

BAY OF QUINTE REGION POLLUTION PREVENTION AND CONTROL PLAN



Final Report
January 2011



The Bay of Quinte Region
Pollution Prevention and Control Plan

Prepared for

The City of Belleville

The City of Quinte West

The Municipality of Prince Edward County

The Town of Greater Napanee

The Town of Deseronto

Final Report

January 2011

Disclaimer

This report was prepared for the Ontario Ministry of Environment in partnership with the Water Environment Association of Ontario and Environment Canada's Great Lakes 2000 Cleanup Fund. The views and ideas expressed in this report are those of the authors and do not necessarily reflect the views and policies of the aforementioned governments and agencies, nor does the mention of vendors, trade names and commercial products constitute an endorsement or recommendation for use.

Foreword

Thanks to another successful partnership the Bay of Quinte is another step closer to reaching its delisting targets. Environment Canada, Quinte Conservation, and the Municipalities around the Bay of Quinte have partnered to address issues around pollution control through studying and making recommendations for improvement to municipal drains and storm water management facilities. The Remedial Action Plan process highlighted the need to reduce the amount of contaminants that enter our waterways and the Bay of Quinte from municipal storm drains.

Through the participation of all the municipalities surrounding the Bay of Quinte, and with the financial help of both the Great Lakes Sustainability Fund and the Ministry of the Environment, we have monitored storm outfalls, reviewed stormwater management systems and made recommendations for improvement to operations. As well, this report synthesizes the outcomes into a regional strategy for storm water management in the Pollution Prevention Control Plan for the Bay of Quinte. Along with the study of existing systems, four master drainage plans for newly developing regions of the municipalities were completed. Those plans will guide development for years into the future.

In this three year project Municipal, Conservation Authority, Federal and Provincial staff worked together to produce a plan that can now be used as a guide for all municipalities around the Bay of Quinte and can hopefully serve as a template for other areas in Canada to use. The concept of having a regional plan that everyone buys into instead of several distinct plans that may not address the larger issues of eutrophication and pollution in the overall picture can save the Municipalities and developers money; this approach will also lead to better water quality in the Bay of Quinte.

Every improvement that gets us closer to delisting the Bay of Quinte is a huge benefit to the Quinte area; the economic value of being able to promote the Bay of Quinte as a Tourist attraction is immeasurable.

I feel that this study has been a great success, not just because of the end product but because of the process that allowed us to educate Municipal politicians and staff. I want to thank Environment Canada, the Ministry of the Environment, Quinte Conservation, Lower Trent Conservation and all of the Municipalities who took part in this study.

Terry Murphy

Co Chair
Bay of Quinte Restoration Council

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A Pollution Prevention and Control Plan (PPCP) For Urban Areas on The Bay of Quinte

1. *PURPOSE*

This report has been prepared to assist Bay of Quinte municipalities in fulfilling the requirements of Recommendation #23 of the Bay of Quinte Remedial Action Plan. Recommendation #23 requires completion of Pollution Prevention and Control Plans (PPCPs) for Belleville, Trenton, Picton and Deseronto. The Town of Napanee is now also included.

2. *SECTION I -- REGIONAL APPROACH*

2.1 *Background/Need*

The primary focus of RAP Recommendation #23 is to address contaminants washing off urbanized areas (urban stormwater runoff) and entering the Bay. At the time of the final RAP recommendations (Stage 2 Time to Act report, September 1993), Recommendation #23 was aimed primarily at dealing with urban stormwater because of its contribution to near-shore bacteriological contamination and public beach postings at Trenton, Belleville, Picton and Deseronto.

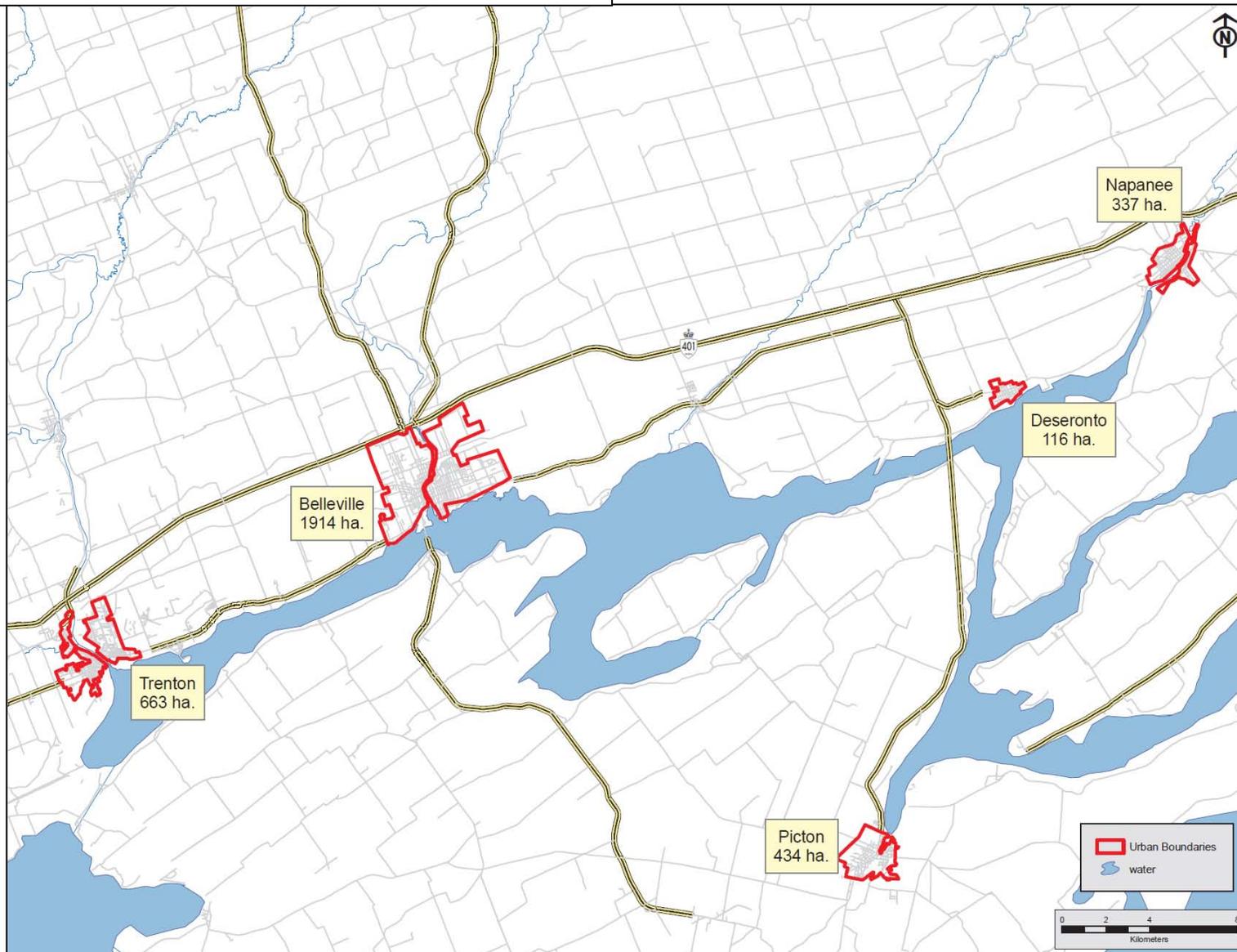
Figure 1 shows the urbanized areas on the Bay of Quinte that this PPCP report addresses: Trenton (now part of the municipality of Quinte West), City of Belleville, Town of Picton (in Prince Edward County), Town of Napanee and Village of Deseronto. As indicated on Figure 1, the "urbanized" land area for each of these town or city areas is as follows.

Town or City site	Urbanized area per Figure 1
Trenton	663 ha
Belleville	1,914 ha
Picton	343 ha
Napanee	337 ha
Deseronto	116 ha
Total of above	3,373 ha
The urbanized area listed above consists of areas with significant amount of impervious surfaces associated with municipal roadways, buildings, parking areas and other associated hard surfaces, and served by municipal drainage systems outletting to the Bay.	

It is now recognized that urban runoff also carries what may be a significant load of phosphorus to receiving waters, and may therefore be contributing to problems associated with nutrient enrichment of the Bay. Preliminary estimation of the average phosphorus loading associated with urban runoff from

Belleville, Trenton, Picton, Deseronto and Napanee is presented in Appendix A. This evaluation includes comparison with other major loading sources to the Bay.

FIGURE 1: Urbanized areas addressed by the PPCP report



The preliminary comparative assessment of average total phosphorus entering the Bay for the subject urban areas has indicated that in the summer period (June through September) the average mass loading of total phosphorus carried by runoff from these urbanized areas into the Bay may be as much as 950 kg. In comparison, the average June-September loading associated with the sewage treatment plants (STPs) serving these same urban areas is estimated at 1,000 kg. However, in the June-September window, the dominant source of phosphorus loadings to the Bay continues to be the tributary river systems (Trent River, Moira River, Salmon River and Napanee River); the analysis presented in Appendix A indicates that the average June-September loading from these tributaries may be as much as 22,700 kg. Nonetheless, the preliminary analysis presented in Appendix A indicates that during the summer period, stormwater discharges from the subject urban areas may be of the same order of magnitude as that from the local STPs, indicating that urban stormwater runoff needs to be dealt with as part of the overall effort aimed at reducing nutrient enrichment within the Bay of Quinte.

Furthermore, as a result of comprehensive studies carried out in the United States and elsewhere, it is now widely recognized urban runoff may carry a variety of other contaminants of concern, including metals, sediments and hydrocarbon compounds that are washed off various urban surfaces such as roadways; and that the loadings associated with urban stormwater may play a significant and even dominant role in determining surface water quality conditions within receiving water bodies.

To provide local information and a basis for action, Quinte Conservation and Lower Trent Conservation have recently engaged in a program of sampling and analysis of discharges from a number of storm sewer outfalls in these urban areas. Results are presented and summarized in Appendix B, and are discussed in further detail in this report.

Storm outfall sampling completed in 2008 and 2009 has shown that:

1. Dry-weather discharges from storm sewer outfall pipes may be contaminated.
 - a. A number of outfalls in Belleville, Trenton, Napanee and Picton had dry-weather discharges that showed bacteriological contamination (i.e. E. coli levels greater than 100 per 100 mL). A number of samples (20%) had E.coli greater than 1,000 per 100 mL, and there were three samples with E.coli greater than 40,000 per 100 mL.
 - b. Also, dry-weather discharges from some outfall pipes showed levels of phosphorus

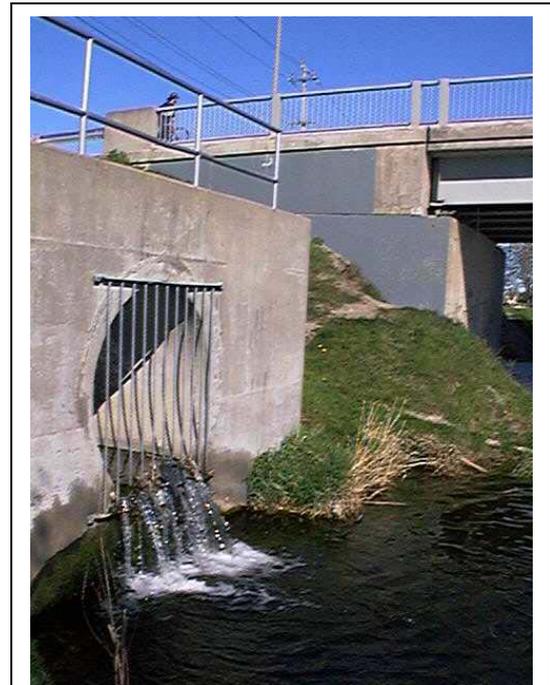


FIGURE 2: Some storm sewer outfalls may discharge continuously, even in dry weather. Above is 1650-mm pipe outfall to Trent River at Dixon Drive.

above the Provincial Water Quality Guideline (PWQG) of 0.03 mg/L, with the dry-weather discharges typically containing 0.1 to 0.2 mg/L total phosphorus.

- c. As well, some storm outfalls had dry-weather discharges that contained levels of lead and copper above Provincial Water Quality Objectives (PWQO).

2. Wet-weather storm discharges carry phosphorus, bacteria and metals.

The recent sampling data show that wet-weather discharges (urban runoff) from the municipal storm pipe system can contain concentrations of total phosphorus and some metals (especially Copper, Cadmium Iron and Lead) that are higher than the PWQO. Please see Table 2 below.

TABLE 2: Range of average outfall discharge concentrations based on grab sampling undertaken during wet-weather episodes in 2008 and 2009			
Parameter	PWQO	Range of average values for individual storm outfalls	Average over all outfalls
Total phosphorus (TP)	0.03 mg/L (guideline value)	0.02 to 0.53 mg/L	0.18 mg/L
Copper (Cu)	5.0 ug/L	0.9 to 44.2 ug/L	10.3 ug/L
Cadmium (Cd)	0.10 ug/L	0.33 to 1.63 ug/L	0.86 ug/L
Iron (Fe)	300 ug/L	52 to 2,194 ug/L	765 ug/L
Lead (Pb)	5.0 ug/L	1.3 to 22.8 ug/L	9.1 ug/L

Notes: Results above are based on a limited data set consisting of results from 138 wet-weather samples gathered from a total of 35 storm outfalls (i.e. average of less than 4 samples per individual outfall). Average values for each outfall were computed as the simple arithmetic average of all grab samples obtained at that outfall. Appendix B provides details of the 2008-2009 storm outfall sampling program and results.

