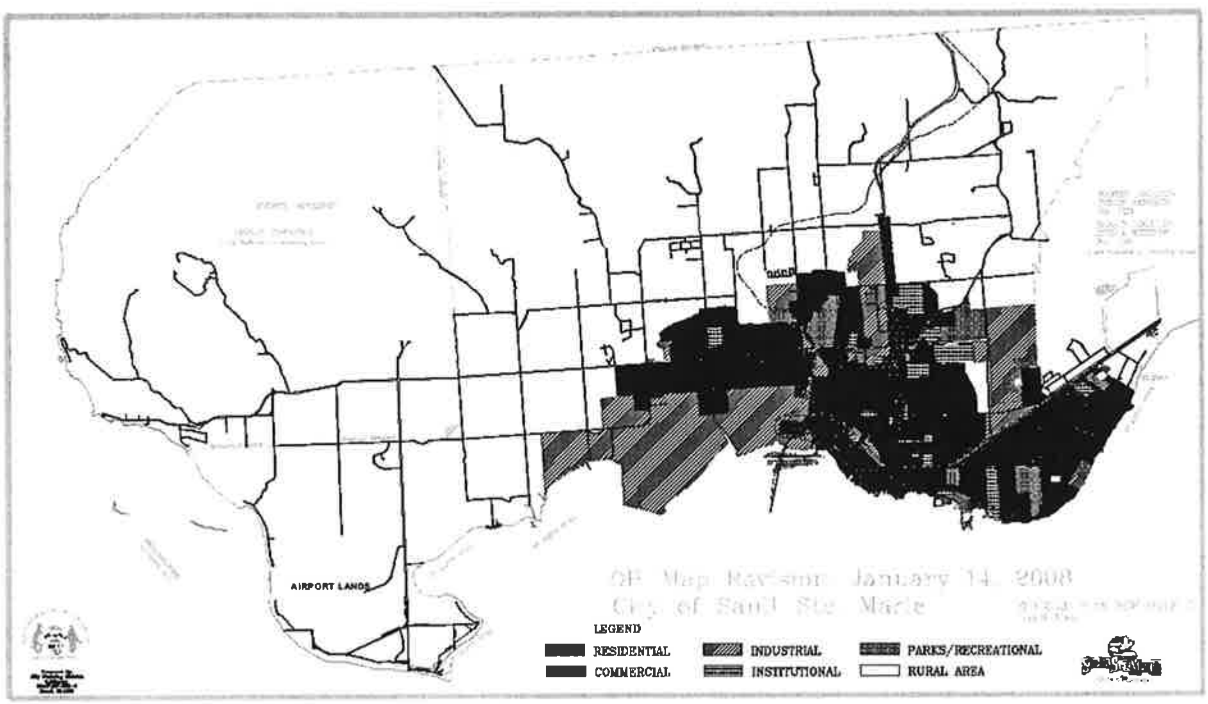
Background

- The St. Marys River is one of 42 Areas of Concern (AOC) as defined by the International Joint Commission. The St. Marys River Remedial Action Plan, aimed at delisting the River as an AOC, has made several recommendations related to storm-water. Sampling at stormwater outfalls along the St. Marys River has indicated that stormwater is a contributor of bacteria and other pollutants to the River.

- The City of Sault Ste. Marie is undertaking a City-wide Stormwater Management Master Plan to develop strategies for managing storm drainage infrastructure related to flooding and stormwater quality.

Study Limits



Land use is directly related to the amount and quality of storm-water discharged to the stormwater conveyance system.

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St. Marys River
Area of Concern

The River was listed as an Area of Concern in 1985. Changes in chemical, physical, or biological integrity of this water body have been sufficient to cause beneficial use impairments:

- Restrictions on fish and wildlife consumption and unhealthy populations
- Fish tumours and other deformities
- Unhealthy populations of bottom-dwelling organisms
- Restrictions on dredging
- Undesirable algae due to excess nutrients in the water
- Beach closures
- Poor aesthetics
- Loss of fish and wildlife habitat

Remedial Action Plan

The Remedial Action Plan (RAP) Program was created in 1987 as part of the Great Lakes Water Quality Agreement between Canada and the United States as a way to guide restoration of Areas of Concern.

Stage 1 of the RAP (1992) outlines environmental conditions and beneficial use impairments.

Stage 2 of the RAP (2002) describes a strategy to remediate beneficial use impairments and defines criteria by which to measure improvement in the waterway. Actions related to stormwater are:

- Identification and remediation of disposal sites transferring contaminants into waterways
- Monitoring non-point sources of pollution
- Implementing Watershed Development Plans

Goal 2 of the 2007 Canada-Ontario Agreement is to, “Make significant progress towards Remedial Action Plan implementation” specifically reducing microbial and other contaminants and excessive nutrients from urban stormwater and continuing to identify and promote implementation of priority actions.

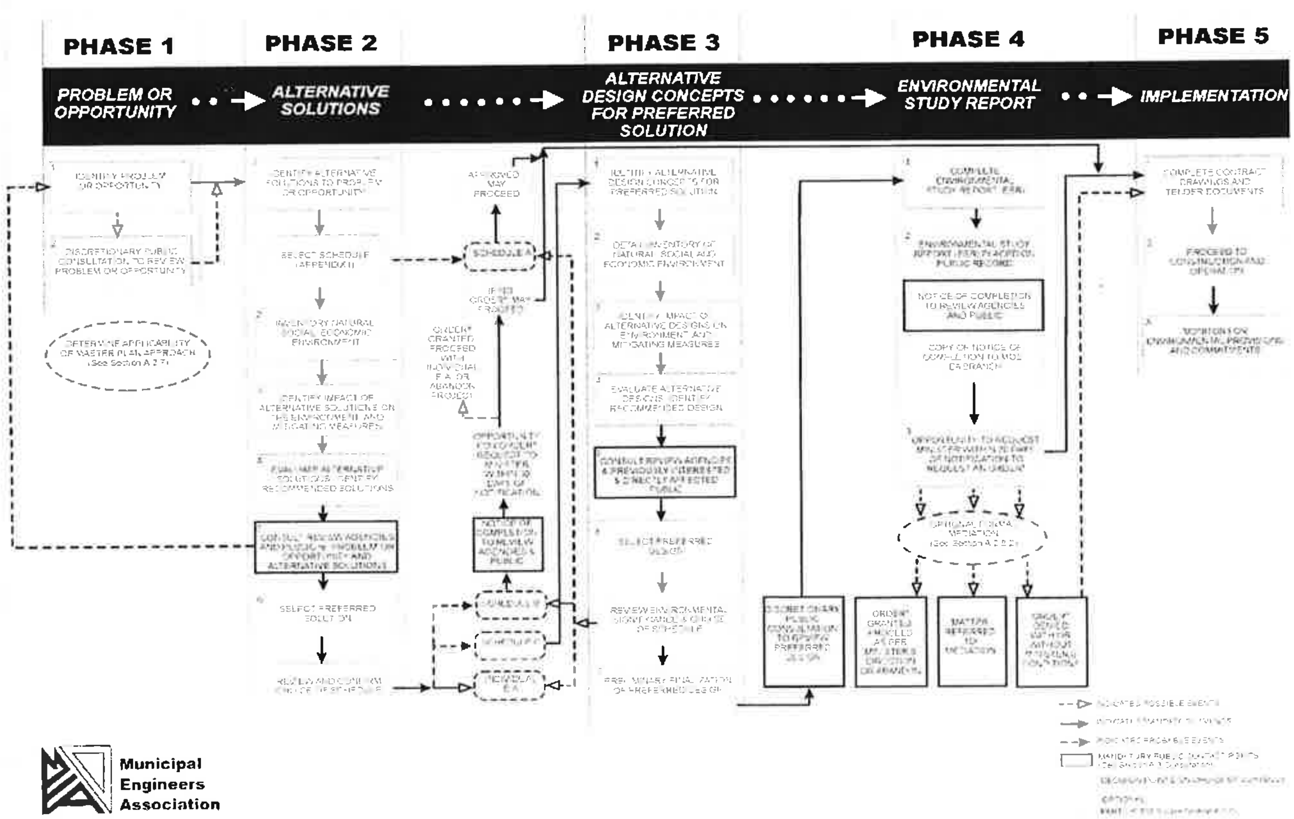
Municipal Class EA Process

Master Plans

- Integrate infrastructure requirements for existing and future land use with environmental assessment planning principles.
- Outline a framework for planning for subsequent projects and/or developments.
- Address Phase 1 and Phase 2 of the Municipal Class EA Process.

This Master Plan follows Approach #1 of the Master Planning Process where it becomes the basis for future investigations for specific Schedule B and C projects.

Municipal Class Environmental Assessment Process



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BEST MANAGED COMPANIES

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Problem Statement

In response to growing recognition of stormwater from approval agencies, source water protection initiatives and the RAP, the City has initiated a Municipal Class Environmental Assessment Master Plan to,

"Develop a stormwater Management Plan Strategy to address stormwater quality and quantity concerns within the City of Sault Ste. Marie from current and future developments."

The Purpose of this Study is to:

- Develop a long-term sustainable plan to assist the City with meeting and maintaining stormwater management goals and address quality objectives.
- Address stormwater related issues identified in the St. Marys River Remedial Action Plan to the extent possible.
- Identify stormwater capacity issues and recommend remedial works for the future.
- Develop a comprehensive monitoring program.

Alternative Solutions

1. Do Nothing
2. New Development
   - Large and small scale SWM facilities as part of new developments
3. Existing development SWM approach
4. City Wide SWM approach

Common Recommendations to All Alternatives

- Point source monitoring program
- Review of snow and salt management
- Remediation of erosion and sedimentation
- Operation and maintenance
- Community involvement and education

Preferred Alternative:

City-Wide Approach Includes:

1. Implement Stormwater Management Policy
2. Improve Snow Disposal Sites
3. Education
4. Point Source Monitoring Plan
5. Establish Oil Grit Separators
6. Snow Disposal Site Review (Environmental Assessment)
7. Stormwater Management Pond Retrofits for Quality
8. Various Storm Pipe Improvements

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Have Something to Say?
Want to Know a Little More?

We welcome your input!

Please complete a comment sheet,
or phone, mail, fax, or email the
contacts provided on the handout.

Please submit comments by June 20, 2011(four weeks)

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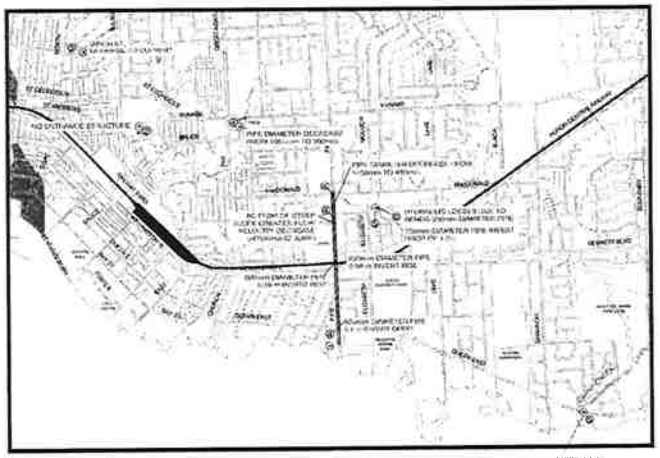

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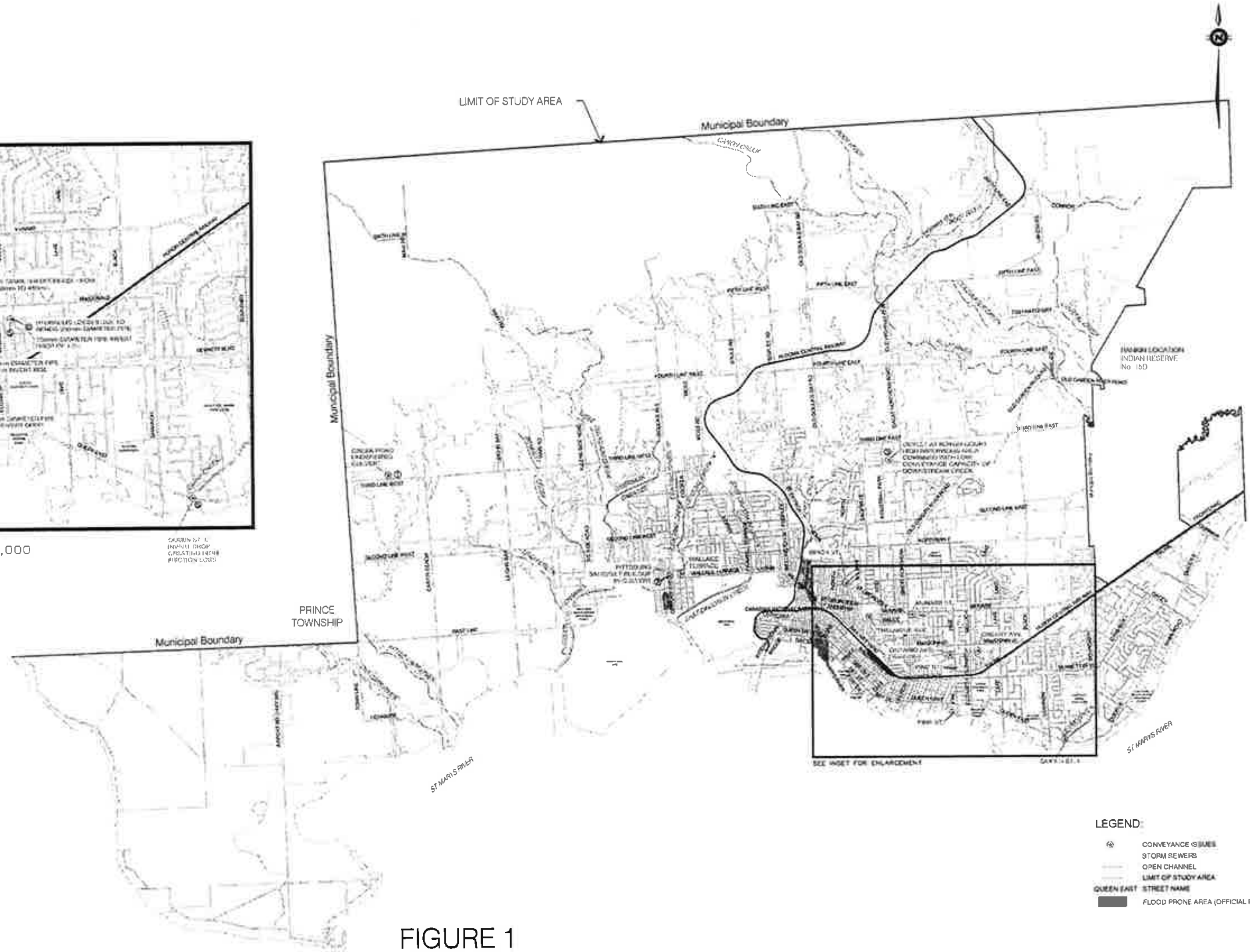

FLOOD MITIGATION MEASURES

① INCREASE CULVERT CAPACITY
② DESIGN ENTRANCE STRUCTURE
③ PROVIDE UPSTREAM QUANTITY CONTROL AND/OR INCREASE DOWNSTREAM CONVEYANCE CAPACITY
④ INCREASE SEWER CONVEYANCE CAPACITY
⑤ ELIMINATE INVERT DROP
⑥ ELIMINATE 90° BENDS
⑦ REMOVE SILT/SAND AND MONITOR

LEGEND:

- CONVEYANCE ISSUES
- STORM SEWERS
- OPEN CHANNEL
- LIMIT OF STUDY AREA
- QUEEN EAST — STREET NAME
- FLOOD PRONE AREA (OFFICIAL PLAN)

FIGURE 1

EXISTING STORM WATER CONVEYANCE ISSUES, FLOOD AREAS AND DRAFT MITIGATION SOLUTIONS

PRELIMINARY

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Total Suspended Solids (mg/L)

Agency	Location	June 4, 2008	June 11, 2008	June 18, 2008	June 25, 2008	July 2, 2008	July 9, 2008	July 16, 2008	July 23, 2008
Ministry of the Environment	Davignon Creek	3.5	3.5	3.3	5.9	7.6	11.1	3.3	7.3
Ministry of the Environment	Queen	-	4.7	2.3	2.1	36.7	12.1	1.2	2.4
Ministry of the Environment	Fort Creek	-	4.7	5	2.2	43.9	14.6	3.2	22.1
Ministry of the Environment	Dennis	-	1.9	1.6	1.9	1.9	1.9	1.5	2.6
Ministry of the Environment	St. Marys River	-	3.2	2.5	2.8	62.9	13.9	1.9	3
Ministry of the Environment	Pine	-	2.1	0.9	1.9	15.3	4.1	2.4	4.5
Ministry of the Environment	Churchill	-	2.1	1.6	2.2	20.8	4.6	1.2	9
Ministry of the Environment	Millwood	-	5.3	3.6	11.8	9.9	4.4	3	1.9
Ministry of the Environment	Dacey	-	2	2	14.3	28.1	5	5.9	6.6

Total Phosphorus (mg/L)

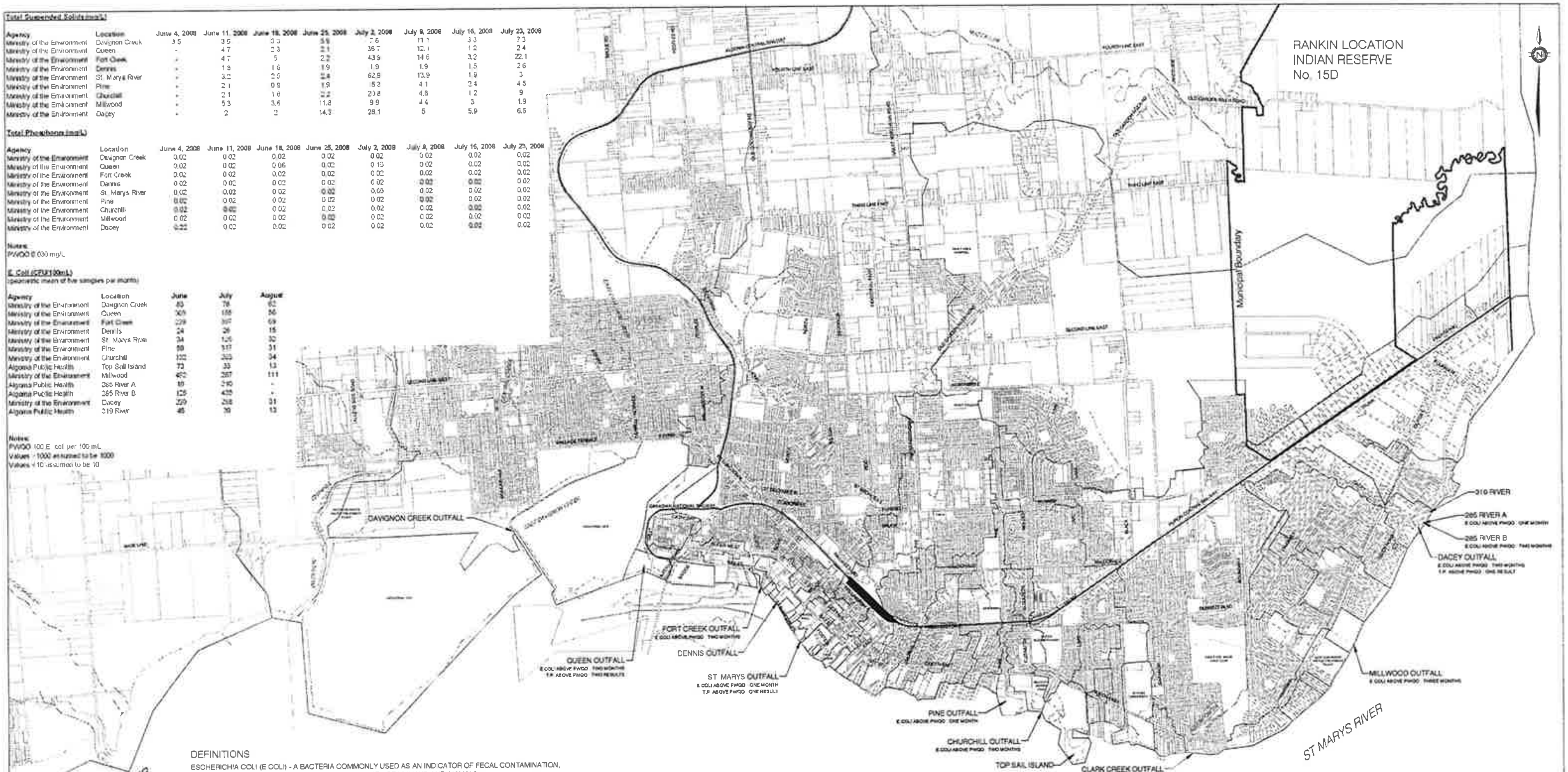
Agency	Location	June 4, 2008	June 11, 2008	June 18, 2008	June 25, 2008	July 2, 2008	July 9, 2008	July 16, 2008	July 23, 2008
Ministry of the Environment	Davignon Creek	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Queen	0.02	0.02	0.06	0.02	0.10	0.02	0.02	0.02
Ministry of the Environment	Fort Creek	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Dennis	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	St. Marys River	0.02	0.02	0.02	0.02	0.06	0.02	0.02	0.02
Ministry of the Environment	Pine	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Churchill	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Millwood	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Ministry of the Environment	Dacey	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Notes:
PWQO 0.030 mg/L

E. Coli (CFU/100mL)
(geometric mean of five samples per month)

Agency	Location	June	July	August
Ministry of the Environment	Davignon Creek	83	78	62
Ministry of the Environment	Queen	309	155	56
Ministry of the Environment	Fort Creek	229	307	69
Ministry of the Environment	Dennis	24	26	15
Ministry of the Environment	St. Marys River	34	126	30
Ministry of the Environment	Pine	59	117	31
Ministry of the Environment	Churchill	102	303	34
Algoma Public Health	Top Sail Island	73	33	13
Ministry of the Environment	Millwood	452	287	111
Algoma Public Health	285 River A	10	210	-
Algoma Public Health	285 River B	125	435	-
Ministry of the Environment	Dacey	229	258	31
Algoma Public Health	319 River	45	39	13

Notes:
PWQO 100 E. coli per 100 mL
Values > 1000 assumed to be 1000
Values < 10 assumed to be 10



DEFINITIONS

ESCHERICHIA COLI (E.COLI) - A BACTERIA COMMONLY USED AS AN INDICATOR OF FECAL CONTAMINATION, NORMALLY HARMLESS BACTERIA IN THE INTESTINES OF HUMANS AND ANIMALS

TOTAL PHOSPHORUS (TP) - A MEASURE OF ALL DISSOLVED AND PARTICULATE FORMS OF PHOSPHORUS, IT IS THE NUTRIENT RESPONSIBLE FOR THE UNNATURAL ENHANCEMENT OF ALGAL PRODUCTIVITY

TOTAL SUSPENDED SOLIDS (TSS) - A WATER QUALITY MEASUREMENT OF SOLID MATERIAL SUSPENDED IN WATER AND RETAINED BY A FILTER, IT IS A POLLUTANT, MEASUREMENT BY DRY-WEIGHT OF PARTICLES TRAPPED BY A FILTER OF A SPECIFIED PORE SIZE

WATER QUALITY PARAMETERS

SOURCE: WATER MANAGEMENT - POLICIES, GUIDELINES, PROVINCIAL WATER QUALITY OBJECTIVES (PWQO) OF THE MINISTRY OF THE ENVIRONMENT (JULY 1994, REPRINTED FEBRUARY 1999)

ESCHERICHIA COLI (E.COLI): 100 E.COLI PER 100 mL (BASED ON A GEOMETRIC MEAN OF AT LEAST FIVE SAMPLES)
TOTAL PHOSPHORUS (T.P.): 0.03 mg/L (BASED ON ELIMINATING EXCESSIVE PLANT GROWTH IN RIVERS AND STREAMS)

SUMMARY OF 2008 WATER QUALITY MONITORING PROGRAM
NUMBER OF TEST RESULTS FOR EACH SAMPLING SITE

MOE
- 5 RESULTS PER MONTH FOR E. COLI (JUNE TO AUGUST)
- 6 RESULTS FOR TOTAL SUSPENDED SOLIDS (JUNE AND JULY)
- 6 RESULTS FOR TOTAL PHOSPHORUS (JUNE AND JULY)

ALGOMA PUBLIC HEALTH
- 3 RESULTS, SAMPLED ONCE PER WEEK FOR E.COLI (JUNE TO AUGUST)

FIGURE 2

2008 WATER QUALITY MONITORING RESULTS

PRELIMINARY

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City of Sault Ste. Marie
Stormwater Management Master Plan
Environmental Assessment

May 19, 2011

Sign-in Sheet:

Please sign your name and provide your contact information if you would like additional information or would like to be notified of further meetings.

	NAME (PLEASE PRINT)	PHONE No.	CONTACT INFORMATION
1	Ryan Walker	705-759-6973	8 Barber Blvd. S.S.M. P6A5T9
2	Scott Williamson	705-542-5809	122 Trelawne Ave P6B 2M9
3	Kira Fry	705-942-6338	
4	Shane Corbett	705-256-0129	
5	Klaas Oswald	705-942-6618	111 Millcreek SSM
6	Susan Hamilton Beach	705-759-5385	s.hamiltonbeach@cityssm.on
7	Catherine Taddo	705-759-5380	c.taddo@cityssm.on.ca
8	AL WRIGHT	705-946-8538	4 VALHALLA PLACE SSM. ONT. P6A 5Z1
9	DON McCONNELL	705-759-5375	Civic Centre
10	Steve Turco	705-759-5279	s.turco@cityssm.on.ca
11	PETER McLARTY	705 759-3392	
12	FRANK TESOLIN	705 942 1049	frank.tesolin@sympatico.ca
13	MARLENA McKINNON	705-946-5642	mmckinnon@ssmrca.ca
14	ANDY CAIRNS	705 254 7640	cairnseng@vianet.ca
15			

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Collection and disclosure of personal information:
Please note that the City of Sault Ste. Marie and R.V. Anderson Associates Limited, are required under the Municipal Class Environmental Assessment Planning Process to attach a list of public contacted, as well as submissions, input and opinions received from the public, to the Environmental Assessment for the Stormwater Management Master Plan. The information on this form (including personal information) will become part of the public record, unless you expressly request the removal of your personal identity information.

PUBLIC INFORMATION CENTRE

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday May 19, 2011

COMMENT SHEET

Please Print

Name: AL WRIGHT

Email: al.wright@sympatico.ca

Address: 4 VALHALLA PLACE, SAULT STE MARIE, ONT

Postal Code: P6A 5Z1

Would you like to be added to a mailing list to receive future project information? Yes ☑ No ☐

Do you consent to having your comments included in the public record? Yes ☑ No ☐

Please indicate your interest in the study.

☐ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☑ Interest Group Representative

☐ Agency or Ministry Representative

Please specify: MEMBER OF ST MARYS RIVER BINATIONAL PUBLIC ADVISORY COUNCIL

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

NOT DIRECTLY BUT HAVE READ CONSERVATION AUTHORITY REPORTS ON THE FLOODING SITUATIONS BEFORE THE AUTHORITY WAS CREATED

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Marys River? If yes, please describe your observations.

I HAVE NOTICED PETROLEUM LIKE SURFACE CONTAMINANTS IN THE VICINITY OF THE DISCHARGE BY [illegible] [illegible] AND ALONG THE SHORE OF CANADIAN BUSHPLANE HERITAGE CENTRE & [illegible]

Are there any particular issues you would like to bring to the attention of the project team?

I BELIEVE THERE ARE CROSS CONNECTIONS BETWEEN SANITARY & STORM SEWERS IN THE OLDER DOWNTOWN RESIDENTIAL AREAS. THIS IS KNOWN TO CITY STAFF BUT IS A PERSISTENT PROBLEM.

Do you feel that this Stormwater Management Master Plan preferred alternative(s) will address concerns that you have regarding stormwater management in the City of Sault Ste. Marie?

YES I THINK THE SWM PLAN WILL GREATLY IMPROVE THE CITY'S READINESS TO SEEK FEDERAL & PROVINCIAL FUNDING TO UNDERTAKE NEEDED INFRASTRUCTURE IMPROVEMENTS.

Thank you very much for your participation in the Sault Ste. Marie Stormwater Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Monday, June 20, 2011 to one of the following:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Fax: (705) 541-7165
Email: s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, LEL, C.E.T.
Project Manager
R.V. Anderson Associates Limited
436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555, ext. 202
Fax: (705) 560-5822
Email: asorensen@rvanderson.com

PUBLIC INFORMATION CENTRE

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday May 19, 2011

COMMENT SHEET

Please Print

Name: Klaas OSWALD

Email: khm.oswald@sympatico.ca

Address: 111 MILLCREEK DR, SSM

Postal Code: P6B 6H7

Would you like to be added to a mailing list to receive future project information? Yes ☑ No ☐

Do you consent to having your comments included in the public record? Yes ☑ No ☐

Please indicate your interest in the study.

☑ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☐ Interest Group ~~Representative~~

☐ Agency or Ministry Representative

Please specify: member of St Marys River BBAC

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

No

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Marys River? If yes, please describe your observations.

1. Creeks filled with sand/sediment, cannot support fish, cannot handle storms.

Are there any particular issues you would like to bring to the attention of the project team?

"DRAINS" should be part of the flowing waters marked on Drawing 3-1. One unmarked one on Old Garden R Rd just South of 3rd Line flows all year, has a good population of minnows. Keeping this pollution-free helps maintain water purity of Root R flowing into St Mary.

Do you feel that this Stormwater Management Master Plan preferred alternative(s) will address concerns that you have regarding stormwater management in the City of Sault Ste. Marie?

No. It does not address natural drainage (streams), their propensity to flood beyond culvert capacity and destroy road crossings. Plan, to be comprehensive should address these as part of permanent policy & direction. For instance, sediment traps would result in greater water capacity & increased water quality.

Thank you very much for your participation in the Sault Ste. Marie Stormwater Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Monday, June 20, 2011 to one of the following:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Fax: (705) 541-7165
Email: s.hamiltonbeach@cityssm.on.ca

Alex Sorensen, LEL, C.E.T.
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Email: asorensen@rvanderson.com

PUBLIC INFORMATION CENTRE

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

MASTER PLAN

Public Information Centre • 3:00 pm – 7:00 pm
Civic Centre • Russ Ramsay Room
Thursday May 19, 2011

COMMENT SHEET

Please Print

Name: Scott Williamson
Email: songo30@hotmail.com
Address: 2-122 Trelawne Ave
Postal Code: P6B 2M9

Would you like to be added to a mailing list to receive future project information? Yes ☑ No ☐

Do you consent to having your comments included in the public record? Yes ☑ No ☐

Please indicate your interest in the study.

☑ City of Sault Ste. Marie Resident or Landowner

OR

☐ Developer Representative

☐ Interest Group Representative

☐ Agency or Ministry Representative

Please specify: ____________________

RECEIVED
MAY 24 2011
ENGINEERING DEPT.

Have you witnessed or experienced a flood in the Sault Ste. Marie region? If yes, please describe the location and the conditions at the time.

I have seen the east Davignon and Fort Creek overflow because of heavy rainfall at the time

Have you noticed indications of degraded water quality in streams and creeks in the City of Sault Ste. Marie or in the St. Marys River? If yes, please describe your observations.

I noticed on occasion an increased concentration of certain kind of algae, especially near the outfalls and sewage treatment plant

Are there any particular issues you would like to bring to the attention of the project team?

I would like to bring to attention the discharge of harmful pollutants from Essar Steel and St. Marys paper, also the use of salt during winter

Do you feel that this Stormwater Management Master Plan preferred alternative(s) will address concerns that you have regarding stormwater management in the City of Sault Ste. Marie?

I think it will address most of the concerns, but public education of what should or should not go down the drain will play a huge factor.

Thank you very much for your participation in the Sault Ste. Marie Stormwater Management Master Plan Class Environmental Assessment.

Please leave your comments at the registration table or send your comments by Monday, June 20, 2011 to one of the following:

Susan Hamilton Beach, P.Eng.
Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
Civic Centre, Box 580
99 Foster Drive
City of Sault Ste. Marie, ON P6A 5N1
Phone: (705) 759-5385
Fax: (705) 541-7165
Email: s.hamiltonbeach@cityssm.on.ca

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436 Westmount Avenue, Unit 6
Sudbury, ON P3A 5Z8
Phone: (705) 560-5555, ext. 202
Fax: (705) 560-5822
Email: asorensen@rvanderson.com

-----Original Message-----
From: Peter McLarty [mailto:petmcla@sympatico.ca]
Sent: May 30, 2011 9:57 AM
To: Susan Hamilton Beach
Subject: stormwater open house.

Hi Susan

Congratulations ...again.

I filled out a response form but forgot to take it with me on Thursday.

My only substantive comment was... for the City to construct more artificial wetlands and retention ponds...behind the hospital, Black Road and whereever "new" subdivisions are developed.

I am also enthused by the Planning Deptment's proposals for new site plan controls ...especially when it comees to stormwater management.

Regards

Peter

Peter McLarty
755 Fifth Line East
Sault Ste Marie, On
P6A 5K7

Alex Sorensen

From: Susan Hamilton Beach [s.hamiltonbeach@cityssm.on.ca]
Sent: Tuesday, June 07, 2011 10:55 AM
To: John McDonald
Cc: Alex Sorensen
Subject: RE: Stormwater Master Plan

Hi John,

Further to your phone message and email below, there is a brief on the City's homepage and comment sheet. The full report indicates it is a City-wide approach with each development responsible for their own stormwater management facility as well as the City shall construct a number of oil/grit interceptors at key locations. Alex Sorenson is best to walk you through the full solution.

Hope this helps.

Regards,

Susan

Susan Hamilton Beach, P. Eng.
Land Development and Environmental Engineer
The City of Sault Ste. Marie
Phone: 705-759-5385
Fax: 705-541-7165
Email: s.hamiltonbeach@cityssm.on.ca

From: John McDonald [mailto:john.mcdonald@tulloch.ca]
Sent: June 06, 2011 4:05 PM
To: Susan Hamilton Beach
Subject: Stormwater Master Plan

Hi Susan

What is the proffered solution/alternative. I can not locate any additional info on the website.

John McDonald, P.Eng.
Project Manager
Tulloch Engineering
369 Queen Street East
Sault Ste. Marie, Ontario
P6A 1Z4
Phone: 705.949.1457
Fax: 705.949.9606
Email: john.mcdonald@tulloch.ca

R.V. Anderson Associates Limited
engineering · environment · infrastructure

436 Westmount Avenue Unit 6
Sudbury Ontario P3A 5Z8 Canada
Tel 705 560 5555 Fax 705 560 5822
www.rvanderson.com

March 6, 2014

RVA 091800

Cover letter and Notice of Completion sent to following addressees.

Batchewana First Nation
Rankin Reserve
236 Frontenac Street, R.R. # 4
Sault Ste. Marie, Ontario
P6A 5K9

Attention: Chief Dean Sayers

Dear Chief Dean Sayers:

Re: City of Sault Ste. Marie
Stormwater Management Master Plan
Notice of Completion

The City of Sault Ste. Marie has completed a long-term Stormwater Management Master Plan following Phases 1 and 2 of the Municipal Class Environmental Assessment process.

Based on the study findings and comments received from review agencies and the public, a series of alternatives have been developed. We have attached the Notice of Completion advertisement for your information. The advertisement further explains the process and findings of the Master Plan.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Alex Sorensen, LEL, C.E.T.
Project Manager

Encl.

AES:mc

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NOTICE OF COMPLETION
STORMWATER MANAGEMENT CLASS ENVIRONMENTAL ASSESSMENT MASTER PLAN

The City of Sault Ste. Marie has developed a long-term Stormwater Management Master Plan following Phase 1 and 2 of the Municipal Class Environmental Assessment process.

Based on the study findings and comments received from review agencies and the public, a series of alternatives have been developed. The preferred alternative is to implement a City-Wide Stormwater Management Approach. This approach will include: improving snow disposal sites, education, implementing a point source monitoring plan, implementing oil grit separators at various locations throughout the City prior to discharge to the natural environment, improving storm water conveyance at known problem areas and the retrofitting of existing stormwater management facilities for quality control. In addition, the City has developed new Stormwater Management Guidelines.

The proposed approach is required to address concerns regarding stormwater quantity and quality. This study falls under the Municipal Class Environmental Assessment (EA) Master Plan Process Approach #1. The City of Sault Ste. Marie has, based on Environmental Assessment requirements, defined the problems to be resolved, developed and evaluated alternative solutions and consulted with the public prior to deciding upon the preferred solution.

Project information can be viewed on the City website at **www.cityssm.on.ca – City Hall Bulletins** or at the Corporation of the City of Sault Ste. Marie, Civic Centre, Engineering and Planning Department – Level 5, and Clerk's Department – Level 3, 99 Foster Drive, Sault Ste. Marie, Ontario.

Comments regarding this project can be directed to Ms. Catherine Taddo, the City's Land Development & Environmental Engineer at 705-759-5380 or Mr. Alex Sorensen at R.V. Anderson Associates Limited at 705-560-5555 in Sudbury.

Interested persons should provide written comment to the City on the proposal within 30 calendar days from the date of this Notice. Comments should be directed to Ms. Catherine Taddo, P.Eng., Land Development & Environmental Engineer, City of Sault Ste. Marie, 99 Foster Drive, Sault Ste. Marie, ON P6A 5N1.
Phone: 705-759-5380, Fax: 705- 541-7165 or Email **c.taddo@cityssm.on.ca**

Thereafter the Master Plan will be reviewed and revised, taking into consideration the further comments received from the public. The recommended Master Plan approach will proceed, subject to Council approval.

This Notice issued March 8, 2014.

Catherine Taddo, P.Eng. , Land Development and Environmental Engineer
Corporation of the City of Sault Ste. Marie
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Strategic Integration and Partnerships Division
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Attention: Sandra Kok

Great Lakes Areas of Concern Unit
Environment Canada
4905 Dufferin Street
Toronto, Ontario
M3H 5T4
Attention: Kate Taillon, MSc.

Ministry of the Environment
199 Larch Street, Suite 1201
Sudbury, Ontario
P3E 5P9
Attention: Celeste Dugas, Supervisor (Acting)

Northern Ontario District
Ontario-Great Lakes Area Fisheries & Oceans
1219 Queen Street East
Sault Ste. Marie
P6A 2E5
Attention: Jennifer Hallett

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Rhonda Bateman

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
P6A 5K7
Attention: Anjim Amin

Algoma Public Health
99 Foster Drive
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P6A 5X6
Attention: Sherri Cleaves CPHI (C), BASc (EH)

Ministry of Natural Resources
64 Church Street
Sault Ste. Marie
P6A 3H3
Attention: Ilsa Langis, Planning and Information Management Supervisor

Lake Superior Advisory Committee
69 Broadview Drive
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P6C 5Z4
Attention: Don Marles

Ministry of the Environment
3rd Floor 289 Bay Street
Sault Ste. Marie, Ontario
P6A 1W7
Attention: Lilian Keen, Environmental Officer

linistry of the Environment
ırd Floor 289 Bay Street
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ttention: Kirk Crosson, Senior Environmental Officer

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Ministry of the Environment
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435 South James Street, Suite 331
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Ministry of the Environment
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Attention: Tym Garside, Area Supervisor

Environment Canada
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Attention: Mark Chambers, Program Officer
Great Lakes Area of Concern

Ministry of Aboriginal Affairs
Policy and relationships Branch
160 Bloor Street East, Suite 400
Toronto, Ontario
M7A 2E6
Attention: Lori Sterling, Deputy Director

Ministry of the Environment – Northern Region
Technical Support Section
199 Larch Street, Suite 1201
Sudbury, Ontario
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Attention: Laurie Brownlee, Environmental Planner
and EA Coordinator

Indian and Northern Affairs Canada
Ontario Research Team
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Gatineau, Quebec
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Attention: Doug Klassen, Senior Policy Analyst

Sault Ste. Marie Region Conservation Authority
1100 Fifth Line East
Sault Ste. Marie
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Attention: Christine Ropeter

Batchewana First Nation
Rankin Reserve
236 Frontenac Street, R.R. #4
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P6A 5K9
Attention Chief Dean Sayers

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May 26, 2014

RVA 091800

Coverletter and Notice of Completion sent also to following ...

Métis Nation of Ontario
355 Cranston Crescent
Midland, Ontario
L4R 4K6

Attention: Mr. Aldean Barty

Dear: Mr. Alden Barty, Consultation Assesment Coordinator

Re: City of Sault Ste. Marie
Stormwater Management Master Plan
Notice of Completion

The City of Sault Ste. Marie is in the process of completing a long-term storm water management plan following Phases 1 and 2 of the Municipal Class Environmental Assessment process. The problem statement is to "Develop a Stormwater Management Plan Strategy to address stormwater quality and quantity concerns within the City of Sault Ste. Marie associated with current and future developments".

The preferred alternative is the city wide Stormwater Management Approach which is further described on the attached Notice. The attached Notice contains a link to the Environmental Assessment document.

Further, the preferred alternative includes the implementation of new Stormwater Management guidelines for the City.

The Environmental Assessment process is nearing completion, however we welcome your comments or questions regarding the project. Should you wish to meet to discuss the project further please let us know.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Alex Sorensen, LEL, C.E.T.
Project Manager
Encl.

AES:mc J:\2009\091800\PROJECT\reports\20130821-report\May 26, 2014 -091800 Newest Letter-aes-noticeofcompletion.doc

Company name	Address Line 1	Address Line 2	City	Name
Ojibways of Garden River	7 Shingwauk Street		Garden River	Chief Lyle Sayers
Historic Sault Ste Marie Métis Council	26 Queen Street Esat		Sault Ste Marie	Kim Powley, President
Metis Nation of Ontario Head Office	500 Old St. Patrick Street, Unit D		Ottawa	Métis Consultation Unit
Indian and Northern Affairs Canada,	Claims Analyst Ontario Team	1310-10 Wellington Street	Gatineau	Ms. Janet Townson
Indian and Northern Affairs Canada	Assessment and Historical Research	10 Wellington Street	Gatineau	Mr. Sean Darcy, Manager

APPENDIX D

Previous Studies

PREVIOUS STUDIES

City of Sault Ste. Marie Drainage Report, December 1965, Proctor and Redfern Limited Consulting Engineers. This report reviews the capacity of sewage treatment facilities and outlines the basis of design for sanitary and storm sewers as well as the projected sanitary and storm requirements for a twenty year period from 1965 to 1985.

Central, East Davignon and Clark Creeks, August 1966, Proctor and Redfern Limited Consulting Engineers. The purpose of this report was to evaluate the current and expected level of public activity in the areas surrounding City creeks. Recommendations are made regarding the provision of public parkland and easements bordering these creeks as well as channel improvements to ensure accommodation of flows.

Fort Creek Channel Second Line to Aqueduct, June 1970, Proctor and Redfern Limited Consulting Engineers. This report was prepared to evaluate the natural open channel from the then unfinished Fort Creek Dam downstream to the Hudson Street (Carmen's Way) aqueduct near Bloor Street. The study found that flooding of the downstream channel would be inevitable following construction of the Fort Creek Dam but would be of lesser severity, and recommended various improvements to minimize and/or control flood effects.

Flood Plain Mapping Report, November 1977, M.M Dillon Limited. This report was prepared to provide an overview and inventory of watersheds and flood control in the City. Floodplain mapping and stream flows for several areas were produced.

Root River Study Hydrology and Hydraulic Technical Reports, January 1988, revised March 1988, Wm. R. Walker Engineering Incorporated. This report was prepared to summarize the hydrology analysis conducted by the Sault Ste. Marie Region Conservation Authority. Included in this report are resulting regulatory flood lines and an inventory of buildings at risk of flood in the event of the Regional Storm.

Clark Creek Capacity Review, January 1998, Wm. R. Walker Engineering Incorporated. This report was generated to evaluate the pressures placed on Clark Creek from increased flows due to development in the area since the channel was reconstructed in 1969. The report found that the creek will accommodate a 1 in 10-year flood without overtopping its banks and recommended additional detailed study of the channel to determine the extent of flooding in the event of a 1 in 100-year storm.

Table D1 summarizes a selection of flows calculated as part of the preceding studies.

Table D1
Calculated Stream Flows

Watercourse	Location	Drainage Area (km^2)	Slope (m/km)	Runoff Curve Number (CN)	Timmins Storm Peak Flow (m^3/s)	1:100 year storm Peak Flow (m^3/s)	1 : 10 Year Storm Flow (m^3/s)
Big Carp River	at St Marys River	58	28.7	70	164*		
Little Carp River	at St Marys River	21	26.8	70	64*		
Leigh Creek	at Leigh Bay	7	18.5	75	43*		
West and East Davignon Creeks	at St Marys River	66	36 & 38	69	223*		
Central Creek	at East Davignon	3	13.9		22*		
Bennett Creek	at confluence with Davignon	22	41.3		72*		
Fort Creek	at St Marys River	7	20	70	38*		
Clark Creek	at St Marys River	6	8.5		31.1**	26.8**	13.3**
Root River	at West boundary of Reserve Lands	114	20.4		174*		
West Root River	at confluence with Root River					35***	
Coldwater Creek	at confluence with Root River	3			12*		
Crystal Creek	at West boundary of Reserve Lands	21		60	67*		

* (Dillon 1977)
** (Wm. R. Walker Engineering 1998)
*** (SSMRCA 1969)

APPENDIX E

Water Quality

WATER QUALITY

Preamble

This document provides a summary of water quality monitoring activities and findings for 2007 and 2008 as well as a description of the weather conditions during this period. Historical water quality findings and beneficial use impairments related to poor water quality are also discussed.

Water Quality Monitoring

In total 2,827 results were examined for the 2007 and 2008 sampling seasons. Numerous historical samples provided for previous years as part of the Provincial Water Quality Monitoring Network (PWQMN) were also studied to establish the sensitivity of water quality in some of the City's waterways and to profile the evolution of legislation and sampling methodologies. A summary of the samples taken is provided in Tables E-1 and E-2. The 2008 Water Quality Monitoring Results were presented at both Public Information Centres and is shown in plan form in Appendix C for the summer months of 2008 for the MOE and Algoma Public Health results.

Microbiological and Inorganic Parameters Testing

Microbiological and inorganic parameter quality data for the subject area was obtained at storm sewer outfalls to drainage courses prior to entering the St. Marys River along the Sault Ste. Marie waterfront by the Ministry of the Environment and at shoreline locations by Algoma Public Health. The monitoring program ran from June 1st to October 3rd in 2007, and from June 4th to September 3rd in 2008.

Most samples collected by the Ministry of the Environment were tested for E. coli, alkalinity, pH, conductivity, TSS, TDS, TP, and BOD_5. Algoma Public Health and Garden River First Nation monitored E. coli only. An effort was made to increase sampling for E. coli after rain events. A brief description of the surroundings, presence of waterfowl and atmospheric conditions were provided for most samples at most locations.

Monitoring programs were carried out by other agencies during this period, however only those samples within Sault Ste. Marie, Ontario are presented in Table E-3.

E. Coli

The E. coli parameter is used as an indicator of the presence of other pathogens in the water. The Provincial Water Quality Objective (PWQO) is based on a geometric mean of at least five samples, exceeding the PWQO value of 100 E. coli per 100 mL.

The 2008 results were evaluated based upon the MOE PWQO standard. Results for the 2007 sampling period, included for illustrative purposes, were obtained from the 2007 report released by the Sugar Island Monitoring Workgroup (SIMWG) regarding the health of the St. Marys River. The SIMWG presented results over 300 cfu/100 mL, considered an exceedance as per Michigan Water Quality Standard (MWQS). The 2007 data obtained was collected by Canadian agencies and evaluated by the SIMWG. The findings for 2007 are summarized in Table E-4 and E-5 for 2008. Drawing D-1 illustrates the 2008 results and shows sample locations.

Total Phosphorus

Total phosphorus information was reviewed for the 2008 sampling program.

Total phosphorus exceeded the PWQO guideline of 30 µg/L at three locations between June 4 and July 2, 2008. Exceedances were recorded at Dacey Road, St. Marys Drive, and Queen Street storm sewer outfalls. The guideline covering discharge of phosphorus from treatment plants is 1 mg/L. All samples taken at the East End WPCP downstream of the UV treatment were considerably below this criterion. A summary of the total phosphorus results is presented in Table E-6. The City's Sewer Use By-Law 2009-50 limit for Phosphorus (Total) is 0.4 mg/L.

Total Suspended Solids

There is currently no PWQO for TSS. The discharge limit for TSS provided in the City's Sewer Use By-law 2009-50 for storm sewers is 15 mg/L. TSS results are generally consistent at each location with the exception of July 2, 2008 where the TSS results are notably high for seven locations. Total suspended solids findings are presented in Table E-7.

pH

The PWQO sets acceptable pH as being between 6.5 and 8.5. All samples tested produced values within this range.

Inorganic Parameters and Metals Testing

The Sault Ste. Marie Region Conservation Authority provided inorganic chemistry and metals data from the Ministry of the Environment Provincial Water Quality Monitoring Network (PWQMN) at five locations for three river systems around the Sault area for 2007 and 2008. Quality data was obtained for Big Carp River at Herkimer St., west of the City; East Davignon Creek near its outfall to St. Marys River at Goulais Avenue: and three locations along the Root River system (on Root River at Highway 17 north of the City, on Coldwater Creek at Landslide Road, and downstream on Root River at Highway 17 east of the City).

The Canadian Environmental Protection Act lists aluminum, cadmium, and chromium as priority substances. These metals appear in concentrations exceeding the safe discharge limits defined in the PWQO a number of locations. The sampling results in the Big Carp River located immediately west of the City reveal levels of aluminum, cadmium, and iron consistently exceeding levels determined by PWQO. The Big Carp River is not influenced by an appreciable amount of urban or industrial stormwater runoff. This suggests that these elements are naturally occurring upstream due to the nature of the soils and rock in the area although this assumption would need to be confirmed with further study. The parameters exceeded at each location is presented in Table E-8.

Historical Water Quality Results

As part of the PWQMN numerous sites across the area have been monitored in the past. A summary of these sites is provided in Table E-9. The parameters tested are usually wide ranging and vary from year to year.

Weather Conditions

Weather conditions influence water quality. The following is a description of the weather activity during the 2007 and 2008 sampling seasons highlighting specific events that correspond with the sampling schedule. Rain events occurring during summer of 2007 and 2008 are provided in Tables E-10 and E-11 respectively.

Dry weather high E. coli values were recorded most at Dacey Road SSO with 3 followed by Queen Street with 2 followed by River Road B and Fort Creek at 1. Dry weather is assumed when there is no accumulation of precipitation during the preceding or current day of sampling.

During 2008, E. coli levels were highest from the end of June to the beginning of August. July was a very wet month in Sault Ste. Marie, far wetter than August, suggesting that the high levels of E. coli are due to increased runoff. Water quality is dynamic and continued monitoring is required to ensure that decisions regarding stormwater quality treatment yield beneficial results. Several sites exhibited levels of E. coli greater than 1000 E.coli/100mL (upper reporting limit).

This may be due to an extended period of rain that occurred during the 48 hours previous. Rain events wash solids into the storm sewer system, and may also disturb solids settled in the pipes, resulting in a higher TSS concentration.

Snow Disposal Sites

Sediment from snow disposal sites was tested for several parameters in October 2009. These results are presented in Table E-12.

The following storm sewer outfalls receive runoff from snow dump areas:

- St. Marys Drive
- Fort Creek
- Millwood
- Davignon

As previously noted, all of these areas have water quality issues.

Snow dumpsites are of particular interest when considering water quality because of the accumulated snow contaminated with salt, waste, and solids. Continued monitoring, in accordance with the Salt Management Plan (February 2005), is key in understanding and reducing pollutant runoff during the spring melt.

BENEFICIAL USE IMPAIRMENTS (BUI)

Beneficial use impairments are one of the conditions employed by the International Joint Commission to measure the extent of environmental degradation and results of remediation regarding Areas of Concern. Listed below are some of the beneficial use impairments or conditions contributing to beneficial use impairment, identified for the St. Marys River as part of the Remedial Action Plan Stage 2 Report.

The information presented is from the Stage 2 RAP report, which was issued in 2002. Much of the information contained within that report is even older, and may not reflect the current environmental status within the St. Marys River Area of Concern. A number of initiatives are now underway to update the current status of these BUIs, which in many cases are likely to be different from what's in the Stage 2 RAP report. The Stage 2 RAP information is somewhat dated, and efforts are underway to update the information.

- Restrictions on fish and wildlife consumption
- Eutrophication or undesirable algae
- Degradation of fish and wildlife populations
- Beach closings
- Fish tumours or other deformities
- Degradation of aesthetics
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Restriction on dredging activities
- Loss of fish and wildlife habitat

Table E-1
Quantity of Biological Water Quality Samples

Year	Agency	Parameter	Quantity
2007	MOE	E.coli	21
	APH	E.coli	10
2008	MOE	E.coli	90
		TSS	90
		TP	90
		pH	90
	APH	E.coli	126
	GRFN	E.coli	35
		Total	552

Table E-2
Quantity of General Chemistry PWQMN (SSMRCA)

Year	Sampling Dates	Locations	Parameters	Quantity
2007	7	5	35	1225
2008	6	5	35	1050
			Total	2275

Table E-3 - Locations of Sampling

2007	2008
Across Bellevue Marina	319 River Road
Across Bells Point	Across Bells Point
Across Top Sail Island	Churchill Storm Outfall
Bellevue Park Outfall	Dacey Road Outfall
Clergue Park	Davignon Creek Outfall
Dacey Road Outfall	Dennis Street Outfall
Dennis Street Outfall	East End Treatment Plant
East End Treatment Plant	Fort Creek
Fort Creek	St. Marys River Drive Storm Outfall
St. Marys River Drive Storm Outfall	Millwood Storm Outfall
Queen Street Outfall	Pine Street Outfall
River Road A	Queen Street Outfall
River Road B	River Road A
Top Sail Island	River Road B
	Top Sail Island

Table E-4
2007 Monitoring Results
Summary of E. Coli (CFU/100mL) above PWQO

Agency	Location	Sample Date (yy/mm/dd)	Reported E.coli Values (single value and geometric mean)
Ministry of the Environment	Bellevue Park SSO	11/07/2007	370
Ministry of the Environment	Bellevue Park SSO	12/09/2007	780
Ministry of the Environment	Bellevue Park SSO	25/09/2007	460
Ministry of the Environment	Bellevue Park SSO	04/10/2007	480
Algoma Public Health	Clergue Park	15/08/2007	1000
Algoma Public Health	Clergue Park	22/08/2007	404
Ministry of the Environment	Dacey Road Outfall	13/06/2007	600
Ministry of the Environment	Dacey Road Outfall	06/06/2007	320
Ministry of the Environment	Dacey Road Outfall	01/08/2007	320
Ministry of the Environment	Dacey Road Outfall	21/08/2007	620
Ministry of the Environment	Dacey Road Outfall	06/09/2007	>1000
Ministry of the Environment	Dacey Road Outfall	12/09/2007	>1000
Ministry of the Environment	Fort Creek	23/07/2007	380
Ministry of the Environment	Fort Creek	12/09/2007	>1000
Ministry of the Environment	Fort Creek	11/07/2007	>1000
Ministry of the Environment	Fort Creek	08/08/2007	970
Ministry of the Environment	Fort Creek	25/09/2007	860
Ministry of the Environment	Fort Creek (geo mean)	06/06/2007	449
Ministry of the Environment	Queen Street Outfall	08/08/2007	>1000
Ministry of the Environment	Queen Street Outfall	13/06/2007	450
Ministry of the Environment	Queen Street Outfall	20/06/2007	470
Ministry of the Environment	Queen Street Outfall	21/08/2007	540
Ministry of the Environment	Queen Street Outfall	12/09/2007	>1000
Algoma Public Health	River Road A	12/07/2007	407
Algoma Public Health	River Road A	20/06/2007	508
Algoma Public Health	River Road A	03/10/2007	1000
Algoma Public Health	River Road B	20/06/2007	1000
Algoma Public Health	River Road B	27/06/2007	509
Algoma Public Health	River Road B	12/07/2007	766
Algoma Public Health	River Road B	07/08/2007	423
Algoma Public Health	River Road B	03/10/2007	1000

Table E-5
2008 Monitoring Results
Summary of E. Coli (CFU/100mL) above PWQO

Agency	Location	June	July	August
Ministry of the Environment	Davignon Creek SSO	83	78	62
Ministry of the Environment	Queen Street SSO	309	155	56
Ministry of the Environment	Fort Creek SSO	229	397	69
Ministry of the Environment	Dennis Street SSO	24	26	15
Ministry of the Environment	Holiday Inn SSO	34	125	32
Ministry of the Environment	Pine Street SSO (Marina)	59	317	31
Ministry of the Environment	Churchill Blvd. SSO	132	283	34
Algoma Public Health	Top Sail Island	73	33	13
Ministry of the Environment	EESTP at UV	118	74	37
Ministry of the Environment	Millwood SSO	492	287	111
Algoma Public Health	285 River Road A	19	210	-
Algoma Public Health	285 River Road B	125	435	-
Ministry of the Environment	Dacey Road SSO	220	288	31
Algoma Public Health	319 River Road	45	39	13
Garden River	Bells Point - Far Left	-	80	-
Garden River	Bells Point - Left	-	26	-
Garden River	Bells Point - Centre	-	24	-
Garden River	Bells Point - Right	-	27	-
Garden River	Bells Point - Far Right	-	29	-

Notes:
PWQO 100 E. coli per 100 mL
Values >1000 assumed to be 1000
Values <10 assumed to be 10

Table E-6
2008 Monitoring Results
Total Phosphorus (mg/L) above PWQO

Agency	Location	Date	T. Phosphorus (mg/L)
Ministry of the Environment	Queen Street Outfall	June 18, 2008	0.060
Ministry of the Environment	Queen Street Outfall	July 2, 2008	0.1
Ministry of the Environment	St. Mary's River Drive Outfall	July 2, 2008	0.05
Ministry of the Environment	Dacey Road Outfall	June 4, 2008	0.22

Notes:
PWQO guideline - 30 µg/L
By-Law 2009-50 - 0.4 mg/L

Table E-7
2008 Monitoring Results
TSS (mg/L) results above PWQO

Agency	Sample	Sample Description	TSS (mg/L)
Ministry of the Environment	02/07/2008	Churchill Blvd. Storm Sewer Outfall	20.8
Ministry of the Environment	02/07/2008	Dacey Road Storm Sewer Outfall	28.1
Ministry of the Environment	02/07/2008	Fort Creek Storm Sewer Outfall	43.9
Ministry of the Environment	23/07/2008	Fort Creek Storm Sewer Outfall	22.1
Ministry of the Environment	02/07/2008	St. Marys Drive Storm Sewer Outfall	62.9
Ministry of the Environment	02/07/2008	Queen Street Storm Sewer Outfall	36.7

Table E-8
General Chemistry above PWQO

	April 26, 2007	May 24, 2007	June 20, 2007	July 26, 2007	August 22, 2007	October 1, 2007	October 24, 2007
BIG CARP R HERKIMER ST	Al, Cd, Cu, Fe	Al, Cd, Fe	Al, Cd, Fe	Al, Cd, Fe	Cd, Fe	Al, Cd, Fe	Al, Cd, Fe
EAST DAVIGNON CREEK, ALGOMA STEEL	Al, Cd	Al, Cd	Cd, Pb, Ni	Cd	Cd	Cd, Co	Al, Cd, TP
ROOT R HWY-17 N. OF SAULT STE. MARIE	Al, Cd, Co	Cd	Cd, Pb	Cd	Cd	Cd, Pb	Al, Cd
COLDWATER CREEK, LANDSLIDE ROAD	Cd, TP	Cd	Cd, Cr, Pb	Cd	Cd, TP	Al, Cd, Fe, TP	Al, Cd, Fe
ROOT R HWY-17 E OF SAULT STE. MARIE	Al, Cd, Cu, Fe, Pb	Al, Cd, Fe, Pb	Al, Cd, Fe	Al, Cd, Fe	Al, Cd, Fe	Al, Cd, Co, Fe	Al, Cd, Cu, Fe

	April 29, 2008	May 22, 2008	June 18, 2008	July 22, 2008	August 27, 2008	September 17, 2008
BIG CARP R HERKIMER ST	Al, Cd, Cr, Fe	Al, Cd, Cr, Fe	Al, Cd, Fe	Al, Cd, Co, Fe, Pb	Al, Cd, Fe	Al, Cd, Fe
EAST DAVIGNON CREEK, ALGOMA STEEL	Al, Cd, Co, Fe	Al, Cd, Cr, Co, Fe	Al, Cd, Fe	Al, Cd, Cr, Fe, TP	Fe	Cd, Fe
ROOT R HWY-17 N. OF SAULT STE. MARIE	Al, Cd	Al, Cd, Pb	Al, Cd, Cu, Fe	Al, Cd, Co, Cu, Fe, Pb	Cd, Fe	Cd, Fe, Pb, TP
COLDWATER CREEK, LANDSLIDE ROAD	Al, Cd, Pb	Cd, Cr	Al, Cd, TP	Cd	Cd, TP	Cd, TP
ROOT R HWY-17 E OF SAULT STE. MARIE	Al, Cd, Cr, Cu, Fe, TP	Al, Cd, Fe, Pb	Al, Cd, Co, Fe	Al, Cd, Fe	Cd, Co, Fe	Cd, Fe

Table E-9
Historical PWQMN (General Chemistry)

Station	Name	Location	Years Sampled
07000900102	Goulais River	Mouth at Goulais Bay	1972-1973, 1985, 1987
07000900202	Goulais River	Hwy 532, Bridge in Searchmount	1972-1973
07000900302	Goulais River	Bridge at Goulais River, S of Hwy 552	1973-1990
13000000102	St. Marys River	Entrance to St. Marys canal	1968-1972, 1983-1986, 1988
13000000202	St. Marys River	Algoma Steel Works, W. of SSM Inter. Bridge	1968-1972
13000000302	St. Marys River	Centre of Huron St dam	1968-1973, 1976-1992, 1994-1995
13000000402	St. Marys River	River Centre, Ferry Dock, S. of Civic Centre	1968-1972, 1983
13000000602	St. Marys River	Private dock, E of Sault St. Marie Golf Club	1976-1992, 1994
13000000702	St. Marys River	Sault St. Marie Civic Centre	1976-1992, 1994-1995
13000001002	Little Carp River	Leigh Bay at 2nd Line West, W. of Carpin Beach Rd	1983-1985
13000001202	St. Marys River	100 ft S of Topsail Island	1986-1989, 1991, 1994
13000300102	Big Carp River	Herkimer St.	1973-1990
13000700202	West Davignon Creek	Baseline Rd.	1972-1973, 1976
13000700302	Bennett Creek	2nd Ln Rd, W. of Allens Side Rd.	1982-1983
13000700402	West Davignon Creek	2nd Ln Rd W, E.of Allens Side Rd,W.of Goulais Ave	1982-1983
13000800102	East Davignon Creek	Near mouth, off Goulais Ave.	1972-1992, 1994-1995
13000800202	East Davignon Creek	4th Ln Rd.	1982-1983
13000900102	Fort Creek	At mouth	1972-1992, 1994-1995
13001000102	Clark Creek	100 m upstrm Queen St.	1986-1992, 1994-1995
13001100102	Root River	Hwy 17, E of Sault St. Marie	1968-1992, 1994-1995, 2003-2005
13001100202	Root River	Hwy 17, N of Sault St. Marie	1972-1973, 1976-1992, 2003-2005
13001100302	Root River	5th Ln E	1986-1989, 1991-1992, 1994-1995
13001100402	Root River	0.70 km N of 5th Ln	1986-1991
13001100502	Root River	S of Heydan, East of Hwy 17	1986-1989
13001100602	West Root River	0.70km N. of confluence with Root River	1986-1989
13001100702	Root River	Hwy 556, 1.15M from Hwy 17	1986-1989
13001100802	Cold Water Creek	4th Ln E, E. of Hwy 17, W. Landslide Rd.	1986-1992
13001100902	Cannon Creek	E. of Old Goulais Bay Rd, N. of 5th Line East	1986-1989
13001300102	Garden River	Hwy 17	1972-1985, 1991-1992
13000700102	Bennett Creek	Base Line , S. of 2nd Line W	1973-1975

Sault Ste. Marie A
Table E-10
Precipitation 2007

Date	Total Precipitation	Date	Total Precipitation	Date	Total Precipitation	Date	Total Precipitation	Date	Total Precipitation	Date	Total Precipitation
01-May	0.7	02-Jun	0.7	03-Jul	0.3	02-Aug	1.2	02-Sep	0.4	01-Oct	1.5
07-May	0.2	03-Jun	2.2	08-Jul	2.4	07-Aug	7.2	04-Sep	18.4	02-Oct	0.4
13-May	0.8	04-Jun	14.3	10-Jul	0.9	11-Aug	2.6	05-Sep	0.4	03-Oct	3.0
14-May	18.2	06-Jun	2.4	11-Jul	3.6	14-Aug	0.8	07-Sep	20.5		
15-May	3.0	07-Jun	10.2	12-Jul	6.4	16-Aug	3.8	09-Sep	1.2		
16-May	10.6	08-Jun	1.4	14-Jul	19.6	17-Aug	0.4	11-Sep	14.0		
19-May	1.0	16-Jun	2.1	27-Jul	1.6	22-Aug	8.6	13-Sep	5.7		
		17-Jun	5.6			23-Aug	1.4	14-Sep	7.7		
		18-Jun	17.2			25-Aug	0.8	15-Sep	1.4		
		19-Jun	6.4			28-Aug	11.8	17-Sep	2.2		
		20-Jun	1.0			29-Aug	0.3	21-Sep	47.6		
						31-Aug	0.4	24-Sep	2.4		
								25-Sep	1.8		
								26-Sep	0.4		
								27-Sep	6.2		
								29-Sep	0.6		
Total (mm)	34.5	Total (mm)	63.5	Total (mm)	34.8	Total (mm)	39.3	Total (mm)	130.9	Total (mm)	4.9

Table E-11
Precipitation 2008

Date	Total Precipitation (mm)	Date	Total Precipitation (mm)	Date	Total Precipitation (mm)	Date	Total Precipitation (mm)	Date	Total Precipitation (mm)
02-May	12.4	05-Jun	1.9	02-Jul	12.0	08-Aug	10.6	02-Sep	3.2
03-May	1.4	06-Jun	4.2	08-Jul	15.8	09-Aug	1.8	04-Sep	8.6
07-May	11.2	08-Jun	5.6	10-Jul	12.6	13-Aug	0.4		
11-May	1.0	09-Jun	4.1	12-Jul	1.4	22-Aug	3.2		
12-May	0.6	10-Jun	10.0	13-Jul	1.2	23-Aug	27.8		
13-May	6.0	11-Jun	0.8	14-Jul	0.2	28-Aug	8.2		
14-May	4.2	12-Jun	7.9	15-Jul	0.8				
16-May	2.4	13-Jun	6.2	17-Jul	17.8				
17-May	0.6	14-Jun	4.8	18-Jul	1.0				
18-May	4.2	15-Jun	1.8	20-Jul	8.3				
19-May	0.4	17-Jun	4.0	21-Jul	3.4				
20-May	0.8	19-Jun	0.4	25-Jul	5.0				
21-May	10.3	21-Jun	1.4	29-Jul	0.8				
25-May	4.3	23-Jun	0.2						
26-May	0.2	27-Jun	1.8						
30-May	9.2	28-Jun	7.6						
31-May	1.4								
Total (mm)	70.6	Total (mm)	62.7	Total (mm)	80.3	Total (mm)	52.0	Total (mm)	11.8

Source Environment Canada

APPENDIX F

Hydrologic and Hydraulic Modeling

Sault Ste. Marie Stormwater Investigative Study
Hydrologic and Hydraulic Modeling – PCSWMM.NET

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1.0 INTRODUCTION

R. V. Anderson Associates Limited (RVA), in conjunction with Wm. R. Walker Engineering, a division of Genivar, has been retained by the Corporation of the City of Sault Ste. Marie (City) to develop a Stormwater Management Master Plan to address the City of Sault Ste. Marie's stormwater quantity and quality concerns.

With regards to the stormwater quantity portion of the project, the City has requested that we identify generally conveyance capacity problem areas of stormwater infrastructure within the City limits. One of the goals of stormwater management is to minimize the risks of loss of life and property damage due to urban floods.

STUDY AREA

The study area encompasses 222 km^2; and is limited to the City of Sault Ste. Marie with consideration being given to the Clark Creek, Pine Street, St. Marys River Drive, Churchill Boulevard, Fort Creek, East Davignon Creek, Central Creek and various smaller shoreline watersheds, contained within the City limits. City area coverage is approximately:

2.7% Clark Creek
0.3% Pine Street
1.1% St. Marys River Drive
0.8% Churchill Boulevard,
6.8% Fort Creek
8.0% East Davignon,
2.9% Central Creek and
3.9% various smaller shoreline watersheds

Drainage from all the watersheds is ultimately conveyed in a southerly direction to St. Marys River. The remainder of the total area consists mainly of undeveloped and/or rural areas which were not modeled under this Stormwater Investigative Study as the City did not consider them priority watersheds.

MODELING PARAMETERS

The percent imperviousness and the Horton infiltration parameters for the sub-catchments are important factors in determining peak runoff flows.

The infiltration parameters are dependant on soil class. Within the study area, the predominant classes of soils are lacustrine sand, lacustrine clay, sandstone, gravel with sand, and glacial till. The hydrologic soils groups parameters used in modeling are shown in Table 1.0.

Table 1.0: Hydrologic Soils Group	
Soil Class	**Hydrologic Soils Group**
Lacustrine sand	AB
Lacustrine clay	BC
Sandstone	CD
Gravel with sand	A
Glacial till	A

The increase in imperviousness of urban areas along with the greater hydraulic efficiency of urban conveyance elements cause increased peak stream flows downstream. Summer floods resulting from high intensity storms are more common in urban areas since infiltration is reduced under developed conditions. The total imperviousness of a site is dependent on the land use characteristics. The total percent imperviousness of a site is increased due to the addition of paved surfaces and rooftops for land use types such as industrial, commercial, residential and institutional sites. Parks and undeveloped lands maintain infiltration into the soils; and tend to have lower imperviousness values. The runoff coefficients (C) and total imperviousness (Timp) values used in the modeling are shown in Table 1.1.