As well, previously sampling programs undertaken in the late 1990s in Belleville and Trenton, and earlier studies carried out in conjunction with the BQRAP, have shown that urban stormwater discharges typically have elevated levels of indicator bacteria (e.g. *E. coli* or fecal coliform), with wet-weather values often exceeding 1,000 counts per 100 mL, with values above 10,000 per 100 mL not being unusual.

It should be noted that this type and degree of contamination of urban stormwater can be considered as



FIGURE 3: Local roadway runoff showing visible evidence of contamination

typical or characteristic of urban areas throughout North America, as indicated by reviewing data summaries published in a number of previous studies such as the US EPA report by Heaney *et al.* (1999).

The need for PPCPs to address urban stormwater discharges is therefore clear, and a number of the 1993 RAP Recommendations addressed this issue.

Because urban drainage and stormwater management infrastructure is generally the responsibility of the local municipalities, the final PPCPs for each urban area would largely become the responsibility of the local municipality. Therefore, developing PPCPs for each of the urban areas requires that the concerns and potential solutions be examined in a comprehensive way, in order to develop practical strategies that can be accepted, adopted and implemented by the individual municipalities.

This report responds by providing a PPCP for the urban areas on the Bay as a whole, followed by individual action plans for each urban area (Belleville, Trenton, Picton, Napanee and Deseronto).

The PPCP and action plans presented here build on the considerable previous work already accomplished by a number of the municipalities since 1993.

In particular, a PCP was previously completed for City of Belleville in 1997, and the City has been acting on a number of the recommendations that formed that PCP. The action plan presented here for Belleville constitutes an update to the 1997 PCP that is based on current status and current conditions.

Similarly, the PCP was completed in 1998 for Trenton. The action plan presented here for Trenton is intended as an update to the 1998 PCP.

2.2 Approach – the PPCP process

The scope of the PPCP is to address pollutant loadings to the Bay emanating from the urban areas (Figure 1) due to wash off during storm events (i.e. stormwater runoff) that does not pass through sewage treatment facilities. Control of pollutant loadings from the STPs is dealt with through well-established regulatory requirements defined by the Ontario Ministry of Environment. At any time, the requirements on STPs imposed by MOE consider the requirements of the BQRAP. In the context of PPCP development for each urban area, the presumption therefore is that municipal wastewater discharges are being managed and controlled to meet RAP requirements, and that therefore the PPCP has focus solely on the urban stormwater issue. However, this does not preclude the need for the PPCP to be based on comparing stormwater loadings to other sources such as STPs. Such comparison is needed to evaluate the relative benefit and priority that should be placed on reducing urban stormwater loadings to the Bay.

To guide PPCP preparation, a “template” was prepared in 2006; see **Appendix E**. The PPCP template outlines a 3-stage process:

Stage 1	Information Gathering and Review
Stage 2	Development of a Stormwater Control Strategy
Stage 3	Implementation Strategy

The PPCP template document provides a detailed description of how to proceed through each of these stages to develop a PPCP that is specific to each Town or urban area.

In general, there are two aspects to the stormwater issue within any urban area of municipality:

1. Existing storm system discharges that originate from urban catchments areas in which there may be little or no structural measures (e.g. stormwater treatment facilities or devices) to control pollutant loadings carried by stormwater.
2. Increased stormwater volumes due to new urban development (expansion of the urban area).

Over the last 15 years, there has been considerable evolution and refinement of regulatory requirements for controlling stormwater impacts on surface water quality from new urban development. There is now in place a set of well-defined requirements established by MOE and applied across the Province (Refer to 2003 MOE Stormwater Management Planning & Design Manual).

Within the Bay of Quinte RAP area, stormwater management guidelines for new development were first set out in 1993, prior to the development of any specific Province-wide guidelines. These were updated in 2006 to make them consistent with and complementary to the 2003 MOE guidelines. For reference the BQRAP Stormwater Management Guidelines are attached in Appendix C.

The BQRAP stormwater guidelines directly address the need to control pollutant loadings from any new urban development area. These guidelines have now been accepted by the local municipalities and the MOE, and are being uniformly applied within the BQRAP implementation area. In other words, the issue of stormwater impacts from new urban development is being addressed.

The central issue in preparing the PPCP and action plan for each urban area is developing practical and feasible strategies for addressing existing stormwater discharges from older urban areas in which there may not be adequate measures to control stormwater pollutant transport to local creeks or the Bay itself. The challenges in developing practical and implementable PPCP action plans may arise from the following factors and considerations:

- The storm drainage systems within existing built-up urban areas typically include numerous individual storm pipe outfalls to the Bay or local creeks. Some outfalls may serve relatively small catchment areas of only a few hectares, whereas larger outfall pipes may serve as outlet for tens or hundreds of

hectares. Refer to Appendix D which provides mapping of outfall locations and corresponding drainage areas, for Belleville, Trenton, Picton, Napanee and Deseronto.

- Substantial at-source reduction of stormwater pollution may not be practical or feasible because of the nature of the sources and the design of the urban environment. Drainage infrastructure is designed to efficiently remove stormwater from various surfaces such as roadways, parking lots and landscaped areas. There is continuous deposition of pollutants on these surfaces from local activities and from atmospheric sources.
- Retrofit installation of stormwater treatment systems or devices would necessarily require numerous individual facilities to deal with the numerous individual outfalls spread across any one urban area. This could be a costly proposition both initially, and over the long term for operation and maintenance.
- The actual practical opportunities for installing treatment systems (e.g. stormwater ponds, settling tanks, etc.) may be limited because of limited available municipal property space at individual outfall locations, coupled with the desire to not lose any valuable waterfront property.

The PPCP template provides a structured approach to dealing with these challenges through information gathering, followed by examination of what the practical and realistic options are within each urban area.



FIGURE 4: Surface runoff along roadway within downtown commercial zone. Highly impervious urban core areas generate substantial volumes of surface runoff, typically collected by catchbasin-to-sewer pipe systems that discharge to local creeks or directly to the Bay.

2.3 PPCP integration with other BQRAP Recommendations

PPCP action plans need to integrate with a number of other RAP recommendations (Table 3) that deal with related issues and in some ways overlap with what the PPCP is intended to address.

TABLE 3	
Summary of Bay of Quinte RAP recommendations related to control of stormwater runoff and sources of bacterial contamination	
RAP recommendation	Summary
24	Disconnect roof drains and sump pumps from sanitary sewer system
25	Implement long-range strategies for sewer system inspection, maintenance and rehab
26	Implement water conservation
27	Enforce domestic pet litter bylaws
28	Take measures to discourage presence of gulls and control dog access at swimming beaches.
29	Routine street cleaning and catchbasin cleaning
30	Ensure pleasure craft on Trent Severn waterway comply with plumbing and boating regulations
31	Storm sewers and drainage ditches should be investigated for sources of dry-weather bacterial contamination
32	Proper disposal of human wastes and litter generated by ice-fishing on the Bay
33	Stormwater quality control for new urban development
34	Ontario's Subwatershed Planning Process should be used as input to municipal Secondary Plans (for new urban development areas).
38	Investigate septic systems on properties fronting on the Bay and take corrective measures where needed

The above recommendations address many of the “source controls” that can be considered when preparing PPCP action plans. PPCPs need to recognize actions that have and are being taken (or not) on the above recommendations.

2.4 PPCP Status

The PPCP development has been based on applying the same approach to each of the urban areas, so that the final PPCP presents a consistent regional approach to the stormwater issue.

However, each of the urban areas being addressed – Belleville, Trenton, Picton, Napanee and Deseronto – is different in a number of respects:

1. Age, building density and imperviousness of the built-up urban area
2. Type, age and capacity of urban drainage infrastructure
3. Extent of existing stormwater management/treatment systems
4. Amount of planned urban development
5. Existence of a previously accepted PCP: this is the case only for Belleville and Trenton

As noted above, PCPs for Belleville and Trenton were previously finalized in 1997 and 1998. The need now is for an update based on current conditions and constraints.

Napanee, Deseronto, and Picton did not have PPCPs, however, some background work was completed between 2003 and 2006 for data collection and understanding of their storm sewer systems. That work was completed under previous GLSF programs. Plans presented in Section II take cognisance of the limited technical resources in the smaller municipalities and their smaller impact (in part due to their smaller urbanized area and lower % impervious).

The implementation status of the Trenton and Belleville PCPs was reviewed in 2003 (XCG Consultants report, April 2003). In summary, it was found that satisfactory progress was being made in both municipalities.

In order to now update the PPCP action plans for Belleville and Trenton, a review of current status is included in subsequent sections of this report.

2.5 Regional Issues Affecting PPCP Implementation

The municipalities surrounding the Bay of Quinte share the same resource and are all stakeholders in the condition of the Bay. No one municipality acting alone can expect to restore the quality of the Bay of Quinte waters and therefore a Bay-wide approach to control and prevention of pollution is necessary.

Unfortunately, not all stakeholder municipalities are technically or financially capable of seeing this work through to completion. Member agencies of the Bay of Quinte Restoration Council of the Remedial Action Plan have been working together toward this aim.

This section identifies some common local issues faced in implementation of PPCPs, specifically related to stormwater management.

2.5.1 Certificate of Approval Conditions for Stormwater Treatment Facilities

According to the Ontario Water Resources Act all stormwater management facilities serving two or more parcels of land must have a Certificate of Approval (C of A) issued by the Ministry of the Environment for the establishment and operation of a sewage treatment facility.

In some cases, the MOE Certificate of Approval is issued with conditions that may include a requirement for monitoring of the quality of discharge from a new stormwater treatment facility such as an end-of-pipe settling pond. The owner/operator (i.e. the local municipality) becomes responsible for ensuring that such conditions are met and that monitoring results are regularly reported to the MOE per C of A requirements. The C of A may include specific "compliance limits" that dictate the maximum allowable average concentration for water-quality parameters that are of concern. If monitoring and reporting show that a facility's discharge is not meeting the compliance limits, then the MOE will typically require that immediate actions be taken to rectify the situation.

This type of C of A, with monitoring/reporting/compliance requirements, can be source of concern for local municipalities that are contemplating the installation of new facilities. This concern stems from the fact that it may be difficult to ensure that stormwater facilities designed in conformance with MOE

design guidelines (the 2003 manual) will be able to consistently meet concentration-based compliance limits on a monthly or even annual basis.

This issue arises from the fact that the MOE design guidelines, as set out in the 2003 manual, represent what might be termed a “presumptive” approach to facility design in which it is presumed that if the facility is designed to achieve the required design treatment volume and adheres to other design guidelines (e.g. minimum width/length ratio, minimum water depth, etc.) then the pollutant load reduction provided by the facility will provide adequate protection of receiving waters.

The 2003 MOE guidelines provide facility sizing requirements for three levels of treatment. The strictest level, the so-called “Enhanced” level (formerly known as “Level 1”) is applied throughout the BQRAP Implementation area. Facilities designed accordingly are expected, based on theoretical analyses, to achieve a long-term average annual removal efficiency of 80% of incoming loading of total suspended solids (TSS). The further presumption inherent in the design guidelines is that achieving average 80% removal of TSS by natural settling within a pond facility will result in substantial removal of other contaminants of concern including metals, nutrients and pathogenic micro-organisms.

In this context, monitoring for compliance with the design intent would require continuous or regular monitoring of facility influent and effluent flow and TSS concentrations. Given the highly variable nature of inflows to stormwater facilities, such monitoring becomes challenging and expensive. Furthermore, only longer-term monitoring could be used to assess compliance, given the stated design intent of achieving a prescribed average annual TSS removal.

Consequently, if MOE proposes Certificate of Approval conditions that require monitoring and compliance limits in the form of monthly or annual average effluent concentration limits, municipalities justifiably become concerned. This is especially true because of the fact that continual or repeated non-compliance with specific numerical effluent targets could technically result in the facility owner/operator being formally charged by the MOE. Local municipalities may therefore look upon such C of A conditions as opening them up to potential legal liabilities. And from the municipalities point of view, the fact that they might be put in this position is not justified, given the presumptive nature of the MOE’s own design guidelines (i.e. the 2003 manual) as described above.

In essence, the situation is one in which the municipalities have been faced with considerable uncertainty about the implications of embarking on any projects to install retrofit end-of-pipe outfall treatment facilities. As well, municipalities are reluctant commit to C of A conditions that could require facility sampling programs that would be onerous and expensive, especially if they believe that results from such sampling may be not be conclusive.

In the end, the situation may be reduced to one in which the municipality realizes that once a facility is constructed to retrofit an existing outfall, it may effectively be assuming a legal obligation to ensure outfall effluent quality meets a specific numerical criterion; whereas, if the outfall were left untreated, the municipality would be assuming no such obligation. No action may become the easier choice.

There nonetheless remains the need for remedial stormwater quality treatment and a qualified willingness on the part of municipalities to own and operate facilities, but there is an uncertainty about the regulatory environment surrounding the performance of the facilities.

2.5.2 Facility Planning and Design

The development of land and creation of impervious areas result in substantial increase in direct surface runoff, and this can in turn cause degradation of local surface water quality. This gives rise to the need for control of surface runoff from urban areas, and for its treatment using structures and facilities such as detention ponds. The MOE Stormwater Management Planning & Design Manual (2003) provides considerable guidance for planning and design.

Facilities for new urban development are often planned by the individual developers who may be at varying stages of readiness, or who may have plans for servicing that are incompatible with those of adjacent developers. The result may be the creation of a larger number of relatively small treatment facilities to service each individual development property, as opposed to what could be a better and more rational approach in which fewer larger facilities serve multiple development properties.