Table 1.1: RUNOFF COEFFICIENTS			
Land Use	**ID**	**C**	**Timp**
Traditional Commercial Zone	C1	0.70	0.70
Central Commercial Zone	C2	0.75	0.80
Commercial Transitional Zone	CT2	0.80	0.85
Riverfront Zone	C3	0.80	0.85
General Commercial Zone	C4	0.70	0.70
Shopping Centre Zone	C5	0.85	0.95
Highway Zone	HZ	0.85	0.95
Light Industrial Zone	M1	0.60	0.60
Medium Industrial Zone	M2	0.75	0.80
Heavy Industrial Zone	M3	0.85	0.95

Estate Residential Zone	R1	0.50	0.45
Single Detached Residential Zone	R2	0.55	0.50
Low Density Residential Zone	R3	0.45	0.35
Medium Density Residential Zone	R4	0.60	0.60
High Density Residential Zone	R5	0.75	0.80
Mobile Home Residential Zone	R6	0.55	0.50
Institutional Zone	I	0.75	0.80
Rural Area Zone	RA	0.25	0.07
Environmental Management Zone	EM	0.25	0.07
Parks and Recreation Zone	PR	0.25	0.07
Rural Precambrian Uplands Zone	RP	0.30	0.15
Rural Aggregate Extraction Zone	REX	0.25	0.07

HYDROLOGIC AND HYDRAULIC MODEL

The information used to develop the model is as follows:

- hydrologic data and reports including runoff and drainage information for existing infrastructure as available;
- mapping (City digital terrain model, topographic - 1:2000 and 1” = 200’, soils, land use);
- as-built drawings for the existing conveyance system (culverts and trunk storm sewers);
- rainfall data as supplied by the City’s stormwater background study; and
- existing sanitary and storm sewer key plans;

To simulate the flood hydrographs, the computer model PCSWMM.NET was used. PCSWMM.NET uses the latest, fully dynamic US EPA SWMM5 hydrology/hydraulics engine originally developed by the US Army Corp of Engineers. This software is common for hydrologic and hydraulic modeling for master drainage planning in Canada. The data files can be imported into other models to facilitate an analysis of water quality, water quantity and erosion potential.

The drainage basins that are included in the hydrologic and hydraulic modeling are further discussed in the following sections.

1.1 Clark Creek Catchment Area

A detailed model has been compiled for the Clark Creek Catchment Area. The model includes 31 sub-catchments with representative areas, slopes, CN values, total imperviousness and widths (shape factors).

For the hydraulic response, the peak flows from the sub-catchments are conveyed to Clark Creek and ultimately to the St. Marys River. In addition, the sewers from Valhalla Place, Atlas Street, Gravelle Street, Drake Street, Centennial Avenue, Greenview Lane, Bennett Boulevard, and a sewer system draining from Trunk Road to Boundary Road are included.

1.1.1 Land Use and Surface Drainage

Industrial and commercial lands with sub-catchment area identifications (ID) of “C02,” “C03” and “C04” are found in the northern portion of the watershed, as shown in Drawing F.1. Natural existing lands and parkland are primarily found in sub-catchments “C15” through to “C21.” All remaining lands are predominately single detached residential.

Soils within the watershed are mostly classified as lacustrine sand with a hydrologic soils group of “AB.” The catchment areas and associated hydrologic parameters are shown in Table 1.1.0.

Table 1.1.0: CLARK CREEK CATCHMENT AREA - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Curve Number (CN)	Timp (%)	Slope (%)	Length (m)	Width (m)
C01	**616**	82.65	65	46	0.2	1800	459
C02	**616**	12.35	89	86	0.1	640	193
C03	**613**	29.65	85	74	0.2	500	593
C04	**619**	88.71	60	54	2.0	2000	444
C05	**68**	14.48	60	55	0.8	670	216
C06	**67**	32.42	60	46	0.5	840	386
C07	**62**	10.48	60	51	0.5	760	138
C08	**620**	18.95	60	48	0.6	820	231
C09	**A24**	26.48	60	48	0.8	1175	225
C10	**628**	47.44	60	51	0.4	1030	461
C11	**623**	18.77	60	56	0.6	900	209
C12	**620**	6.38	60	53	0.2	430	148
C13	**A9**	6.01	60	50	0.2	630	95
C14	**CCP9**	11.40	70	48	0.2	460	248
C15	**CCP4**	12.74	45	7	1.0	320	398
C16	**C3**	8.04	45	16	1.3	350	230
C17	**C4**	53.55	60	45	1.3	1550	345
C18	**C4**	7.19	40	7	1.4	500	144
C19	**C5**	18.85	42	7	1.1	815	231
C20	**G1**	7.98	65	7	2.3	415	192
C21	**G1**	1.76	65	7	7.0	160	110
C22	**G1**	34.18	60	48	0.9	1350	253
C23	**C6**	2.49	60	50	0.5	280	89
C24	**G5**	7.88	60	50	0.7	440	179

C25	**A1**	6.72	60	50	0.9	600	112
C26	**V1**	2.43	55	50	1.3	260	93
C27	**V4**	3.01	70	50	0.4	300	100
C28	**C7**	6.78	65	44	1.0	425	160
C29	**C6**	8.20	30	7	4.0	155	529
C30	**C5**	5.73	65	50	3.0	275	208
C31	**MHT1**	3.62	70	50	0.6	300	121
	TOTAL AREA =	**597.32**					

1.1.2 Problem Areas

Problem areas are in the vicinity of Drake Street and Queen Street East where Clark Creek enters the storm structure as shown on the attached plan.

1.1.3 Hydrologic and Hydraulic Modeling Results

Modeling results for the Clark Creek Catchment Area have been forwarded to the City of Sault Ste. Marie digitally.

1.1.4 Possible Problem Mitigation Options:

1. Review invert grade along the southerly section of Clark Creek upstream of Drake Street, the grade should be gradual entering the Drake / Queen East culvert;
2. Removal of obstructions such as branches, debris, etc; and
3. Review the need for upstream dry ponds north of South Market Street and Cambridge Place intersection, and to the west of homes on Heath Road to mitigate flows.

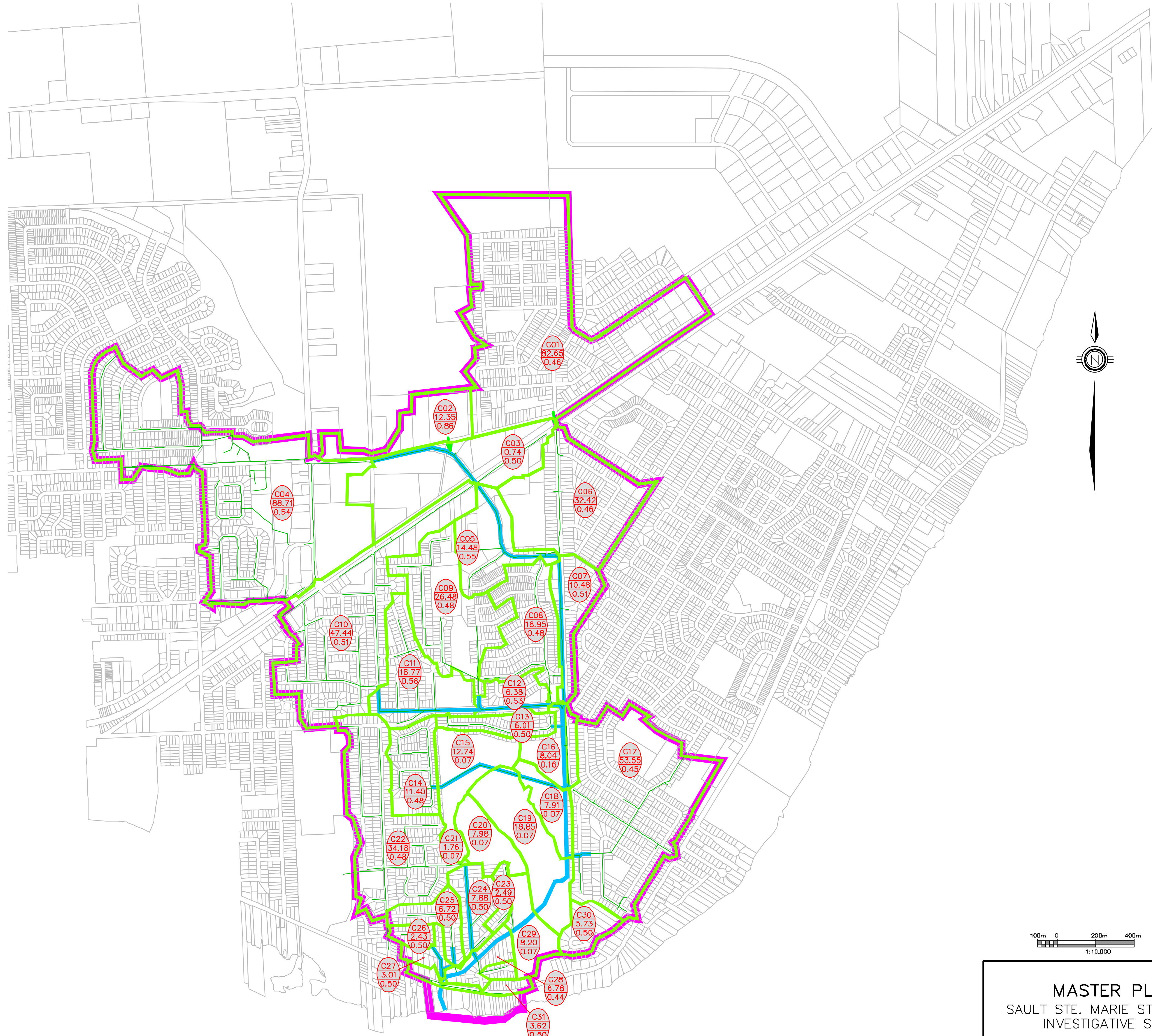
1.2 Pine Street Catchment Area

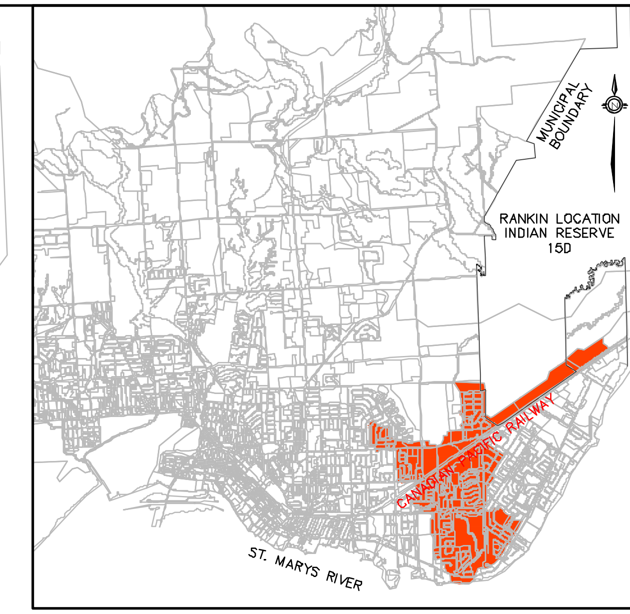
A detailed model has been compiled for the Pine Street Catchment Area. The model includes 14 sub-catchments with representative areas, slopes, CN values, total imperviousness and widths (shape factors).

For the hydraulic response, the peak flows from the sub-catchments are conveyed to the main trunk of the Pine Street storm sewer that ultimately conveys flows to the St. Marys River.

1.2.1 Land Use and Surface Drainage

All lands within the Pine Street Catchment Area are predominately single detached residential. The sub-catchments are illustrated in Drawing F.2.





KEY PLAN

SCALE: 1:75,000

LEGEND

C05 / 5.96 / 0.50 — CATCHMENT AREA ID / AREA (ha) / TOTAL IMPERVIOUSNESS

TOTAL CATCHMENT AREA

SUB-CATCHMENT AREA

TRUNK STORM SEWER (INCLUDED IN MODEL)

EXISTING STORM SEWER

100m 0 200m 400m

1:10,000

MASTER PLAN

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

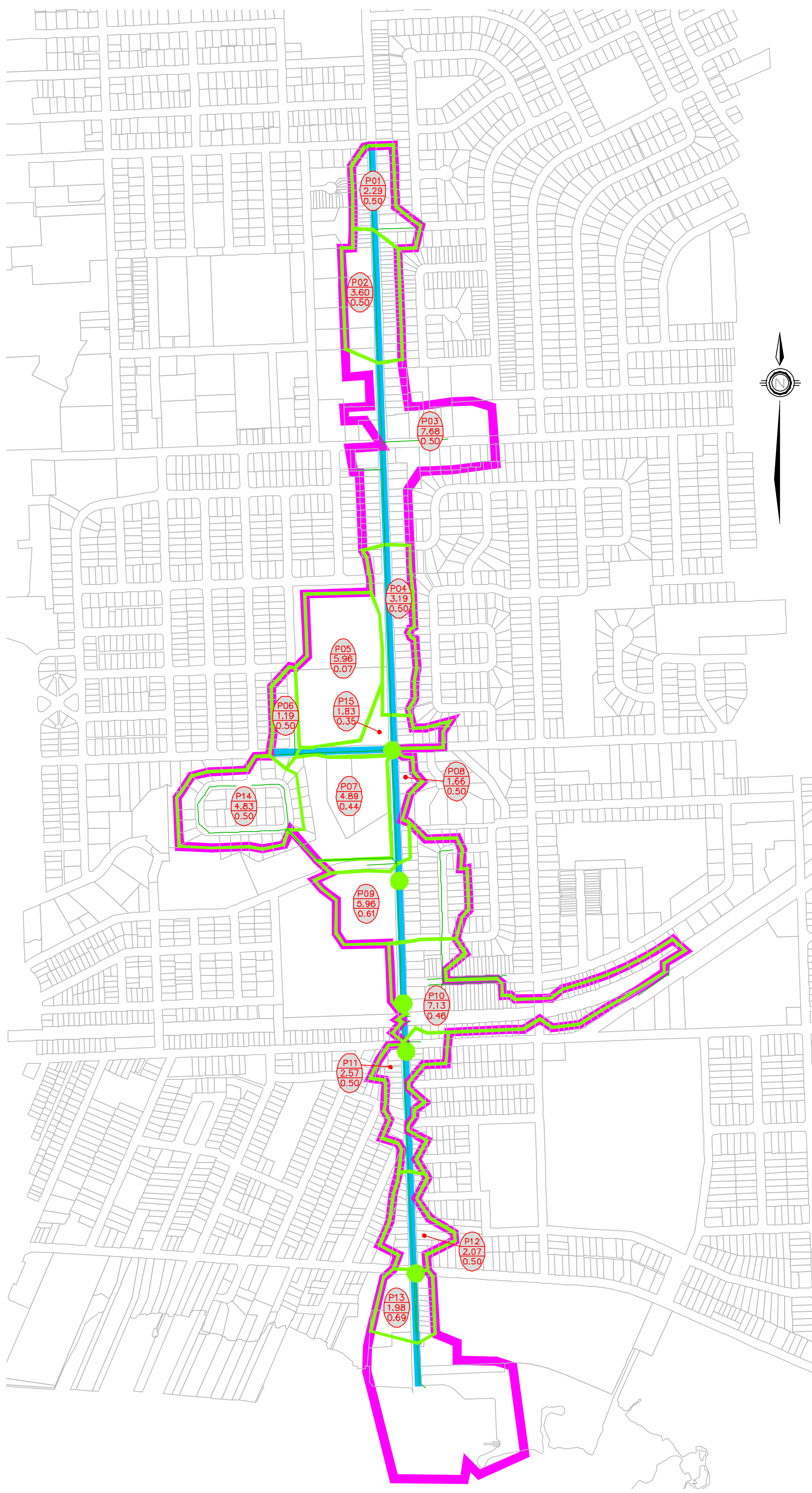
R.V. Anderson Associates Limited

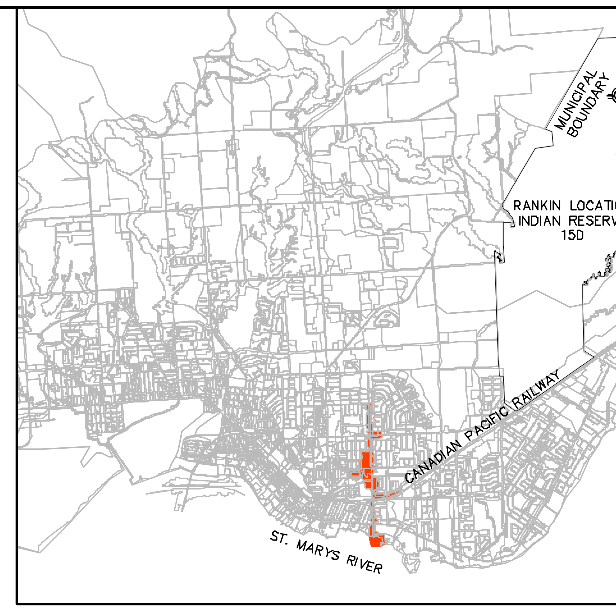
GENIVAR

DRAWING F.1

CLARK CREEK CATCHMENT AREA

STORMWATER MANAGEMENT MASTER PLAN





KEY PLAN

SCALE: 1:75,000

LEGEND

C05 — CATCHMENT AREA ID
5.96 — AREA (ha)
0.50 — TOTAL IMPERVIOUSNESS

HISTORICAL CONVEYANCE PROBLEM

TOTAL CATCHMENT AREA

SUB-CATCHMENT AREA

EXISTING STORM SEWER

TRUNK STORM SEWER (INCLUDED IN MODEL)

50m 0 100m 200m

1:5000

MASTER PLAN

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

R.V. Anderson Associates Limited

GENIVAR

DRAWING F.2

PINE STREET CATCHMENT AREA

STORMWATER MANAGEMENT MASTER PLAN

Soils within the watershed are mostly classified as lacustrine clay with a hydrologic soils group of "BC." The catchment areas and associated hydrologic parameters are shown in Table 1.2.0.

Table 1.2.0: PINE STREET CATCHMENT AREA - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Curve Number (CN)	Timp (%)	Slope (%)	Length (m)	Width (m)
P01	**4-43**	2.29	78	50	1.2	180	127
P02	**4-39**	3.60	78	50	1.6	300	120
P03	**4-32**	7.68	80	60	0.8	400	192
P04	**4-28**	3.19	78	50	1.5	380	84
P05	**6-1**	5.96	65	7	2.0	350	170
P06	**6-2**	1.19	78	50	2.0	180	66
P15	**4-27**	1.83	74	35	2.0	90	203
P07	**4-23**	4.89	72	44	10.0	240	204
P08	**4-23**	1.66	72	50	9.5	220	75
P09	**4-20**	5.96	80	61	2.5	170	351
P10	**4-13**	7.13	67	46	0.2	600	119
P11	**4-8**	2.57	70	50	0.2	270	95
P12	**4-4**	2.07	77	50	0.2	210	99
P13	**4-1**	1.98	85	69	3.8	130	152
P14	**5-1**	4.83	77	50	1.1	360	134
	TOTAL AREA =	**56.83**					

1.2.2 Problem Areas

Problem areas are in the vicinity of Pine Street and Queen Street East, Pine Street and Wellington Street East, and near the intersection of Pine Street and Ontario Avenue.

1.2.3 Hydrologic and Hydraulic Modeling

Modeling results for the Pine Street Catchment Area have been forwarded to the City of Sault Ste. Marie digitally.

1.2.4 Possible Problem Mitigation Options:

1. Provide positive drainage at McNabb Street (conduit MH4-37 to MH4-36, 8.81 m 450 m diameter sewer);
2. Rectify conveyance deficiency between Wellington Street East and CPR right-of-way (downstream invert of conduit MH4-14 to MH4-13 is lower than upstream invert of conduit MH4-13 to MH4-12).

3. Increase pipe size at Queen Street East (from conduit MH4-6 to MH4-3 from a 900 mm diameter to 1050 mm diameter);
4. Eliminate invert drop structures at Queen Street East (MH4-4 and MH4-3); and
5. Increase sewer diameter from McDonald Avenue to Ontario Street (MH4-27 to MH4-23).

1.3 St. Marys River Drive Catchment Area

A detailed model has been compiled for the St. Marys River Drive Catchment Area (the St. Marys Drive catchment is sometimes referred to the Holiday Inn catchment). The model includes 32 sub-catchments with representative areas, slopes, CN values, total imperviousness and widths (shape factors).

For the hydraulic response, the peak flows from the sub-catchments are conveyed to the main trunk, as shown in Drawing F.3.

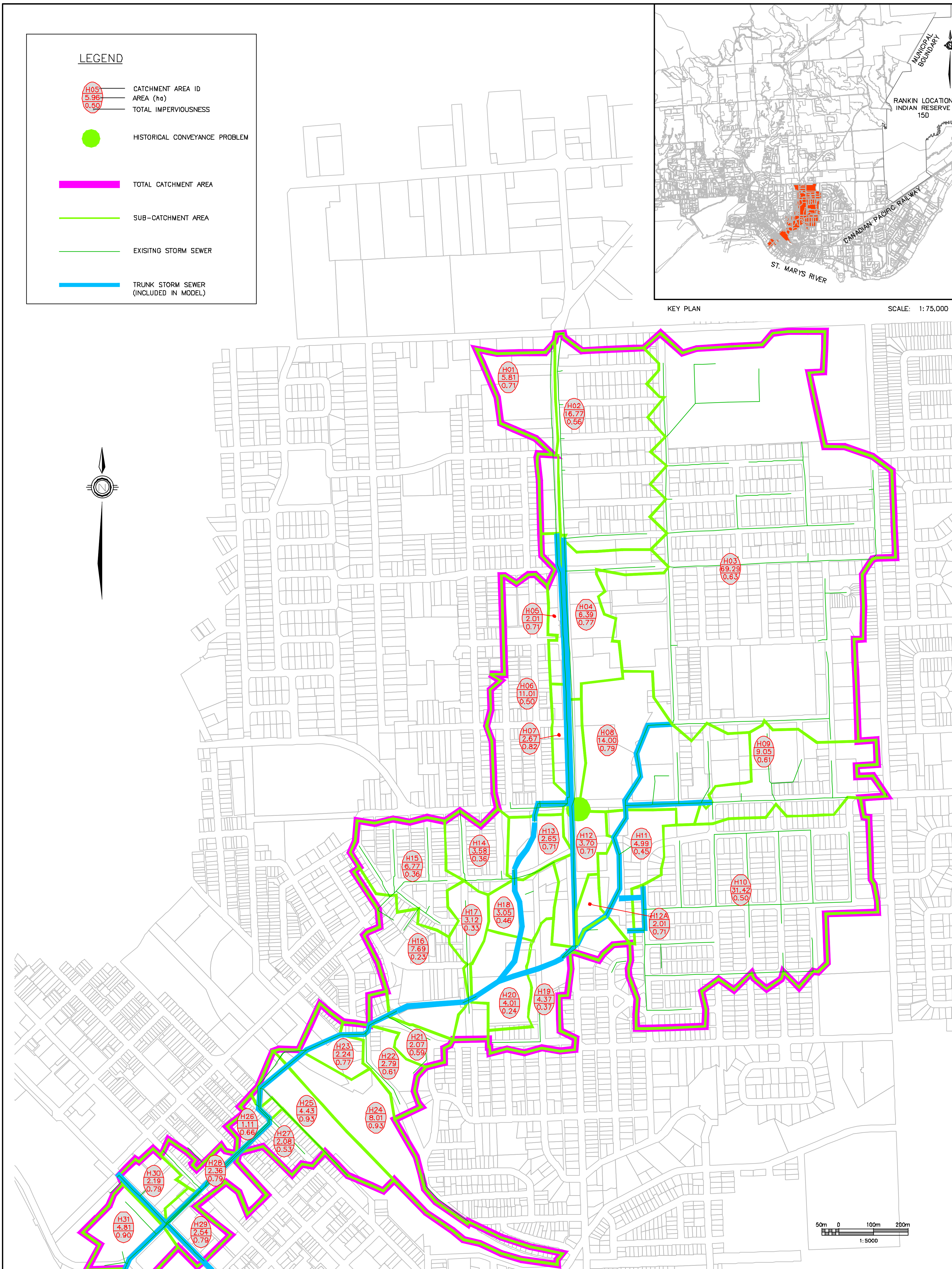
1.3.1 <u>Land Use and Surface Drainage</u>

Industrial and commercial lands with high imperviousness ratios are found north of McNabb Avenue. A mix of parkland and residential areas are predominantly found within the remainder of the lands.

Soils within the watershed are classified as glacial till with a hydrologic soils group of "A" for lands located southwest of Trelawne Avenue. Northeast of Trelawne Avenue, the soils are classified as lacustrine clay with a hydrologic soils group of "BC." The sub-catchment areas and associated hydrologic parameters are shown in Table 1.3.0.

Table 1.3.0: ST MARYS RIVER DRIVE CATCHMENT AREA - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Curve Number (CN)	Timp (%)	Slope (%)	Length (m)	Width (m)
H01	**MH 1-16**	5.81	80	71	2.3	520	112
H02	**MH 1-30**	16.77	60	56	2.6	770	218
H03	**MH R-20**	69.29	65	63	2.6	1200	577
H04	**MH 1-22**	6.39	90	77	1.4	550	116
H05	**MH 1-10**	2.01	88	71	1.4	420	48
H06	**MH 1-2**	11.01	75	50	1.4	600	184
H07	**MH 1-5**	2.67	93	82	1.5	330	81
H08	**MH R-11**	14.00	92	79	1.5	310	452
H09	**MH R-14A**	9.05	85	61	1.4	500	181
H10	**MH R-3**	31.42	75	50	0.8	960	327



MASTER PLAN

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

R.V. Anderson Associates Limited

engineering · environment · infrastructure

GENIVAR

DRAWING F.3

ST. MARYS RIVER DRIVE CATCHMENT AREA

STORMWATER MANAGEMENT MASTER PLAN

H11	**MH R-4**	4.99	73	45	1.8	250	200
H12	**MH P-6**	3.70	88	71	0.8	410	90
H12A	**MH R-3**	2.01	88	71	0.8	160	126
H13	**HW F1**	2.65	88	71	1.3	175	151
H14	**MH F-1**	3.58	73	36	0.7	265	135
H15	**HW 9-26**	6.77	73	36	0.8	300	226
H16	**HW 9-26**	7.69	68	23	4.0	310	248
H17	**HI5**	3.12	72	33	1.4	350	89
H18	**HI1**	3.05	80	46	1.5	160	191
H19	**HI2**	4.37	73	37	1.6	150	291
H20	**HI4**	4.01	69	24	1.5	180	223
H21	**MH 9-25**	2.07	86	59	7.5	190	109
H22	**MH 9-22**	2.79	86	61	15.0	260	107
H23	**MH 9-21**	2.24	88	77	1.4	125	179
H24	**MH 9-37**	8.01	93	93	1.4	700	114
H25	**MH 9-19**	4.43	95	93	1.2	445	100
H26	**MH 9-31**	1.11	75	66	1.4	160	69
H27	**MH 9-14**	2.08	75	53	1.0	220	95
H28	**MH 9-29**	2.36	75	79	3.1	155	152
H29	**MH 9-2**	2.54	77	79	3.4	125	203
H30	**MH 9-2**	2.19	80	79	1.6	185	118
H31	**MH 9-0**	4.81	90	90	0.5	215	224
	TOTAL AREA =	**248.99**					

1.3.2 Problem Areas

Problem areas are in the vicinity of McNabb Street and Pim.

1.3.3 Hydrologic and Hydraulic Modeling

Modeling results for the St Marys River Drive sub-catchment area have been forwarded to the City of Sault Ste. Marie digitally.

1.3.4 Possible Problem Mitigation Options:

1. Increase sewer capacity from 900 mm diameter to 1050 mm diameter from McNabb Street to Herbert Street (conduit MHR-11 to MHR-8); and
2. Investigate need for further quantity controls south of the Bruce Street and Melrose Avenue intersection, and in the parkland north of Chapple Avenue following pipe upgrade.

1.4 Churchill Boulevard Catchment Area

A model has been compiled for the Churchill Boulevard Watershed. The model includes 20 sub-catchments with representative areas, slopes, CN values, total imperviousness and widths (shape factors).

For the hydraulic response, the peak flows from the sub-catchments are conveyed to the main trunk, as shown in Drawing F.4.

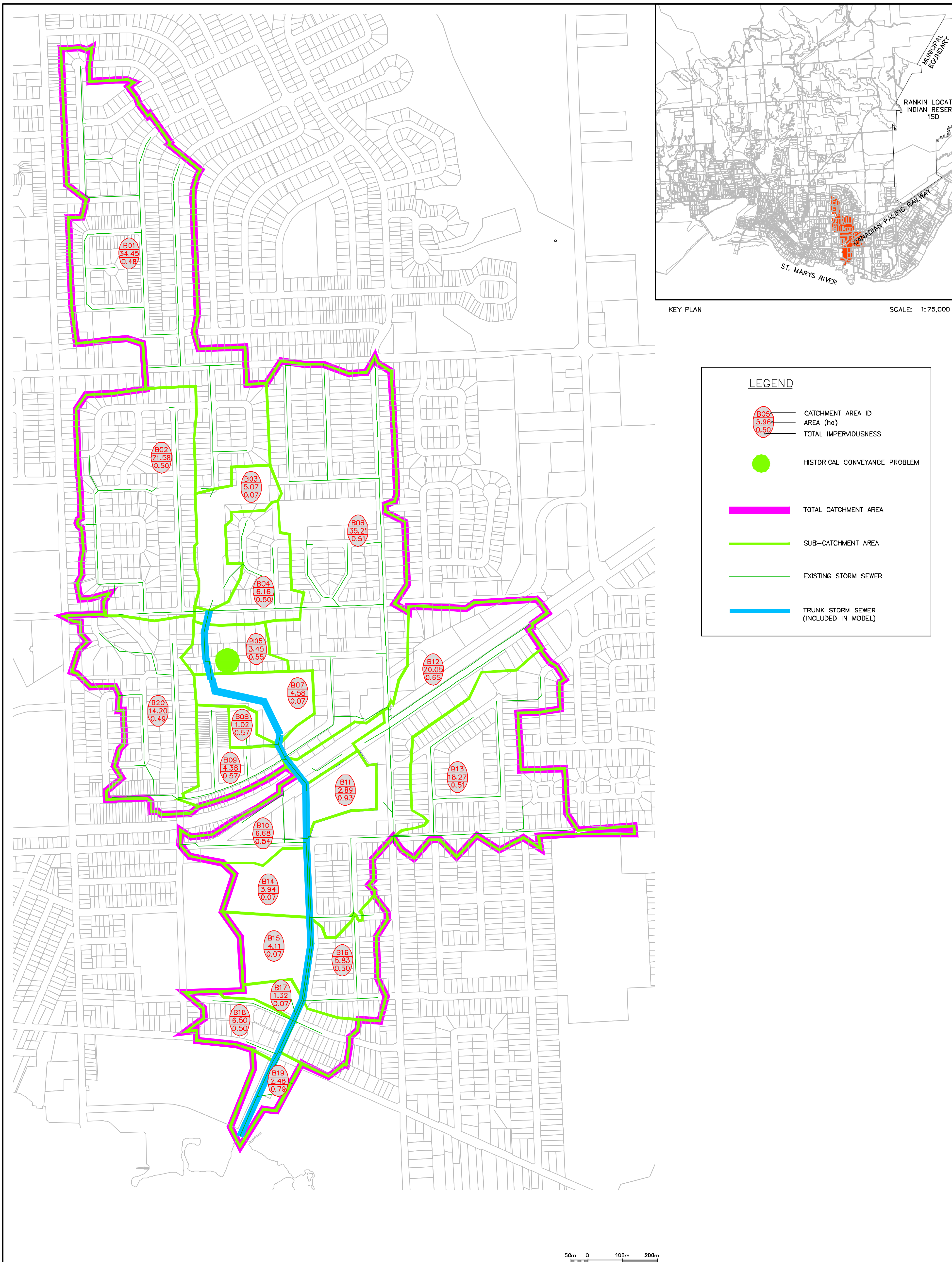
1.4.1 Land Use and Surface Drainage

A mix of parkland and residential land use are predominant found within the subject lands. Industrial and commercial lands with high imperviousness ratios are located in sub-catchments B10, B11, and B12.

Soils within the watershed in sub-catchments B18, B19, and B01 to B07 are classified as lacustrine clay with a hydrologic soils group of “BC.” For the soils found in sub-catchments B10 to B17, they are classified as lacustrine sand with a hydrologic soils group of “AB.” Sub-catchment B08 is predominantly glacial till with a hydrologic soils group of “A.” The catchment areas and associated hydrologic parameters are shown in Table 1.4.0.

Table 1.4.0: CHURCHILL BOULEVARD CATCHMENT AREA - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Curve Number (CN)	Timp (%)	Slope (%)	Length (m)	Width (m)
B01	**HW4**	34.45	78	48	1.0	1500	230
B02	**HW3**	21.58	78	50	2.5	830	260
B03	**HW3**	5.07	65	7	0.8	375	135
B04	**HW3**	6.16	78	50	3.6	380	162
B05	**HW2**	3.45	79	55	2.5	200	173
B06	**MH6**	35.21	77	51	2.1	1600	220
B07	**HW1**	4.58	55	7	3.9	280	164
B08	**HW1**	1.02	63	57	1.1	190	54
B09	**MH6**	4.38	65	57	1.1	450	97
B10	**MH4**	6.68	65	54	1.0	560	119
B11	**MH1**	2.69	95	93	0.9	180	149
B12	**MH3**	20.05	77	65	1.4	1300	154
B13	**MH7**	18.27	62	51	2.1	890	205
B14	**MH3**	3.94	45	7	0.9	200	197
B15	**MH2**	4.11	45	7	0.5	250	164
B16	**MH1**	5.83	60	50	0.5	390	149



MASTER PLAN

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

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DRAWING F.4

CHURCHILL BOULEVARD CATCHMENT AREA

STORMWATER MANAGEMENT MASTER PLAN

B17	**MH2**	1.32	45	7	0.5	140	94
B18	**MH1**	6.50	65	50	0.5	250	260
B19	**MH0**	2.46	83	79	0.6	220	112
B20	**MH0**	14.20	70	49	3.8	790	180
	TOTAL AREA =	**187.75**					

1.4.2 Problem Areas

Problem areas are in the vicinity of Creery Avenue and Elizabeth Street.

1.4.3 Hydrologic and Hydraulic Modeling

Modeling results for the Churchill Boulevard sub-catchment area have been forwarded to the City of Sault Ste. Marie digitally.

1.4.4 Possible Problem Mitigation Options:

1. Review surface drainage; determine need for rear yard or side yard catch basins below the escarpment; and
2. Following surface drainage review, investigate benefit of eliminating invert drop and 90 degree bends on Creery Avenue to improve conveyance capacity or improving conveyance capacity of channel from Creery Avenue to Breton Road.