Similarly, there may be opportunities to implement individual stormwater treatment facilities that can serve a dual purpose: treatment of existing drainage systems, with provision of capacity to also treat planned urban development.

Master Drainage Planning seeks to provide a more regional drainage management design that would see facilities located strategically to reduce the numbers of facilities and costs of maintenance. This is an obvious benefit to the eventual operators – the municipalities.

Planning for retrofit facilities is wholly the responsibility of the municipalities. But first, the need, opportunity and commitment must be established. The PPCP has a focus to establish the need and opportunities for the storm sewer systems that require remedial quality treatment to reduce the contaminants released into the Bay of Quinte. The commitment to construct a facility is both a financial and political decision reliant upon local conditions and attitudes.

Planning must be led by the municipalities for all stormwater management facilities in order to assure the success of water quality improvement of the Bay.

In this context, municipal stormwater management facilities should have the same status as STPs in terms of recognition of the ability to control and reduce discharges, and be eligible for capital works funding support.

2.5.3 Location Opportunities May be Limited

As touched on earlier, the opportunity for constructing facilities for remedial treatment is limited by the state of the development in the sub watershed. Ponds and wetlands require substantial land commitments and can be in conflict with the surrounding development or land use. Finding opportunities for facilities that may become amenities could be the answer. A well designed and placed facility can be very complementary to a waterfront location or within green space of a development.

Some areas have no space available. In this circumstance underground treatment may be the only option.

Space limitation has been considered in the Bay of Quinte RAP Stormwater Management Guidelines for retrofit ponds. Retrofit facilities may have a reduced water quality target in the event there is no opportunity for achieving Enhanced water quality treatment.

2.5.4 Funding Stormwater Treatment Facilities

It is common practice to levy a charge on lands being developed in order to accumulate funds to finance required facilities. This has long been the practice in the case of water and sewage works; new developments 'pay their share' of facility expansion and extension.

In the case of storm water management (SWM) the picture is a bit more complex. If the drainage area or sub watershed is owned by one developer the required facility would be constructed as part of the project and included in the subdivision or development agreement. However, if the required facility treats more than one property within the drainage basin the municipality could impose a charge or levy and bank the funds to construct the facility. If there is existing development in the basin the municipality would contribute a share of the cost.

The simple diagram below shows an example sub watershed in which there are several parcels with separate owners. Given an overall drainage strategy has been developed for the area, a proposed SWM facility could be constructed as shown to service all the development lands. If for some reason the municipality or developers cannot reach an arrangement or the lands are not in their ownership for the facility (as is this example case) developers may construct a facility serving only their development. In this example upwards of three facilities would be needed.

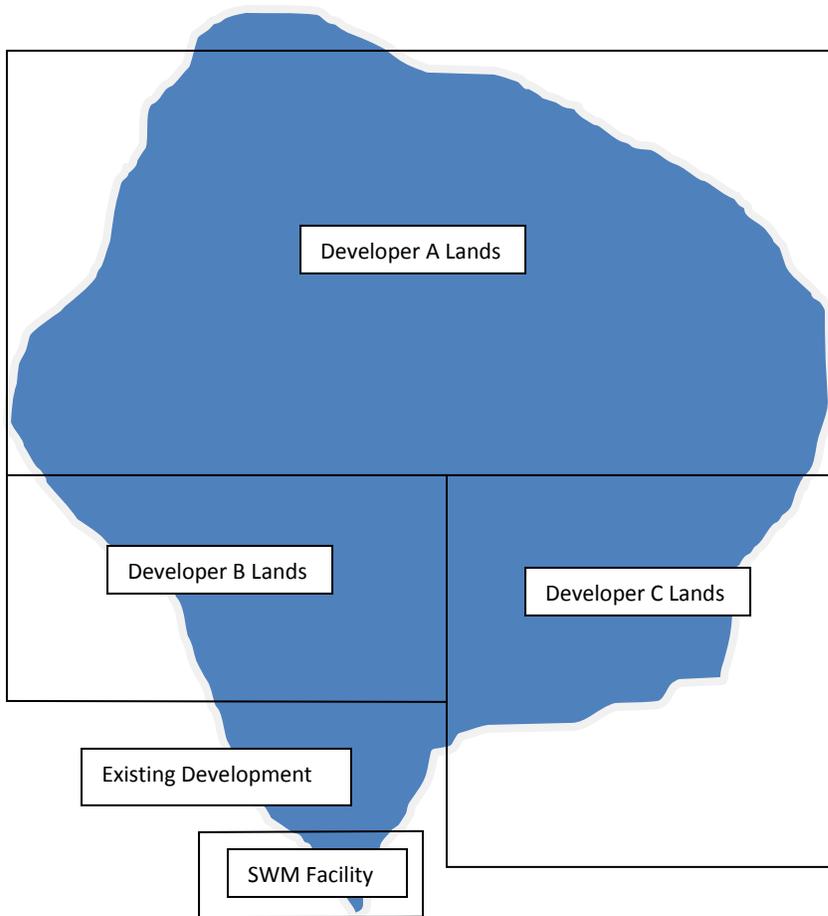


FIGURE 5: Example Sub Watershed with Multiple Landowners

2.5.5 Capital Works Planning

New Development

In order to develop a capital works plan an estimate of future required facilities is necessary. This includes location, cost and when the facility is needed. Companion Master Drainage Plans, prepared with funding by the BQRAP and area municipalities, provides the municipality with a plan of facilities required in new development areas. The Bay of Quinte PPCP provides the municipality with a plan of works required in the existing urban area.

Effort should be made to locate large central facilities in order to reduce future maintenance and to provide an opportunity to incorporate recreation and open space features.

Because development occurs over a long time it may be necessary to have smaller temporary works to serve a part of the development area. Ideally a drainage basin would be under the aegis of a single or

group of land owners who would be responsible for necessary SWM facilities as part of a development agreement.

However in most cases there are different interests and unless a joint approach can be encouraged, the required facilities must be planned and undertaken by the municipality utilizing a funding mechanism as described below.

Remediation

In some cases (for example Foster Avenue Pond in Belleville) the need for SWM in the existing urban area may have been identified in a PPCP. Or part of a drainage basin may be vacant but slated for development. The portion of the facility attributable to the existing development would be financed by the municipality through tax revenues or a local improvement. These funds can be taken from current revenue, from a reserve fund or debentured.

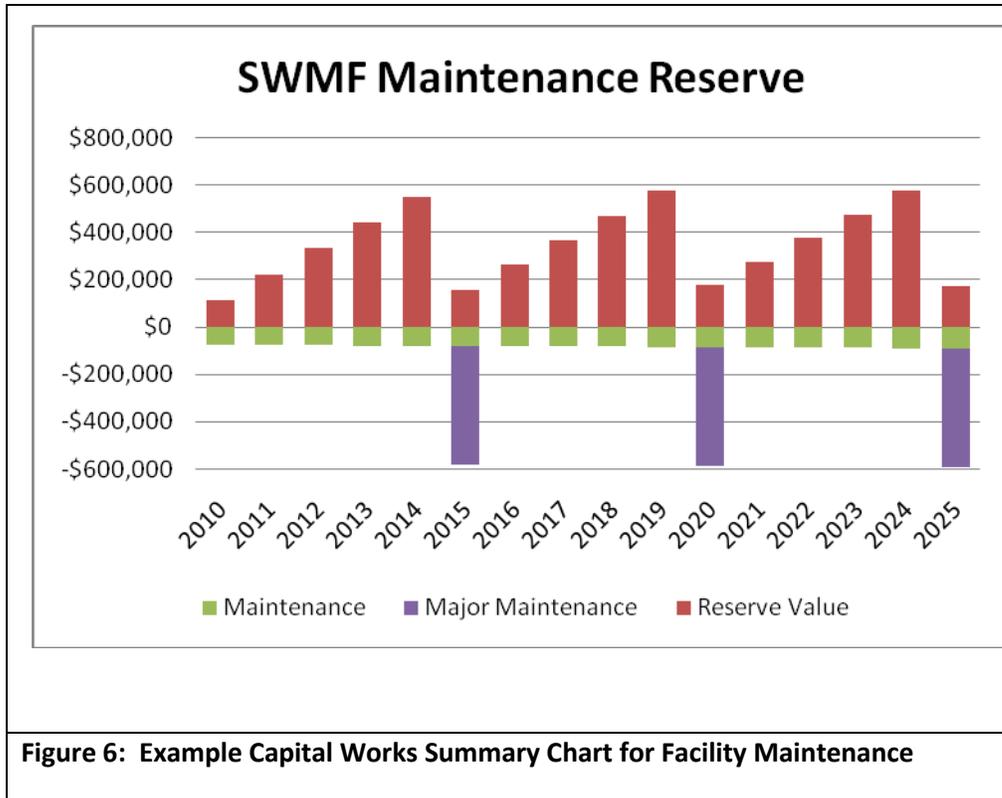
2.5.6 Funding of SWM Facilities

The funds required for SWM facilities in new development areas are usually collected through a lot levy or development charge unless the developer constructs the facility as part of the development agreement. This 'cash in lieu' or levy would be sufficient for the municipality to construct necessary works at a later date. Since SWM facilities are necessitated by creation of impervious areas, the charge may be on that basis versus a total acreage basis.

Because funds may be accumulated from different development areas, it isn't necessary to reserve them for an associated facility as long as overall reserve funds are sufficient to construct all required works over time.

Capital works for existing urban areas could be funded through the creation of a reserve fund to which the municipality would contribute at a rate which would accumulate the required funds when needed.

The following chart is an example of how the municipal maintenance reserve fund would operate assuming an annual contribution of \$187,000, annual minor maintenance expenses of \$75,000 (growing \$1,000 annually), and 5-year periodic major maintenance of \$500,000. The reserve fund could also be expanded to include costs of new construction.



Knowing the lifecycle costs of facility management and the contributing area, the municipality can determine the amount of contributions needed and can make policy decisions on the source of the revenue.

The capital works planning process should be revisited every two to three years to ensure cost and revenue projections are still valid. If capital spending is required sooner than revenue accumulates, the municipality could debenture expenditures and recover funds from the reserve fund over time.

2.5.7 Funding of Facility Maintenance

Good facility performance is highly dependent upon good facility maintenance. Ponds, oil-grit separator (OGS) units and catchbasin sumps must be cleaned on a regular cycle. Performance diminishes as sediment accumulates. Often what is out of sight is out of mind. This is the case for underground OGS units and catchbasins. When their sumps fill with sediment, OGS units bypass and catchbasins continue to drain. There are no performance indicators to assist the responsible authorities to trigger a cleanout. Ponds can suffer the same neglect, but can visually be diagnosed for poor performance.

The cost to maintain these is borne by the municipality. The more infrastructure is owned – the more will be the cost of maintenance. These costs are incurred the municipality on behalf of the residents around the Bay of Quinte and in support of the many visitors and tourists that are being attracted to the area.

Stormwater management facilities must be treated with the same regard as other infrastructure such as sewage treatment plants that have annual maintenance budget line items and have capital asset planning.

Should developers contribute more for facility maintenance? This may be appropriate for facilities serving new development. However, the maintenance costs for retrofit facilities will ultimately be the responsibility of the municipality.

SECTION II INDIVIDUAL PPCPs

This section describes the methodology that has been applied to update or develop PPCP actions plans for each of the urban areas: Belleville, Trenton, Picton, Napanee and Deseronto.

The procedure that has been followed is described in the 2006 PPCP “template” document prepared for Quinte Conservation by XCG Consultants Ltd. This is included for reference as Appendix E. The diagram below summarizes the process described in the template document.



The above process has been followed to the extent possible by Quinte Conservation with available resources. A significant portion of the effort has been focused on efforts to complete Stage 1, since it is the foundation for recommendations for action that get developed in Stages 2 and 3.

At this juncture (December 2010), the entire process has not been fully completed for each of the urban areas under consideration. Stages 1 and 2 have been completed to the extent that available resources have allowed.

Finalizing the PPCP for each of the urban areas requires further input from and review by the local municipalities that ultimately would be the parties primarily responsible for implementation, including associated costs and integration with other ongoing infrastructure planning, design, operation and maintenance.

The individual PPCPs presented here are intended for review and refinement by the local municipalities. It is expected that each municipality will make due regard for the recommendations made within their respective PPCP presented below. Generally, this would include items and actions such as:

1. Review and modification to existing drainage infrastructure maintenance programs.
2. Additional follow-up monitoring and investigative work to track down and eliminate sources of contamination of storm drainage networks.
3. Integration of PPCP recommendations within existing or updated municipal planning documents such as the Official Plans, OPAs, secondary plans or neighbourhood redevelopment plans, to promote integrated planning of new SWM facilities, and to formally designate specific lands for retrofit stormwater treatment facilities.

The individual PPCPs presented below provide further detail on the types of actions needed by each local municipality to address specific information gaps or specific opportunities within each urban area.

In reviewing the following PPCPs, it needs to be recognized that they have been based on

- completing the PPCP template “Stage 1 Information Assembly and Analysis” based on best available information as gathered from various sources, including the local municipalities, since 2006;
- The available information does not completely fulfill the information requirements identified in the PPCP template; and
- Identifying remaining or outstanding information deficiencies or gaps, and therefore recommending action plans that include further information gathering to help make final implementation decisions.

Some of the PPCP recommendations made in this report are therefore provisional, based on the need for more or better information on existing conditions and infrastructure.

3. BELLEVILLE

3.1 Basis for PCP Update

A PPCP update for Belleville has been undertaken by reviewing the implementation status of the 1997 PCP recommendations, reviewing the 2008-2009 storm outfall sampling results, and considering other relevant information including input received from City staff.

3.1.1 Review of 1997 PCP

The Pollution Control Plan for Belleville was prepared in 1997. It was developed from examining the storm and sanitary sewer systems for their impact on the Moira River and Bay of Quinte waterfront. The study found extensive dry-weather and wet-weather contamination in discharges from storm sewer systems draining into the river and the Bay.

The 1997 PCP includes a number of recommendations for dealing with dry-weather and wet-weather discharges from the municipal storm drainage system. Some emphasis was placed on dealing with wet-weather stormwater discharges, because of their potential impact on water quality in the Bay. As a result, the PCP recommendations were based, in part, on an assessment of where there were physical location opportunities to install retrofit stormwater treatment (e.g. treatment ponds) at the larger storm outfalls along the Bayfront or along the Moira River, within the urban area. In many cases there was limited land available to effect an end-of-pipe treatment solution.

The recommendations from 1997 study were presented by zones; see Figure 7. Zone 1 included West Bay of Quinte and Zwick's Beach area, Zone 2 included Moira River above Riverside Park, Zone 3 is the lower Moira River, and Zone 4 is East Bay Shore.

The recommendations are reproduced below by zone:

3.1.1.1 Zone 1: West Bay and Zwick's Beach Area

Recommended that the **source control** program in Zone 1 include;

- Continued investigation of storm sewers draining to outfalls Q10, Q20 and Q30 in dry weather including sampling and investigative work is needed to pinpoint bacteria sources (Ontario Realty Corporation has already begun investigations at the Sir James Whitney School draining to Q20).

Recommended **stormwater treatment** in Zone 1

- The potential pond locations to treat Q10, Q20, Q30, Q40, and Q50 (refer to report) be further reviewed by City of Belleville with respect to long-term plans for the waterfront area with a view to acquiring or setting aside lands and, when resources become available the City should proceed with detailed design and construction of the outfall treatment facilities.

3.1.1.2 Zone 2: Moira River Above Riverside Park.

Recommended **source control** program in Zone 2

- Adam Street catchment. Continue the practice of draining lots and roadways by ditches and swales.

Recommended **stormwater treatment** in Zone 2

- Adam Street outfall pond requires design analysis and decision to proceed with construction as resources become available and priorities dictate.

3.1.1.3 Zone 3: Lower Moira River

Recommended **source control** program in Zone 3

- Continued investigation of storm sewers identified in this study as having bacterial contamination in dry weather, with priority placed on further investigating sewers draining to outfalls W40, W60 and W80. After these priorities are addressed, further investigation of outfalls E80 and E100 should be carried out, along with checks on E120.

Recommended **stormwater treatment** in Zone 3

- End-of-pipe treatment is judged to be not feasible in Zone 3.

The recommended approach was therefore:

- Make use of all available opportunities to install stormwater treatment within the storm sewer catchments draining to the Moira River below Riverside Park. Review all development projects and road/sewer infrastructure projects for opportunities. Apply the recommended stormwater control policy to each project to decide on the technically preferred stormwater control measures, and to decide on whether these measures should be incorporated into the project.

3.1.1.4 Zone 4: East Bay Shore

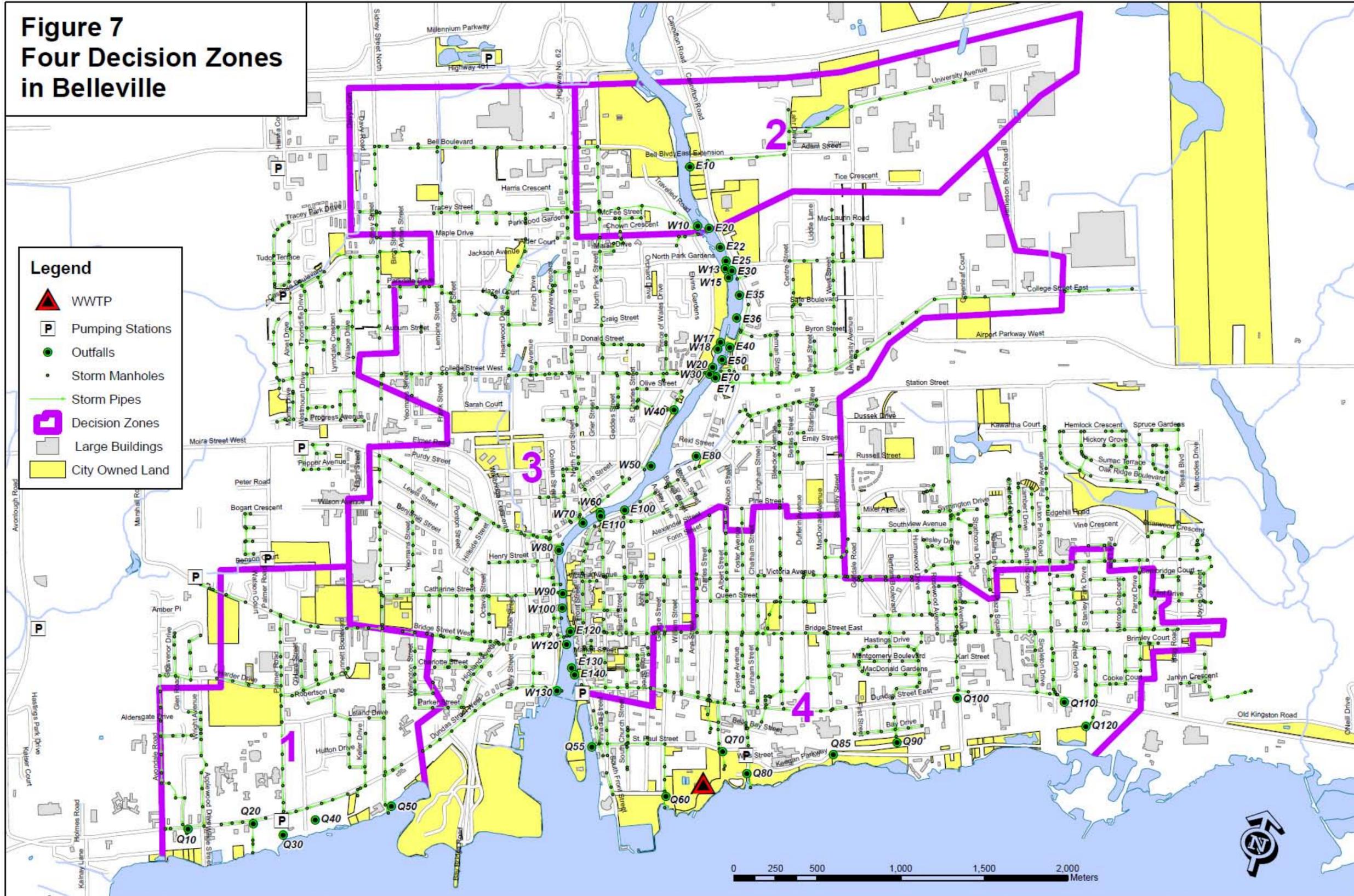
Recommended **source control** program in Zone 4:

- Continued investigation of storm sewers identified in this study as having bacterial contamination in dry weather, with priority placed on further investigating the sources areas identified above for outfalls Q 110 and Q80, After these priorities are addressed, further investigation of outfalls Q85 and Q 120 should be carried out.

Recommended **stormwater treatment** in Zone 4

- The following stormwater treatment projects have recently been completed or initiated:
- Stormwater Pond for Newberry Street storm outfall (070), note this pond has been constructed.
 - Belleville Marsh Restoration and Habitat Enhancement Project. The Belleville Marsh is a 28 ha wetland located along the Bay of Quinte in the east end of Belleville. A preferred approach was selected. The implications of these options for long-term waterfront redevelopment needed to be assessed.
 - Outfall ponds for Q80, Q90, and Q100 needed further assessment.

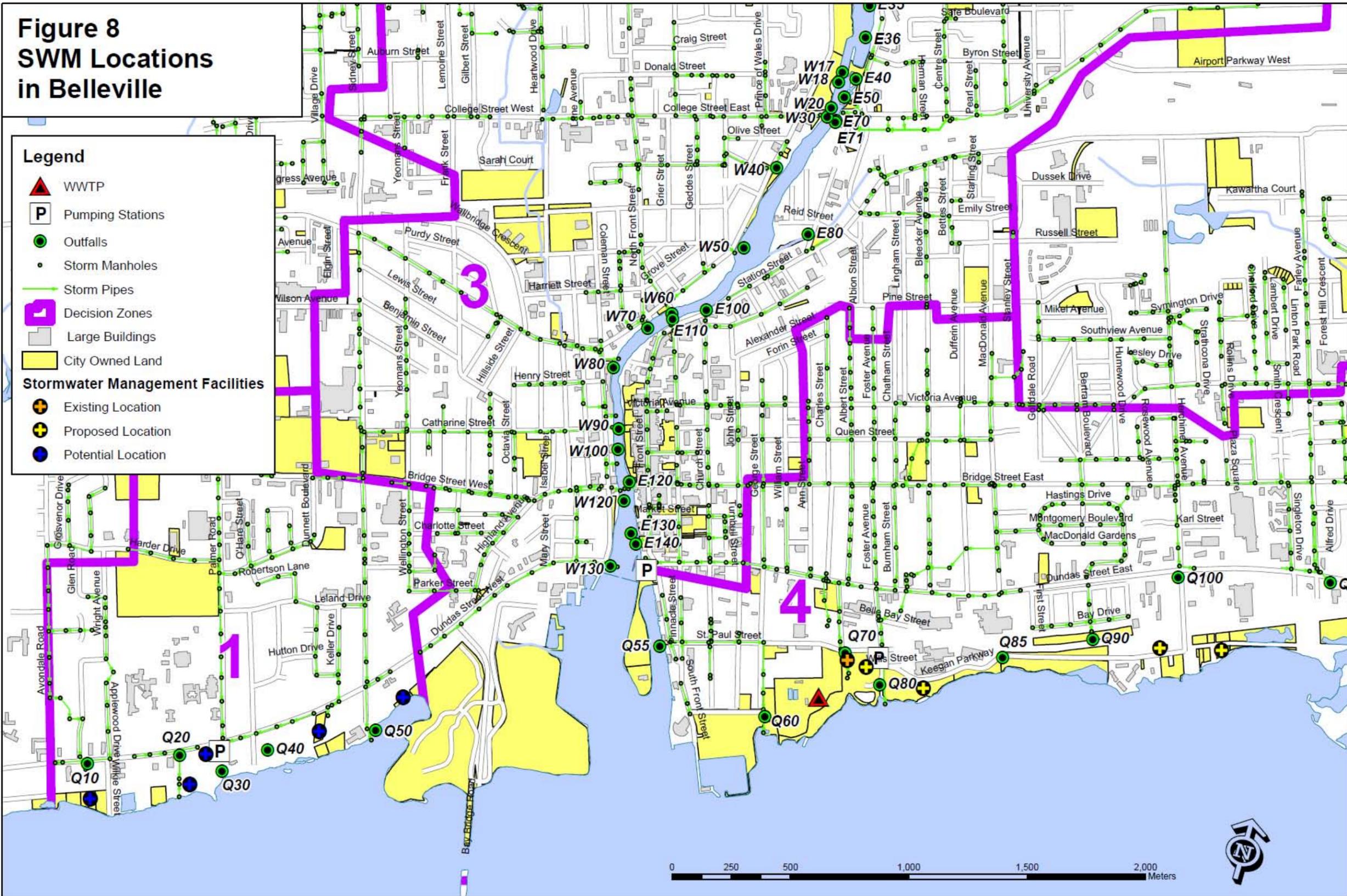
**Figure 7
Four Decision Zones
in Belleville**



**Figure 8
SWM Locations
in Belleville**

Legend

-  WWTP
 -  Pumping Stations
 -  Outfalls
 -  Storm Manholes
 -  Storm Pipes
 -  Decision Zones
 -  Large Buildings
 -  City Owned Land
- Stormwater Management Facilities**
-  Existing Location
 -  Proposed Location
 -  Potential Location



3.1.2 Current Status of PCP Recommendations

In 2003, XCG prepared a report for the Restoration Council of the Bay of Quinte Remedial Action Plan wherein the Pollution Prevention and Control Plan recommendations for action were reviewed. This report found that many actions remain uncompleted. Generally, a lack of coordinated effort, staffing and funds were attributed for the inaction. Recommendations from this report included:

- Form a staff task force to examine how the plan is currently administered and explore ways to coordinate activities such as new development approval, administration of CIL fund and capital budget for SWM facilities.
- Revisit the SWM facility recommendations and consider multi stakeholder multi-use facilities such as ponds with educational or recreational use. Obtain inter departmental commitment in planning and developing the facilities.
- Undertake a comprehensive sampling and monitoring program over several years to verify priorities and provide research data for determining the effectiveness of implemented measures.

Some of the more significant recommendations from the 1997 PCP were recommendations for implementing stormwater retrofit treatment along the Bay of Quinte waterfront, with a number of opportunities having been mapped out in the 1997 report along the East Bayshore (see **Figure 8**).

Subsequent to 1997, the City completed the development of the Belleville East Bayshore Concept Plan (2003) and the Belleville Waterfront Development Master Plan (June 2005).