1.5 Fort Creek Catchment Area

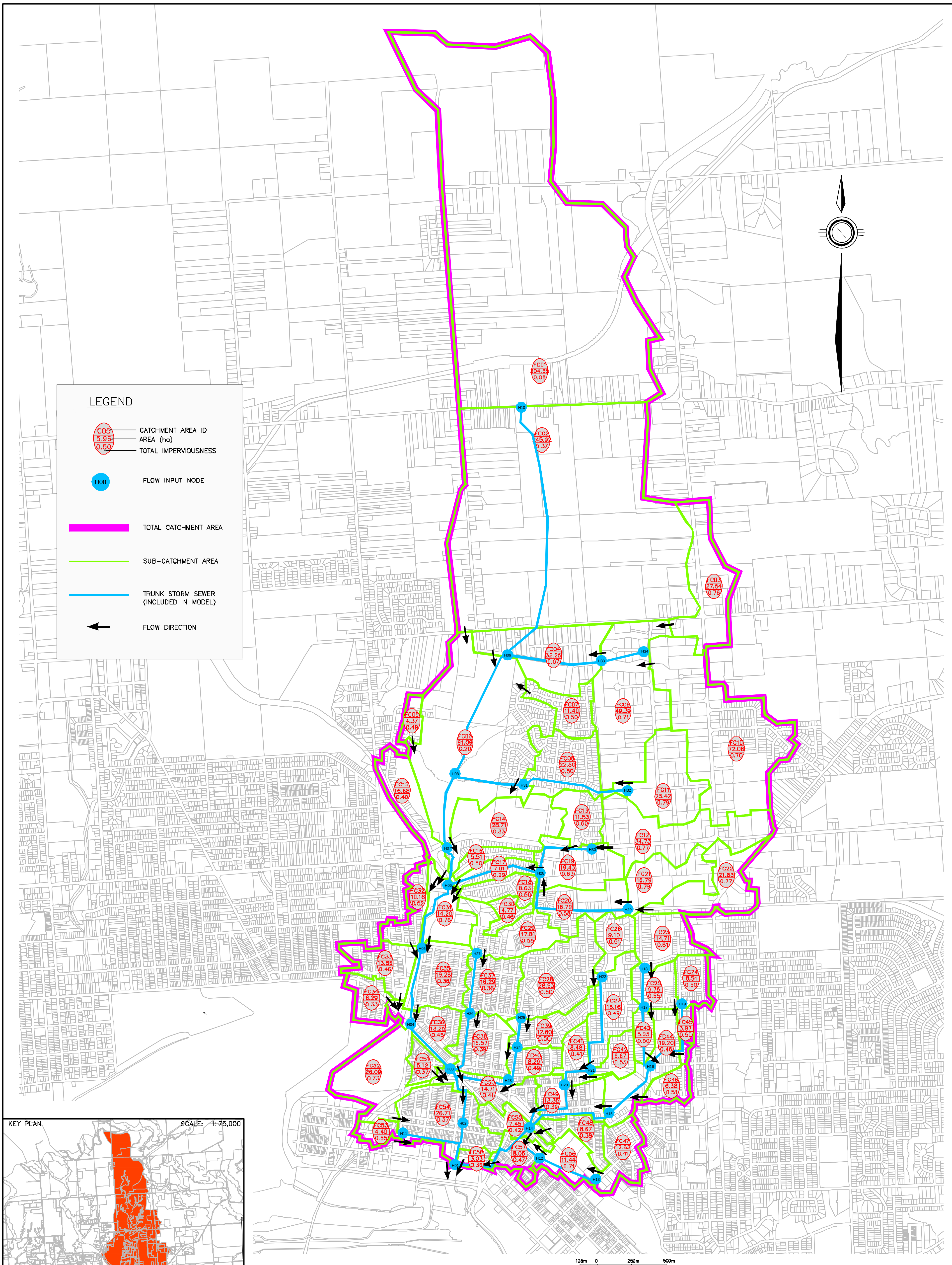
A model has been compiled for the Fort Creek watershed. The model includes 58 sub-catchments with representative areas, slopes, total imperviousness and widths (shape factors). The CN value used for all sub-catchments is 70. The model is used to provide an estimate of peak flows.

1.5.1 Land Use and Surface Drainage

All subject lands are predominately residential. The sub-catchment areas and associated hydrologic parameters are shown in Table 1.5.0 and further illustrated in Drawing F.5.

Table 1.5.0: FORT CREEK CATCHMENT AREA - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Timp (%)	Slope (%)	Length (m)	Width (m)
FC01	**H10**	304.35	8	2.1	2500	1217
FC02	**H09**	245.92	37	2.1	1600	1537
FC03	**H34**	27.54	76	0.8	900	306
FC04	**H09**	32.25	7	4.2	760	424
FC05	**H08**	4.37	49	0.5	260	168



MASTER PLAN
SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

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DRAWING F.5
FORT CREEK
SUB-CATCHMENT AREAS
STORMWATER MANAGEMENT MASTER PLAN

FC06	**H07**	91.09	20	1.9	1200	759
FC07	**H09**	11.40	50	1.7	450	253
FC08	**H31**	22.50	50	2.1	580	388
FC09	**H33**	49.39	71	2.8	950	520
FC10	**H34**	72.08	70	1.0	1100	655
FC11	**H32**	25.42	79	1.8	420	605
FC12	**H30**	34.73	77	2.2	960	362
FC13	**H30**	11.53	60	1.2	370	312
FC14	**H07**	28.71	33	3.3	650	442
FC15	**H06**	16.68	40	1.0	830	201
FC16	**H06**	5.51	50	2.4	580	95
FC17	**H06**	7.01	29	3.1	580	121
FC18	**H06**	8.63	50	5.6	530	163
FC19	**H28**	19.43	63	1.6	700	278
FC20	**H28**	16.79	58	1.6	620	271
FC21	**H29**	16.79	79	2.7	630	267
FC22	**H29**	21.83	77	1.8	830	263
FC23	**H18**	14.71	61	2.7	350	420
FC24	**H19**	8.51	50	1.4	300	284
FC25	**H17**	9.75	55	1.2	310	315
FC26	**H22**	9.10	51	1.7	390	233
FC27	**H21**	18.16	49	1.7	590	308
FC28	**H25**	28.93	50	4.0	1000	289
FC29	**H27**	17.81	55	5.1	300	594
FC30	**H27**	4.77	46	7.3	300	159
FC31	**H05**	14.20	76	1.3	470	302
FC32	**H05**	10.16	52	0.6	500	203
FC33	**H04**	13.86	46	1.0	480	289
FC34	**H04**	8.29	33	1.0	310	267
FC35	**H04**	19.28	36	1.4	440	438
FC36	**H03**	13.25	45	0.6	530	250
FC37	**H26**	16.29	36	2.6	320	509
FC38	**H03**	16.57	39	2.1	430	385
FC39	**H24**	12.60	50	5.0	210	600
FC40	**H23**	8.29	49	1.9	230	360
FC41	**H20**	8.48	41	10.0	330	257
FC42	**H21**	6.67	55	1.0	500	133
FC43	**H16**	5.25	50	0.9	390	135
FC44	**H15**	19.20	46	1.1	760	253
FC45	**H16**	3.97	50	1.3	430	92
FC46	**H15**	6.38	51	1.0	500	128
FC47	**H13**	12.82	41	5.9	420	305
FC48	**H14**	8.67	38	2.5	660	131
FC49	**H14**	13.35	39	2.3	470	284
FC50	**H02**	14.71	41	0.7	190	774
FC51	**H03**	5.12	37	0.9	350	146
FC52	**H11**	26.09	73	0.3	670	389
FC53	**H11**	4.40	55	1.2	220	200

FC54	**H01**	26.71	37	1.6	960	278
FC55	**H02**	7.45	42	1.8	540	138
FC56	**H12**	11.44	71	3.0	430	266
FC57	**H01**	8.05	47	2.1	470	171
FC58	**H01**	3.03	36	0.5	130	233
	TOTAL AREA =	**1510.27**				

1.5.2 Problem Areas

Problem areas are around the north end of Birch Street, the north end of Trelawne Avenue and in the vicinity of the outlet sewer from Rovon Court.

1.5.3 Hydrologic and Hydraulic Modeling

Modeling results for the Fort Creek Watershed have been forwarded to the City of Sault Ste. Marie digitally.

1.5.4 Possible Problem Mitigation Options:

1. Provide upstream quantity control and/or increase downstream conveyance capacity and provide erosion control for outlet from Ro-von Court; and
2. Review increasing sewer capacity or modifying sewer inlet at the northern portions of Birch Street and Trelawne Avenue.

1.6 West Davignon, Central, and East Davignon Creeks Catchment Areas

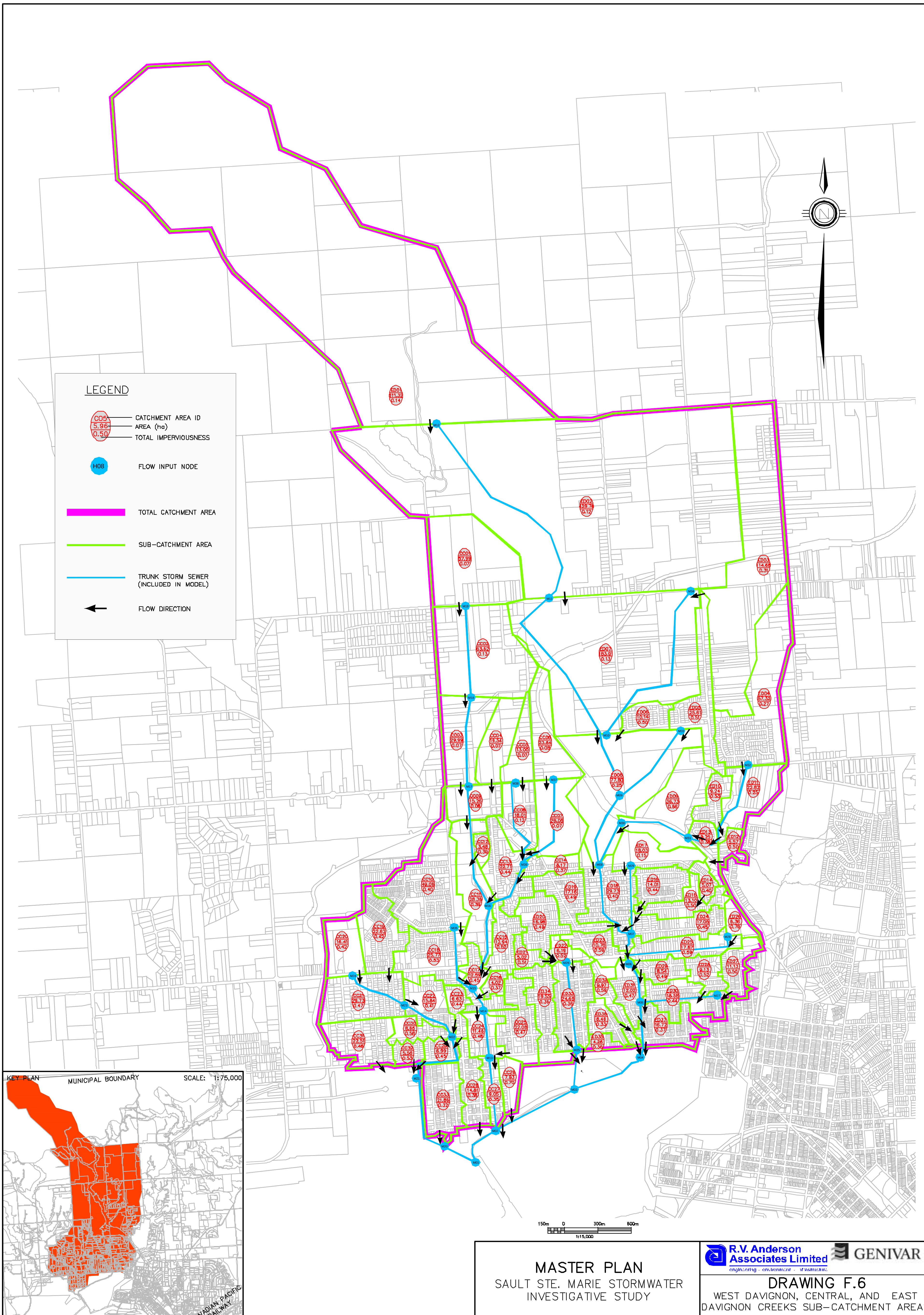
A model has been compiled for the West Davignon Creek, Central Creek and East Davignon Creek sub-catchments. The model includes 70 sub-catchments with representative areas, slopes, total imperviousness and widths (shape factors). The CN value used for all sub-catchments is 70. The model is used to provide an estimate of peak flows.

1.6.1 Land Use and Surface Drainage

All subject lands are predominately residential. The catchment areas and associated hydrologic parameters are shown in Table 1.6.0 and Table 1.6.1 and further illustrated in Drawing F.6.

Table 1.6.0: EAST DAVIGNON CREEK SUB-CATCHMENT AREA - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Timp (%)	Slope (%)	Length (m)	Width (m)
ED01	**M12**	511.32	14	1.7	3500	1461
ED02	**M11**	429.76	12	4.1	1830	2348
ED03	**M34**	114.68	31	2.6	750	1529
ED04	**M32**	57.32	27	1.4	1330	431


LEGEND
CD5
5.96
0.50
CATCHMENT AREA ID
AREA (ha)
TOTAL IMPERVIOUSNESS
H08
FLOW INPUT NODE
TOTAL CATCHMENT AREA
SUB-CATCHMENT AREA
TRUNK STORM SEWER (INCLUDED IN MODEL)
FLOW DIRECTION
KEY PLAN
MUNICIPAL BOUNDARY
SCALE: 1:75,000
ST. MARYS RIVER
CANADIAN PACIFIC RAILWAY
150m
0
300m
600m
1:15,000
MASTER PLAN
SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY
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DRAWING F.6
WEST DAVIGNON, CENTRAL, AND EAST DAVIGNON CREEKS SUB-CATCHMENT AREAS
STORMWATER MANAGEMENT MASTER PLAN

ED05	**M33**	25.61	51	1.5	280	915
ED06	**M10**	10.14	50	1.8	390	260
ED07	**M10**	163.91	13	3.4	1190	1377
ED08	**M08**	77.80	25	2.5	1150	677
ED09	**M30**	36.73	66	0.7	440	835
ED10	**ED13**	9.24	53	1.0	420	220
ED11	**ED13**	22.82	25	0.8	540	423
ED12	**ED13**	5.57	50	5.2	190	293
ED13	**M31**	9.25	38	2.4	330	280
ED14	**ED15**	5.07	40	3.6	380	133
ED15	**M07**	13.10	50	0.6	730	179
ED16	**M07**	14.01	44	0.8	660	212
ED17	**M29**	18.03	15	4.0	680	265
ED18	**M06**	29.73	40	0.5	810	367
ED19	**M07**	17.16	49	0.4	830	207
ED20	**M26**	16.98	49	0.7	710	239
ED21	**M26**	5.02	51	0.9	480	105
ED22	**M26**	6.19	52	1.0	380	163
ED23	**M06**	10.76	59	0.7	530	203
ED24	**M07**	17.05	45	0.3	800	213
ED25	**M06**	17.67	59	0.2	950	186
ED26	**M28**	6.36	79	3.3	210	303
ED27	**M27**	11.13	50	1.3	620	180
ED28	**M27**	9.13	52	0.8	380	240
ED29	**M06**	8.54	49	0.9	500	171
ED30	**M05**	18.58	44	0.7	740	251
ED31	**M05**	12.02	47	0.5	590	204
ED32	**M04**	9.97	59	0.5	820	122
ED33	**M25**	24.65	36	0.3	690	357
ED34	**M25**	19.55	36	0.4	940	208
ED35	**M25**	4.26	36	0.3	350	122
ED36	**M04**	8.46	33	0.8	380	223
ED37	**M04**	16.72	37	0.4	680	246
	TOTAL AREA =	**1794.29**				

Table 1.6.1: WEST DAVIGNON AND CENTRAL CREEK SUB-CATCHMENT AREAS - HYDROLOGIC MODEL PARAMETERS

Area I.D.	**INLET MH ID**	**Drainage Area (ha)**	**Timp (%)**	**Slope (%)**	**Length (m)**	**Width (m)**
CC01	**M19**	57.99	7	2.9	700	828
CC02	**M18**	63.62	13	2.8	870	731
CC03	**M17**	29.99	7	1.7	720	417
CC04	**M17**	19.54	7	2.1	720	271
CC05	**M38**	13.00	7	2.8	720	181
CC06	**M37**	23.84	8	3.3	900	265
CC07	**M36**	26.05	7	2.7	640	407
CC08	**M36**	18.01	12	5.1	670	269

CC09	**M17**	15.26	8	3.7	460	332
CC10	**M35**	49.06	40	1.0	900	545
CC11	**M15**	28.36	39	0.6	1290	220
CC12	**M16**	3.48	39	0.8	180	193
CC13	**M16**	22.71	44	0.4	500	454
CC14	**M36**	8.17	37	0.7	470	174
CC15	**M15**	12.94	52	0.3	720	180
CC16	**M14**	4.02	37	0.4	320	126
CC17	**M14**	12.59	45	0.4	460	274
CC18	**M15**	25.77	53	0.7	850	303
CC19	**M23**	22.62	42	0.4	770	294
CC20	**M24**	16.41	42	1.4	400	410
CC21	**M23**	29.73	47	1.0	960	310
CC22	**M22**	15.84	41	0.6	530	299
CC23	**M22**	6.63	44	0.3	440	151
CC24	**M13**	11.46	48	0.5	440	260
CC25	**M13**	22.08	47	0.5	890	248
CC26	**M02**	7.93	70	2.0	490	162
CC27	**M02**	9.05	35	0.3	600	151
CC28	**M02**	14.81	38	0.4	900	165
CC29	**M21**	6.99	45	0.6	450	155
CC30	**M22**	8.65	58	0.6	480	180
CC31	**M21**	22.51	46	0.9	630	357
CC32	**M21**	5.56	53	0.6	360	154
CC33	**M20**	21.86	32	1.0	780	280
	TOTAL AREA =	**656.53**				

1.6.2 Problem Areas

Problem areas are noted by the City to be in the Wallace Terrace area around Pittsburgh Avenue and between Douglas Street and Wallace Terrace.

1.6.3 Hydrologic and Hydraulic Modeling

Modeling results for the West Davignon Creek, Central Creek and East Davignon Creek Watersheds have been forward to the City of Sault Ste. Marie digitally.

1.6.4 Possible Problem Mitigation Options:

Possible mitigation options include clear and grub open channels; and remove silt and sand from culvert crossings and monitor.

1.7 Shoreline Catchment Areas

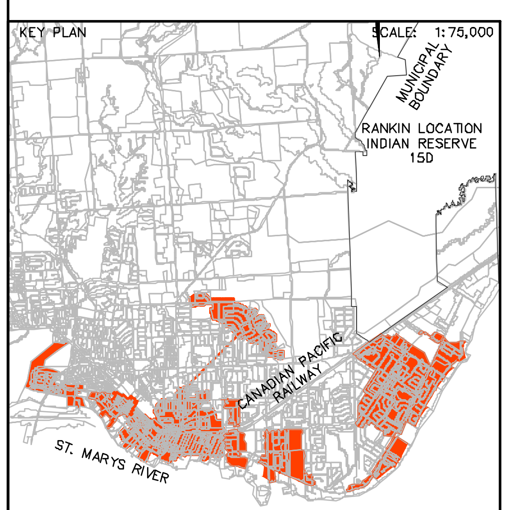
A model has been compiled for the smaller sub-catchments along the shoreline of St Marys River and a smaller portion draining to Black Creek to the northeast from the area northwest of the Black Road and McNabb Street intersection. The model includes sixty-five (65) sub-catchments of which nine (9) drain to Black Creek with representative areas, slopes, total imperviousness and widths (shape factors). The CN value used for all sub-catchments is 70. The model is used to provide an estimate of peak flows.

1.7.1 Land Use and Surface Drainage

All subject lands are predominately residential in sub-catchments S10, S02 to S04, S16 to S27, and S32 to S66. The remainder of the sub-catchments are mainly industrial and commercial land use. The catchment areas and associated hydrologic parameters are shown in Table 1.7.0 and further illustrated in Drawing F.7.

Table 1.7.0: SAULT STE. MARIE WATERFRONT SUB-CATCHMENT AREAS - HYDROLOGIC MODEL PARAMETERS

Area I.D.	INLET MH ID	Drainage Area (ha)	Timp (%)	Slope (%)	Length (m)	Width (m)
S01	**R01**	25.08	93	2.0	1110	226
S02	**S01**	8.76	41	3.0	440	199
S03	**S02**	8.56	51	2.5	490	175
S04	**S01**	5.98	45	2.7	400	150
S05	**S07**	5.52	64	2.7	520	106
S06	**R02**	7.62	77	3.0	570	134
S07	**R03**	7.58	90	2.5	300	253
S08	**R04**	11.19	82	2.5	340	329
S09	**R05**	8.45	83	2.0	470	180
S10	**S09**	11.80	48	5.0	500	236
S11	**R06**	7.28	83	3.0	510	143
S12	**R07**	3.40	86	2.0	110	309
S13	**R08**	5.41	83	2.2	270	200
S14	**S13**	13.15	81	3.5	380	346
S15	**S28**	13.08	78	5.1	400	327
S16	**S15**	12.92	50	4.0	460	281
S17	**S27**	9.73	50	3.7	630	154
S18	**S19**	5.94	50	3.7	360	165
S19	**S27**	10.48	50	3.0	510	205
S20	**S18**	6.85	50	3.6	510	134
S21	**S25**	15.20	49	4.6	400	380
S22	**S23**	18.75	61	3.5	400	469
S23	**R15**	17.68	47	2.0	690	256
S24	**R14**	9.67	50	1.8	460	210
S25	**S26**	17.79	50	3.3	900	198
S26	**R13**	16.21	55	1.8	680	238
S27	**R12**	14.94	51	2.0	770	194
S28	**R10**	9.98	74	2.0	410	243
S29	**R09**	4.10	83	1.7	300	137



MASTER PLAN

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

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DRAWING F.7

SAULT STE. MARIE WATERFRONT SUB-CATCHMENT AREAS

STORMWATER MANAGEMENT MASTER PLAN

S30	**R11**	3.26	86	2.2	220	148
S31	**S23**	14.20	49	3.8	790	180
S32	**R16**	29.69	51	2.3	760	391
S33	**S36**	25.55	50	2.1	1000	256
S34	**R19**	23.03	65	2.8	1140	202
S35	**R18**	6.74	50	3.0	440	153
S36	**R17**	8.70	37	2.4	480	181
S37	**R20**	20.96	75	2.4	490	428
S38	**R21**	4.67	50	2.0	330	142
S39	**R22**	6.80	40	2.0	440	155
S40	**S43**	3.59	50	5.3	410	88
S41	**R23**	6.53	50	2.0	380	172
S42	**R24**	3.40	50	2.1	280	121
S43	**R25**	16.08	68	2.1	630	255
S44	**R26**	13.95	48	1.9	700	199
S45	**S44**	27.25	49	3.0	890	306
S46	**S44**	15.98	50	3.3	670	239
S47	**R27**	31.95	44	2.0	750	426
S48	**S47**	11.09	45	2.7	250	444
S49	**S53**	12.45	47	2.8	530	235
S50	**S48**	10.23	50	4.0	560	183
S51	**S52**	13.87	49	4.0	610	227
S52	**S53**	25.66	50	4.2	880	292
S53	**S54**	45.96	49	4.0	1300	354
S54	**R28**	13.51	50	2.4	240	563
S55	**R29**	15.29	50	2.5	350	437
S56	**S55**	35.58	59	3.0	1940	183
S57	**R30**	31.26	44	2.6	1100	284
S58	**R31**	3.68	58	2.6	420	88
S59	**R32**	6.91	48	2.4	390	177
S60	**R33**	4.70	50	2.2	310	152
S61	**R34**	5.99	50	2.6	610	98
S62	**R35**	9.28	54	2.0	530	175
S63	**R36**	2.44	50	2.0	340	72
S64	**R37**	11.47	50	2.0	630	182
S65	**S62**	15.09	54	2.2	940	161
S66	**R38**	25.87	56	2.0	890	291
	TOTAL AREA =	**861.56**				

1.7.2 Problem Areas

Problem areas have not been specifically reported.

1.7.3 Hydrologic and Hydraulic Modeling

Modeling results for the subject sub-catchment areas have been forwarded to the City of Sault Ste. Marie digitally.

APPENDIX G

Storm Water Monitoring Plan

SAULT STE. MARIE STORMWATER MONITORING PLAN

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1.0 INTRODUCTION

The City of Sault Ste. Marie retained R.V. Anderson Associates Limited in conjunction with Genivar, formerly Wm. R. Walker Engineering Incorporated, to prepare a Stormwater Management Master Plan including a Point Source Monitoring Plan. As identified in the Master Plan, the goal of the Point Source Monitoring Plan is to identify, document, and mitigate sources of contamination in the watershed. This document is intended to serve as a guide for the City of Sault Ste. Marie to monitor stormwater and its effects.

1.1 Background

The St. Marys River is an Area of Concern (AOC) as identified by the International Joint Commission. As an AOC, a Remedial Action Plan (RAP) has been developed for the watershed. Stage 2 of the RAP identifies numerous activities aimed at delisting the River as an AOC. One of these activities is designing and implementing a monitoring system for stormwater.

Quality monitoring of water entering the St. Marys River has been conducted in the past throughout the region by several different agencies.

1.2 Overview and Organization

It is intended that the monitoring plan be flexible. The following chapters describe the guidelines and methodology to be followed and illustrate the procedures for monitoring and documentation.

2.0 METHODOLOGY AND OBJECTIVES

Outlined in the following subsections are several documents for consideration that provide guidance as to the collection and treatment of water samples as well as prescribed limits for comparison of results. It is recommended that prior to collection of water samples the laboratory conducting the analysis be consulted to ensure proper collection techniques are followed and sufficient volumes are collected.

2.1 Municipal / Industrial Strategy for Abatement (MISA)

The sampling and testing procedures to be followed is outlined by the Ministry of Environment in the documents "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (PIBS 2724e01) and "Protocol for Conducting a Stormwater Control Study" (PIBS 2695e). It should be noted that while these guidelines were primarily developed for stormwater discharges from industrial lands, they form a strong basis for any monitoring program.

2.2 Provincial Water Quality Objectives

Originally published by the Ministry of Environment in 1994, the "Provincial Water Quality Objectives" (PIBS 3303e) provide a guideline for the protection of ground water and surface water resources. The concentrations and descriptions of the parameters listed are the MOE's ambient surface water quality criteria that are set at levels intended to protect all aquatic life and beneficial uses. The document also includes principles and policies of water management applicable to all lakes and rivers in Ontario.

2.3 Sault Ste. Marie Sewer Use By-law

The City has enacted a new comprehensive sewer use by-law (By-law No. 2009-50, consolidation current to November 2009) which provides for the protection of storm sewers, structures and receiving waters. Included in the by-law are provisions for discharge characteristics and limits. The prohibited discharge characteristics include visible film, sheen or discolouration, two or more separate layers, pH out of the 5.5 to 9.5 range, temperature greater than 40°C. In addition, discharge is prohibited from containing various types of wastes and products and E. coli colonies in excess of 200 per 100 mL.

It should be noted that the 15 mg/L limit for Total Suspended Solids appears very low and is more in line with sanitary sewage treatment plant effluent. Typically storm sewer discharge is in the range of 60 mg/L Total Suspended Solids removal.

The following is Table 2 excerpted from the City's sewer use by-law, with current spelling corrections:

Table 2: Limits for Storm Sewer Discharges

Parameter	**Limit (mg/L)**	**Parameter**	**Limit (mg/L)**
Biochemical Oxygen demand	15	1, 2–Dichlorobenzene	0.0056
Cyanide (Total)	0.02	1, 4–Dichlorobenzene	0.0068
Phenolics (4AAP)	0.008	cis-1,2-Dichloroethylene	0.0056
Phosphorous (Total)	0.4	Trans-1, 3-Dichloropropylene	0.0056
Suspended Solids (Total)	15.0	Ethyl benzene	0.002
Oil & Grease – Mineral & Synthetic	15.0	Methylene chloride	0.0052
Aluminum (Total)	1.0	1, 1, 2, 2 - Tetrachloroethane	0.017
Ammonia	10.0	Tetrachloroethane	0.0044
Arsenic (Total)	0.02	Toluene	0.002
Barium (Total)	1.0	Trichloroethylene	0.0076
Cadmium (Total)	0.008	Xylenes (Total)	0.0044
Chlorine (Free)	0.1	Di-n-butyl phthalate	0.015
Chromium (Total)	0.08	Bis (2-ethylhexyl) phthalate	0.0088
Chromium (Hexavalent)	0.04	Nonylphenol	0.001
Copper (Total)	0.04	Nonylphenol ethoxylates	0.01
Lead (Total)	0.12	Aldrin/dieldrin	0.00008
Manganese (Total)	0.05	Chlordane	0.04
Mercury (Total)	0.0004	DDT	0.00004
Nickel (Total)	0.08	Hexachlorobenzene	0.00004
Selenium (Total)	0.02	Mirex	0.04
Silver (Total)	0.12	PCBs	0.0004
Tin (Total)	1.0	3, 3' – Dichlorobenzidine	0.0008
Zinc (Total)	0.04	Hexachlorocyclohexane	0.04
Benzene	0.002	Pentachlorophenol	0.002
Chloroform	0.002	Total PAHs	0.002

3.0 SAMPLING PROCEDURE

3.1 Site Selection

Sampling locations are to be reviewed yearly. Sampling locations are to be selected based on imperviousness of the area, land use, historical water quality, and observed conditions. A list of potential sampling locations along with criteria influencing site selection are presented in the tables at the end of this appendix.

3.2 Indicator Parameters and Sampling Frequency

Parameters are selected to give a fair indication of the general health of water discharged. It is suggested that stormwater outfalls be monitored during the summer season. It should be noted that the parameters suggested here for inclusion in the monitoring program are general and the City is encouraged to review the parameters tested to ensure objectives are met.

Testing frequency is determined to best capture a representative interpretation of the stormwater quality in the City as follows:

- E. coli once per week
- Total Suspended Solids (TSS) once per week
- Total Phosphorus (TP) once every two weeks
- Total Oil and Grease (O&G) once per month
- Biochemical Oxygen Demand (BOD) once per month
- Total Kjeldahl Nitrogen (TKN) once per month
- pH once per month
- Total phenols once per month

An effort should be made to collect additional grab samples from selected sites during the "first flush" which occurs within the first half hour of a rainstorm. It should be noted that testing for all of these parameters is not necessarily required at each site monitored each year and that, as a minimum, E.coli, TSS, and TP should be determined. Efforts should also be undertaken to estimate velocity and channel water depths and flows.

3.3 Expected Outcome

Following each monitoring season, the proponent is encouraged to prepare a report detailing the monitoring efforts and findings. This report will be used to organize the monitoring session for the next year and to aid in planning stormwater management controls.

4.0 FIELD SCREENING AND SOURCE TRACKING

4.1 Site Selection

Ideally the entire stormwater conveyance system and all creeks and rivers within the City should be visually monitored for signs of pollutants and degradation. The extent of visual monitoring is dictated by accessibility and practicality. As a minimum, the sites which are included in the sampling program, or may be included in subsequent years, should be visually monitored regularly.

4.2 Indicator Conditions and Visual Monitoring Frequency

Turbid waters, overgrowth or undergrowth, floating debris or foreign objects, and foam or scum are all conditions which may indicate a level of degradation within a watershed. The occurrence of any of these conditions should be documented and explored further.

Visual monitoring should occur throughout the spring and summer months, during dry weather and wet weather, on a minimum weekly basis.

4.3 Expected Outcome

Field screening provides the City an opportunity document areas which may require future detailed study and remediation.

5.0 DOCUMENTATION

To best understand the stormwater quality issues that need to be addressed, the observations and results of the monitoring program need to be properly documented to allow for tracking.

The City has a comprehensive GIS program; incorporating stormwater quality/quantity data into the GIS system would be appropriate.

Internet surveys for residents to provide input can be an effective monitoring tool.

Operations staff is to be required to document findings in the field such as full catch basins, extreme sedimentation in waterways, and condition of stormwater management controls.

A worksheet is included at the end of this appendix to assist with data collection in the field.

6.0 PARALLEL STUDY BY OTHER AGENCIES

In order to minimize duplication of efforts, coordination with other agencies conducting similar activities is required. It is recommended that stormwater monitoring goals be communicated to all interested organizations during the planning stages of the upcoming monitoring period. Public involvement when determining the monitoring activities for an upcoming season could be beneficial.

Subwatershed Characterization and Evaluation

	Size (ha)	Monitored 2007 or 2008[1]	Percent Impervious[8]	Land Use: Residential	Land Use: Commercial/ Institutional	Land Use: Industrial	Land Use: Agricultural	Land Use: Development Pressure[5]	Water Quality Parameters Elevated at Stormwater Outfalls[9]: E. Coli[2]	TSS[3]	Total Phosphorus[2]	Poor Aesthetics[4]	Stormwater Conveyance Problems: Erosion/ Sedimentation[7]	Flood Area or Floodway[6]	Pipe Deficiencies[7]
Black Creek	1502	No	Low	√	√	√	√	High							
Carp Rivers	6671	No	Low	√	-	√	√	None						√	
Central Creek	445	Part of Davignon Creek	-	√	√	-	-	-					√		
Church	51	No	51	√	√	-	-	None							
Churchill	202	Yes	49	√	√	-	-	Low	√	√		√			
Clark Creek	597	No	47	√	√	√	-	Medium							
Dacey	56	Yes	56	√	√	-	-	High	√	√	√				
Davignon Creek	2815	Yes	25	√	√	√	√	Medium					√	√	
Dennis	20	Yes	63	√	√	√	-	Low							
East	36	No	67	-	√	-	-	Low							
Elizabeth	30	No	51	√	√	-	-	None							
Faldien	37	No	44	√	√	-	-	Medium							
Fort Creek	1514	Yes	40	√	√	√	-	High	√	√		√	√	√	
Hadley Park	36	No	54	√	√	-	-	Low							
Leigh Creek, West Davignon	3795	No	Low	√	√	√	√	Medium							
Millwood	57	Yes	49	√	-	-	-	None	√						
Pim	48	No	50	√	√	-	-	Low							
Pine	57	Yes	47	√	√	-	-	Low	√	√					√
Queen	48	Yes	70	√	√	√	-	Low	√	√	√				
River	53	No	45	√	-		-	Low							
Root River	6322	No	Low	√	-	√	√	None							
Spring	19	No	82	√	√	-	-	None							
St. Marys River Drive	249	Yes	60	√	√	√	-	Low	√	√	√	√	√		√
Upton	10	No	50	√	√	-	-	None							
Willowdale	99	No	49	√	-	-	-	Low							

[1]MOE or APH
[2]Exceeds PWQO at least once
[3]Exceeds SSM Bylaw 2009-50 at least once
[4]As reported by City Staff, Official Plan, and Residents
[5]Based upon Residential Land Inventory, May 7, 2009
[6]Official Plan Schedule B
[7]As reported by City staff
[8]Weighted Average
[9]Based on 2008 Monitoring Results

Assign value noted for each yes answer and add to determine site score

Catchment	Area	Timp	Was sampling conducted at the site the previous year with unfavourable results? (1)	Have there been stormwater quality related complaints or concerns noted for the area in the past year? (2)	Have there been stormwater management activities in the area in the last year? (2)	Sum	Notes	Revised Score
Church	51	51						
Churchill	202	49						
Clark Creek	597	47						
Dacey	56	56						
Davignon Creek	2815	25						
Dennis	20	63						
East	36	67						
Elizabeth	30	51						
Faldien	37	44						
Fort Creek	1514	40						
Hadley Park	36	54						
Millwood	57	49						
Pim	48	50						
Pine	57	47						
Queen	48	70						
River	53	45						
Spring	19	82						
St. Marys River Drive	249	60						
Upton	10	50						
Willowdale	99	49						

3,4 or 5 - Collect water samples from outfall and conduct testing in addition to visual inspection
0,1, or 2 - Provide visual inspection

Catchments are named for the street at which the outfall to the river is located
Limited to catchments containing urban development

Site ID: ______________________ Date ____________ Time ____________

Weather Condition

Air Temp	____________	Precipitation	
Wind Direction	____________	Current	______________________
Wind Speed	____________	Last 24 hours	______________________
Sunlight	____________	Last 48 hours	______________________

	Yes	No
Sample Taken		

Sample taken from: ______________________

Testing Planned: ______________________

General Observations: ______________________

Activity Level (waterfowl or bathers present): ______________________

Water Clarity & Bank Condition: ______________________

Attach Photo Here

Refer to ____________ for sampling result (if applicable)

Signature ______________________

APPENDIX H

New Storm Water Management Initiatives

As part of the Sault Ste. Marie stormwater master plan we are attaching the following summary of established and new stormwater management practices being implemented in Ontario.

HISTORY

Stormwater management (SWM) initially began as a response to flood and erosion concerns, primarily in urbanized settings. This has evolved since the early 1990s to include water quality, groundwater recharge, stream morphology, and aquatic habitat.