The East Bayshore Concept Plan incorporated conceptual locations for retrofit stormwater management in keeping with the 1997 PCP; see **Figure 9** below which is a partial reproduction of the East Bayshore Concept Plan map prepared by Hough Woodland Naylor Dance Leinster in March 2003. This map shows the proposed locations of stormwater management, and these locations are generally consistent with those suggested in the 1997 PCP to address a number of existing storm sewer outfall pipes along this portion of the Belleville waterfront.

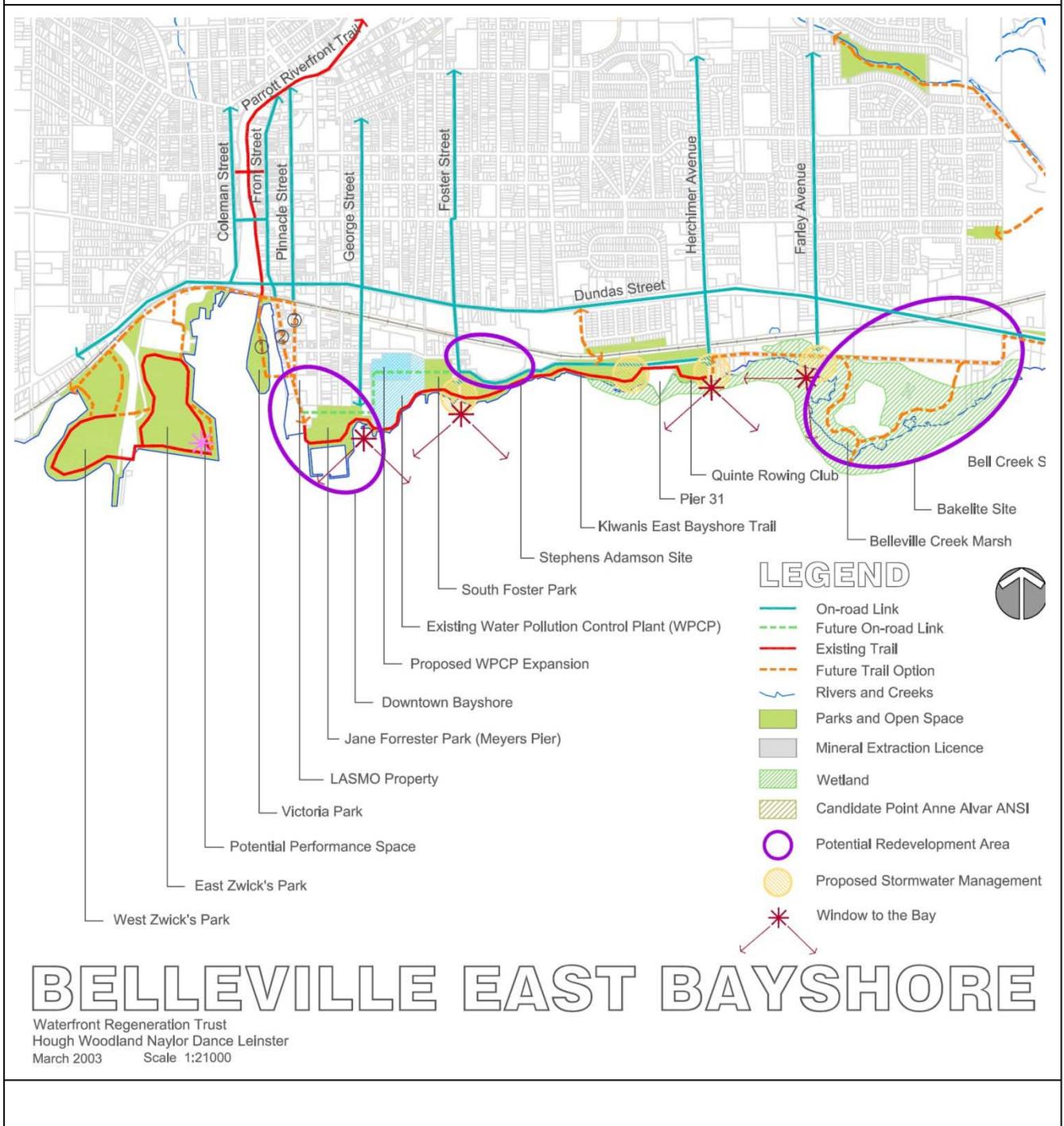
The explicit incorporation of stormwater management retrofits within the East Bayshore Concept Plan represented a significant step forward, inasmuch as it demonstrated how such SWM retrofits could be integrated into the evolving plan for redevelopment and enhancement of Belleville's important waterfront area. Demonstrating such integration and getting it formally recognized and adopted as part of larger urban planning processes is an important step on the road to implementation.

Since 2003 the City has not been able to make substantial progress on actual implementation of stormwater facilities along the Bay of Quinte waterfront area. The reasons for this are discussed below.

3.1.3 *Current Conditions Affecting PCP Implementation*

In the 13 years since the original PPCP external and internal conditions within the City may have changed affecting the implementation of the original PPCP recommendations. The RAP process was still relatively new in 1997 and enthusiasm for cleaning up the Bay was strong. The plan of action was well

FIGURE 9: Excerpt from the 2003 East Bayshore Concept Plan prepared for the Waterfront Regeneration Trust and City of Belleville by Hough Woodland Naylor Dance Leinster, dated March 2003



considered and much effort was made to implement the actions. Several stormwater management facilities were constructed in the late 1990s.

However, in the past decade no significant remedial storm water quality pond has been constructed (see **Table 4**).

The Jackson Woods pond on No-Name Creek was constructed in 2000 for the new development only. This site is also capable of “Enhanced” stormwater treatment of an additional 100 ha of existing urbanized lands tributary to the pond. The pond was constructed by the developers to address the treatment required for only the new subdivision, and they did not have a mandate to provide remedial water quality treatment for existing development. Nevertheless, sufficient land was conveyed to the City and a design was prepared that would satisfy Enhanced water quality objectives.

The Canniff Mills ponds and the Putman ponds were also built around 2000, but again were for new development only.

3.1.3.1 Financial Constraints

The City has indicated cost as their primary reason in the delay of implementation of SWM facilities recommended in the 1997 PCP report. Being a relatively small community, the City has a tax base of approximately 48,000 people from whom to raise the capital to construct any proposed remedial treatment facilities. It has been very difficult politically for City staff to obtain direction from Council and funding to construct the needed facilities.

At the same time, recent changes in provincial direction to municipalities require that each completes an asset management plan for their entire publicly owned infrastructure. This process has required significant staff attention and reduced interest in expanding their infrastructure responsibilities with stormwater management facilities.

3.1.3.2 Approval Constraints

The City has also experienced some difficulty obtaining Ministry of Environment (MOE) Certificate of Approval for the construction of retrofit stormwater treatment facilities due to issues related to approval conditions that would require monitoring of facility performance. As discussed above, stormwater management facilities are regulated under the Ontario Water Resources Act that is administered by the MOE. In Belleville, plans to develop the Belleville Marsh pond and the Farley Street pond were held up over disagreements between the City and the MOE over the conditions for approval regarding effluent targets.

Table 4: Stormwater Management Facilities in Belleville

SWM Facility			Contributing Drainage Area	Impervious Level	Storm Sewer Catchment (per 1997 PPCP Report)		Type of Development	Level of Control	
Name	Type	Approx. Date of Construction			Name & Total Drainage Area	% Captured		Water Quantity	Water Quality & Permanent Pool Volume
			(ha)	(%)	(ha)			(m ³)	(m ³)
Jackson Woods	Wetland/Dry Pond	2000	37.2	30	W80 – 207.2	18	Residential	100-yr post-to-pre - 6143	Unknown – less than 1000
Putman Industrial – Pond 'A'	Dry Pond/Shallow Water Hybrid	1999	139.6	80% assumed – not built-out	E10 - 310	45	Industrial	100-yr post-to-pre - 40167	Unknown – forebay w/unknown PP volume
Putman Industrial – Pond 'B'	Dry Pond/Shallow Water Hybrid	1999	22.6	80% assumed – not build-out	E1- 310	7	Industrial	100-yr post-to-pre - 17476	Unknown – forebay w/unknown PP volume
Millennium Parkway – MAC-5	On-line 3 Cell Wetland (No-Name Creek)	1999	95	50	W80 -340	28	Commercial/Residential/Industrial	100-yr post-to-pre - 30000	Level 1 - 6700
Lemoine St.	On-line Wetpond (No-Name Creek) w/Sediment Forebay	1999	75 + 95 (from MAC-5 pond)	83	W80 -340	50	Commercial/Residential/Industrial	100-yr post-to-Tracy Street Storm Sewer Capacity - 16000	Level 1 – 15000
Stanley Park	On-line Dry Pond (Bell)	1997	197.2	40	n/a	n/a	Residential/Industrial	100-yr post-to-pre – 10000	Site-specific controls

SWM Facility			Contributing Drainage Area	Impervious Level	Storm Sewer Catchment (per 1997 PPCP Report)		Type of Development	Level of Control	
Name	Type	Approx. Date of Construction			Name & Total Drainage Area	% Captured		Water Quantity	Water Quality & Permanent Pool Volume
			(ha)	(%)	(ha)			(m ³)	(m ³)
	Creek)							Minor storm event by-passed	implemented
Wal-Mart	Extended Detention Wet Pond	1995	9.8	80	n/a	n/a	Commercial	None – quality storm extended detention provided	Basic - 370
Canniff Mills	Extended Detention 2 Cell Wetpond	1999-2008	74.4	35	n/a	n/a	Residential	None – quality storm extended detention provided	Level 1 - 7442
McFarland Drive	Extended Detention Wetpond	1998	25.0	35	n/a	n/a	Residential/C ommercial	None – quality storm extended detention provided	Level 1 - 2500

The original Bay of Quinte RAP stormwater management guidelines (1993) were target-based requiring effluent not to exceed 25 mg/l of total suspended solids (TSS) and 100 counts per 100 mL of *E.Coli*. As well, the 1993 guidelines included the following discharge targets:

- Dissolved oxygen not to be less than 5 mg/l in summer and 4 mg/l in winter
- Emulsified oils not to exceed 0.05 of the 96 hour LC 50
- pH to be greater than 6.2
- Concentration of hexane extractable substances (exclusive of sulphur) in air dried sediments not be increased above 100 mg/kg on a dry weight basis
- No discharge temperatures in excess of 20 C.

Quinte Conservation administered these guidelines completing reviews of stormwater management around the Bay of Quinte by agreement with MOE until 1998.

In acknowledgement of the difficulty of demonstrating that a proposed design for a new stormwater management facilities would meet all of the specific effluent targets listed above, and recognizing the Ministry of the Environment had a newly published "*Stormwater Management Practices Planning and Design Manual*" (1994), Quinte Conservation began to substitute the effluent target-based objectives with a design objective using the "Level 1" requirements in the 1994 MOE manual. The technical rationale and justification were described in Appendix K of the Belleville PPCP Report (1997). At this time, Quinte Conservation adopted the MOE's "Level 1" requirement for stormwater treatment facility design (essentially a facility sizing guideline) as a more practical approach to defining stormwater treatment requirements for the Bay of Quinte RAP implementation area.

In the early 2000s the Ministry of the Environment began to undertake reviews of stormwater management for the Bay of Quinte region and was not familiar with this change. At the time, their understanding of the RAP was also that stormwater quality objectives should be more stringent than the non-RAP areas. There was also not a clear distinction between design targets for new development vs. retrofit ponds for existing development.

To remove the conflict between practice and guidelines, new Stormwater Management Guidelines for the Bay of Quinte were prepared and adopted in March 2006. These identified an "Enhanced" (formerly "Level 1") stormwater treatment target for all new urban development (as defined in the MOE's updated "*Stormwater Management Planning & Design Manual*", 2003). Ponds designed for remedial treatment of existing development should also achieve the MOE's Enhanced target where possible, but a lower target can be considered (e.g. the MOE's 2003 manual's "Normal" or "Basic" design requirement) if cost and land availability make it unfeasible to construct an "Enhanced" design.

By their nature, remedial stormwater management ponds are intended to reduce pollutant loading from existing development. Developers carry the responsibility of design and implementation for ponds that will mitigate pollution from new development. Thus, the responsibility of design and implementation

for remedial facilities rests with the municipality. Advancement of the PPCP must be the initiative of the City.

3.1.3.3 Evolving and Changing Plans for Waterfront Development

In addition to constraints due to funding and approval requirements, urban growth and changes in land use have reduced or eliminated opportunities for retrofit facilities. An example is the land south of Dundas Street and West of Palmer that was suggested as an option for remedial treatment for Palmer Road outlet (Q30). While that opportunity has been lost, a second location south of the Canadian Pacific Railway also exists that may be suitable for a SWM facility.

The location opportunities for installing retrofit end-of-pipe treatment are typically on City-owned property where outfalls are located. Many such properties are municipal waterfront park areas, and therefore proposed facility locations are often in conflict with the desire to retain and improve high-use park lands. Some of the challenges can be overcome if designers consider the importance of the recreational use and blend their designs to that use, or incorporate improving technologies that reduce the loss of parks and natural upland areas that are connected to the waterfront.

As shown above in Figure 9, for the East Bayfront area of Belleville, explicit allowance was made in the overall development plan for proposed stormwater management facilities. This demonstrates that the City maintained its commitment to construct such facilities, in spite of implementation difficulties caused by lack of funding, and uncertainties surrounding the regulatory approval process and its implications for the City.

3.1.3.4 Changing Priorities about Recreational Water Use

How has waterfront usage changed since the BQRAP action plan was finalized in 1993, and the PPCP was prepared in 1997?