SWM is a response to urbanization, which alters watershed characteristics and in turn increases the volume and peak magnitude of stormwater runoff. Base flow is also decreased due to the increase in impervious surfaces associated with urbanization and the resulting reduction in infiltration and groundwater recharge. Urbanization increases flooding potential and changes flow characteristics.

The quality of urban stormwater is affected by: suspended solids, nutrients from natural or agricultural lands, metals, bacteria and pathogens from animal droppings, as well as herbicides and pesticides. The type and magnitude of urban stormwater quality degradation is a function of rainfall, soils, vegetation, land use and the presence/type of agricultural practices, and the presence of animals such as geese and livestock.

Urbanized runoff also carries oil, vehicle drippings, tire wear, dust and dirt, winter sand and salt, nutrients from residential fertilizers, zinc, copper, and lead, hydrocarbons leaching from asphalt pavement, chemicals, and bacteria from domestic animals. This change of runoff quality causes a general degradation of water quality.

IMPLEMENTATION

SWM implementation by municipalities generally focuses on individual development sites. New sites are being required to implement SWM Best Management Practices (BMPs) to prevent increases in the peak rate of runoff and capture suspended solids contained in the runoff from development. These BMPs are generally required to ensure that the post development peak rate of runoff matches the pre development peak rate of runoff, the concentration of hydrocarbons (oil and grease) in runoff is less than 1 ppm and between 60% and 80% of suspended sediment in site runoff is captured (along with the absorbed contaminants such as phosphorous and metals).

Municipalities are recently adding SWM facilities as part of road reconstruction activities, usually at the request of Conservation Authorities.

DRAINAGE DESIGN

The effective management of stormwater within a municipality requires a comprehensive approach to the design of drainage infrastructure that will provide an acceptable level of service during storm events with a wide range of magnitudes and minimize the amount of damage during extreme events. This section of the report presents the design philosophy that is the basis for stormwater management in an urban setting.

Stormwater drainage systems have historically consisted of an underground network of pipes and associated structures designed to transport flows for relatively minor or low intensity storms, as a matter of convenience. Although this works well for minor storms, it is unable to accommodate major storm events. Since little or no consideration was given to controlling runoff from major storm events, flooding due to inadequate drainage capacity could occur.

The solution to these past problems was to make allowances for these major storm events in the planning and design of new developments. The division of the urban drainage system into major and minor systems became known as the “Dual Drainage Concept”. The minor system provides a basic level of service by conveying flows from the more common (low intensity, more frequent) storm events as a convenience. The major system conveys runoff from the extreme (high intensity, less frequent) storm events that produce runoff in excess of what the minor system can handle. Good planning and design are critical to successful stormwater management.

Minor System

The minor stormwater drainage system includes the underground pipe network, manholes, outfalls, roof drains, lot drainage, and drain tiles. The minor system can contain both public infrastructure (sewer piping and catch basins) and private infrastructure (drain tile and roof drains). The minor stormwater drainage system is designed to provide a basic level of service, mainly safe and convenient use of streets, lot areas, and other areas. In Sault Ste. Marie, the minor system is designed to convey the runoff produced by a 10-year-return-period storm event.

Major System

The major stormwater drainage system conveys runoff that exceeds the conveyance capacity of the minor system. Components of the major system typically include overland flow pathways (including drainage channels and floodwater diversion channels), streets, swales, stormwater detention and retention ponds, outfalls, and culverts. Drainage pathways for major events will always exist whether planned or not, but proper planning of a major system could reduce or eliminate unnecessary flooding and associated damages. Channels for the overland flow of stormwater during major storm events (having a return period in excess of 10 years) should be via public roadways and trails, and not through private property. The use of utility rights-of-way as part of the major system might be acceptable subject to the approval of the Director of Engineering and Public Works. Generally the major system is designed to accommodate the Regional Storm or 100 year storm event. Appendix D tabulates the various major design storm flows in the local Creek and River System. Not all streams can carry the indicated flows; for instance Clark Creek can only convey the 1:10 Year Design Storm.

The minor and major drainage systems are connected via catch basins. Catch basins should be designed to capture all of the flows up to the design capacity of the sewer (e.g., runoff from the minor storm).

In systems where weeping tiles are connected to the storm sewer, the catch basins should be designed to capture less than the 10 year design storm to prevent surcharging of the storm sewer. The catch basin inlet determines the runoff that enters the sewer system or travels along the street.

Inlet control devices are often used to control the peak flow entering the storm sewer so that it will not be surcharged. Inlet control devices usually limit the flow to less than the catchbasin lead capacity so free surface flow is maintained in the leader. Inlet control design is governed by the existing surface grade. Surface flow should be restricted from the sewer system and also be directed to detention storage such as parking lots, parks, low lying areas or underground storage.

Very recently, catchbasins can also be fitted with inserts to trap hydrocarbon and other contaminants through the use of cartridge filtration.

By providing the major and minor system for urban drainage, a higher level of flood protection can be provided and the chance of extreme flooding and specifically basement flooding can be reduced.

The following sections present a brief overview of selected stormwater best management practices applicable to Sault Ste. Marie. The list of BMPs presented below is provided as a general illustration for discussion purposes only and is not intended to be complete nor comprehensive. A more comprehensive treatment of stormwater best management practices can be found in the Ontario Ministry of the Environment 2003 Stormwater Management Planning and Design Manual (Queen's Printer for Ontario. ISBN 0-7794-2969-9).

LOT LEVEL CONTROLS

Municipalities are moving to an emphasis on site design measures and lot level and conveyance controls (low impact development) to help achieve required SWM objectives. Low impact lot and conveyance controls consist of minimizing clearing and grubbing areas, maximizing overland sheet flow and increasing site and lot vegetation cover.

Lot grading is typically away from homes at a minimum of 2% to facilitate drainage from the building. For areas further away from the building envelope, grades can be reduced to about 0.5%. This design increases depression storage and encourages natural infiltration.

Culverts under driveways and elsewhere can be raised above the invert of the ditch trapping stormwater for infiltration or evaporation. The culvert design would also reduce sedimentation and icing within the culvert which in turns reduces the frequency of the culvert cleaning or thawing. The trapped sediment will settle amongst the vegetation in the swale. Areas that use winter sand and salt may have problems with this as vegetation typically will be impacted with the addition of salt and sand.

Some municipalities are fearful of ponding water containing water borne disease such as West-Nile Virus. Typically municipalities deal with this type of disease in conjunction with the local Health Unit and Conservation Authority.

ROOF DESIGN

Roof gutter downspouts are increasingly being directed to grass areas. While this does not provide a high level of water quality treatment, the runoff volume reduction has improved the overall water quality of runoff.

For commercial and industrial buildings, using roof drain restrictors, with roof overflow scuppers, can detain stormwater on rooftops to reduce the runoff rate into the storm sewer.

Roof leaders can also be discharged into soakaway pits or dry wells which are essentially an underground infiltration trench, filled with coarse aggregate.

Roof leaders can be discharged to rain barrels and / or cisterns which temporarily store the rainfall for lawn and garden watering. In Wingham, Ontario the Insurance Bureau of Canada is measuring how much rainfall is diverted from the sewer systems. Other communities are beginning the implementation of rain barrel plans as a form of SWM.

There are barrel building websites so that home owners can get involved on their own.

Green roofs are also becoming prevalent in institutional construction as part of the Leadership in Energy and Environmental Design (LEEDs) certification system which provides third-party verification that a building or community was designed and built while improving performance of items such as water efficiency and stewardship of resources and sensitivity to their impacts.

PAVING

Porous pavements have been implemented at a few private sites in southern Ontario and recently in northern Ontario instead of the usual asphalt or concrete surface. The porous pavement structure stores water within the granulars beneath the pavers for infiltration to the ground water table. Water storage is almost immediate and the storage availability in the granulars can typically accommodate storm runoff.

Recently there is a movement away from open or missing block as the open blocks are hazardous for certain types of footwear such as high heels and boots. Openings are preferred to be shorter wide slits along the block perimeter.

Runoff pollutants can be trapped in soil beneath the porous pavement. The system should be vacuumed periodically especially in areas that utilize winter sand. Inspection should also be undertaken to ensure that the system continues to operate.

OIL / GRIT SEPARATORS

Oil/grit separators (OGS) are designed to trap grit and oil from parking areas and roads. Typically OGS have historically been used in heavy industrial areas and on sites containing commercial developments.

OGS were originally designed as three chamber systems where the first chamber collects grit and litter, the second collects oil and gas floating on the surface and the third chamber houses the outlet pipe and allows for some additional settling. A permanent pool is present throughout the chamber.

The usefulness of oil / grit separators conforming to this original design is limited and they are generally not used.

OGS have evolved to be used in a municipal setting with the main OGS manufacturers being Stormceptor, CDS, ADS and Vortechnics. Recent designs have improved the capture of runoff by increasing the storage capacity and providing a washout protection mechanism for larger flows. Nevertheless, only rigorous field monitoring programs can determine the effectiveness of new designs. Although the oil / grit separator is primarily designed to control commercial and industrial parking lot runoff, there is no reason to prevent its use in residential areas. It can be installed under parking lots or along a road and/or sewer system which is undergoing reconstruction or rehabilitation. However, the responsibility of maintenance will fall upon the municipalities if oil/grit separators are installed along local residential roads or within City owned property.

ADS has recently implemented a spreadsheet that can calculate annual sediment removal efficiencies of their units for user selected sediment gradations and specific climate conditions over a number of Canadian cities. This presents a new advance in the estimation of suspended sediment removal predictions, and could potentially alter the way sediment removal efficiencies for SWM treatment products will be assessed in the future.

The City of Toronto Wet Weather Flow guidelines note that with respect to OGS units that they will accept a unit that has received the US TARP (The Technology Acceptance and Reciprocity Partnership) Tier 1 Conditional Interim Certification by NJDEP (New Jersey Department of Environmental Protection).

This position of the City of Toronto reflects the fact that aside from TARP, there has not been a much independent testing of these units.

It is pointed out that Toronto’s guidelines only allow an OGS used by itself to be counted as providing a maximum 50% TSS removal. This is a response to the fact that the performance claims of these units are based on proprietary testing and the grain size distribution / particle sizes used in the testing will obviously have a huge impact on the claimed performance. (i.e. 80% or greater TSS removal is not difficult when your solids are mostly large particles).

OGS selection is often based solely on the physical constraints (i.e. the footprint and depth of a unit), the cost, or the unit or any preference that an approval agency might have. Since the sizing / performance of the units are proprietary, designers / specifiers are not in a position to question it other than reviewing how it functions and possibly developing a personal preference.

Many of the OGS manufacturers also have a filtration unit as well, which are likely to be more prevalent in the SWM market.

The Ontario Ministry of Transportation (MTO) does not have any specific type of OGS that they prefer. Oil / grit separators are used by the MTO provided that they are approved by the Ministry of Environment (MOE). Typically the MTO never installs OGS units in their highways due to maintenance issues, however, the MTO uses OGS units in their truck inspection stations and highway rest stop parking lots where there are requirements to provide stormwater quality.

Ministry of the Environment Certificate of Technology Assessments, are available for some OGS units. There is also the Environmental Technology Verification (ETV) Program which independently reviews performance claims.

PONDS

Stormwater management ponds are designed to attenuate the post development flows back to the pre-development conditions in order to protect downstream areas from flooding. They are generally sized to provide quantity control for storm events ranging from the 2 to 100 year frequency and the Regional design storm (Timmins Storm / Hurricane Hazel). Both dry and wet ponds have been used for flood control purposes. This does not guarantee water quantity control along the watercourse as the controlled peak from one site may coincide with the peak flows from other sites which results in higher and longer cumulative peak flows in the watercourse at certain times.

Individual SWM plans should be completed in accordance with a watershed master plan approach. The impact of urbanization on aquatic resources, wildlife corridors, natural area linkages, rehabilitation areas, and impact of individual subdivision/site water management practices can be addressed comprehensively in the watershed planning process. At times there are many instances where a SWM plan for a subdivision or site plan proceeds before the watershed plan. Such a development may be an infill situation or redevelopment situation. As a result, more stringent stormwater control requirements must be imposed to prevent severe degradation to the water ecosystem.

Wet ponds are most commonly used for end-of-pipe stormwater quality control where land is available. They are designed with a smaller sediment forebay for larger particles and a deeper / larger pool for the sedimentation of smaller size particles. Engineered wetlands can also be used to reduce nutrients in stormwater. The active storage is detained usually for 24-48 hours by installing a rise-pipe control outlet or a system of orifices.

Engineered wetlands are shallower than wet ponds however require substantial land.

CLIMATE CHANGE

The possible effects of climate change on the performance of (minor and major) drainage systems and stormwater best management practices are potentially substantial, and the increased risk of flooding and associated water quality impacts as the result of these possible changes cannot be ignored by municipalities. The effects of climate change that have the most severe impacts on municipal drainage systems and the occurrence of flooding consist of increases in the severity and frequency of storm events. The First National Engineering Vulnerability Assessment Report for Roads and Associated Infrastructure, written by Dennis Consultants, a division of R. V. Anderson Associates Limited for the neighbouring City of Greater Sudbury's Infrastructure Department (March 25, 2008) which studied the effects of climate change found in it's conclusions that:

"The assessment revealed the drainage infrastructure (culverts, bridges, ditches, catch basins and storm sewers) to have potentially major vulnerabilities to the predicted increases in the severity and frequency of rainfall events associated with climate change. These vulnerabilities are expected to consist of the surcharging and flooding of the drainage infrastructure, with likely impacts on all performance responses (including structural integrity, functionality, and operations & maintenance). It was however not possible to quantify this vulnerability due to the lack of hydraulic information for the existing drainage infrastructure within the City of Greater Sudbury."

Although it is recognized that Sault Ste. Marie's climate differs from Sudbury's climate and that the magnitude of the predicted changes in climate conditions at these two locations may vary, the climate change trends are the same and similar adaptation measures should be implemented at both locations to avoid the expected damaging effects of climate change.

The predictions for future increases in precipitation amounts associated with storm events range considerably for Canada. For Sault Ste. Marie we reviewed the Ministry of Natural Resources

'Climate Change Mapping Tool'. The change in precipitation from 1971-2000 to 2071-2100 for warm and cold weather is forecasted to increase about 10-20%. It should be noted that for warm weather there is also an area just north of Sault Ste. Marie which shows an increase of 0-10%.

The City of Sault Ste. Marie has implemented a number of projects and procedures that will help mitigate the potential impacts of climate change and help understand climate change. This includes:

- The implementation of Sustainable Site Plan Guidelines;
- Stormwater Management ponds to mitigate the impact of stormwater runoff on the current stormwater system. Benefits include the reduction of basement flooding;
- Completion of flow monitoring of priority sewers to enhance resiliency of the sewer system and improve assessment of flooding risk;
- Completion of Infrastructure projects such as the Bellevue SSO tank to mitigate stormwater infiltration impacts and loading to the East End Sewage Treatment Plant;
- Completion of improvements to the SCADA system to more accurately track sanitary sewer overflows, and;
- Implementation of an updated sewer use by-law in 2009 with more stringent requirements for quantity and quality.

In addition to the above works the City of Sault Ste. Marie will be updating the IDF curve data more frequently to account for climate change.

APPENDIX I

Budget Cost and Scheduling Analysis

As stated in Section 8.1 of the Master Plan document, the recommended management approach to address stormwater concerns within the City of Sault Ste. Marie is the City Wide Stormwater Management Approach which establishes objectives for new development areas as well as a guide to implement stormwater controls and upgrades for the built-up areas of the City. The following outlines project costs and additional details for items identified within the Master Plan.

New Development Stormwater Management

Stormwater management for new development is addressed under the Planning Act and as per the Stormwater Management Policy for the City of Sault Ste. Marie (2010).

Stormwater Management Ponds

Stormwater management ponds are a widely accepted method of treatment. Wet ponds can typically be designed to achieve any level of treatment while dry ponds generally provide a lower level of treatment due to a lack of settlement time and the risk of re-suspension of solids.

A general cost analysis using sizing and costing methods outlined in the MOE's document Stormwater Management Planning and Design Manual (2003) is provided in Table I.1. The estimate is prepared considering wet pond installation for typical residential development with a percent imperviousness of 50% and drainage areas ranging from 5 ha to 50 ha with a Normal Level of Protection of 70% solids removal. A permanent pool depth of 1.5 m was assumed with an allowance made for ice formation. Assumptions made in the Stormwater Management Planning and Design Manual include a rectangular shaped pond bottom with a length to width ratio of 3:1, and side slopes of 4:1 and 5:1 in the permanent pool and extended detention portion respectively. Costs do not include stormwater conveyance systems upstream or downstream of ponds.

Table I.1

Estimated Wet Pond Costs

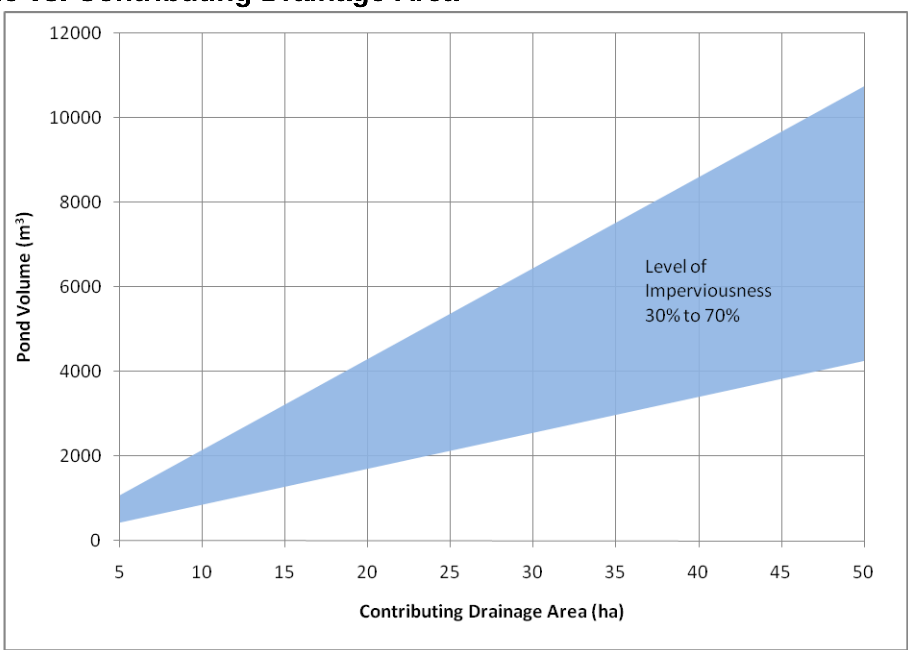
Wet Pond Construction	*Cost*
Fixed Cost	$14,500
Cost per m^3	$25.00 to $27.00

Annual Wet Pond Maintenance	*Cost*
Fixed Cost	$100
Cost per m^3	$3.00 to $4.00

Pond size is a function of the level of protection required for the region, and the level of imperviousness and size of the contributing drainage area. This relationship is illustrated in Figure I.1.

Figure I.1

Pond Volume vs. Contributing Drainage Area



Dry ponds with a quality control device, or similar facilities, should be implemented on new residential developments. Development plans need to be reviewed as a whole and meetings held where different developers drain to a single area or outfall. Agreements need to be arrived at early in the Planning stage as to placement of ponds, lands required and timing of construction. The City should oversee the planning aspects of such facilities. The placement of single ponds, by phase of construction on limited development areas should be discouraged.

Existing Development Stormwater Management

Several projects are presented in Section 6.3 of the Master Plan document to mitigate quality and quantity concerns related to stormwater in the urbanized areas of the City as determined by City staff, computer modeling, or inspection of water sampling results. The following summarizes costs that may be expected during implementation of these measures and the proposed sequencing of these events. Priority is assigned based on ease of execution and relative extent or seriousness of the known problem area.

Oil and Grit Separators

Oil and grit separators vary by manufacturer, catchment area size, and level of protection. For large areas with levels of imperviousness typical of urban development, oil and grit separators are often manufacturer designed pre-cast or cast-in-place concrete structures.

A cost model was developed using contract costs obtained from suppliers and recent similar projects in Northern Ontario. The estimates and priority rankings for oil and grit separator installations suggested in Section 6.5 of the Master Plan document are provided in Table I.2 at the end of this appendix.

Conveyance Improvement Projects

Cost estimates are generated using industry standard estimating technique and current unit prices for piping and structures. The estimates and priority rankings for the conveyance improvement projects described in Section 6.5 of the Master Plan document are provided in Table I.2 at the end of this appendix.

Additional Recommendations

Costs for additional recommendations intended to augment the City Wide Stormwater Management Approach were developed. These costs are included in Table I.2 at the end of this appendix.

Snow Disposal Upgrades and Snow and Salt Management Review

Operations upgrades to snow disposal sites by such measures as silt fencing, straw bales, and so forth, at sites where controls are not yet in place is recommended.

A detailed review of how snow, salt, and runoff is managed within the City may necessitate an Environmental Assessment. Further discussion with the MOE is needed to determine the appropriate measures to be taken and the scope of further studies.

Education Initiatives

Education programs can be an inexpensive and effective route to improving stormwater quality across the City. Utilizing local media, mail outs and the internet, awareness of low impact stormwater management controls, storm sewer use best management practices, and existing bylaws can be generated.

It is proposed that approximately $8,000 to $10,000 be allocated in the first year for establishing education initiatives.

Point Source Monitoring Program for Stormwater

It is recommended that stormwater visual monitoring be incorporated into the day-to-day activities of City operations staff.

The number of sampling sites included in the monitoring program will likely vary year to year. Sampling costs per year following the sampling regime outlined in the Point Source Monitoring Plan would be approximately as follows:

- Per year per site testing costs: $500.
- Person hours per year per site: 25
- Person hours per year documenting and reporting: 60

Table I.2
Sault Ste. Marie Stormwater Management Costs and Sequencing

PRIORITY RATING	NATURE OF IMPROVEMENT (QUANTITY / QUALITY)	CATCHMENT AREA	IMPROVEMENT ITEM	CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE (IF APPLICABLE)	SAMPLING AND MONITORING	APPROXIMATE COST - INCLUDES 15% ENGINEERING, 5% MARKET ADJUSTMENT AND 10% CONTINGENCY	NOTES
1	QUALITY/QUANTITY		POLICY IMPLEMENTATION				IMPLEMENT NEW SWM POLICY
2	QUALITY	VARIES	SNOW DISPOSAL SITES	A	Commenced	$100,000	OPERATIONS WORK, SILT FENCING
3	QUALITY/QUANTITY	VARIES	EDUCATION			$10,000	
4	QUALITY	VARIES	POINT SOURCE MONITORING PLAN			$10,000	SITE SELECTION AND COMMENCEMENT
5	QUALITY	QUEEN	PORTAGE OGS	A	Current	$1,100,000	
6	QUALITY	MILLWOOD	MILLWOOD OGS	A	Current	$1,020,000	
7	QUALITY	DACEY	DACEY OGS	A	Current	$1,020,000	
8	QUANTITY	PINE	PINE STREET - McDONALD to OUTFALL	A	NA	$3,250,000	SUBJECT TO DETAILED DESIGN
9	QUALITY	PINE	PINE / SHORE OGS	A	Current	$1,010,000	
10	STUDY - QUALITY AND QUANTITY	VARIES	SNOW DISPOSAL ENVIRONMENTAL ASSESSMENT		Commenced	$150,000	DISCUSSIONS WITH MOE TO BE HELD PRIOR TO STUDY IMPLEMENTATION
11	QUALITY	FORT CREEK	HUDSON OGS	A	Current	$250,000	
12	QUALITY	FORT CREEK	ST. GEORGES OGS	A	Current	$880,000	
13	STUDY - QUALITY	VARIES	REVIEW EXISTING SWM POND RETROFITS			$50,000	SCHEDULE A+ ACTIVITY IF IMPLEMENTED - TYPICALLY IMPLEMENT AN OGS AT POND
14	QUALITY	FORT CREEK	QUEEN WEST OGS- east catchment	A	Current	$890,000	
15	QUALITY	CHURCHILL	CHURCHILL OGS	A	Current	$2,060,000	
16	QUALITY	ST. MARYS	FOSTER OGS	A	Current	$2,790,000	
17	QUANTITY	ST. MARYS	McNABB / PIM	A	NA	$1,800,000	SUBJECT TO DETAILED DESIGN
					Sub-total	$16,390,000	

Monitoring recommended prior to implementation of the following OGS controls. Based on land use these areas have the potential to be problem areas. Monitoring results may alter priority or timing

NATURE OF IMPROVEMENT (QUANTITY / QUALITY)	CATCHMENT AREA	IMPROVEMENT ITEM	CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE (IF APPLICABLE)	SAMPLING AND MONITORING	APPROXIMATE COST - INCLUDES 15% ENGINEERING, 5% MARKET ADJUSTMENT AND 10% CONTINGENCY	NOTES
QUALITY	CLARK	BENNETT OGS		future monitoring	$1,550,000	SSMRCA AND OTHERS NOTE SEDIMENT IN AREA
QUALITY	CLARK	BOUNDARY OGS		future monitoring	$2,820,000	
QUALITY	CLARK	GOLF RANGE OGS		future monitoring	$260,000	
QUALITY	CLARK	DELL OGS		future monitoring	$920,000	
QUALITY	PIM	PIM OGS		future monitoring	$900,000	
QUALITY	CHURCH	CHURCH OGS		future monitoring	$930,000	
QUALITY	RIVER	RIVER OGS		future monitoring	$940,000	
QUALITY	WILLOWDALE	WILLOWDALE OGS		future monitoring	$1,480,000	
				Sub-total	$9,800,000	

Monitoring required prior to implementation of OGS controls, possible potential problem areas based on land use.

NATURE OF IMPROVEMENT (QUANTITY / QUALITY)	CATCHMENT AREA	IMPROVEMENT ITEM	CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE (IF APPLICABLE)	SAMPLING AND MONITORING	APPROXIMATE COST - INCLUDES 15% ENGINEERING, 5% MARKET ADJUSTMENT AND 10% CONTINGENCY	NOTES
QUALITY	DAVIGNON CREEK	KORAH OGS	A	future monitoring	$370,000	
QUALITY	FORT CREEK	WILSON OGS	A	future monitoring	$1,440,000	
QUALITY	ELIZABETH	ELIZABETH OGS	A	future monitoring	$590,000	
QUALITY	DAVIGNON CREEK	GREENFIELD OGS	A	future monitoring	$1,060,000	SITE DEPENDANT UPON FUTURE DEVELOPMENT
				Sub-total	$3,460,000	

Sampling results in Davignon Creek did not show high e. coli or total phosphorus in 2007-2008 - continue monitoring prior to consideration

NATURE OF IMPROVEMENT (QUANTITY / QUALITY)	CATCHMENT AREA	IMPROVEMENT ITEM	CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE (IF APPLICABLE)	SAMPLING AND MONITORING	APPROXIMATE COST - INCLUDES 15% ENGINEERING, 5% MARKET ADJUSTMENT AND 10% CONTINGENCY	NOTES
QUALITY	DAVIGNON CREEK	LETCHER OGS	A	continue monitoring	$280,000	only if monitoring warrants construction
QUALITY	DAVIGNON CREEK	CENTRAL OGS	A	continue monitoring	$190,000	only if monitoring warrants construction
				Sub-total	$470,000	

Other urban areas outletting directly to St. Marys River or Black Creek (Dependant on future monitoring results) could potentially cost:

Refer to Drawing F.7 (Appendix F) for Locations

NATURE OF IMPROVEMENT (QUANTITY / QUALITY)	CATCHMENT AREA	IMPROVEMENT ITEM	CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE (IF APPLICABLE)	SAMPLING AND MONITORING	APPROXIMATE COST - INCLUDES 15% ENGINEERING, 5% MARKET ADJUSTMENT AND 10% CONTINGENCY	NOTES
QUALITY	S05 S07	OGS	A	future monitoring	$380,000	implement in known or future problem areas
QUALITY	S06	OGS	A	future monitoring	$240,000	implement in known or future problem areas
QUALITY	S08	OGS	A	future monitoring	$340,000	implement in known or future problem areas
QUALITY	S09 S10	OGS	A	future monitoring	$470,000	implement in known or future problem areas
QUALITY	S11	OGS	A	future monitoring	$250,000	implement in known or future problem areas
QUALITY	S12	OGS	A	future monitoring	$150,000	implement in known or future problem areas
QUALITY	S13 S14	OGS	A	future monitoring	$520,000	implement in known or future problem areas
QUALITY	S15 S16 S28	OGS	A	future monitoring	$820,000	implement in known or future problem areas
QUALITY	S22 S23	OGS	A	future monitoring	$730,000	implement in known or future problem areas
QUALITY	S24	OGS	A	future monitoring	$230,000	implement in known or future problem areas
QUALITY	S29	OGS	A	future monitoring	$170,000	implement in known or future problem areas
QUALITY	S30	OGS	A	future monitoring	$150,000	implement in known or future problem areas
QUALITY	S33 S36	OGS	A	future monitoring	$630,000	implement in known or future problem areas
QUALITY	S34	OGS	A	future monitoring	$540,000	implement in known or future problem areas
QUALITY	S35	OGS	A	future monitoring	$180,000	implement in known or future problem areas
QUALITY	S37	OGS	A	future monitoring	$550,000	implement in known or future problem areas
QUALITY	S38	OGS	A	future monitoring	$150,000	implement in known or future problem areas
QUALITY	S39	OGS	A	future monitoring	$170,000	implement in known or future problem areas
QUALITY	S40 S43	OGS	A	future monitoring	$470,000	implement in known or future problem areas
QUALITY	S41	OGS	A	future monitoring	$180,000	implement in known or future problem areas
QUALITY	S42	OGS	A	future monitoring	$130,000	implement in known or future problem areas
QUALITY	S57	OGS	A	future monitoring	$570,000	implement in known or future problem areas
QUALITY	S58	OGS	A	future monitoring	$140,000	implement in known or future problem areas
QUALITY	S59	OGS	A	future monitoring	$180,000	implement in known or future problem areas
QUALITY	S60	OGS	A	future monitoring	$150,000	implement in known or future problem areas
QUALITY	S61	OGS	A	future monitoring	$170,000	implement in known or future problem areas
QUALITY	S62 S65	OGS	A	future monitoring	$510,000	implement in known or future problem areas
QUALITY	S63	OGS	A	future monitoring	$110,000	implement in known or future problem areas
QUALITY	S64	OGS	A	future monitoring	$270,000	implement in known or future problem areas
QUALITY	S66	OGS	A	future monitoring	$550,000	implement in known or future problem areas
				Sub-total	$10,100,000	

APPENDIX J

Funding Opportunities

Funding Opportunities

As part of this Master Plan, the funding opportunities were investigated and are summarized below. City staff should consider all of the information below.

2010 Federal Budget

The 2010 Federal Budget states:

Green Jobs and Growth

Budget 2010 builds on Canada's position as an energy superpower with measures to encourage investments in energy projects and clean energy generation. The budget also includes measures to preserve Canada's natural heritage through environmental protection in the North and further protection of the Great Lakes.

Great Lakes Action Plan

Millions of Canadians depend on the Great Lakes for their drinking water, for recreation and for jobs. Protecting ecosystem health and securing the water supply in the Great Lakes is an important responsibility shared by all orders of government, including the federal government. Cleaning up the Great Lakes is a key objective of our Government's Action Plan for Clean Water.

Under the Canada-United States Great Lakes Water Quality Agreement, both countries are committed to restoring environmental quality in areas identified as being most degraded. In June 2009, the Governments of Canada and the United States announced a commitment to strengthen and modernize the agreement to better address concerns resulting from pollution, invasive species and climate change.

Budget 2010 provides Environment Canada with $8 million per year ongoing to continue to implement its action plan to protect the Great Lakes. Through this new investment, the Government will continue working with its partners to address environmental restoration issues in the Areas of Concern and support Canada's commitments under international agreements.

Environment Canada

Environment Canada is responsible for preserving and enhancing the quality of the natural environment, providing weather forecasts and warnings and protecting

Canadians from environmental threats through its scientific expertise, legislation and regulatory tools.

Through its strategic review, Environment Canada identified opportunities to focus on priorities and deliver its suite of programs and services more efficiently, while ensuring the right balance between environmental stewardship and economic interests.

As a result, Environment Canada is strengthening its capacity to preserve and enhance the environment through improved scientific capacity and an efficient approach to regulation.

As discussed in Chapter 3, this budget is reinvesting funds in Environment

Canada to sustain the Government's annual reporting on environmental indicators, deliver meteorological services in the Arctic and clean up the Great Lakes.

The 2011 Federal Budget was rejected by the three opposition parties and has resulted in a vote of non-confidence and an election, which as of the writing of this report is ongoing.

Municipal Act

The City can also impose fees under Section 391 of the Municipal Act, 2001 to offset capital cost where future development may be benefited. Using this method would allow area specific charges. Below is an excerpt of Section 391.

By-laws re: fees and charges

391. *(1) Without limiting sections 9, 10 and 11, those sections authorize a municipality to impose fees or charges on persons,*

(a) for services or activities provided or done by or on behalf of it;

(b) for costs payable by it for services or activities provided or done by or on behalf of any other municipality or any local board; and

(c) for the use of its property including property under its control. 2006, c. 32, Sched. A, s. 163 (1).

Local board

(1.1) A local board may impose fees or charges on persons,

(a) for services or activities provided or done by or on behalf of it;

(b) for costs payable by it for services or activities provided or done by or on behalf of any municipality or other local board; and

(c) for the use of its property including property under its control. 2006, c. 32, Sched. A, s. 163 (1).

Deferred benefit

(2) A fee or charge imposed for capital costs related to services or activities may be imposed on persons not receiving an immediate benefit from the services or activities but who will receive a benefit at some later point in time. 2006, c. 32, Sched. A, s. 163 (2).

Costs related to administration, etc.

(3) The costs included in a fee or charge may include costs incurred by the municipality or local board related to administration, enforcement and the establishment, acquisition and replacement of capital assets. 2006, c. 32, Sched. A, s. 163 (3).

Fees for mandatory services, etc.

(4) A fee or charge may be imposed whether or not it is mandatory for the municipality or local board imposing the fee or charge to provide or do the service or activity, pay the costs or allow the use of its property. 2006, c. 32, Sched. A, s. 163 (3).

Conflict

(5) In the event of a conflict between a fee or charge by-law and this Act, other than this Part, or any other Act or regulation made under any other Act, the by-law prevails. 2006, c. 32, Sched. A, s. 163 (3).

Development Charges

The Development Charges Act enables City council to impose development charges against land for increased capital expenditures attributable to growth. This allows for the potential to use this vehicle as a method to recuperate expenditures.

City Council may pass a By-law under subsection 2(1) of the Development Charges Act, 1997. The By-law would impose development charges for residential and / or non-residential lands within the boundaries of the City, payable typically upon issuance of a building permit.

Exemptions in addition to those that are legislated under the Development Charges Act, 1997 can be approved by City Council.

As required by the *Development Charges Act, 1997*, the City must prepare an annual financial statement reporting on the status and transactions relating to the development charges reserve funds for the previous year.

Services to Which Development Charges Relate include: Transportation, Storm Drainage, Transit, Recreation Facilities, Parkland Development, Library, Growth Studies and Fire.

Development Charges in Northern Ontario

The City of Sault Ste. Marie is currently having a study completed for Development Charges. The 2009 Municipal Study completed by BMA Management Consulting Inc. noted that Timmins and Thunder Bay also do not have Development Charges.

A review of the North Bay Development Charges indicates their urban detached and semi-detached Development Charge is at $6,099. Varying Development Charges and incentives exist for other land uses and residential densities.

Greater Sudbury's Development Charges were being phased in to full value over a three year period and are applicable to Residential, Multi-residential, Commercial, Institutional and Industrial Developments.

On January 1, 2010 and each year thereafter to January 1, 2014, the charges are indexed subject to the Construction Price Statistics adjustment. Based on By-law 2009-200 the single family residential Development Charge was $14,829 with all services as of January 1, 2013. In addition Greater Sudbury is now applying Development Charges to non-residential development.

APPENDIX K

Stormwater Management Guidelines

APPENDIX K

STORMWATER MANAGEMENT GUIDELINES

Prepared for:

The Corporation of the City of Sault Ste. Marie

Engineering and Planning Department

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GLOSSARY

Aquifer:	A geologic formation of which all voids are full of groundwater.
Approval:	The approval of the Commissioner of Engineering and Planning, whose decisions will be final and binding in matters of design and construction. Prior to construction the Ministry of the Environment's Environmental Compliance Approval (ECA) will be required, as necessary.
Assimilative Capacity:	The capacity of natural water to receive wastewaters or toxic materials without negative effects and without damage to aquatic life or humans who consume the water.
Attenuation Pond:	A stormwater management pond that is designed to reduce the peak rate of stormwater flow by temporary storage of runoff (also known as a detention pond or retention pond).
Bacterial Water Contamination:	The introduction of unwanted bacteria into a water body.
BMP:	"Best Management Practice" Activities, projects or management approaches that achieve environmental objectives. Includes structural and nonstructural stormwater management controls.
Base Flows:	Flow remaining in a channel once runoff has stopped.
Branch Sewer:	A sewer that receives stormwater from a relatively small area and which discharges into a main sewer serving more than one area served by branch sewers.
City:	The Department of Engineering and Planning appointed by Council in the City of Sault Ste. Marie, or their designated representative.

Channel Morphology:	The physical make –up of a channel (e.g. slope, depth, width, bed and bank material, alignment).
Commissioner of Engineering and Planning:	The person appointed by Council to oversee all capital works of the City of Sault Ste. Marie Engineering and Planning Department, or their designated representative.
Contractor:	The firm that performs the construction work under a construction agreement with the developer and in accordance with plans, specifications, and other documents as may be prepared by the Engineer and approved by the Engineer.
Design Storm:	The magnitude of precipitation from a storm event measured in probability of occurrence (e.g., 50 year storm) and duration (e.g., 24 hours), and used in designing stormwater management control systems.
Developer:	The owner of the area of land proposed for development, or their designated representative.
Development:	Development includes any erection, construction, addition, alteration, replacement, or relocation of or to any building or structure and any change or alteration in land use.
Engineer:	The professional engineer who performs the planning and design of the stormwater system. The professional engineer must be a member of Professional Engineers Ontario (PEO).
Detention Basin:	A basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. This basin is designed to drain completely after a storm event.

Detention Storage:	Precipitation detained on the surface during a storm, and which does not become runoff until sometime after the storm has ended.
Drainage Area:	(1) The area tributary to a single drainage basin, expressed in hectares. The drainage area may also be referred to as the catchment area, watershed, sub watershed, drainage basin, or drainage sub basin. (2) The area served by a drainage system receiving storm sewer discharge and surface water runoff. (3) The area tributary to a watercourse.
Drainage Master Plan:	The compilation of data and mapping that delineates watersheds, indicates routes of the major and minor drainage systems, defines floodplains, indicates constraints associated with water quality and quantity; indicates erosion and bank stability problems, and indicates specific flood control and environmental objectives in the watershed.
Evapotranspiration:	The loss of moisture due to transpiration from vegetation and evaporation.
Flood Plain:	The relatively flat or low-lying area adjacent to a watercourse which has been, or may be, temporarily covered with floodwater during storms of specified frequency.
Grassed Swales:	Natural depressions or engineered shallow ditches that convey and can infiltrate stormwater runoff. The grass or emergent vegetation in the swale acts to reduce flow velocities, prevent erosion, and filter stormwater contaminants.
Groundwater:	Water within the earth that supplies wells and springs; water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.
Groundwater Hydrology:	The branch of hydrology that deals with groundwater.

Hydraulics:	The determination of water flow characteristics in the channels, pipes, streams, ponds, and rivers which convey stormwater.
Hydrograph:	A graph showing the discharge of water with respect to time for a given point within a watershed.
Hydrotechnical:	Term encompassing both engineering hydrology and hydraulics. Hydrotechnical engineering is a general term for fields of civil engineering related to the investigation, development, protection, and management of water bodies and water resources.
Hyetograph:	A graph showing average rainfall, rainfall intensity, or rainfall volume with respect to time within a watershed.
Impervious:	A term applied to a material through which water cannot pass, or through which water passes with great difficulty over a prolonged duration of time.
Infiltration:	(1) The migration of water through a soil or other porous medium. (2) The quantity of groundwater which enters into a sewerage system through cracks and defective joints. (3) The entrance of water from the ground into a sewer or drain through breaks, defective joints, or porous walls. (4) Absorption of liquid water by the soil, either as it falls as precipitation, or from a stream flowing over the surface.
Infiltration Trench:	A shallow, excavated trench that has been backfilled with stone to create a narrow underground storage reservoir from which water drains into the subsoil and eventually to the water table. Enhanced infiltration trenches also include pre-treatment systems to remove sediment and oil.
Intensity:	The rate of precipitation expressed as a quantity of precipitation per unit of time.

Interflow: The flow of water through near-surface soils.

Lag Time: The time from the center of a unit storm (or hyetograph) to the peak discharge or center of volume of the corresponding unit hydrograph.

Lateral Sewer: A sewer that discharges into a branch or other sewer and has no other common sewer tributary to it.

Main Sewer: In small urban drainage systems, the main sewer refers to the sewer with one or more tributary branch sewers.

Major Storm: A storm used for design purposes – the runoff from which is used for design and sizing the major storm drainage system. The frequency of such a storm is 1 in 100 years (1% probability of being equaled or exceeded in any year). A historic large storm that results in major flow. (Timmins Storm)

Major Storm Drainage System: The stormwater drainage system which will discharge stormwater during a major storm when the capacity of the minor system is exceeded. The major system usually includes features such as streets, curb and gutter systems, swales, and major drainage channels. Minor stormwater drainage systems may reduce the flow in many parts of the major stormwater drainage system by storing and conveying water underground. Design of a major system is based on a storm frequency of 1 in 100 years and the Regional Storm.

Minor Storm: A storm used for design purposes – the runoff from which is used for design and sizing the minor storm drainage system.

Minor Storm Drainage System: The stormwater drainage system which is designed to eliminate or minimize inconveniences or disruption of activity resulting from runoff produced by more frequent, less intense storms. The minor stormwater drainage system is sometimes termed the “convenience system”, or “initial system”. The minor system may include features such as curbs and gutters, storm sewer pipes and open drainage channels. Design of a minor system is based on a storm frequency of 1 in 10 years.

MOE: The Ontario Ministry of the Environment.

MTO: The Ontario Ministry of Transportation.

Municipal Service Systems: Municipal service systems include all sanitary sewerage systems, stormwater drainage systems, water distribution systems, streets, sidewalks and miscellaneous appurtenances within the City which are owned, operated, and maintained by the City.

Oil and Grit Separators (OGS): Engineered stormwater treatment structures that remove oil and sediment from storm runoff. They consist of one or more chambers that remove sediment, screen debris, and separate oil from stormwater. OGS are also referred to as oil and water separators, water quality inlets, and oil and sediment separators (OSS).

Non-point Source: Source of pollution from which wastes are not released at one specific, identifiable point but from an area, making this source of pollution difficult to identify and control. Non-point source pollutants commonly carried in stormwater runoff include solids, nutrients, and pesticides.

Open Channels: Natural streams and their flood plains, and artificial channels used to convey stormwater.

Outfall Sewer:	A sewer that receives water from the drainage system and discharges it to a treatment area or to a receiving water body.
Overland Flow:	The concentration and conveyance of stormwater runoff over the ground surface.
Peak Discharge:	The maximum rate of flow of water at a given point and time resulting from a predetermined storm.
Pervious:	A term applied to a material through which water passes relatively freely over a short duration of time.
Point Source:	A source of pollution collected and conveyed in pipe works or other well defined path that is discharged at one location.
Precipitation:	Any moisture that falls from the atmosphere, including snow, sleet, rain, and hail.
Regulatory Storm:	Storm events that have been selected as the approved standard(s) to be used in particular watershed(s) to define the limits of the flood plain for regulatory purposes. The Timmins Storm, which occurred on August 31, 1961 and into September 1, 1961. It is a 12 hour storm with 193 mm of rainfall and was selected to be used for regulatory purposes in North and Central Ontario.
Retention Basin:	A basin or pond containing a permanent pool of water and designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.
Runoff (Direct):	The total amount of stormwater that reaches stream channels.
Runoff Characteristics:	The surface components on any water shed which, either individually or in any combination thereof, directly affect the rate, amount and direction of stormwater runoff. These may include, but are not limited

	to, vegetation, soils, slopes and any type of manmade landscape alterations.
SCS:	Soil Conservation Service, U.S. Department of Agriculture.
Sewer:	A pipe or conduit that carries wastewater or drainage water.
Stream:	A general term for a body of water flowing in clearly defined natural channels to progressively lower levels.
Storm Drain:	An entrance into the underground stormwater pipe system.
Stormwater Drainage System:	A system receiving, conveying, and controlling discharges in response to precipitation and snowmelt. Such systems consist of ditches, culverts, swales, subsurface interceptor drains, roadways, curb and gutters, catch basins, maintenance holes, pipes, attenuation ponds, and sewers.
Stormwater Runoff:	That part of the precipitation which is concentrated and conveyed as overland flow.
Stormwater Runoff Depression Storage:	Precipitation retained in small depressions and surface irregularities that does not become part of the stormwater runoff.
Storm Service Lateral:	A pipe that conveys foundation drain water from the outer side of the wall through which the pipe exits the building to the storm sewer.
Storm Sewer:	A sewer that carries only surface runoff, street wash, and snow melt from the land. In a separated sewer system, storm sewers are completely separate and isolated from sewers that carry domestic and commercial wastewater (sanitary sewers).

Subdivision:	(1) The division of any area of land into parcels, including a re-subdivision or a consolidation of two or more parcels. (2) Area of predominantly residential development.
Surcharge:	The flow condition occurring in closed conduits when the hydraulic grade line (or water surface) is above the conduit crown, or the transition from open channel flow to pressurized flow.
Surface Water:	All water naturally open to the atmosphere, including rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries and wetlands.
Time of Concentration:	The time required for stormwater runoff to concentrate and flow from the hydraulically most remote point of a watershed to reach the point in question.
Total suspended solids:	A water quality measurement, usually abbreviated TSS, of solid material suspended in water and retained by a filter. It is a pollutant. Measurement is by a dry-weight of particles trapped by a filter, of a specified pore size.
Watershed:	A land area from which water drains to a particular water body.
Wetland:	Land that either periodically or permanently, has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions.

STORMWATER MANAGEMENT POLICY

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APPENDICES

APPENDIX 1

Plan 1 – Stormwater Management Requirements

1.0 INTRODUCTION

The City of Sault Ste. Marie spans a geographic area of 222 square kilometers and has a population of approximately 75,000. One of the oldest European settlements in Canada, Sault Ste. Marie was incorporated as a City in 1912.

In order to meet provincial and federal objectives the City developed the following Stormwater Management Guideline, which is to be implemented for projects undertaken in the City of Sault Ste. Marie. Projects would include any projects dealing with the drainage system.

A stormwater drainage system receives, conveys, and controls stormwater runoff in response to precipitation and snow melt. Such systems include: channels, ditches, culverts, swales, subsurface interceptor drains, roadways, curb and gutters, catch basins, maintenance holes, pipes, attenuation ponds and service lateral lines. In the City of Sault Ste. Marie, stormwater drainage systems are owned, operated, and maintained by the City, the Sault Ste. Marie Region Conservation Authority (SSMRCA), private landowners, or a combination of these entities.

All stormwater drainage systems that are connected or may be connected to the City's system shall be designed to:

- Prevent adverse effects of stormwater on human health and safety;
- Protect property, structures and public infrastructure from damage;
- Preserve natural watercourses and wetlands; and
- Minimize the effects of development on surface water and groundwater quantity and quality.

The guidelines, recommendations, and design standards presented in these general specifications are intended to promote uniformity of the design and construction of stormwater drainage systems within the City of Sault Ste. Marie. Stormwater drainage systems must be carefully designed in accordance with general technical, municipal, provincial and federal guidelines and standards. In addition to the specifications for drainage infrastructure in the City of Sault Ste. Marie (as presented in this document), all stormwater drainage systems shall conform to any applicable requirements established by the Ontario Ministry of the Environment (MOE). Furthermore, no system shall be constructed until the design has been accepted by the City and reviewed and approved by the MOE as evidenced by the issuance of an Environmental Compliance Approval under the Ontario Water Resources Act (OWRA), if applicable. These specifications for drainage infrastructure can be used by the City and regulatory authorities in the evaluation of drainage system designs.

A complete description and documentation of all parameters relating to the design and construction of stormwater drainage systems is beyond the scope of this document. However, an attempt has been made to define the parameters of greatest importance, and to present the policies and accepted methods of the City of Sault Ste. Marie's Engineering and Planning Department in conjunction with the requirements of the approval authorities. Designs submitted to the City of Sault Ste. Marie's Engineering and Planning Department for approval should be accompanied by a written statement that the designs have been completed in accordance with these guidelines and that appropriate contact has been made with the SSMRCA, Department of Fisheries and Oceans Canada (DFO) and other agencies as required.

2.0 ENGINEERING RESPONSIBILITY

The planning and design of urban stormwater drainage systems requires knowledge of two basic fields:

- Hydrology, which is the estimation of runoff produced from rainfall and/or snowmelt, and understanding the factors which influence it; and
- Hydraulics, which is the determination of water flow characteristics in channels, pipes, streams, ponds, and rivers.

A Professional Engineer, Licensed in the Province of Ontario, is responsible for the selection of the method(s) best suited for a design. Proposed stormwater drainage systems must be based on sound engineering design with due consideration of potential environmental impacts. For stormwater design, good quality hydrologic and hydraulic modeling is required.

The design of municipal services, when submitted to the City of Sault Ste. Marie’s Engineering and Planning Department for approval, must bear the seal of a Professional Engineer licensed with Professional Engineers Ontario (PEO). Acceptance by the City of Sault Ste. Marie’s Engineering and Planning Department of a drainage infrastructure design does not relieve the professional engineer of the responsibility for proper design. The Engineer will retain full responsibility for their work as a Professional Engineer.

It should be noted that Stormwater Management is rapidly evolving. It is important to be aware of developments in this field in jurisdictions throughout North America when implementing the policy and to consider the adoption of new and innovative approaches. In addition data in support of holistic stormwater management is known to provide benefits such as energy savings and thermal mitigation. Alternate approaches will be considered for approval. If an Engineer proposes variations from this document, and the Engineer can show that alternate approaches can produce acceptable results, such approaches may be considered satisfactory. In considering requests for variations from these specifications for drainage infrastructure, the Engineer shall take into consideration such factors as safety, nuisance, sustainability, maintenance costs, environmental impacts, constructability, compatibility with adjacent land use, etc. Where the Engineer uses standards other than those outlined in this document, they shall be clearly indicated in all relevant documents and plans.

The Engineer has the responsibility of supplying 1) the Developer with adequate information as needed to make decisions concerning the proposed project, 2) the Contractor with detailed plans and specifications as needed to construct the stormwater drainage system and 3) the City with accurate and timely as-builts of the completed works. The City of Sault Ste. Marie requires that works that become part of the City's system, and which will be maintained by the City, will be inspected by an Engineer approved by the Commissioner of Engineering and Planning.

3.0 EFFECTS OF URBAN DEVELOPMENT

Urbanization alters natural conditions by increasing impervious areas and possibly creates new pathways of stormwater conveyance. This results in an increase in direct runoff, degradation of water quality and decreases in base flow and evapo-transpiration. The net effect of development on the hydrologic regime of receiving streams could include an increase in the net effects of runoff events, a greater proportion of annual flow as surface runoff rather than base flow or interflow, and increased flow velocity during storms. The decrease in infiltration that occurs with urbanization also reduces soil moisture replenishment and groundwater recharge. The response to rainfall and snowmelt in urban areas differs from that in natural basins in the shape of their hydrographs (they tend to be more intense and have a shorter duration). The imperviousness of urban areas along with the greater hydraulic efficiency of urban drainage infrastructure causes greater runoff volumes and greater peak flows compared to natural basins.

Stream channels in urban areas respond and adjust to the altered hydrologic regime that accompanies urbanization. The severity and extent of stream adjustment is a function of the stream's characteristics and the hydrologic changes. Stream adjustments could include adjustments to channel size and shape (channel degradation, scour and erosion) to accommodate higher flows, modification of the streambed (typically a change in the size of stream bed material), and changes in stream alignment or sinuosity. Research results imply that a threshold for urban stream stability exists at approximately 10% to 15% imperviousness of a watershed, beyond which unstable and eroding channels would result. A stable stream and channel system is a fundamental goal of stormwater management.

Urban stormwater runoff may contain contaminants such as suspended solids, nutrients, bacteria, heavy metals, oil and grease, and pesticides. Suspended solids may interfere with photosynthetic activity and fish feeding by reducing light penetration in the receiving watercourse.

Water temperature is a concern regarding fish and their habitat, especially where discharge is to a cold water stream. Stormwater ponds can compound this increase in water temperature since open water will tend to acclimate with the ambient air temperature. Where impacts on water temperature are a significant concern, it is recommended that the Engineer consult with the DFO during the design process.

The ecology of aquatic habitat can be altered by major shifts in hydrology, in channel morphology, and in water quality that may accompany the development process. The health and diversity of fish, plant, animal, and aquatic insect communities in urban watercourses could be affected. In Sault Ste. Marie, developers should attempt to minimize the potential for adverse effects of development on aquatic habitat by using best practices with respect to subdivision design and construction. Riparian buffers along urban streams should be preserved. Urban drainage systems should be designed to reduce negative impacts to receiving watercourses (urban streams and wetlands) caused by changes to the hydrologic cycle.

In Sault Ste. Marie, stormwater management and the design of drainage infrastructure should aim to preserve the ecology of streams in urban areas, including but not limited to: Fort Creek, Bennett Creek, Central Creek, Clark Creek, Root River and Davignon Creek.

The Conservation Authority notes that all of the above streams listed (except Root River) have been altered to serve as flood control channels to some extent. While preserving the ecology is a consideration, a primary goal is the water flow continuity during high flow events. As such the decrease in sedimentation from storm water discharge to these water courses is of prime importance.

4.0 STORMWATER MANAGEMENT

4.1 Planning for Stormwater Management

The process of planning for stormwater management should consider the entire upstream drainage area including basin characteristics (size, vegetation, land use planning and topography), runoff conditions (the rate and amount of runoff, and water quality), existing and future development and actual and proposed alterations to natural drainage patterns. The design of drainage infrastructure within the City of Sault Ste. Marie should conform to this policy unless a separate Watershed Study has been completed and approved by the Commissioner of Engineering and Planning. Prior to initiating design of drainage infrastructure within the City of Sault Ste. Marie, it is recommended that the Engineering and Planning Department be contacted to review the proposed stormwater management plans, and assess the potential impact of these plans. A pre-design meeting shall be held to understand the design approach (conventional or innovative) and to review the approval process. The need for in-ground stormwater infrastructure and measures to control stormwater quality and quantity should be assessed considering both the incremental and total effects of changes in development on the drainage basin.

4.2 Quantity Control

Controlling the quantity of stormwater implies reductions in the total volume and/or the rate of runoff. Control of the rate of runoff (peak stormwater flow) from areas of new development will be required. For all development, peak post-development flows should not exceed pre-development flows for all storms up to the major drainage system design storm at the discretion of the Commissioner of Engineering and Planning or his Designate.

Specific methods of stormwater quantity control are addressed elsewhere in this document. Various methods of stormwater quantity control can be found in the MOE's "Stormwater Management Planning and Design Manual" (2003).

For the purposes of quantity control a hydrologic / hydraulic model is required to compare pre-development and post-development site runoff and the stormwater management quantity control facilities. The rational method shall not be used as the sole method of analysis for designing these facilities.

4.3 Quality Control

The City of Sault Ste. Marie expects developers to consider the “treatment train” approach when developing plans for stormwater management. The treatment train approach involves a series of structural and non-structural water quality management measures aimed at minimizing stormwater pollution wherever possible through appropriate reductions of pollutants at their source, during transit, and, if necessary, in receiving waters. Controlling stormwater pollution at its source includes controls on construction site runoff, better land use practices, reduced lot grading, the construction of litter traps, and on-site detention with rain barrels or infiltration trenches. Stormwater contaminants at the source can be minimized if a large percentage of the area being developed is kept vegetated or is re-vegetated quickly during and after construction.

Floatable pollutants such as oil, debris, and scum can be reduced with separator structures. Other methods of pollutant removal include sedimentation / settling, filtration, plant uptake, ion exchange, adsorption, and bacterial decomposition. Within these processes, there are generally three levels of treatment:

- Primary treatment including screening of gross pollutants, sedimentation of coarse particles;
- Secondary treatment including sedimentation of fine particulates, filtration; and,
- Tertiary treatment including enhanced sedimentation and filtration, biological uptake.

Pollutants in urban stormwater typically includes suspended solids (e.g., sand, silt); metals (e.g., copper, lead, and zinc); nutrients (e.g., nitrogen and phosphorous); bacteria and viruses; and organics (e.g., petroleum hydrocarbons and pesticides). The water quality parameters that are addressed in the City of Sault Ste. Marie Sewer Use By-law (By-law No. 2009-50), as amended from time to time, include the following limits for Storm Sewer Discharge.

Parameter	Limit (mg/L)	Parameter	Limit (mg/L)
Biochemical Oxygen Demand	15	1, 2–Dichlorobenzene	0.0056
Cyanide (Total)	0.02	1, 4–Dichlorobenzene	0.0068
Phenolics (4AAP)	0.008	cis-1,2-Dichloroethylene	0.0056
Phosphorous (Total)	0.4	Trans-1, 3-Dichloropropylene	0.0056
Suspended Solids (Total)	15.0	Ethyl benzene	0.002
Oil & Grease – Mineral & Synthetic	15.0	Methylene chloride	0.0052
Aluminum (Total)	1.0	1, 1, 2, 2 - Tetrachloroethane	0.017

Ammonia	10.0	Tetrachloroethane	0.0044
Arsenic (Total)	0.02	Toluene	0.002
Barium (Total)	1.0	Trichlolethylene	0.0076
Cadmium (Total)	0.008	Xylenes (Total)	0.0044
Chlorine (Free)	0.1	Di-n-butyl phthalate	0.015
Chromium (Total)	0.08	Bis (2-ethylhexyl) phthalate	0.0088
Chromium (Hexavalent)	0.04	Nonylphenol	0.001
Copper (Total)	0.04	Nonylphenol ethoxylates	0.01
Lead (Total)	0.12	Aldrin/dieldrin	0.00008
Manganese (Total)	0.05	Chlordane	0.04
Mercury (Total)	0.0004	DDT	0.00004
Nickel (Total)	0.08	Hexachlorobenzene	0.00004
Selenium (Total)	0.02	Mirex	0.04
Silver (Total)	0.12	PCBs	0.0004
Tin (Total)	1.0	3, 3' – Dichlorobenzidine	0.0008
Zinc (Total)	0.04	Hexachlorocyclohexane	0.04
Benzene	0.002	Pentachlorophenol	0.002
Chloroform	0.002	Total PAHs	0.002

Note - spelling corrections have been made on this chart for Dichloroethylene and bichlorobenzidine.

Table 4.1: Limits for Storm Sewer Discharges

4.3.1 Total Suspended Solids

Total Suspended Solids (TSS) has been selected by the City as a surrogate for the above water quality parameters as sediment is also a carrier of trace metals and toxicants associated with stormwater runoff.

As well, historically, the priority of stormwater management facilities with respect to water quality has typically been the control of suspended solids. Many stormwater management facilities can also successfully remove other stormwater contaminants as well.

As shown in Table 4.1 above, the City's Sewer Use By-Law limits TSS storm sewer discharge to 15.0 mg/L.

The MOE's "Level of Protection" for stormwater quality facilities are shown below. The areas where the different levels of protection are to be implemented are defined in the MOE's "Stormwater Management Planning and Design Manual" (2003). The Level of Protection is further defined as:

- Basic protection corresponds to the end-of-pipe storage volumes required for the long-term average removal of 60% of suspended solids.
- Normal protection corresponds to the end-of-pipe storage volumes required for the long-term average removal of 70% of suspended solids.
- Enhanced protection corresponds to the end-of-pipe storage volumes required for the long-term average removal of 80% of suspended solids.

Levels of Protection by geographic area within Sault Ste. Marie are shown on the drawing in Appendix 1.

Particle size distribution and settling velocities have an effect on TSS removal efficiencies. Settling velocities are not linearly related to particle sizes. Particle size distribution varies depending on site use and storm events.

Particle Size (μm)	% of Particle Mass	Average Settling Velocities (m/s)
≤ 20	0 - 20	0.00000254
20 - 40	20 - 30	0.00001300
40 - 60	30 - 40	0.00002540
60 - 130	40 - 60	0.00012700
130 - 400	60 - 80	0.00059267
400 - 4000	80 - 100	0.00550333

Table 4.2: Typical Stormwater Particle Size Distribution & Settling Velocities

For the purposes of computer modeling, the overall solids removal efficiency shall be assessed using settling velocities corresponding to the particle size distribution provided in Table 4.2, which is excerpted from Table 3.3 of the Stormwater Management Practices Planning and Design Manual, Ontario Ministry of Environment and Energy, 1994. This table should be used when there is no data supporting particle size distribution and settling velocities other than those shown above.

The City's Sewer Use By-Law 2009-50, Section 12.5 of the By-Law states:

Sediment interceptors:

(i) Every owner or operator of any land or premise from which sediment may directly or indirectly enter a sewer, included but not limited to a ramp drain, an area drain, a construction area or parking area which is maintained for winter use and has capacity of 12 or more vehicles or car and vehicle wash establishments, shall take all necessary measures to ensure that sediment is prevented from entering a sewer; [AMENDED BY BY-LAW 2009-185]

(ii) Every owner or operator required to have a sediment interceptor pursuant to Section 12.5(i) shall ensure that each and every sediment interceptor is properly and adequately maintained to prevent sediment from entering a sewer.

At the discretion of the Commissioner of Engineering and Planning sediment interceptors may be required on properties smaller than that stated in Sewer Use By-Law 2009-50 Section 12.5 (i).

Developments that have less than 10% imperviousness should be considered to be exempt from stormwater management. This type of development would be typical of Estate Lot developments. In this type of development the Engineer is to consider controls at any areas of concentrated runoff such as level spreaders or buffer strips.

4.4 Downstream Effects

4.4.1 General

The drainage facilities (both minor and major system components) for each new development shall be adequately sized to drain onsite runoff and convey estimated future runoff from upstream areas that have traditionally drained through a property. All drainage infrastructure shall be contained within the property boundaries of each development. Concentrated stormwater runoff leaving a development site must be discharged directly into an existing storm sewer (minor system) or into a well-defined, natural, or constructed channel (as part of the major system). The downstream stormwater drainage system shall have adequate capacity to convey the discharge from the proposed new stormwater drainage system. Designers shall confirm that the downstream capacities are not exceeded.

The potential for adverse downstream impact, such as flooding or erosion, because of an increased rate of discharge or increased runoff volume, shall be considered by the Engineer. As stated in the previous section, new development is not to result in an increase in peak flows. The extent of these impacts, if any, will be assessed by the Engineer. Depending upon the nature of any adverse impacts, the City of Sault Ste. Marie's Engineering and Planning Department may require measures to prevent or alleviate such adverse impacts.

Consideration must be given to public health and safety, provincial and federal government regulations (including those of MOE, SSMRCA, DFO and Environment Canada), and maintenance implications of ditches, open channels, and drainage courses. Attempts shall be made to limit the number of partial enclosures of a ditch, open channel, or natural drainage course by driveways, roadways, and other crossings.

4.4.2 Discharges to Existing Drainage Infrastructure

New development shall not result in an increase in peak flows for all storm events up to and including the peak runoff from a storm event with a 100-year return period and the Timmins Storm.

However, if a proposed development is expected to increase stormwater runoff to an existing drainage system, the existing system needs to be completely analyzed to ensure that the system will convey the additional flows without problems. Prior to making submission, the proponent must consult with the City and the SSMRCA to determine the specific technical analyses that will be required to support higher site release flows.

For each component of the stormwater drainage system (such as a storm sewer, open channel, watercourse, or culvert), the hydraulic capacity of that portion of the system needs to be determined and compared to the flow determined from the hydrologic calculations. To determine the capacity of open channels, ditches, and watercourses, the Manning equation may be used where grades are greater than 1%, considering the runoff from the major storm event at appropriate points. Where grades are less than 1%, it may be necessary to account for backwater effects using the energy equation and the direct-step or standard-step methodologies. The water surface elevation at the outlet of the ditch, watercourse, or channel should be determined. To calculate the hydraulic capacity of a culvert, both inlet control and outlet control must be checked.

The conveyance capacity of the minor storm sewer system should be checked for the 10-year return period storm. Analysis should account for pipe friction losses, junction and bend losses, and transition losses through maintenance holes, outlet tail water elevation, and capacity constraints of the downstream system. The hydraulic grade line (HGL), as determined by the standard-step method, the direct-step method, or acceptable energy equation principles, should be plotted on the profile drawing to ensure that the water surface profile is contained in the pipe, there is no back-up into service laterals or basements, and that no surcharging of the minor storm sewer system will occur during the 10-year return period design flow subject to the extent of downstream constraints.

4.4.3 Discharges to Stormwater Control Facilities

The design of a stormwater storage facility required as part of a new development shall be carried out using appropriate methods and sound engineering principles. To check the performance of a stormwater attenuation pond, a hydrograph shall be generated considering all design storms including the Regulatory (Regional) storm and the 1 – hour AES distribution for 2, 5, 10, 25, 50 and 100-year return periods applied to the watershed. Consideration should also be given to using the Chicago storm distribution (4 hour duration) for the 2, 5, 10, 25, 50 and 100-year return periods for fast draining urban sites. The design shall take into consideration various factors including, but not limited to, watercourse protection, erosion, and sediment control, impact on adjacent property, maintenance requirements, public safety, access, liability, and nuisance. Such storage facilities shall be designed to control the peak runoff conditions for the 100 year and Regional storm.

Where new drainage infrastructure discharges to existing stormwater control facilities (such as attenuation ponds) it will be necessary to determine the inlet and outlet hydrographs of the stormwater control facilities. The use of simple instantaneous peak flow will not be adequate to analyze storage facilities. The inflow and outflow at this pond shall be calculated, taking into consideration the outlet structure design parameters. The maximum flood elevation shall be calculated as part of this work. Downstream capacities shall be checked to properly convey any control facilities' overflows.

4.4.4 Discharges to Adjacent Properties

No stormwater drainage is to flow onto, through, or over private property, other than by a natural watercourse, excavated ditch or swale, minor stormwater drainage system, with an agreement as necessary. Natural drainage may flow onto a neighbouring property if the cross-property boundary discharge existed in the pre-development condition. If the cross-property boundary discharge did not exist pre-development, directed drainage may not flow onto a neighbouring property without permission from the receiving property owners. Proposed drainage is not to adversely impact natural drainage or impact neighbouring properties (i.e. natural drainage may not be "cut-off" and the construction of hydraulic controls may not cause off-property flooding). Runoff from a property may be directed to a natural watercourse, or to a municipal stormwater drainage system, with approval.

The grading along the limits of a property shall be carefully controlled to avoid disturbance of adjacent properties or an increase in the discharge of stormwater to those properties. Temporary drainage of all blocks of land within multiple-parcel properties that are intended for future development should be considered. During the design of stormwater drainage systems, provision must be made to accommodate natural drainage from adjacent properties by means of an interceptor swale or other system component.

Where a drainage channel to service one property is to be constructed on an adjacent property, written permission from the adjacent property owner(s) for such construction shall be required. A copy of the document which grants said approval shall be submitted to the Engineering and Planning Department and the SSMRCA.

4.4.5 Stormwater Drainage Blocks

For access to stormwater drainage systems, a municipal service block of adequate width shall be deeded to the City of Sault Ste. Marie when a need to accommodate future upstream drainage is identified to ensure proper functioning of the stormwater drainage system of a development. Generally, a municipal block will be required for stormwater conveyance from a development onto adjacent properties other than in a natural watercourse. Service blocks may be required for both the minor and major stormwater drainage systems. No development or placement of fences, barriers and the like shall be permitted on any block unless otherwise approved by the Commissioner of Engineering and Planning.

The minimum width of a block for a stormwater pipe shall allow safe access to excavate the minor system components in accordance with the requirements of the Occupational Health and Safety Act (OHSA) for the Province of Ontario, or 6.0 m, (whichever is larger). Depending upon the length and location of the block, the City may require a travel way to be provided within the block for access and maintenance purposes.

Drainage blocks for open channels shall be of sufficient width to contain the open channel, with the top of banks one meter or more within the Block. If the design flow for the open channel exceeds 1.0 m^3/s, the Block shall include a 4.0-m wide maintenance access road on one side of the channel. Turning room for vehicles operating on the service road should be provided at 250 metre intervals.

Where a development is traversed by a natural channel or stream, a drainage block conforming substantially to the limits of such a watercourse at flood stage may be required by the Commissioner of Engineering and Planning. Generally, no development should encroach upon a watercourse so that its flow conveyance is reduced. A hydrotechnical study by a qualified professional engineer will be required prior to changes in dimensions or alignment of a stream and shall be reviewed by the City and the SSMRCA. It should be noted that buffers or other requirements may be required through the review processes of the City, SSMRCA, MNR or DFO.

The minimum municipally owned land area for an attenuation pond shall include the area of the pond for the required storage volume plus freeboard, and the area required for associated facilities and maintenance access around the entire perimeter of the pond. A maintenance road to the pond from a municipal road will also be required. Maintenance road widths shall be sufficient for vehicles to access the pond and work to maintain the pond. Discussion shall be held with City staff prior to detailed design.

4.5 Fluvial Floods

Fluvial flooding of low-lying areas at rivers and streams occurs due to upstream snow and ice melt. In Sault Ste. Marie, flooding can occur along Fort Creek in the John Street and Wellington Street area and south of Cathcart Street and at the Central Creek / Davignon Creek area. Fluvial flooding should be considered with respect to development and land use within the City of Sault Ste. Marie, and with respect to the design of stormwater systems.

Flood risk mapping and inundation mapping is available from the SSMRCA for parts of Sault Ste. Marie and should be consulted and fully considered prior to any design.

5.0 DESIGN APPROACH

5.1 Dual Drainage Systems

5.1.1 Dual Drainage Concept

Stormwater drainage systems consist of underground pipes and associated structures designed to transport flows for minor or low intensity storms. This system is unable to accommodate major storm events. Since consideration was not given in the past to controlling runoff from major storm events, localized flooding in low areas, due to inadequate drainage system capacity would occur periodically.

The solution is to make allowances for these major storm events in the planning and design of new developments. The division of the urban drainage system into major and minor systems became known as the "Dual Drainage Concept". The minor system provides a basic level of service by conveying flows from the more common (low intensity, more frequent) storm events. The major system conveys runoff from the extreme (high intensity, less frequent) storm events that produce runoff in excess of the minor system capacity. Proper planning and design are critical to successful stormwater management. All areas of new development within the City of Sault Ste. Marie shall be designed using the Dual Drainage Concept (Minor/ Major systems) to achieve specific levels of service.