In developing the BQRAP and the 1997 PPCP, there was much focus on bacterial contamination from urban runoff that impacted public beaches. **Table 5** is reproduced from the Remedial Action Plan Beach Closings report (Keene, 2003) showing all the public beaches surrounding the Bay of Quinte that were tested by the health units for bacterial contamination. Riverside beaches for example were posted for high levels of bacteria more often than they were open in most years. Zwick's beach was also often closed.

Of note is the period from 1997 onward when no postings were reported. This period coincides with the closure of the beach by the City. The Health Unit continued to perform sampling and never encountered an *E.Coli* sample result above 100 counts/100 ml. The City later closed the Riverside beaches and no public beach remains open within Belleville.

The Restoration Council has reviewed the RAP criteria for beach closings and has considered the changing recreational usage of the Bay of Quinte. There is increased usage of open water activities such as boating (including jet-ski boating) and water skiing where users come into contact with much diluted

urban runoff. Bacterial concentrations from stormwater discharges are reduced with dilution and die-off. Public health concerns have arguably diminished in significance in reflection of this change of usage.

Table 5: Bay of Quinte Beach Postings

	Bay of Quinte Beaches # of Days Posted							
	Bain Park Trenton	Frankford Park B of Q	Centennial Deseronto	Centennial Northport	Kingsford Salmon R.	Riverside E. Moira R.	Riverside W. Moira R.	Zwick's B of Q
1988	28		7	0		86	86	0
1989	0		8	0	7	81	81	14
1990	14	14	0	0	68	97	97	43
1991	0	30	0	0	28	211	211	0
1992	7	0	0	0	0	108	98	0
1993	0		0	0	0	121	157	0
1994	35	45	0	0	0	97	97	49
1995	8	0	8	0	0	105	105	11
1996	0	15	6			70	70	7
1997	9	63	15	0	7	60	60	0
1998	0	0	15	8	9	107	107	0
1999	35	17	17	0	7	101	101	0
2000	25	20	17	0		64	64	0
2001	18	62	7	6		104	104	0
2002	7	14	14	0		70	84	0

(Blank Cell) Information Unavailable
Stopped Testing

3.1.4 Storm Outfall Sampling results (2008-2009)

Quinte Conservation staff conducted a program of storm outfall sampling in 2008 and 2009. A selected number of outfalls were sampled occasionally in dry weather and in wet weather. The set of outfalls selected for sampling was based on considering outfall characteristics (e.g.; size of drainage area, land use within drainage area) as determined from available information, including the system mapping prepared in the 1997 PCP; as well as consideration of outfall accessibility and other logistical factors.

The sampling program was limited in scope by available resources. Samples collected from dry-weather outfall discharges were sent to the MOE laboratory in Toronto (Resources Road) for analysis for a number of parameters including TSS, nutrients, metals and indicator bacteria (E. coli).

Results of the outfall sampling in Belleville are summarized in Table 6. Further details on the sampling program and outfall inspections, are provided in Appendix B.

3.2 Review of current plans/programs

Finalizing the Belleville PPCP requires review of all City programs that are related to

1. Source control (Street sweeping, catchbasin cleaning, catchbasin labelling, cross-connection investigation, or any other program that helps reduce storm sewer contamination)
2. Stormwater management/treatment: maintenance of existing ponds, plans to construct ponds to deal with existing untreated outfalls
3. Other: public awareness/education programs

TABLE 6
SUMMARY OF 2008-2009 STORM OUTFALL SAMPLING IN BELLEVILLE, ONTARIO
 conducted by Quinte Conservation

Location	Outfall ID	Location Description	Estimated drainage area	Pipe	Land use	Location Coordinates Obtained by	Bacteriological																Metals									
							TSS		TS		TP		E.coli GM		FS		Cu		Fe		Cd		Pb		Ni							
							Target level >>		General guideline		0.03 PWQG		100 PWQG				5.00 PWQG		300 PWQG		0.10 PWQG		5.00 PWQG		25.00 PWQG							
							No. of samples		AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY				
Wet	Dry	mg/L	mg/L	mg/L	mg/L			#/100mL	#/100mL	#/100mL	#/100mL	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L									
BE10	E10	Adam St	320	60" pipe	Industrial park	Coords from GPS unit by Quinte Conservation staff, Jan 2008	6	4	155	1	549	759	0.18	0.06	No data	76	No data	138	11.71	2.98	1,378	50	1.19	1.07	3.00	4.34	3.52	2.18				
BE70	E70	College Street	28	72" pipe	Mixed urban	Coords from GPS unit by Quinte Conservation staff, Jan 2008	5	1	139	84	362	662	0.25	0.12	No data	44	No data	36	21.05	18.00	1,357	350	1.02	0.52	19.36	4.06	3.56	1.23				
BE71	E71	College Street	118	72" pipe	Mixed urban	Coords from GPS unit by Quinte Conservation staff, Jan 2008	6	1	120	1	369	632	0.14	0.01	No data	3	No data	12	23.72	7.84	1,097	19	0.93	1.99	21.37	13.00	3.08	0.70				
BE80	E80	Station Street/Cannifton Rd.	65.9	15" to ditch	Urban core	Per 1997 Belleville PCP report Table 2-3	4	2	47	No data	321	No data	0.17	No data	No data	No data	No data	No data	7.24	No data	778	No data	0.36	No data	4.56	No data	1.98	No data				
BE100	E100	Station Street west of Pinnacle Street	15	24" pipe	Urban core	Per 1997 Belleville PCP report Table 2-3	4	6	26	5	451	625	0.09	0.05	No data	888	No data	610	6.39	2.05	311	67	0.72	1.08	8.94	6.84	0.80	1.45				
BE120	E120	Bridge Street W./Front Street	40	42" pipe submerged	Urban core	Per 1997 Belleville PCP report Table 2-3	1	2	30	No data	62	No data	0.07	No data	No data	No data	No data	No data	4.52	No data	176	No data	0.78	No data	6.09	No data	1.30	No data				
BQ10	Q10	Avondale/Wright Ave	112	42" pipe to ditch	Residential	Coords from GPS unit by Quinte Conservation staff, Jan 2008	3	2	11	No data	297	No data	0.08	No data	No data	No data	No data	No data	2.69	No data	300	No data	1.16	No data	1.25	No data	0.86	No data				
BQ30	Q30	Palmer Road	49	36" pipe to ditch	Residential & institutional	Coords from GPS unit by Quinte Conservation staff, Jan 2008	6	1	43	43	235	457	0.16	0.21	No data	420	No data	2,400	6.32	14.40	689	35	0.61	0.76	2.91	7.09	1.47	1.23				
BQ80	Q80	Foster Avenue	118	27" pipe (circa 1997, may since have been replaced by City)	Residential & commercial	Estimated by HPC from Google Earth	3	2	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data				
BQ85	Q85	Keegan Pkwy. South of Belleville General Hospital	8.1	Local ditch	Mixed urban	Per 1997 Belleville PCP report Table 2-3	4	2	13	4	277	653	0.53	0.44	No data	275	No data	930	18.40	23.10	267	158	0.90	1.04	7.79	8.50	1.01	0.55				
BQ110	Q110	Fairley Avenue	21	36" pipe to ditch	Mixed urban	Coords from GPS unit by Quinte Conservation staff, Jan 2008	6	1	34	10	269	1,380	0.18	10.50	No data	42,000	No data	2,100	7.50	21.50	362	117	0.96	3.45	5.95	14.90	0.88	4.10				
BQ120	Q120	Bradgate	69	42" pipe to ditch	Mixed urban	Coords from GPS unit by Quinte Conservation staff, Jan 2008	5	1	51	9	319	194	0.15	0.11	No data	520	No data	2,000	5.86	11.60	1,032	43	1.00	0.81	3.95	3.38	1.63	2.12				
BW40	W40	Moir Street east near C.N.R.	24	27" pipe to ditch	Mixed urban	Per 1997 Belleville PCP report Table 2-3	4	2	195	6	323	1,886	0.09	0.02	No data	1,502	No data	865	16.86	7.31	1,416	75	0.72	2.43	17.81	15.42	2.99	3.87				
BW80	W80	Moir Street	207	42" x 42" box pipe	Urban core	Estimated by HPC from Google Earth	4	2	197	No data	412	No data	0.15	No data	No data	No data	No data	No data	10.58	No data	1,525	No data	0.85	No data	19.23	No data	3.54	No data				

Accordingly, Quinte Conservation interviewed City staff to understand their opinions/needs for PPCP and to determine how frequently they conduct their maintenance activities. Pollution prevention and control includes all activities that reduce pollution from entering a waterway. These include measures that reduce pollutants at the source such as street sweeping, cleaning out catch basin sumps, eliminating cross connections, reducing peak flows events that tend to overload sewage treatment plants, stoop and scoop by-laws etc. End-of-pipe controls such as stormwater management ponds and oil-grit separators are used to capture pollutants after they have entered the drainage system. Responses were provided for some questions and these are included below. Specific information was not returned regarding individual stormwater management facilities.

3.2.1 Street Sweeping

Sediment from winter road maintenance, animal waste, metals and oils from automobiles, and pollutants deposited from the atmosphere all end up on city streets. Rainfall and snowmelt events wash these materials into streams and rivers and finally the Bay of Quinte. Street sweeping is the first line of defence (a source control) for pollution prevention for these materials.

The City has a fairly intensive program to maintain city streets. Curbed streets are swept once per month with major arterial and collector streets targeted for once per week. Uncurbed streets are swept once per year. This is considered an acceptable frequency.

3.2.2 Pet Litter Control (Stoop and Scoop) By-law

The City has a stoop and scoop by-law that is intended to reduce the amount of bacteriological contamination that washes off into the storm sewer systems. In addition, they have an off-leash, fenced dog walking area in Zwick's Park that is a popular place for animal owners to bring their dogs. It provides an alternative to roads and sidewalks for exercising their dogs. The use of this area reduces the use of roads and sidewalks. The stoop and scoop requirement applies to this area.

3.2.3 Catchbasin Cleanout

Catchbasins are often the first point of entry for drainage into the storm sewer system. They have sumps in the bottom that collect the large fraction of sediment (grit). The sumps are usually 0.3 m in depth and catchbasins measure 0.9 m x 0.9 m. This means they can collect up to 0.25 m³ of material. Once sumps fill the grit is transported through the sewer pipes and is deposited along with the fine fractions into receiving waters. Cleaning out the sumps on a regular basis reduces the volume of sediment and pollutants associated with the sediment that reaches the Bay of Quinte. The frequency of cleanout is once per year. Sediment removal is accomplished by vacuum truck. Removed sediment is taken to a drying facility and disposed in an approved landfill site.

If catchbasin sumps are found to be full each maintenance cycle the frequency should be increased. In particular, storm sewer systems that drain directly to the receiving waters and have no end of pipe treatment should be targeted for increased frequency of cleanout if they are found to be full each maintenance cycle. Those which drain to a stormwater management facility have a second line of defence in the sediment forebays. However, higher sediment accumulation rates in storm facilities will

increase their maintenance frequency. The comparatively lower cost of frequent catchbasin cleanout must be weighed with the high cost of infrequent maintenance of stormwater management facilities.

3.2.4 Oil-Grit Separators

Also known as OGS units, oil-grit separators are often used as end-of-pipe treatment in smaller catchment areas (e.g. less than 2 ha) where space is limited. They are often placed as inlets into stormwater management facilities in a treatment train approach to capture the major sediment fraction allowing for easier cleanout. An additional advantage is they are able to trap oily substances that would otherwise not be treated in ponds or wetlands.

The City of Belleville has a number of existing OGS units under municipal ownership/operation, including “Stormceptor” and “Storm King” brands. These are cleaned once per year. If they are not maintained adequately they will bypass sediment to the receiving waters. It would be important for maintenance staff to record the quantities of sediment and oils that are removed and compare to capacities for each to decide on the adequacy of the removal frequency. The environmental services department should record these volumes and determine if a more frequent cleanout is warranted.

3.2.5 SWMF Maintenance

Stormwater management facilities require infrequent major maintenance as well as frequent minor maintenance. Minor maintenance includes inspections, removal of any accumulated debris or blockages at inlet/outlet structures, confirmation that signage and fencing are secure, checks on sediment accumulation, etc. These activities may be carried out from intervals ranging from monthly to annually. Each facility will have a maintenance procedure that would have accompanied the design brief. Municipalities may adapt the maintenance procedures as needed. The facility maintenance will have ongoing costs that must be considered in the annual operating budgets. In 2010, \$40,000 was allocated to SWMF maintenance. This was the first time a line item for SWMF maintenance was included in the City’s budget for maintenance. It has not been determined if this is an adequate amount and it is expected that with some experience in major maintenance this number will change.

3.2.6 New Retrofit Facilities

Facilities that have been identified in the 1997 PPCP as retrofit end-of-pipe treatment for existing built-up areas are budgeted as needed. Management staff prepare annual capital projects requests for budget review and a SWMF would be considered as a one-time cost. There is not a capital reserve set aside for SWMFs. In City council there is moderate to low support for construction of new facilities. Some cite concerns about impacts on adjacent lands and other are concerned with the high cost. There are other demands and competing priorities for the tax revenues that limit the implementation of the PPCP recommendations for retrofit facilities.

3.2.7 Sanitary Cross-connections

Cross-connections are believed to exist in the older parts of the City. As roads and sewer systems are upgraded cross-connections are eliminated. In 2009–2010 the City undertook ten infrastructure upgrades. Several streets have yet to be addressed and therefore some cross-connections remain.