Developments within the City of Sault Ste. Marie shall continue to be serviced by a dual drainage system consisting of a minor stormwater drainage system (piped system) and a major stormwater drainage system (overland system). Design of stormwater drainage systems shall include consideration of drainage for both minor and major storms. The design of the dual stormwater drainage system shall be carried out to ensure that no proposed or existing structure shall be damaged by the runoff generated by a major storm event. This requires proper design of streets, curb and gutters, catch basins, pipes, open channels, grading of lots and road profiles, setting of elevations and openings into buildings, foundation drains, roof drains, or other "off-street" connections. In the event that the Engineer identifies existing infrastructure that may be damaged by runoff, the Engineer shall notify the Commissioner of Engineering and Planning so that the situation may be reviewed and resolved.

5.1.2 Minor System

The minor stormwater drainage system includes the underground pipe network, maintenance holes, outfalls, roof drains, lot drainage, and drain tiles. The minor system can contain public infrastructure (sewer piping and catch basins) and private infrastructure (drain tile and roof drains). The minor stormwater drainage system is designed to provide a basic level of service that ensures safe and convenient use of streets, lot areas, and other areas. In Sault Ste. Marie, the minor system is to be designed to convey the runoff produced by a 10-year return period storm event. Detailed requirements and specifications associated with the design and construction of the minor system are presented in Section 6 of this policy.

5.1.3 Major System

The major stormwater drainage system conveys runoff that exceeds the conveyance capacity of the minor system. Components of the major system typically include overland flow pathways (including drainage channels and floodwater diversion channels), streets, swales, stormwater detention and retention ponds, outfalls, and culverts. Drainage pathways for major events will always exist whether planned or not, but proper planning of a major system will reduce or eliminate unnecessary flooding and associated damages. The overland flow of stormwater during major storm events (return period of 100 years and the Timmins Storm) is preferably via public roadways, City blocks or trails. The use of utility rights-of-way as part of the major system might be acceptable subject to the approval of the Commissioner of Engineering and Planning and the utility owner.

5.1.4 Climate Change

In Sault Ste. Marie, the major storm system has typically been designed to accommodate the runoff produced by a 100-year return period storm event and / or the Regional design storm – the Timmins Storm. Due to uncertainty surrounding the effects of climate change the City of Sault Ste. Marie will be more frequently updating the rainfall data (intensity-duration-frequency) used to establish municipal design standards. As such, it is recommended that the major system continue to be designed based on the 100-year return period storm as well as the Timmins Storm.

Detailed requirements and specifications associated with the design and construction of the major system are presented in Section 7 of this policy.

Dual System Design of stormwater drainage systems shall include consideration of both a minor stormwater drainage system and a major stormwater drainage system.

When adequate downstream capacity does not exist, one option is to upgrade downstream infrastructure, however this is not the only option. The Developer and/or Engineer may reduce peak flow through the use of storage. The MOE's “Stormwater Management Planning and Design Manual” (2003) states that post-development peak runoff must not exceed pre-development runoff for storms with return periods ranging from 2 to 100 years. According to the manual, new development projects should manage runoff from average rainfall events using a variety of methods, such as directing impervious runoff onto lawns, side and rear yard swales and road gutters and from larger events by directing runoff down streets, to large storm sewers, storage ponds and other structures before being discharged to a water body.

It is the responsibility of the Engineer to ensure that the proposed development does not exacerbate or aggravate existing downstream problems. Further, it is the responsibility of the Engineer to exercise engineering design solutions, approved by the Commissioner of Engineering and Planning, including various methods of on-site storage to mitigate the detrimental effects of their development by any design storm.

5.1.5 System Discharge

The dual stormwater drainage system shall discharge to an existing stormwater drainage system, or to a natural watercourse. This stormwater peak flow requirement may be satisfied by either integrating new development into City of Sault Ste. Marie stormwater management plans (which attempt to control the drainage and management of stormwater through the use of area-wide measures for selected sections of the City), or through the use of development-specific stormwater management measures and controls (e.g. lot-based or development-based stormwater quantity best management practices).

If connecting to an existing stormwater drainage system, the downstream stormwater drainage system must have adequate capacity to convey the discharge from the existing and proposed stormwater drainage systems (Section 4.4). The potential for adverse impacts (such as flooding or erosion) from the combined discharges on the downstream stormwater drainage system must be considered. When downstream capacity in the existing stormwater drainage systems is inadequate, downstream infrastructure must be upgraded or peak flow to the downstream systems reduced with stormwater retention and storage to a point where the existing stormwater drainage systems becomes adequate.

If discharging to a receiving watercourse, water quantity and quality impacts on the receiving water body shall be assessed by the Engineer. Depending upon the nature and severity of potential adverse impacts, the City of Sault Ste. Marie's Engineering and Planning Department may require the implementation of measures to prevent or alleviate these potential adverse impacts.

5.2 Basis of Design

5.2.1 Return Periods

Return period (or recurrence interval) is the average time between occurrences of an event with a given magnitude, e.g. a 10-year return period flood means that a flood with a similar or larger magnitude would occur once every ten years, given a long period and assuming hydro-climatic conditions do not change. The return period is based on past records, in the case of Sault Ste. Marie from 1962-2006. Probability is the inverse of return period; e.g. a 10-year storm event has a 10% chance of occurring in any year. The choice of a return period for the design of drainage infrastructure depends on what is considered to be an acceptable risk to property and public safety, and the desired level of service.

The minor stormwater drainage system shall be designed to convey stormwater runoff from the 10-year return period storm, without surcharging. Surcharging of the minor system can be prevented by either increasing the capacity of minor system components, or (following approval of the Engineering and Planning Department) reducing the magnitude of the flow entering the minor system by directing more flow towards the major (overland) stormwater drainage system.

The major stormwater drainage system shall be designed to convey stormwater runoff from the major storm event (the 100-year return period storm and the Timmins Storm), thereby protecting structures and property from damage. The capacity of the major stormwater drainage system shall be adequate to convey the runoff from a major storm event when the capacity of the minor stormwater drainage system is exceeded. The design of the major system shall include measures to limit the degree of surcharging of the minor system during a major storm event. These measures may include inlet control devices and flow relief to the major system at the discretion of the Commissioner of Engineering and Planning. The degree of minor system surcharging during major storm events shall be controlled so as to prevent flooding of buildings connected to the minor system.

5.2.2 Meteorological Data

Rainfall data is used in a variety of forms including Intensity-Duration-Frequency (IDF) Curves, synthetic design storms, historical design storms, and historical long-term rainfall records. Data selection depends upon the type of computational procedure to be used, the type of problem to be solved and the level of analysis required.

Design storms can be generated from IDF Curves derived from the Sault Ste. Marie Airport climate station operated by the Atmospheric Environment Service (AES). Recent IDF curves for the Sault Ste. Marie Airport are presented in Figure 5.1.

For the Rational Method an initial time of concentration of 10 minutes is recommended for single family residential development using a design storm with a 10 year return period. This results in an initial rainfall intensity of approximately 102 mm/hr.

Advanced procedures for the design of stormwater drainage systems require the input of rainfall hyetographs, which specify rainfall intensities for successive time increments during a storm event. For this purpose, both synthetic and historical design storm hyetographs can be used.

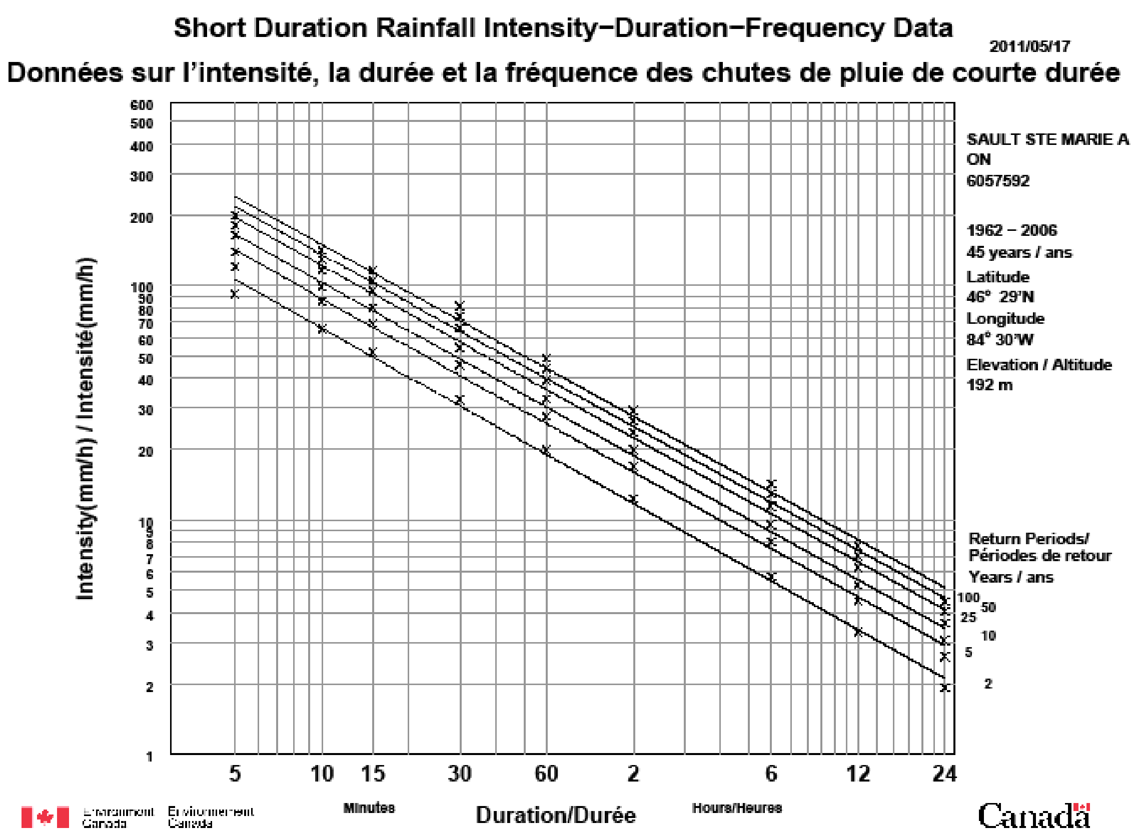


Figure 5.1 Rainfall Intensity-Duration-Frequency Curves for Sault Ste. Marie Airport

	2 year	5 year	10 year	25 year	50 year	100 year
Mean of **R**	31.6	42.2	49.2	58.1	64.7	71.2
Std. Dev. Of **R**	31.7	41.4	47.8	56.0	62.0	68.0
Std. Error	5.3	8.0	9.8	12.1	13.9	15.6
Coefficient, **A**	18.9	25.6	30.1	35.7	39.9	44.1
Exponent, **B**	-0.691	-0.685	-0.682	-0.679	-0.678	-0.677
Mean % error	5.7	7.5	8.2	8.8	9.2	9.5

interpolation equation: $\boxed{R = A \times T^{B}}$ Where R = rainfall rate

T = time in hours

Table 5.1 Rainfall Intensity-Duration-Frequency Values for Sault Ste. Marie Airport

5.2.3 Synthetic Design Storms

Synthetic design storm hyetographs are intended to represent some of the long-term statistical properties of recorded rainfall. There are a number of approaches that specify the total depth of design rainfall events and the distribution of rainfall intensity during these design rainfall events. They include the distributions listed below.

a) Atmospheric Environment Service (AES) type 2 distribution. This distribution is based on the analysis of one-hour duration rainfall data, and is specific to different regions in Canada.

b) HYDROTEK distribution. This distribution is similar to the AES type 2 distribution described above, is based on the same one-hour duration rainfall data, and is specific to different regions in Canada.

c) SCS type II distribution. This distribution is similar to the AES type 2 and HYDROTEK distributions described above, but the SCS Type II distribution is based on 6, 12, 24, and 48 hour duration rainfall data.

d) Chicago distribution. This distribution assumes that for a given return period, the design storm (which can be derived from local IDF information) should contain all of the maxima corresponding to the various durations (i.e. the peak 5 minute duration intensity of a 1 hour duration storm should be equal to the 5 minute intensity specified by the local IDF curves).

The AES Type 2, HYDROTEK, and SCS Type II distributions are invariable with respect to time (i.e. the distribution is the same for different duration storms), while the last distribution (the Chicago distribution) is variable with respect to time (i.e. the “relative resolution” of the hyetograph ordinates is less for shorter storm durations). The use of rainfall distributions that are invariable with respect to time results in more conservative designs than the use of rainfall distributions that are variable with respect to time for storm durations less than one hour, and less conservative designs for storm durations longer than one hour.

The AES type 2 distribution is the preferred rainfall distribution for a design storm for the City of Sault Ste. Marie. The AES Type 2 one hour storm distribution is presented in Table 5.2 below. Faster draining sites should consider the Chicago distribution design storms.

Percentage of total storm rainfall in the interval	1	3	8	16	31	15	11	7	4	2	1	1	100
Interval (5 min)	1	2	3	4	5	6	7	8	9	10	11	12	60

Table 5.2 AES Type 2 One Hour Storm Distribution

5.2.4 Regional Design Storms

In certain instances the design of stormwater drainage systems requires the input of historical design storms. Regional design storm hyetographs are intended to represent a specific recorded rainfall. Detailed historical rainfall information is available through the Atmospheric Environment Service (AES) of Environment Canada. For the City of Sault Ste. Marie the Timmins Storm is the Regional design storm. The Timmins storm and the 1:100 year storm are used for the design of flood control structures, overland flow, major drainage channels and aqueducts.

5.2.5 State of Development

Design of the dual stormwater drainage system shall be based on the state of development anticipated to exist for both the area being developed (e.g. the limits of the development) and the upstream watershed areas, when all areas are completely developed in accordance with the land-use zoning in place at the time of design. Peak post-development flows are not to exceed the pre-development flows for all storms up to and including the major design storm event (the 100-year return period storm) and the Timmins Storm.

5.3 Runoff Methodology

There are numerous techniques and models available to the Engineer for use in the determination of stormwater runoff. Selection of an appropriate method must be based on an understanding of the principles and assumptions underlying the method and of the problem under consideration. It is, therefore, essential that appropriate techniques and models be selected and used by qualified engineers.

The City of Sault Ste. Marie does not exclude or limit acceptable computational methods for design. A commentary on a few widely-used computational methods is presented below. The listing of computational methods is neither complete nor comprehensive. Methods other than those listed below may be used if their use is justified by the Engineer and accepted by the City of Sault Ste. Marie.

The Rational Method: The Rational method is a widely used empirical equation for predicting instantaneous peak discharge from a small watershed. The peak rate of runoff is assumed to occur at a rainfall duration equal to the time of concentration. The peak rate of runoff at each inlet in a storm sewer system is determined using the Rational Method. The rate of runoff is determined using the total time of concentration to that point in the system, which may include time to flow to an upstream inlet and travel time from that inlet through the storm sewer system to a given point in the system. After the peak rate of runoff arriving at each inlet has been established, the storm drain conduits can be designed to carry this discharge. The Engineering and Planning Department considers the Rational Method as generally acceptable for the determination of instantaneous peak runoff for the design of stormwater drainage systems up to 20 hectares (0.20 km^2) in area; for preliminary design of systems serving larger areas; and as a check on flows determined by other methods. This method should not be used to determine the size or hydraulic performance of storage or retention facilities.

The SCS Methods: Methods described in the United States Soil Conservation Service (US SCS) Technical Report No. 20 and No. 55 may be used to determine peak flow and volume for rural areas, to determine the hydrologic impacts of urbanization, and to evaluate the performance of storage facilities.

Simulation Modeling: Commonly used models include:

- The United States Environmental Protection Agency (USEPA), Stormwater Management Model (SWMM) computational engine, and the University of Ottawa version of the model (OTTSWMM) may be used for the design of piped systems and to model overland flow in a major system. SWMM can simulate backwater, surcharging, pressure flow, and looped connections. It also contains several approaches for water quality simulation. The City of Sault Ste. Marie's Engineering and Planning Department considers the SWMM-based models to be valuable tools for the design of stormwater systems for new development. It is especially useful for the design of stormwater drainage systems larger than 20 ha; the evaluation of measures to control peak flow magnitudes (such as attenuation ponds); and for the assessment of the hydraulic performance of drainage infrastructure under surcharged conditions.

- The HYMO (Hydrologic Model) and the University of Ottawa version OTTHYMO may be used for the development of stormwater drainage Master Plans, and the analysis of stormwater management proposals for new development. The model includes capability for storage calculations and stream channel routing.
- The Storage-Treatment-Overflow-Runoff Model, (STORM), was developed for the US Army Corps of Engineers in the 1970s. The model applies the Rational Method to compute stormwater runoff to a storage-treatment control structure. The model provides a simple but useful method for checking stormwater system designs.
- The Microcomputer Interactive Design of Urban Stormwater Systems (MIDUSS) model facilitates the design of conveyance or detention facilities in a drainage network. The model is interactive and allows the user to perform alternative trials before processing the final design. As the design proceeds, a file records the commands, design decisions and data which are input by the user.

Regardless of the model used, the Engineer should ensure that the model has been properly applied considering model limitations and data requirements, and calibrated using flow measurements or compared against an independent method.

5.4 Hydrologic Design Criteria

The parameters that are used in the design of stormwater drainage systems are primarily a function of the percentage of the drainage area that is impervious (e.g. pavement or roof areas), the soil type, and the vegetation cover. To accommodate the variability in design parameters resulting from these site conditions, the City of Sault Ste. Marie suggests minimum design parameters, including runoff coefficients used in the Rational Method and the curve numbers used in the SCS Method.

5.4.1 Rational Method Runoff Coefficients

The Engineer shall develop a composite runoff coefficient based on the percentage of different types of surfaces in the drainage area. The Engineer is responsible for selecting the runoff coefficients appropriate for the catchment area considering proposed development. Rational Method runoff coefficients associated with a general character of surface, considering land use, can be selected from tables in trustworthy engineering publications. The Ministry of the

Environment's Design Guidelines for Sewage Works 2008 recommends the runoff coefficients in Table 5.3 for use in the Rational Method, while the City of Sault Ste. Marie has in the past accepted the factors in the third column.

Under the current Ministry of the Environment Environmental Compliance Approval application process the Ministry requires a rationale if the design runoff co-efficient do not fall within their recommended range. The Engineer should be able to provide the rationale based on Engineering principles.

Surface	**Recommended Runoff Coefficients (MOE)**	**Runoff Coefficients Sault Ste. Marie**
Asphalt, Concrete, Roofs	0.90 – 1.00	0.90
Gravel	0.80 – 0.85	
Grassed Areas, Parkland	0.15 – 0.35	0.20
Commercial	0.75 – 0.85	0.75 – 0.90
Industrial	0.65 – 0.75	0.60 – 0.75
Single Family Residential	0.40 – 0.45	0.30 – 0.40
Semi-detached Residential	0.45 – 0.60	-
Row housing, Townhouses	0.50 – 0.70	0.60
Apartments	0.60 – 0.75	-
Institutional	0.40 – 0.75	-

Table 5.3 Runoff Coefficients

These minimum values must be increased to accommodate the hydrologic effects of steeply sloped areas, longer duration events, and return periods greater than 10 years to account for antecedent precipitation. For urban areas, the values of the runoff coefficient may be increased for the high magnitude storms under urban conditions. For the 25, 50 and 100-year events, it is recommended to increase the coefficient by 10, 20 and 25% respectively up to a maximum value of 0.95. (MTO Drainage Management Manual Chapter 8, Page 19). The MTO further notes that no adjustments are recommended for rural drainage areas.

The runoff coefficients in any design, if different than the MOE Coefficients, must be supported by detailed calculations and be approved by the Commissioner of Engineering and Planning.

5.4.2 US SCS Curve Numbers

The US SCS categorizes soils into one of four Hydrologic Soil Groups (HSG) contingent upon its surface infiltration rate, and subsurface permeability, as provided in Table 5.5.

US SCS Hydrologic Soil Group (HSG)	**Description**
A	Very low runoff potential Very high infiltration rate (consistent with a well-drained sand and gravel)
B	More moderate runoff potential Moderate infiltration rate (consistent with silt and sand)
C	High runoff potential Low infiltration rate (consistent with clay and silt)
D	Very high runoff potential Very low infiltration rate (consistent with saturated clays and high water tables)

Table 5.4 US SCS Hydrologic Soil Groups

Using the City of Sault Ste. Marie Geotechnical Study (1977, The Trow Group), the predominant soil types found in the Sault Ste. Marie area are classified as either lacustrine clay, lacustrine sands and silts, gravel with sand, glacial till, alluvial deposits, organic deposits, sandstone and man-made fill. In the absence of detailed soils analyses, the Engineer should review available geologic maps to select US SCS curve numbers. The City will consider other Hydrologic Soils Groups provided that the selection is based on a site specific geotechnical investigation.

The Engineer shall develop a composite SCS curve number based on the percentage of different types of surfaces in the drainage area, and shall be responsible for selecting the SCS curve numbers appropriate for the catchment area considering proposed development. The minimum CN number for impervious areas shall be 95 and for pervious areas shall be 70.

5.4.3 Time of Concentration and Lag Time

The Rational Method and the US SCS curve number based simulation models require the estimation of the time of concentration (Tc) defined as the time required for surface runoff from the far end of a sewershed to reach the sewershed outlet, or the lag time (Tl), the time between the peak rainfall and the peak runoff flow. For minor system drainage design, the time of concentration or lag time should include inlet time (time associated with overland flow) and travel time (time associated with flow through sewer pipes).

Commonly used methods for the determination of the inlet time (the time associated with overland flow) are listed below:

Kirpitch Method: This method was developed for natural drainage areas. Inlet time is a function of drainage length and slope only, while the effects of soil type and land use are not accounted for. Estimates of inlet time are shorter than the majority of other methods.

Airport Drainage Method: This method was developed for the design of airport drainage systems. Inlet time is a function of length, slope and runoff coefficient (soil type and land use). Estimates of inlet time are generally longer than the majority of other methods resulting in a lower estimate of peak flow. Typically this method is used for areas where C-factors are less than 0.40.

SCS Upland Method: This method was developed for flow overland and through gullies and grassed waterways. Inlet time is a function of length, slope, and land use, while soil type is not accounted for. Estimates of inlet time are similar to the Bransby Williams Method although they vary with the type of conveyance.

<u>SCS Curve Number Method:</u> This method was developed for natural drainage areas. Inlet time is a function of length, slope, and curve number (soil type and land use). Estimates of inlet time are generally longer than the majority of other methods.

<u>Bransby Williams Method:</u> This method was developed for natural drainage areas. Inlet time is a function of drainage length, slope and area, while the effects of soil type and land use are not accounted for. Estimates of inlet time are average when compared against other methods. Typically this method is used for areas where the C-factor is greater than 0.40.

<u>M.J. Simas and R.H. Hawkins Method:</u> This method was developed for natural rural drainage areas using a database of measured inlet times from a large number of rainfall-runoff events. Inlet time is a function of drainage length, slope, area and curve number (soil type and land). Estimates of inlet time are generally substantially shorter than the majority of other methods.

The Bransby Williams and Airport methods have been used successfully in the past within the City and should continue to be the method to estimate minimum inlet times. The estimated inlet time should not be less than five minutes.

Urban development design in the City of Sault Ste. Marie typically uses an initial time of concentration of 10 minutes. This should not preclude the use of the above methods to estimate inlet times.

It should be noted that the SCS Curve Number method estimates of inlet time are expressed as lag time, while the Rational Method requires estimates of inlet time expressed as time of concentration. The City recommends that the conversion between these two different inlet time estimates be based on a ratio of 1.67 as follows:

Tc=1.67 x Lag Time

Travel times (Tt) in piped systems should be based on velocities at peak design flow. As the roughness factor or resistance coefficient of the pipe material affects travel time, the City of Sault Ste. Marie specifies a minimum Manning's resistance coefficient of 0.013 for all non-corrugated pipes. For corrugated pipes a minimum Manning's n shall be 0.022.

6.0 ON-LOT STORMWATER MANAGEMENT

6.1 Lot Grading

Carefully controlled lot grading can provide effective stormwater management. In Sault Ste. Marie, if properties drain front-to-back (away from the street), a designed swale or stormwater collection channel or natural watercourse has to be present along the back of each property to drain the lots.

A lot grading plan (scale 1:750 or larger) is a requirement for subdivision approval. The plan is to show the drainage pattern for individual lots, the limits of the entire development as well as the surrounding areas including all rear yard catchbasins, pipes, swales, proposed grades and slopes including steepness.

Reduced lot grading can be implemented, subject to the approval of a geotechnical engineer, in areas that have more permeable soil types (a minimum infiltration rate of 15 mm / hr is recommended). In these cases, the grading can be flattened to 0.5% to promote greater depression storage and natural infiltration, except within 2 m to 4 m of buildings where a 2% minimum grade away from the building should be maintained and soils should be well compacted in order to avoid foundation drainage problems. The proposed finished elevations of the front lot corners shall be graded at 2% above the design back of curb at the street.

6.2 On-Lot Storage

On-lot retention of runoff reduces downstream flooding and erosion, and includes rooftop and surface storage. Rooftop storage is only deemed suitable for commercial, industrial, and institutional sites. Structural supports must be adequate to support the additional weight of the ponded water, scuppers must be employed and the design of rooftop storage requires a qualified professional engineer and coordination with the stormwater management design and the building design.

Surface storage can be utilized for medium density residential, high density residential, commercial, industrial or institutional development, and is one of the most cost effective ways to implement stormwater management.

Surface storage areas (or ponding areas) on single detached and low density residential lots is not allowed.

Surface storage areas should not interfere with access to, and egress from, the above developments. Storage of stormwater on parking lots should not result in water depths in excess of 300 mm during the 100-year storm or Timmins Storm.

Depending on the type of On-Lot storage proposed, the Engineering and Planning Department may require a deposit to ensure final construction conforms to the design and the receipt of associated as-built information.

6.3 Infiltration Trenches

This section is intended to provide general guidance on the use of infiltration trenches within the City of Sault Ste. Marie. Details regarding the design and use of infiltration trenches can be found in the MOE's "Stormwater Management Planning and Design Manual" (2003) and in technical literature, the more prominent of which are listed in Chapter 9.0 (Bibliography).

6.3.1 Hydrotechnical Considerations

- The design of an infiltration trench should be done by a professional engineer with experience in stormwater management.
    - The Engineer should consider specific site conditions, such as soil type, depth of water table, topography, and contributing area conditions.
    - The Engineer should aim to improve the quality of stormwater runoff by removing particulate and soluble pollutants by means of the infiltration trenches. Effective removal of sediment, phosphorus, nitrogen, trace metals, coliforms, and organic matter is accomplished through adsorption by soil particles, and biological and chemical conversion in the soil. Rates of pollutant removal are affected by the type of soil.
- Infiltration trenches and basins should reduce runoff volumes normally directed toward minor drainage systems.
- Infiltration trenches and basins should be designed to collect and temporarily store surface runoff and to promote subsequent infiltration, considering the volume of stormwater from a 10-year return period storm.
- Infiltration basins should drain within 72 hours to maintain aerobic conditions (which favour bacteria that aid in pollutant removal) and to ensure there is capacity to receive the next storm.

- Infiltration trenches shall have a cleaning / excavation and disposal regimen established prior to implementation.
- The use of infiltration galleries can be used for roof water providing soils parameters and distance from the building are properly engineered.

6.3.2 Location

- Infiltration basins can be used as recharge devices for compact residential developments (less than 2 ha). Infiltration trenches differ from on-lot infiltration systems in that they are generally constructed to manage stormwater flow from a number of lots in a developed area, not a single property.
- Infiltration trenches should only be used where the soil is porous and can absorb the required quantity of stormwater.
- Potential contamination of groundwater should be considered when examining runoff quality directed to an infiltration trench or basin.
- Infiltration trenches and basins are not recommended for use in commercial or industrial areas because of the potential for high-contaminant loads or spills, depending on actual property use, that may result in groundwater contamination.
- Infiltration trenches and basins should not be built under parking lots or other multiuse areas, within 2.0 m (measured vertically) of bedrock, near a septic field, on fill material, where the underlying soils have a low percolation rate of less than 15 mm/hour, or where runoff is likely to be highly polluted.

6.3.3 Construction and Maintenance

- Only clear stone of appropriate diameter should be used in the construction of an infiltration trench.
- Regular inspections and maintenance including the cleaning of inlets to prevent clogging is required to maintain proper operation, and to prevent the nuisances of insect infestations, odours, and soggy ground. A guide for maintenance procedures is available in the MOE’s “Stormwater Management Planning and Design Manual” (2003) Chapter 6.0.

6.4 Buffer and Filter Strips

Buffer and filter strips are practical and low-cost measures that provide stormwater quality control. The following is intended to provide general guidance on the use of buffer and filter strips within the City of Sault Ste. Marie. Details regarding the design and use of buffer and filter strips (as well as other Best Management Practices) can be found in the MOE's "Stormwater Management Planning and Design Manual" (2003) as well as in technical literature, the more prominent of which are listed in Chapter 9.0 (Bibliography).

Buffer strips remove pollutants from overland runoff due to the fact that vegetation promotes pollutant filtration and infiltration of stormwater.

- Whenever possible, natural buffer strips should be maintained within 30 meters of the natural boundary of a wetland or the banks of a watercourse. Within the buffer strip, land should not be disturbed, vegetation removed, soil removed, or materials deposited.

Filter strips are bands of close-growing vegetation, usually grass, planted between a source area and receiving watercourse, to provide a degree of stormwater quality control. The filtering action of the vegetation, sediment deposition, and infiltration of pollutant-carrying water reduces pollution to watercourses from sediment, organic matter, and trace metals, but are not considered reliable for the removal of soluble pollutants. Filter strips are used primarily in residential areas around streams or ponds, where runoff does not tend to be heavily polluted.

- When planning a stormwater management system for a drainage area, all filter strips should be considered ineffective for runoff velocities greater than 0.75 m/s, and for runoff volumes greater than that produced from a two-hectare catchment during a 25-year return period, 24-hour duration storm.
- The actual width of the filter strip should be determined considering topography, the characteristics of the upstream development, and the types of soil and vegetation at the site, with 10 m considered the minimum practical width.
- The maintenance of filter strips should be arranged during the design and construction of filter strips and as a critical component of stormwater quality control. Filter strips require periodic repair, such as re-seeding and the removal of dead vegetation.

Components of the minor drainage system include storm sewers, maintenance holes, oil and grit separators, foundation and roof drains, catch basins, and inlets and outfalls. The following subsections present design and construction specifications for these components.

6.5 Storm Sewers

6.5.1 Hydrotechnical Considerations

- Minor stormwater drainage systems shall be designed to convey, without surcharge, the peak design flow associated with a 10-year return period storm, subject to downstream constraints.
- The capacity of a proposed storm sewer system or an existing storm sewer system shall be checked by accounting for the head loss through the pipe system and through any junctions including maintenance holes and bends. As a preliminary check on the capacity of a piped storm system, the Manning's equation can be used. This will be particularly useful for preliminary sizing of pipes; however, a more detailed analysis of the system as a whole will be required.
- This more detailed analysis will determine the hydraulic grade line (HGL) when the storm system is conveying the 10-year return period flows, and will take into account losses at maintenance holes, other junctions, transition maintenance holes, the head loss through the pipes, and any backwater conditions at the outlets of the minor drainage system.
- Contingent upon the results of the HGL analysis, the Engineer shall revise as necessary the storm sewer design (e.g. diameter, slope, invert elevations, etc.).
- The flow should be subcritical with no backwater adversely affecting upstream properties.
- To help mitigate the potential that the minor drainage system is not surcharged to a degree that could result in flooding of property when the system is subjected to flows greater than its design capacity (i.e. major storm events), it is required that the Engineer check the individual and total inlet capacity for the entire system, at the discretion of the Commissioner of Engineering and Planning.
- This analysis may determine that during a major storm flows greater than a 10-year return period storm will enter the storm sewer system and, if there is evidence it will, then the Engineer will need to specify control measures (such as inlet control devices (ICDs) or limits on the surcharging of catch basin grates) in order to limit the quantity of stormwater runoff

entering the minor drainage system, at the discretion of the Commissioner of Engineering and Planning.

- The sewer must have an adequate gradient to maintain a velocity to minimize sedimentation. For a peak design flow from the tributary area, when fully developed, stormwater flow velocities must exceed 0.76 m/s but be less than 6.0 m/s.

6.5.2 Dimensions and Layout

- Storm sewer diameter shall not be less than 300 mm.
- Storm sewer diameter must not decrease in the downstream direction.
- Maintenance holes are to be provided where the storm sewer diameter changes.
- Ideally, storm sewers shall be deep enough such that all service connections accommodating surface and foundation drainage from upstream lots can be drained to the storm sewer system by gravity.
- The minimum depth of cover of storm sewers, measured from the design grade of the finished surface to the top of the pipe, is 1.5 m. Where this minimum cover cannot be provided, an explanation of the reasons and pipe loading calculations shall be submitted with the proposed method of pipe protection (insulation thickness and details, or frost tapers) to the Commissioner of Engineering and Planning.
- The maximum depth of storm sewers, measured from the design grade of the finished surface to the top of the pipe, is 4.0 m. Under special conditions, if justifiable reasons are given, the maximum depth of storm sewers may be increased with approval of the Commissioner of Engineering and Planning.
- The minimum pipe slope for permanent dead-end storm sewer mains is 0.5%. For other storm sewers lesser slopes are allowed if self-cleansing velocities under full flow conditions are maintained.

6.5.3 Location

- Wherever possible, all storm sewers and appurtenances shall be located within the street right-of-way or block of land owned by the City. Sewers shall be located 3 meters south and west of the centre line of the roadway. All storm drainage outfalls shall be located within land owned by the City.

- Where Master Planning indicates a need to accommodate future upstream lands naturally tributary to the drainage area, a municipal block of land shall be provided from the edge of the street right-of-way to the upstream limit of the subdivision.

6.5.4 Material

Pipe, when installed within the street right-of-way or a City Block shall be either:

- Reinforced concrete pipe (RCP) manufactured to conform to CAN/CSA-A257.2-M92 Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe and Fittings, or
- Polyvinyl Chloride Pipe (PVC) pipe to conform to CAN/CSA B182.1-99 Plastic Drain and Sewer Pipe and Pipe Fittings, or
- Polyvinyl Chloride Pipe (PVC) pipe, smooth inside wall, corrugated to conform to CSA Standard B182.4. Minimum pipe stiffness shall be 320 kPa supplied by IPEX (Ultra-RIB and Ultra X2), or Royal Pipe (Kor-Flo), or reviewed equivalent. Pipe up to 750 mm diameter shall have joints certified to 100 kPa. 900 mm dia. pipe shall have joints certified to 75 kPa.

Pipe joints are to satisfy requirements with respect to leakage, durability, and performance throughout the life cycle of a storm sewer, which is generally considered to be 50 years or more. All pipe lines must meet leakage test requirements as set forth in the Ontario Provincial Standards, if required by the Commissioner of Engineering and Planning.

6.5.5 Required Pipe Strength

- Required pipe strength should be determined using the Marston and Spangler equations, or by nomograph method as published by the American Concrete Pipe Association for reinforced concrete pipe or the Uni-Bell PVC Pipe Association for PVC pipe.
- Separate calculations for pipes of deeper bury may be required at the discretion of the Commissioner of Engineering and Planning.
- A factor of safety (FS) of 1.5 should be applied when determining required pipe strength.
- All pipes shall be clearly identified with the manufacturer’s name and strength class or category.

6.6 Maintenance Holes

6.6.1 Hydraulic Considerations

- A maintenance hole must be hydraulically designed wherever two or more incoming laterals greater than 750 mm in diameter enter a maintenance hole. The design should be done by a professional engineer with experience in stormwater sewer design.
- The Engineer shall take into consideration energy losses at maintenance holes during peak flow conditions to ensure that surcharging of the system does not occur.
- Sufficient change in sewer invert elevation must be provided across maintenance holes and at junctions and bends to account for energy losses due to flow transitions, turbulence, and incoming flows.
- Junction maintenance hole calculations shall be required at locations where incoming and outgoing pipe velocities differ by more than 0.6 m/s.
- A specially designed drop maintenance hole may be required to address hydraulic requirements due to the elevation change for drops greater than 1 m. Large drops in elevation should be avoided where possible.