3.2.8 Public Awareness Programs

Education programs can be developed and implemented to raise awareness of ways that human activities introduce pollution to the Bay of Quinte. Changing the habits of the population can have an effect on the quality of stormwater runoff and the levels of pollution entering the Bay of Quinte. Two such programs have been implemented in Belleville and are discussed below.

3.2.8.1 Yellow Fish Road

The conservation authority has promoted Trout Unlimited Canada's Yellow Fish Road program that works with local youth to promote the awareness and understanding of the linkages between the city catchbasins and the streams. School children, teachers and parents participate with conservation authority and city staff to paint yellow fish on streets near catch basins to remind residents that what goes down the catchbasin is released in a stream and affects fish. The program is widely successful across Canada and is beginning to be implemented across the Bay of Quinte region. To date, two residential streets within the City of Belleville have been painted. For more information visit the Yellow Fish Road program website <http://www.yellowfishroad.org/>.



FIGURE 10: Children painting the curb at a catchbasin in Belleville as part of the Yellow Fish Road program.

3.2.8.2 Stream of Dreams

Another cross Canada program implemented by the conservation authority in cooperation with municipalities is called Stream of Dreams. Stream of Dreams is a copyrighted program out of British Columbia that the conservation authority is licensed to deliver through the Stream of Dreams Mural Society. Its intention is to raise awareness of society's effect on streams and fauna. Again, working with school children and teachers, authority staff and other volunteers assist children in learning about their local waterways and how to protect them. Children then paint wooden fish and place them on prominent fences on the school yards or in public parks to create awareness and discussion in the community around water. One such demonstration is on the fence at Zwick's Island. For more information on the Stream of Dreams program visit www.streamofdreams.net.



FIGURE 11: An example of a Stream of Dreams installation along a school fence.

3.3 Identification of information gaps/needs

Through review of available information, and consideration of current status of existing programs, some information gaps and requirements have been identified. These are information items or information-gathering activities that should be addressed as part of PPCP implementation.

The primary information needs or gaps that have identified fall into two categories:

- **Municipal drainage infrastructure inventory and mapping:** While no significant deficiencies have been identified, a review is required to ensure information is complete, and is being kept up to date. Complete and accurate information on the existing drainage system including all stormwater treatment devices or facilities, is needed to support the PPCP.
- **Ongoing monitoring of storm outfall discharges:** Regular monitoring of discharges to the Bay from storm outfalls is needed to help monitor system performance and ensure that any contamination problems are being addressed.

Further discussion of how the City should proceed to address these needs, is provided below as part of recommendations for action.

3.4 Recommendations for action

The following recommendations are put forward for consideration by the City of Belleville.

3.4.1 Address Dry-Weather Outfall Contamination:

Observed dry-weather contamination of storm sewer discharges should be addressed. Priorities for action have been identified based on consideration of the sampling results, as well as consideration of the relative size of drainage area. See Table 7 below.

For outfalls showing significant dry-weather bacteriological contamination, then the immediate action required is for investigation within the tributary storm pipe or ditch system to attempt to locate sources. Sources could include cross-connection with sanitary sewer pipes, or possibly wildlife activity within the pipes.

High levels of phosphorus or other contaminants in dry-weather discharge could also indicate sewage contamination, and would further indicate the need for tracking down and eliminating sources.

Investigative work would consist of:

- Review of engineering drawings with municipal operations staff to identify any possible locations where sewer cross-connection might exist. Are there, for example, locations within sanitary sewer system at which the sanitary system can overflow into the storm pipe system?
- Sampling at various manholes within the storm pipe system to try to narrow down the area that the contamination is coming from.

- Potentially the use of dye testing to check for direct plumbing connections into the storm sewer system.

Outfall	Notes
BE100: Station St near Pinnacle St	DW bacterial and Pb contamination
BQ30: Palmer Road	DW bacterial, Cu and Pb contamination
BQ110 Farley Avenue	DW bacterial contamination, as well as high DW phosphorus, may indicate direct sewage contamination
BQ120 Bradgate	Low-level DW bacterial contamination, and DW copper contamination
BW40: Moira Street near CNR	DW bacterial, Cu and Pb contamination

3.4.2 Control Wet-weather Discharges:

The wet-weather data are more limited, and do not include bacteriological indicators. However, previous investigations have shown that most storm events will result in bacteriologically contaminated runoff (i.e. *E.coli* > 100 #/100 mL) from urban catchments.

Priorities for retrofit stormwater treatment measures have been chosen based on considering size of drainage catchment, as well as the sampling results.

Table 8 is a list of outfalls that should be considered as priorities for addressing wet-weather discharges.

Wet-weather control could be achieved by retrofit measures such as installation of end-of-pipe treatment facilities (settling ponds or tanks), or through runoff reduction measures within respective catchment areas. Elimination of sources of dry-weather contamination will help reduce wet-weather pollutant discharges.

The 1997 PCP report had identified location opportunities to install retrofit end-of-pipe facilities to treat weather discharges from the Adam Street outfall (BE10) along the east side of the Moira River, and the Farley Avenue (BQ110) and Bradgate (BQ120) outfalls along the East Bayshore waterfront. Refer to Figure 7 above.

Outfall	Drainage area	Concerns
BE10: Adam Street	150 ha	Wet-weather loadings of TP and metals
BQ30: Palmer Road	49 ha	Wet-weather TP and E.coli loadings
BE70 & BE71: College Street outfalls	146 ha	Wet-weather metals and TP loadings
BE80: Station Street	66 ha	Wet-weather TP and metals loadings
BQ110: Farley Avenue and BQ120 Bradgate outfall	21 ha	Nutrient, bacterial and metals loadings to waterfront

At this stage, the City needs to review these opportunities in light of current planning for this portion of the East Bayshore, to determine whether or not these retrofits can in fact proceed in future if resources become available. Consideration needs to be given to whether the proposed locations for retrofit SWM facilities need to be refined or better defined, and whether these locations need to be clearly referenced in current planning documents related to this area of Belleville, so that opportunities are preserved and formally acknowledged.

3.4.3 Review Municipal Infrastructure Inventory and Mapping:

The City of Belleville should undertake a review of its existing database and GIS mapping of municipal drainage infrastructure (including all stormwater treatment or management facilities) to ensure that the existing inventory is complete and accurate. No significant deficiencies have been identified as part of this project; however, there may be some minor deficiencies such as incomplete mapping of existing oil-grit separator units, or incomplete mapping of known sewer cross-connection locations.

3.4.4 Storm Drainage System Monitoring

The City of Belleville should undertake a program of routine inspection of storm outfalls and sampling of dry-weather discharges, in order to track current conditions and identify contamination problems if and when they arise. A monitoring program should be designed and implemented, possibly with assistance from Quinte Conservation.

Procedures should be put in place to record and store all information gathered, and to document what actions are taken in response to any identified problems such as discharge contamination.

4. **QUINTE WEST (FORMER TRENTON)**

4.1 **Basis for PCP Update**

A PPCP update for Trenton has been undertaken by reviewing the implementation status of the 1998 recommendations from the Trenton PCP report, reviewing the 2008-2009 storm outfall sampling results, and considering other relevant information including input received from staff of the City of Quinte West.

4.1.1 **Review of 1998 PCP**

The 1998 study outlined a strategy for stormwater management in Trenton incorporating the following two principles:

1. At a minimum, stormwater pollutant loads entering the Trent River and Bay of Quinte should not be allowed to increase.
2. All practical measures to reduce these loads also should be taken.

The following recommendations were made to implement the strategy.

Table 9	
Summary of Recommendations in 1998 Trenton Pollution Control Plan	
No. 1	Maintain Existing Contamination Control Programs The City should maintain programs of routine street sweeping and catchbasin cleaning, along with continuing the effort to ensure there are no sanitary-to-storm sewer cross-connections.
No. 2	Review Existing Programs for Possible Improvements: The City should conduct a review of existing programs to determine if there are any ways these programs can be improved or optimized within available resources.
No. 3	Maintain Drainage Infrastructure Inventory Information The City should continue to maintain accurate information on the physical condition and status of Trenton's storm drainage system.
No. 4	City-wide Review of Runoff Reduction Possibilities That the City carry out a general review of private and public properties to identify which properties might be candidates for simple measures such as downspout redirection. Fund
No. 5	Review Municipal Sewer/Road Projects during planning and design That the City adopt a policy requiring all municipally-funded road and sewer construction/reconstruction projects be reviewed for opportunities to implement cost-effective stormwater pollution control and/or stormwater treatment.
No. 6	Regulatory Practice for New Development In addition to controlling and reducing contamination in the existing built-up area, stormwater management is needed on all new development or redevelopment properties, to ensure that stormwater pollutant loadings to the Trent River and Bay do not increase over time. The existing Quinte RAP stormwater guidelines continue to be applied to new development proposals unless subject to 'cash in lieu' (see below).
No. 7	Adopt Cash-in-lieu Option for New Development Properties The 1998 study suggested adoption of a 'cash-in -lieu' policy whereby instead of installing on-site

Table 9	
Summary of Recommendations in 1998 Trenton Pollution Control Plan	
	<p>stormwater management systems, property developers could be asked to contribute towards stormwater pollution prevention measures elsewhere within the municipality. The 1998 PCP recommended that the City review the administrative acceptability and implications of implementing a cash-in-lieu stormwater policy for new development.</p> <p>If it proves feasible and acceptable, then the cash-in-lieu option should be adopted by City of Quinte, in accordance with Recommendation 8 and 9 below.</p>
No. 8	<p><i>Define Stormwater Measures that can be Funded via Cash-In-Lieu</i></p> <p>The City, in cooperation with other stakeholder agencies, should prepare a list of the specific types and categories of stormwater pollution reduction measures that would be eligible for funding using cash-in-lieu contributions.</p>
No. 9	<p><i>Develop a Protocol that Describes How the Cash-In-Lieu Policy will be Administered</i></p> <p>The City should develop a protocol for deciding on how cash-in-lieu would be implemented on a case-by-case basis as development proposals are received. This protocol should include a requirement to confer with other stakeholder agencies to determine whether cash-in-lieu should be considered in the specific development case at hand; and, if so, to determine what uses the cash-in-lieu money would ultimately be put.</p>

4.1.2 Current Status of PCP Recommendations

In 2003 and in 2010 Quinte West staff were interviewed regarding their practices and efforts toward control and reduction of pollution from city drainage.

- Quinte West has successfully implemented many of the recommendations of the 1998 study.
- Source control measures such as increased street sweeping, disconnection of downspouts, and elimination of sanitary-to-storm cross-connections have all been implemented.
- Road salt application has been changed to reduce use of MgCl resulting in less sediment wash-off from the road.
- The cash-in-lieu policy has been implemented and expanded to cover the whole of Quinte West.
- A comprehensive inventory of all drainage infrastructure was developed in GIS.
- In short, City of Quinte West has accepted and acted on the 1998 recommendations.

4.1.2.1 Retrofit Stormwater Quality Treatment

End-of-pipe storm outfall treatment was considered in developing the 1998 PCP for Trenton. Although it was an option that was not ruled out for implementation, it was not determined to provide a significant benefit for the cost. Two of the largest systems (Dixon Road and Victoria Avenue) would provide the greatest water quality benefit if retrofit SWM were undertaken. To date, no retrofit facility has been constructed.

4.1.2.2 New Development

For areas of the City undergoing new development the City has been supportive of the planning, construction and ultimately the ownership of new water quality treatment facilities. Several new stormwater management facilities have been implemented since the completion of the Trenton PPCP in 1998.

Table 10 lists the facilities in Quinte West and information that could be obtained regarding the design and approximate year of construction.

4.1.3 Current Conditions Affecting PCP Implementation

Despite commitment by City staff to the PPCP completed in 1998, they indicated the lack of a firm and sufficient budget for carrying out pollution prevention and control measures is their greatest challenge to full implementation of the 1998 recommendations.

Other conditions that have changed that have affected the implementation of the PPCP are discussed below.

4.1.3.1 Soil Contamination

An unexpected situation arose as staff were planning an upgrade to the Victoria Avenue sewer system when they encountered contaminated soils where a retrofit pond was proposed. The cost to remove the soil was prohibitive, and the City was concerned that infiltration from the pond to surrounding soils could mobilize contamination. That location for a retrofit pond was unsuitable.

4.1.3.2 Monitoring Requirements for Certificate of Approval

Similar to Belleville's concerns with monitoring requirements, Quinte West had great difficulty providing confirmatory sampling that was satisfactory to the Ministry of the Environment for the Canadian Tire stormwater management pond. It was 14 years after construction of the pond before the sampling results were satisfactorily received by the Ministry of the Environment. Quinte West staff are very reluctant to build or own a facility for this reason.

4.1.3.3 Phosphorus Control

City staff provided comment on the phosphorus loadings from storm sewer systems. They thought that the best approach to reducing stormwater phosphorus loadings would be to develop a 'cap and trade' phosphorus system for the Bay of Quinte. Under this system, a phosphorus loading limit would be placed on the City of Quinte West. The City could then determine the cost per unit of phosphorus reduction under the stormwater and STP scenarios and pick the most financially sound solution.