6.6.2 Dimensions and Layout

- Overall layout of storm maintenance holes shall be in accordance with Ontario Provincial Standard Drawings and Ontario Provincial Standard Specifications (OPSD / OPSS).
- The minimum internal diameter of a maintenance hole shall be 1200 mm. The Engineer shall ensure that the internal diameter is adequate to accommodate all pipe and appurtenances in accordance with manufacturer's recommendations. Safety appurtenances (ladders and rungs) must be in accordance with OPSD 404 to OPSD 406, as amended.
- The obvert of a downstream pipe shall not be higher than the obvert of an upstream pipe unless approved by the Commissioner of Engineering and Planning.
- Where no change in pipe diameter occurs, a minimum drop of 30 mm is required in a maintenance hole where there is a deflection of 135 degrees or greater. A 60 mm drop is required where there is a deflection from 135 to 90 degrees. Incoming pipes should not be at an angle less than 90 degrees.
- Drop maintenance holes shall be in accordance with OPSD 1003 series of drawings.

- All storm maintenance holes shall be benched and channeled.

6.6.3 Location

- A maintenance hole must be provided on a storm sewer at:
  - Any change in diameter, material, horizontal alignment, or vertical alignment;
  - Pipe intersections; and at
  - The upper end of a sewer for maintenance purposes.
- Maintenance holes at non-permanent storm sewer terminations shall have a sewer stub that shall extend beyond the limit of development sufficient to allow excavation to the Ontario OHSA.
- Maintenance holes shall ideally be located 3 m south or west of the centre line of the road and generally 3 m upstream or downstream of sanitary maintenance holes if they are paired.
- Maintenance hole spacing shall not exceed 100 m for storm sewers up to 750 mm diameter. For storm sewers greater than 750 mm diameter, maximum spacing shall not exceed 150 m.
- Transitions in direction of sewer pipes are to be accomplished by means of maintenance holes, except in the case of curved sewers. Modifications to maintenance hole spacing may be required where sewers are curved.

6.6.4 Material

- All maintenance holes shall be reinforced concrete and conform to CSA A257.4.
- Concrete used in maintenance holes shall be air entrained in accordance with CAN/CSA A23.1.

6.7 Oil and Grit Separators (OGS)

6.7.1 Design Considerations

- Oil and grit separators are intended to remove sediment, debris and hydrocarbons (oil and grease) from stormwater, and may consist of commercial in-ground structures, ponds, or other Best Management Practices (BMPs).
- The cases where oil and grit separators may be required are described in section 4.3 of this document.

- The oil and grit separators should be designed such that high flows from infrequent rainfall events do not result in the re-suspension of contaminants in the separator and the discharge of these contaminants into the receiving environment or the storm sewer system.
- The design of oil and grit separators or the selection of commercially available oil and grit separators should be done by a Professional Engineer with experience in stormwater management. The Engineer should consider the specific site conditions, such as soil type, depth of water table, topography, the expected types and amounts of pollutants, and overall stormwater management for the catchment. The specifications for any oil and grit separators models proposed for a development must be signed and sealed by a Professional Engineer. The required submission of information for review and approval by the City must include design computations including estimated performance, supported with well-documented sizing (computer modeling) program and CADD details.
- The oil and grit separators make and model specified on the approved Stormwater Management Report cannot be substituted with an "equivalent" model later, without the approval of City staff. Requests for substitution must be accompanied by certification of equivalency by the Professional Engineer who prepared the approved Stormwater Management Report with additional supporting documentation required for certification and approvals.
- The OGS performance criteria must meet the requirements specified in Table 4.2 and the associated TSS Removal requirements from the Stormwater Management Requirements Plan in Appendix 1.

6.7.2 Location and Maintenance

- Oil and grit separator structures should be installed underground as a component of the minor drainage system. Location should allow access for maintenance activities at any time of the year, typically in a street setting. Oil and grit separator ponds or other non-structural BMPs should generally be installed in the most downstream portion of a property.
- Oil and grit separators should be located so as to allow the collection of all runoff from a property and prevent the discharge of contaminated runoff into the minor stormwater system or receiving watercourses.
- Oil and grit separators should be designed and constructed to ensure easy access for inspection and cleaning.

- Oil and grit separators should be cleaned of sediment, accumulated oils and grease, debris and other pollutants as needed to ensure the continued proper operation of the system. The maintenance protocol for oil and grease separators shall be reviewed and given to the City of Sault Ste. Marie prior to installation.
- For private oil and grit separators, an acceptable written maintenance protocol shall be supplied to the City as part of the Site Plan Control Agreement. Maintenance for private oil and grit separators shall be by the property owner.

6.8 Service Connections

6.8.1 Dimensions and Layout

- The storm sewer service connection shall be laid at a minimum grade of 2.0% to 3.0 m beyond the limit of the street right-of-way to a depth of 1.5 m.

6.8.2 Location

- For single residential lots, one storm sewer service connection is to be supplied to each existing lot or potential future lot which could be created under the zoning in effect at the time of approval by the City. For semi-detached lots, one storm sewer service connection is required for each side of the lot.

6.8.3 Material

Where manufacturer’s names or products are mentioned alternates will be allowed with approval of the Commissioner of Engineering and Planning.

- Storm sewer service connections shall be PVC DR28.
- Any change in vertical or horizontal alignment of storm sewer service connections shall be made with a “long sweep” bend, PVC DR28.
- Storm sewer service connections to concrete pipes, with all saddles secured in place with an appropriate seal to render the connection water tight, shall be one of the following:
    - Multi-fitting PVC service saddle with two, one-piece stainless steel straps and a solid lip protruding into the main by no more than 10 mm.
    - Canron polypropylene service saddle with two, one-piece stainless steel straps and a solid lip protruding into the main by no more than 10 mm.
    - Appropriately specified Fowler Inserta-Tee.

  - Kor-N-Tee service saddle.
  - DFW/HPI flexible rubber service saddle.
- Storm sewer service connections to PVC pipe, with all saddles secured in place with an appropriate seal to render the connection water tight, shall be one of the following:
  - Multi-fitting PVC service saddle with two, one-piece stainless steel straps and a solid lip protruding into the main by no more than 10 mm.
  - Appropriately specified Fowler Inserta-Tee.
  - Gasketed one-piece PVC Tee.
  - DFW/HPI flexible rubber service saddle.

6.9 Foundation and Roof Drains

- Foundation drainage will normally be pumped or gravity fed to the minor stormwater drainage system to minimize the likelihood of basement flooding or foundation damage in accordance with the City Sewer Use By-Law as amended.
- Where a minor stormwater drainage system does not exist, other options are permitted as specified in the Ontario Building Code.
- Foundation drains shall not be permitted to discharge to ground surface in such a way as to direct stormwater runoff to the street surface, curb, walkway, or adjacent private property as stipulated in the City Streets By-Law.
- Roof drains from buildings with a roof area less than 250 m^2 or from single family / semi-detached homes shall not be connected to storm drains, but shall discharge onto splash pads at the ground surface a minimum of 600 mm from the foundation wall in a manner that will carry water away from the foundation wall.
- Roof drains from buildings with a roof area equal to or larger than 250 m^2 may be directly connected to a stormwater drainage system pending available system capacity. In order to limit the surcharging of the minor drainage system during storm events with a return period in excess of 10 years, the maximum discharge from roof drains with a roof area equal to or larger than 250 m^2 into the stormwater drainage system should be restricted to the stormwater surface flow from a 10-year return period storm event.

6.10 Catch basins

6.10.1 Hydrotechnical Considerations

- The interception capacity of the catch basins connected to a drainage system should be compatible with the design capacity of the stormwater drainage system. The storm drainage mains will be designed to convey the 10-year return period storm without surcharging.
- The inlet capacity of each catch basin should be sufficient to receive the calculated surface stormwater flow at that location from storm events with a maximum return period of 10 years.
- In order to limit the surcharging of the minor drainage system during storm events with a return period in excess of 10 years, the inlet capacity of each catch basin should be restricted to limit the maximum inflow into the catch basin to the stormwater surface flow from a 10-year return period storm event.
- Catchbasin leads should be graded so that the top of pipe is below the subgrade elevation and such that the pipe grade is maximized for future lot drainage systems.

6.10.2 Dimensions and Layout

- All catch basin bodies shall be precast concrete meeting OPSS 1351 unless otherwise approved.
- Typical spacing between catch basins shall be in accordance with the maximum spread and depth of stormwater as noted in subsection 7.4.2, and shall not be more than:
    - 90 m for roads up to 3% grade;
    - 75 m for roads of greater than 3% grade and up to 4.5% grade; and
    - 60 m for roads of greater than 4.5% grade and up to 6% grade.
    - The spacing of curb inlet catchbasins located within roads having grades greater than 1% must be approved by the Commissioner of Engineering and Planning.
- For road grades greater than 6%, twin inlet catch basins shall be placed at 60 m spacing.
- Twin inlet catch basins shall be placed prior to intersections when the road grade beyond the platform exceeds 4.5%.
- Road low points are to have curb inlet catch basins.
- The minimum inside diameter of road catch basin leads shall be 250 mm, rear yard catchbasin leads shall be 200 mm.

- All structures with a catch basin shall have a 600 mm sump to trap silt and gravel.

6.10.3 Location

- Catch basins shall be installed at the curb of the street and shall be adequately spaced to prevent excessive water from flowing in the traveled lanes during storm events corresponding to the design of the minor system.
- Rear yard catch basins shall have a birdcage grate to OPSD 400.120 and shall accept water from a swale of less than 90 meters in length.

6.11 Inlets

- All inlets to piped stormwater drainage systems shall be via a catch basin or grated pipe, preferably with an inlet structure.
- Inlets to piped stormwater drainage systems shall, for pipes 300 mm diameter or larger, have grates to prevent entry. The orientation of the bars on the grate shall be vertical.
- The design of the inlet shall take into consideration the effect of the grating on restriction of flow into the pipe.
- All frames and grates shall conform to OPSD 400 series of drawings.

6.12 Outfalls

- Design of outfalls from piped stormwater drainage systems into any receiving body of water shall take into consideration such factors as public safety, erosion control and aesthetics.
- Outfalls from piped stormwater drainage systems of 300 mm in diameter and larger shall require a headwall and grate to prevent entry unless otherwise approved by the Commissioner of Engineering and Planning. The headwall and grate shall be as per OPSD 804.
- Inverts of outfall pipes should be installed above the normal winter ice level in the receiving stream wherever possible.
- The maximum outfall discharge velocity is 6.0 m/s. Erosion control measures are to be incorporated in the design of outfalls to prevent the uncontrolled scour of the receiving channel.
- New outfalls should have stormwater management facilities at the end of pipe or placed prior to outletting.

7.0 MAJOR DRAINAGE SYSTEM DESIGN REQUIREMENTS

The components of the major drainage system include natural streams and their floodways, artificial channels (including swales), roadways, and ponds. The following subsections present design and construction specifications for these components.

7.1 Hydrotechnical Considerations

Historically, the 100-year return period storm and the Regional Storm (Timmins Storm) was used as the basis for major drainage system component design and this will continue to be the City's criteria. In an effort to accommodate any effects of climate change on urban drainage, the City will re-evaluate the IDF chart periodically to include recent precipitation and intensity data.

7.2 Open Channels

- The capacity of open channels should be carefully considered during design.
- The most widely used formula for determining the hydraulic capacity of open channels is the Manning Equation:

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

where:

V = mean velocity of flow, m/s,

R = the hydraulic radius, defined as the area of flow, A (m^2) divided by the wetted flow surface or wetted perimeter Pw (m),

S = the slope of hydraulic grade line, m/m, and

n = Manning roughness coefficient

In terms of discharge, Q, the above formula becomes:

$$Q = AV = \frac{A\,R^{2/3} S^{1/2}}{n}$$

- For determination of the flow conveyance of natural streams within the City of Sault Ste. Marie, the minimum Manning's coefficient shall be 0.025 for minor natural streams, and

0.030 for major rivers and flood plains. Values of ‘n’ in excess of these minimum values may be chosen from published values in textbooks on open channel hydraulics (e.g., Chow, V-T. Open Channel Hydraulics. McGraw-Hill Book Company, New York, 1959) considering changes in cross sectional area and shape, vegetation, the irregularity of the channel surface, obstructions and channel alignments. A composite ‘n’ based on the values of ‘n’ for the stream and its flood plains should be determined if a large portion of stormwater flow during the major design storm will occur on the flood plains.

- Storm inlets, outlets and areas of concentrated flow shall have erosion protection. It is recommended that an analysis of receiving channel or downstream drainage course conditions be assessed to determine the potential effects of post-development flows, water levels, and flow velocities on erosion. An analysis of erosion potential should be completed downstream to a point where the runoff from the upstream drainage area controlled by the pond represents only 10% of the total drainage area or to a creek or river.

7.3 Grassed Swales

7.3.1 Hydrotechnical Considerations

- Grassed swales should be designed as open channels using the Manning Equation, using a Manning’s coefficient of 0.030 or greater.
- The minimum swale grade shall be 1%, and in special cases 0.5% with approval of the Commissioner of Engineering and Planning
- The maximum length of a rear yard swale to a suitable outlet shall be 90 metres.

7.3.2 Dimensions and Layout

- A minimum bottom width of 0.3 m should be maintained.
- A minimum depth of 0.2 m should be maintained.
- Side slopes should be no greater than 2.5 horizontal to 1 vertical, but ideally should be less than 4 horizontal to 1 vertical.

7.3.3 Location

- Grassed swales are not permissible as replacements for curb and gutter systems in commercial and urban residential areas.

- Grassed swales are typically used in more rural areas with rolling or relatively flat land or for rear yard drainage as part of the lot grading process. Grassed swales can be considered as an enhancement to stormwater curb and gutter system.
- Grassed swales should be considered for use at sites where contamination from suspended solids is possible.
- Since many stormwater contaminant particulates are filtered by grassed swales, they should be considered for use at sites where contamination from suspended solids might occur. Grassed swales are not considered effective in filtering contaminants such as organic nitrogen, phosphorus, and bacteria.

7.3.4 Construction and Maintenance

- Grass should be local species or standard turf grass where a more manicured appearance is required.
- The grass should be allowed to grow higher than 75 mm so that suspended solids can be filtered effectively.

7.4 Streets

7.4.1 Roadway Drainage

- Provision shall be made to remove runoff from streets into drainage channels, watercourses, and pipe systems at low points and at intervals that will assure that ponding of stormwater on streets does not occur for long durations.
- The maximum depth of stormwater flow on any street shall not exceed 0.3 m, with a maximum flow velocity of 2 m/s.
- For storms greater than the design storm of the minor drainage system (i.e. a storm event with a return period in excess of 10 years), streets shall be designed to temporarily convey flow as part of the major drainage system. The flow conveyance capacity of a street shall be determined using the Manning Equation, with a Manning's resistance coefficient of 0.013 (asphalt surface), 0.015 (concrete surface) and 0.030 (sod surface).
- For storms up to and including the 10-year return period storm, the Engineer must consider that, for all roads, a traveled way of adequate width is maintained to ensure the safe passage of all vehicles in both directions.
- For residential streets and local collector streets, the Engineer must ensure that during storms up to and including the major design storm (the 100-year return period storm), the

depth and spread of flow does not exceed the curb height and does not exceed the right-of-way width (see next section).

- For major collector streets and arterial streets (emergency access routes), the Engineer must ensure that during storms up to and including the major design storm (the 100-year return period storm), a traveled way of adequate width is maintained to ensure the safe passage of vehicles in both directions.

7.4.2 Curbs and Gutters

- A curb should confine the surface water from the roadway to the gutter, which transports water to inlets into the minor drainage system or the major drainage system.
- Curbs and gutters are usually installed along city streets. The gutter should be hydraulically efficient with a smooth surface texture and a minimum grade of 0.3%. Gutter flow can be determined using a modified version of the Manning Equation:

$$Q = (0.375\ \ S_o^{0.5}\ d^{2.667})\ /(n * S_x)$$

where

Q	= the gutter flow in m^3/s,
S_o	= the longitudinal slope, m/m,
d	= the depth of flow at the curb, m,
n	= Manning's resistance coefficient, and
S_x	= cross slope over the pavement area, m/m.

- In applying the equation, allowance should be made for changes in the gutter cross section if the slope of the gutter is depressed near the curb.
- The depth and spread of flow during the major design storm (the 100-year return period storm) and the Timmins Storm shall be contained within the right-of-way if the curb acts as a barrier, or discharged from the right-of-way through municipal land designed to convey the overland flow if the curb can and is designed to be overtopped.
- For storms with a magnitude less than or equal to the design storm of the minor drainage system, i.e. the 10-year return period storm, roadways should remain free of water, except for water accumulated between inlets. The maximum spread of water across a street as

measured from the curb should not exceed 3 m or one half of the width of the traffic lane closest to the curb, whichever is less. The calculation of maximum stormwater spread should be based on a road crown of 2.0%, in accordance with the City of Sault Ste. Marie general specifications for road and street design.

- The spacing between two consecutive inlets shall be as shown in Section 6.10.2.
- Inlets along streets should also be provided at:
    - Sag points in the gutter grade, upstream of major street intersections and pedestrian cross walks, and along median barriers,
    - Upstream and downstream of bridges, and
    - Upstream of the starting point of a horizontal curve where there are major changes in cross (transverse) and longitudinal slope.

7.4.3 Roadway Ditches

- Roadway ditches shall be designed as an open channel with maximum side slopes of 2 horizontal to 1 vertical.
- Ditches shall be designed with adequate capacity to carry the expected flow from either the minor storm (10-year storm) or major storm (the 100-year return period storm and Timmins Storm) based upon the use of the ditch.
- The minimum grade of a roadside ditch shall be 0.5% unless otherwise approved by the Commissioner of Engineering and Planning.
- The maximum velocity in an unlined ditch shall be in accordance with Table 7.1.

7.5 Culverts

7.5.1 Hydrotechnical Considerations

- Culverts are to be sized to convey instantaneous peak flows with a headwater depth (HW) to culvert diameter (D) ratio of 1.0 accounting for both inlet control and outlet control.
- Culverts located under driveways are to have a minimum size of 375 mm, culverts under roadways are to have a minimum size of 600 mm. Both are to be designed to accommodate the 10-year return period storm, unless otherwise directed by the City.

- Culverts located in major drainage courses or natural watercourses are to be a minimum size of 600 mm and be designed to accommodate the major design storm (the 100-year return period storm), and the Timmins Storm unless otherwise directed by the City.
- The maximum culvert outlet velocity is 4.0 m/s.
- A rip rap splash pad and apron or a plunge pool must be designed to transition the culvert outlet velocity to the maximum permissible mean downstream channel velocity. Rip rap should be sized in accordance with the following equation:

$$D_{mean} = 0.019 \times V^2$$

where:
D_{mean} = equivalent spherical diameter of rip rap (m), and
V = culvert outlet velocity (m/s).

- Notwithstanding the above guidelines, culverts are not to initiate or aggravate flooding of private or public property.

7.5.2 Dimensions and Layout

- Minimum culvert diameter are as per Section 7.5.1.
- No downstream decrease in culvert sizing is permitted.
- Minimum cover for culverts under roadways is 500 mm.
- The Engineer should base maximum cover for culverts on pipe strength calculations including earth loading, live loading, and induced loading, accounting for site conditions and construction practices.

7.5.3 Inlet and Outlet Headwalls

- All culverts under roadways are to be equipped with an inlet and outlet headwall, or some other form of embankment stabilization and erosion control, approved by the City.
- Headwalls on driveway culverts are to be in accordance with Public Works and Transportation Standards.

7.5.4 Inlet and Outlet Grates

- Culverts longer than 25 m and smaller than 1.2 m in diameter shall be equipped with inlet and outlet grates.
- Under no circumstances shall a culvert be equipped with an outlet grate and no inlet grate.
- Inlet grates shall be constructed of vertically oriented bars. Outlet grates shall be constructed of horizontally oriented bars.
- Design and sizing of inlet and outlet grates must account for the restriction in flow created by the grate and blockage.
- Placement of any grate shall be as per Ontario Provincial Standards.

7.5.5 Culvert Materials

- For culvert design, material shall consist of the following:
    - Less than 900 mm diameter – concrete, CSP - poly-coated CSP, aluminized CSP;
    - 900 mm to 1800 mm – poly-coated CSP, aluminized CSP, and concrete;
    - Greater than 1800 mm – concrete box culverts only.
- Polyethylene culverts require minimum 600 mm cover.

Exceptions will be allowed with approval of the Commissioner of Engineering and Planning or his designate or by Public Works and Transportation.

7.6 Stormwater Attenuation Ponds

This section is intended to provide general guidance on the use of stormwater attenuation ponds within the City of Sault Ste. Marie. Details regarding the design and use of stormwater attenuation ponds can be found in the MOE's "Stormwater Management Planning and Design Manual" (2003) and in technical literature, the more prominent of which are listed in Chapter 9.0 (Bibliography).

Stormwater ponds within a subdivision are to be on lands dedicated to the City of Sault Ste. Marie. Ponds are not considered parkland dedication.

7.6.1 Dry Versus Wet Ponds

- The City of Sault Ste. Marie's Engineering and Planning Department prefers the use of dry ponds over wet ponds.

- Stormwater attenuation ponds can include wet ponds and dry ponds. Wet ponds have a permanent standing body of water. Dry ponds only contain water immediately following a storm event. Wet ponds provide better breeding habitat for insects than dry ponds (and thereby increase the spread of biting insect-borne diseases such as the West-Nile virus) and have a greater potential than dry ponds to increase water temperature to levels detrimental to aquatic life.
- The purpose of a dry pond is to temporarily store stormwater runoff in order to restrict peak discharge to pre-development conditions and reduce the potential of downstream flooding and erosion. Dry ponds are considered effective for volume reduction. As a detention facility, a dry pond should flatten and spread the inflow hydrograph, thus lowering the peak discharge.
- As dry ponds have no permanent pool of water, the removal of stormwater contaminants in dry ponds is a function of the pond's drawdown time. Dry ponds operating in a batch mode are considered more effective than a dry pond operating in a continuous mode. Dry ponds typically have limited effectiveness with regards to quality control and should be used in tandem with other stormwater management measures such as oil grit separators and low impact development measures.
- During the design process, the Engineer is to generate hydrographs to assess the performance of the stormwater pond. Other design considerations include ease of maintenance and use of the pond. In addition, the Engineer could consider alternate means, including fabricated storm drainage detention facilities, to reduce peak flows.

7.6.2 Hydrotechnical Considerations

- The emergency spillway of the pond should be designed to accommodate overtopping beyond the typical design storms.
- The pond should be designed to empty within 72 hours following the termination of stormwater inflow.

7.6.3 Dimensions and Layout

The following is to be read in conjunction with Table 4.8 of the MOE's "Stormwater Management Planning and Design Manual" (2003). In general all stormwater management ponds shall meet the requirements of the Ministry of the Environment.

- In order to maximize the water quality benefits from a stormwater attenuation pond, the ratio of effective pond length to width should exceed 3 to 1, and the inlet should be located as far away from the outlet as possible.
- The bottom of dry ponds shall be graded to drain all areas after operation. The minimum bottom slope is 0.5%. The recommended bottom slope is 2.0%.
- In consideration of public safety, the maximum allowable active retention storage depth for a dry pond shall be in accordance with Ministry of the Environment Guidelines.
- The maximum embankment slopes of stormwater retention ponds are 4 horizontal to 1 vertical for interior (inward facing) slopes, and 3 horizontal to 1 vertical for exterior (outward facing) slopes. Consideration is to be given to terracing.
- The minimum pond freeboard is 0.3 m.
- Stormwater treatment measures will need to be accessible to the largest piece of equipment that will be needed for maintenance. Large basins need to have a perimeter access road accessible by heavy vehicles for sediment removal and controlling emergent vegetation. Access shall be from a municipal road allowance via a 4 meter wide gravel access road consisting of 600 mm Granular B and 150 mm Granular A. A hammerhead turn around shall be provided, unless the access road is less than 60 meters length. Access shall be to the inlet, outlet and any point where maintenance is required.
- Signage shall be installed by the City and the City shall collect costs from the developer for the signage.
- At any point where an excavator is to enter the pond a “Turf stone” or similar material shall be utilized on the slopes.
- Material excavated during construction of the pond shall be disposed of appropriately.
- The pond bottom shall be re-established as designed once maintenance is completed.

8.0 DESIGN DOCUMENTATION

8.1 General Submissions

The submission requirements presented in this document are limited to drainage infrastructure only, and may be superseded by the City of Sault Ste. Marie. A detailed design must be performed for each stormwater system that is to be built in the City of Sault Ste. Marie. The Engineer must retain a copy of all design information supplied to the Developer. Upon request, the Engineer will submit to the Engineering and Planning Department computational sheets, and related model output used to determine design flows, hydraulic capacity of components of the drainage systems and the entire drainage system, and estimates of the depth and extent of flow in open channels.

A Developer must supply in a timely manner to the Engineering and Planning Department all required technical briefs and reports, design drawings and supplementary calculations as may be required by that office. Development is not to proceed until the Commissioner of Engineering and Planning has received and accepted the requested information.

Acceptance of design documents by the Engineering and Planning Department does not relieve the Engineer of the responsibility for proper design, nor does it imply that the Engineering and Planning Department has checked the plans, technical briefs, and supplementary calculations for compliance with this document. Additional copies of any plans, technical briefs, and supplementary calculations as deemed necessary by the Commissioner of Engineering and Planning may be required.

In order to facilitate the overall management of stormwater within the City of Sault Ste. Marie, any development that involves the installation or upgrading of municipal stormwater infrastructure requires that two (2) copies of a **Drainage Plan** (also referred to as the dual drainage plan) and two (2) copies of a **Drainage Design Report** be submitted along with the **Lot Grading Plan** and other required documentation to the City of Sault Ste. Marie's Engineering and Planning Department.

If On-Lot storage is proposed as part of a development, the Engineering and Planning Department may require a deposit to ensure final construction conforms to the design and ensure the receipt of associated record information. The need for this deposit is a function of the type of On-Lot storage, and is at the discretion of the Commissioner of Engineering and Planning.

All Drainage Plans and Drainage Design Reports must be prepared under the direct supervision of, and be signed and sealed by a licensed Professional Engineer, who is a member of Professional Engineers Ontario (PEO). The requirements of the Drainage Plans and the Drainage Design Report are presented in the following subsections.

8.2 Drainage Plans

The intent of the Drainage Plan is to provide a graphical representation of new or upgraded drainage infrastructure, and the manner in which it affects the drainage of, or is affected by the drainage from, surrounding land. The Drainage Plan is to be prepared at a scale of 1:1,000 or larger and must include the following in either graphic and/or tabular form:

- The location of the development within the total topographic drainage area;
- Site layout including proposed streets, lots and approximate location of proposed structures;
- Pre-development contours at an interval adequate to illustrate the topography;
- All existing watercourses including creeks, ponds and wetlands indicating direction of flow;
- Boundaries of catchment and sub-catchment areas tributary to each: set of catch basins, infiltration pond, or drainage channel, indicating the direction of flow, drainage area, and where appropriate, runoff coefficients;
- The location and layout of the proposed stormwater drainage system including swales, maintenance holes, catch basins, and all storm sewers indicating pipe material, diameter, slope, and direction of flow;
- The size and location of any proposed post-development stormwater storage and retention facilities; and
- The location of outfalls, or connections to existing systems.

8.3 Drainage Design Reports

The intent of the Drainage Design Report is to summarize all of the relevant design information associated with the installation or upgrading of municipal stormwater infrastructure. These reports will facilitate the overall management of stormwater within the City of Sault Ste. Marie, and the integration of stormwater drainage infrastructure. All drainage design reports shall include:

- A description of the design methodology used. This shall include the computational methods or computer model(s) and the design storms used.
- For all drainage infrastructure and discharge points from a property, a summary shall be provided of: drainage area, percentage impervious area, runoff coefficient or curve number, and design flows for existing and post-development conditions.
- Model results including outflow hydrographs and hydraulic grade lines associated with the minor and major design flows.
- Design calculations on downstream drainage facilities confirming capacity is available. Where capacity is not available the report shall include specific recommendations on downstream improvements to be made to accommodate the additional drainage.

8.4 Engineering Design and As-Built Drawings

Engineering Design Drawings and As-built Drawings are to meet the requirements of the City of Sault Ste. Marie.

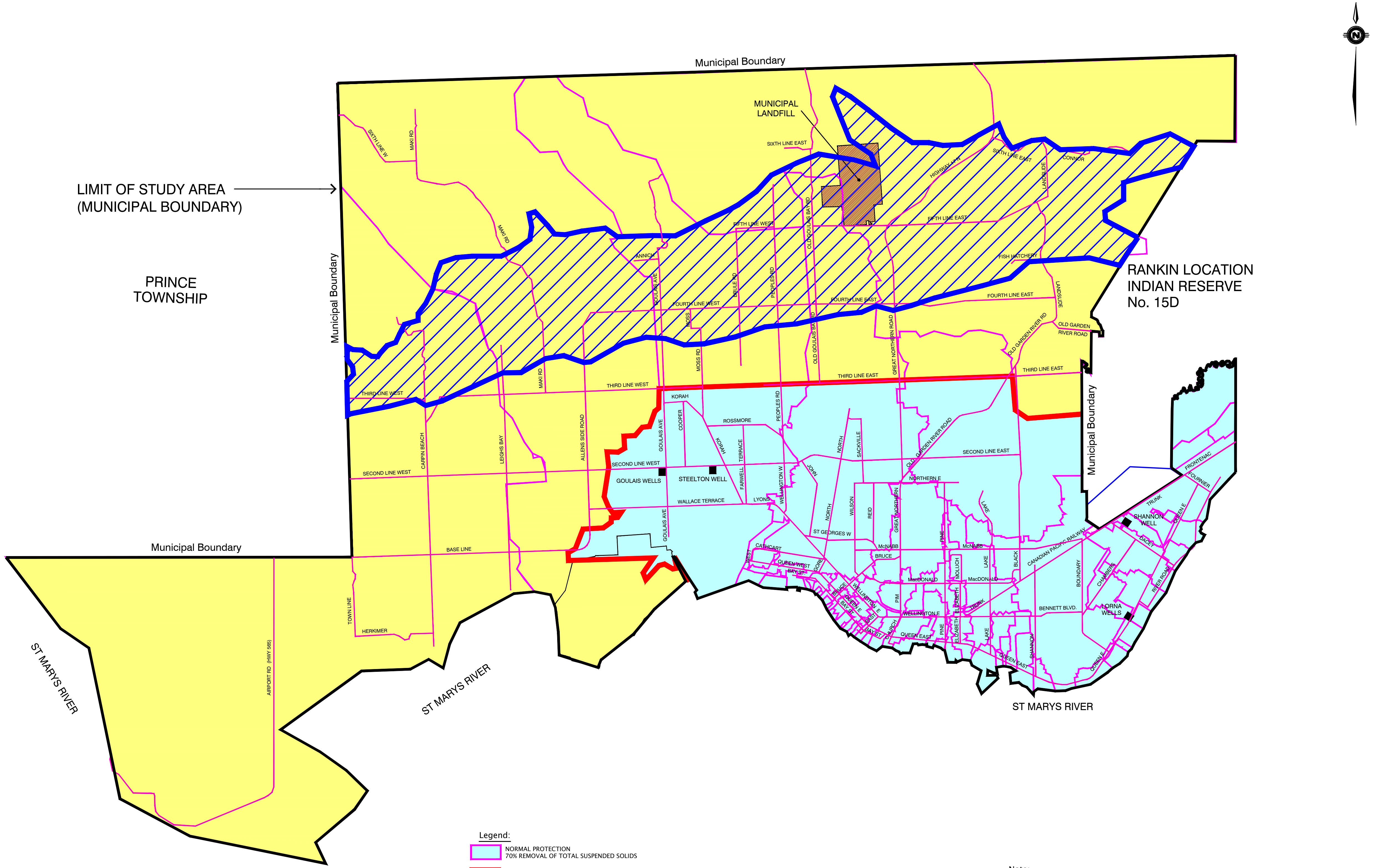
9.0 BIBLIOGRAPHY

- Alberta Environmental Protection. 1999. Stormwater Management Guidelines for the Province of Alberta. Municipal Program Development Branch. Pub T/378. ISBN: 0-7732-5149.
- City of Calgary, Alberta, 2000. Stormwater Management and Design Manual.
- City of Cambridge, Ontario. 1997. Stormwater Management Policies and Guidelines. Online: http://www.city.cambridge.on.ca/relatedDocs/Stormwater%20Mngt.pdf
- City of Chilliwack, British Columbia. 2002. Policy and Design Criteria Manual for Surface Water Management. Final Draft. Prepared by: CH2MHill. 48 p.
- City of Greater Sudbury, Ontario. 2005. Engineering Design Manual
- City of Greater Sudbury, 2006. Official Plan Stormwater Background Study
- City of Nanaimo, British Columbia. 2003. Manual of Engineering Standards and Specifications. Section 7: Storm Sewer System. Online: http://www.city.nanaimo.bc.ca/a_engineering/engineering_standards.asp
- Environment Canada. 1974. New Brunswick Flood, April-May 1973. Technical Bulletin No. 81, Inland Waters Directorate, Atlantic Region, Halifax, Nova Scotia, 1974.
- Environment Australia (2002). Introduction to Urban Stormwater Management in Australia. Prepared Under The Urban Stormwater Initiative of the Living Cities Program 2002. Department of the Environment and Heritage © Commonwealth of Australia, 2002
- National Research Council, Canada and Federation of Canadian Municipalities. 2003. Source and On-Site Controls for Municipal Drainage Systems. A Best Practice by the National Guide to Sustainable Municipal Infrastructure. © Copyright National Guide to Sustainable Infrastructure. Issue No. 1.
- Ontario Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Queen's Printer for Ontario. ISBN 0-7794-2969-9.
- Ontario Ministry of Transportation. 1997. Drainage Management Manual
- Ontario Ministry of Transportation and Communication. 1986. MTC Drainage Manual
- Roads & Transportation Association of Canada. 1987. *Drainage Manual*.
- Trow Group, The. 1977. Geotechnical Study City of Sault Ste. Marie
- Publication 709. Technical Bulletin 30, pp. 51. Canada: Department of Agriculture.

- Chow, V.T. 1959. Open-Channel Hydraulics. McGraw-Hill Book Company. ISBN 07-010776-9

APPENDIX 1

PLAN 1 - STORMWATER MANAGEMENT REQUIREMENTS



Legend:

- NORMAL PROTECTION 70% REMOVAL OF TOTAL SUSPENDED SOLIDS
- ENHANCED PROTECTION REQUIRED 80% REMOVAL OF TOTAL SUSPENDED SOLIDS
- HIGH POTENTIAL GROUND WATER RECHARGE AREA STORM WATER INFILTRATION SYSTEMS RECOMMENDED WHERE APPROPRIATE
- MUNICIPAL WELLS

Note:-

THIS PLAN SHOULD BE CONSIDERED A GENERAL GUIDE ONLY. SPECIFIC PROPERTIES/DEVELOPMENTS MAY REQUIRE DIFFERENT LEVELS OF TREATMENT. THE CITY ENGINEERING DEPARTMENT AND THE SAULT STE MARIE REGION CONSERVATION AUTHORITY SHOULD BE CONSULTED.

MASTER PLAN

SAULT STE. MARIE STORMWATER INVESTIGATIVE STUDY

R.V. Anderson Associates Limited
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GENIVAR

PLAN 1

STORMWATER MANAGEMENT REQUIREMENTS

STORMWATER MANAGEMENT MASTER PLAN