TABLE 10: Stormwater Management Facilities in Trenton, Ontario (within City of Quinte West)

Table 10 SWM Facility in Trenton (Quinte West)			Contributing Drainage Area	Impervious Level	Storm Sewer Catchment		Type of Development	Level of Control	
Name	Type	Approx. Time of Construction			Name & Total Drainage Area	%Captured		Water Quantity	Water Quality & Permanent Pool Volume
			(ha)	(%)	(ha)			(m ³)	(m ³)
Wild Orchid- Telephone Rd./Wooler Rd.	2-Downstream Defenders (OGS)– 1800mmΦ and 1200mm Φ	2007	3.8	30	n/a	n/a	Residential	none	none
Rosewood Acres Phase II – Huffman St./Trent St. Frankford	Dry Pond & 2- Stormceptors (OGS) – Model 4000 and Model 9000	2008	52.5	7	n/a	n/a	Residential	100-yr post-to- pre - 4600	none
Appledene – 2 nd Dug Hill Rd/Dundas St. W.	Wetpond	2008	23.1	35	n/a	n/a	Residential	none	Level 2 – Perm. Pool 1390 & ED 1900
Brett Park Development – Nicholas St. Trenton	Wetpond	2001	13.6	35	—	47	Residential	100-yr post-to- pre - 1620	Level 1 - 1360
Central Industrial Park – South Limits Creelman Ave; North Limits CNR; East Limits Sidney Street Trenton	Dry Pond w/Forebay	2004	26.4	70	n/a	n/a	Industrial	none	ED 1700

Table 10 SWM Facility in Trenton (Quinte West)			Contributing Drainage Area	Impervious Level	Storm Sewer Catchment		Type of Development	Level of Control	
Name	Type	Approx. Time of Construction			Name & Total Drainage Area	%Captured		Water Quantity	Water Quality & Permanent Pool Volume
			(ha)	(%)	(ha)			(m ³)	(m ³)
Crestview Estates – Stage I and II Telephone Rd. just west of 2 nd Dug Hill Rd. intersection Trenton	Dry Pond	2003	19.1	30	n/a	n/a	Residential	100-yr post-to- pre – 2170	none
Frost Subd. Blocks 34 and 35, Registered Plan 137, Frankford	Extended Detention Wetland	1996	75	5	n/a	n/a	Residential	None	Level 1 -Perm. Pool 800 & ED 4500
Stockdale Subd. Part of Lot 3, Conc. 7, Murray Twsp., Northumberland Cty.	Extended Detention Dry Pond	1993	23.2	24	n/a	n/a	Residential	3890	ED 2070
Montrose Rd. Subd. North Limits CP Rail Line; South Limits Parkside Dr.; East Limits Montrose Rd.; West Limits Open Land	Dry Pond	1997	31.0	35	n/a	n/a	Residential	100-yr post-to- pre – 8200	none
Scott Subd.	2 Dry Ponds	1996	4.9	20	n/a	n/a	Residential	100-yr post-to-	none

Table 10 SWM Facility in Trenton (Quinte West)			Contributing Drainage Area	Impervious Level	Storm Sewer Catchment		Type of Development	Level of Control	
Name	Type	Approx. Time of Construction			Name & Total Drainage Area	%Captured		Water Quantity	Water Quality & Permanent Pool Volume
			(ha)	(%)	(ha)			(m ³)	(m ³)
Part of Lot 4/5, Conc. 6, Twp. of Murray, Northumberland Cty., west of Stockdale								pre Pond A-240 Pond B-350	
Rollins Commercial/Industrial Subd. North Limits 401; South Limits CNR Line; East Limits Gregory Rd; West Limits Sidney St.	2 Dry Ponds	1989	33.8	35	n/a	n/a	Commercial/Industrial	100-yr post-to-pre Pond A-1100 Pond B-2500	none

TABLE 11: Summary of storm outfall sampling results, 2008-2009, Trenton, Ontario

TABLE 10
SUMMARY OF 2008-2009 STORM OUTFALL SAMPLING IN TRENTON, ONTARIO
 conducted by Quinte Conservation and Lower Trent Conservation Authority

Location	Outfall ID	Location Description	Estimated drainage area	Pipe	Land use	Location Coordinates Obtained by	No. of samples		TSS		TS		TP		Bacteriological				Metals										
							Wet	Dry	mg/L		mg/L		mg/L		E.coli GM		FS		Cu		Fe		Cd		Pb		Ni		
							Wet	Dry	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET
									25	General guideline			0.03	PWQG	100	PWQG			5.00	PWQG	300	PWQG	0.10	PWQG	5.00	PWQG	25.00	PWQG	
TA	TA	Highway 33 just north of Highway 401, west side of Trent River	Unknown	Circular CSP unknown size		Per Hand held GPS	4	2	3	2	348	345	0.02	0.02	No data	40	No data	0	0.88	1.18	52	186	0.76	0.72	3.90	8.02	0.44	0.61	
TB	TB	Front Street, west side of Trent River	2.2	300 mm pipe		Per Hand held GPS	4	0	186	No data	536	No data	0.22	No data	No data	0	No data	No data	18.05	No data	1,519	No data	1.62	No data	15.15	No data	2.72	No data	
TC	TC	Dixon Drive, east side of Trent River	126.1	66" concrete pipe	Mixed urban	Per Hand held GPS	4	4	74	3	527	691	0.34	0.08	No data	5,440	No data	740	10.45	6.89	585	27	0.88	1.15	7.39	6.23	1.24	1.30	
TD	TD	Ontario St. marina, east side Trent River	13.9	600 mm pipe		Per Hand held GPS	4	0	48	No data	220	No data	0.18	No data	No data	0	No data	No data	11.94	No data	866	No data	0.67	No data	8.10	No data	4.68	No data	
TE	TE	Mouth of Trent River, west side of river	67.3	900 mm pipe		Per Hand held GPS	4	2	125	3	601	236	0.14	0.02	No data	300	No data	140	12.89	2.71	714	52	1.15	1.08	15.96	5.66	1.68	0.98	
TF	TF	McGill Street dog park	65.4	1200 mm pipe		Per Hand held GPS	4	3	164	3	462	1,036	0.29	0.02	No data	7,139	No data	0	19.08	4.43	1,056	38	1.14	0.77	16.42	10.01	2.59	1.74	
TG	TG	2nd Dug Hill Road	50.5	825 mm pipe		Per Hand held GPS	4	3	36	8	419	497	0.13	0.01	No data	11	No data	63	7.48	1.68	405	94	0.90	0.60	7.83	2.08	1.14	0.49	

4.1.4 Storm Outfall Sampling results (2008-2009)

Staff of Lower Trent Conservation Authority and Quinte Conservation conducted a program of storm outfall sampling in 2008 and 2009 that included outfalls in Trenton, Ontario. A selected number of outfalls were sampled occasionally in dry weather and in wet weather. The set of outfalls selected for sampling was based on considering outfall characteristics (e.g.; size of drainage area, land use within drainage area) as determined from available information, including information available from the 1997/1998 PCP; as well as consideration of outfall accessibility and other logistical factors.

Samples collected from outfall discharges were sent to the MOE laboratory in Toronto (Resources Road) for analysis for a number of parameters including TSS, nutrients, metals and indicator bacteria (E. coli).

Results of the outfall sampling in Trenton are summarized in Table 10. Further details on the sampling program and outfall inspections, are provided in Appendix B.

4.2 Review of current plans/programs

The City has ongoing programs designed to reduce the pollutant loading to the bay originating from City streets through their ditches and storm sewer systems. These are generally maintenance programs intended to reduce sediment transport through drainage systems. As noted earlier, they are budget constrained and this affects the frequency of maintenance efforts. There is no active plan to construct retrofit ponds for reasons discussed earlier, but there is a willingness to consider OGS type water quality units.

4.2.1 Drainage Planning

Quinte West participated in a regional master drainage planning project funded through the Great Lakes Sustainability Fund and the Ministry of the Environment in which the Mayhew Creek subwatershed was studied. Areas planned for new development were investigated through hydrologic modelling, and locations for central stormwater management facilities were identified. Investigators developed generalized facility concepts for outlet controls and determined detention and retention volumes and overall footprints of each pond.

By this process, the City hopes to reduce the numbers of smaller SWMFs by encouraging planned, sharing of facilities between developments. It is hoped that more efficient SWMFs treating larger catchment areas will be constructed and that overall maintenance costs will be minimized.

The Master Drainage Plan forms a supporting document for a Secondary Plan that will preserve the general locations of the stormwater management facilities. While the locations are protected from development, there is opportunity for change in the facility placement through negotiation with the City and developers. In Quinte West, developments proceed in small phases of 15 to 30 lots and the experience gained is that the establishment of centralized facilities is very difficult when not all contributors are ready to share the high construction costs compared to the small profits in each phase. The Master Drainage Plans assist in the negotiations for cost sharing and provide an opportunity for the municipality to take the lead on planning and establishment of the facilities. Facilities usually need to be

constructed early in the development and the municipality could upfront those costs and charge it back to developers as they come on board.

4.2.2 Street Sweeping

The City has a regular program of street sweeping where all streets are swept a minimum of once per year after the spring melt. Downtown streets are swept as frequently as three times per week in the spring time.

4.2.3 Catchbasin Cleanout

Catchbasins are typically the first point of entry for drainage into the storm sewer system. They have sumps in the bottom that collect the large fraction of sediment (grit). The sumps are usually 0.3 m in depth and catchbasins typically measure 0.9 m x 0.9 m. This means they can collect up to 0.25 m³ of material. Once sumps fill the grit is transported through the sewer pipes and is deposited along with the fine fractions into receiving waters. Cleaning out the sumps on a regular basis reduces the volume of sediment and pollutants associated with the sediment that reaches the Bay of Quinte. The frequency of cleanout is once every other year. Sediment removal is accomplished by vacuum truck. Removed sediment is taken to a drying facility and disposed in an approved landfill site.

If catchbasin sumps are found to be full each maintenance cycle the frequency should be increased. In particular, storm sewer systems that drain directly to the receiving waters and have no end of pipe treatment should be targeted for increased frequency of cleanout if they are found to be full each maintenance cycle. Those which drain to a stormwater management facility have a second line of defence in the sediment forebays. However, higher sediment accumulation rates in storm facilities will increase their maintenance frequency. The comparatively lower cost of frequent catchbasin cleanout must be weighed with the high cost of infrequent maintenance of stormwater management facilities.

4.2.4 Sewer Cross-Connections

The City conducts annual camera and infiltration investigations, which identifies cross-connections. There is also a by-law prohibiting connecting sump-pumps and down spouts to sanitary systems. Smoke tests have not been completed in a long time.

There is a lack of funding issue with disconnecting cross-connections. As stated previously, the maintenance budget is used to fix cross-connections; however, this budget is consistently underfunded. Consequently, identified cross-connections do not have high priority and are therefore seldom corrected.

There are by-law penalties for illegal connections of downspouts and sump pump drains to sanitary sewer system, but these are not high enough to cover the cost of disconnection.

4.2.5 SWM Pond Maintenance and Construction

Due to the constrained budget, municipally-owned SWM ponds are not maintained. For an example, the oldest pond the municipality owns is the Canadian Tire SWM pond which was built in 1995. This pond

has not been maintained. Just recently, the City has managed to have the MOE C. of A. requirement that they need to monitor influent/effluent retracted.

City staff emphasized the fact that the municipality does not own a lot of stormwater management ponds. In fact, the municipality is a very reluctant owner of SWM ponds and has made an effort to minimize the amount of ponds being built. The municipality prefers OGS units and softer engineering techniques such as swales to achieve stormwater quality objectives. Water quantity control can be achieved via dry vegetated swales or underground pipe storage. They are also of the opinion that residents do not want standing water in their backyards.

The City has taken this view of SWM pond ownership due to lack of funding for maintenance. They may change their opinion on pond development and operation if they were able to obtain funding through more development charges or a provincial program.

4.2.6 Cash-in-Lieu Program

Quinte West has adopted a cash contribution formula that may be made in lieu of constructing small stormwater management facilities to address water quality. Cash that is collected in this program are designated to construction of facilities either in the general location of the project or potentially in another area of the city. The intention is that the program will reduce inefficient and costly installation of many small SWMFs and fund the construction of larger retrofit ponds in an area of known need that will have a much higher benefit for the cost. The formula used by the City dates to 1998 and needs to be updated to reflect 2009 construction costs. It does not take into account the cost of pond maintenance. The value of the cash-in-lieu account was not provided.

Given that the municipality has a concern with constructing retrofit facilities, there is a need to review the cash-in-lieu program to determine its effectiveness if cash is being collected towards construction of facilities that are not actively being planned.

4.2.7 Yellow Fish Road Program

The conservation authority has promoted Trout Unlimited Canada's Yellow Fish Road program that works with local youth to promote the awareness and understanding of the linkages between the city catchbasins and the streams. School children, teachers and parents participate with conservation authority and city staff to paint yellow fish on streets near catch basins to remind residents that what goes down the catchbasin is released in a stream and affects fish. The program is widely successful across Canada and is beginning to be implemented across the Bay of Quinte region. The Canadian Forces Base in Trenton saw the first catchbasins painted in Quinte. For more information visit the Yellow Fish Road program website <http://www.yellowfishroad.org/>.



Figure 12: A painted catchbasin.

4.2.8 *Stream of Dreams*

Another cross Canada program implemented by the conservation authority in cooperation with municipalities is called Stream of Dreams. Stream of Dreams is a copyrighted program out of British Columbia that the conservation authority is licensed to deliver through the Stream of Dreams Mural Society. Its intention is to raise awareness of society's effect on streams and fauna. Again, working with school children and teachers, authority staff and other volunteers assist children in learning about their local waterways and how to protect them. Children then paint wooden fish and place them on prominent fences on the school yards or in public parks to create awareness and discussion in the community around water. The program has not yet been implemented in Quinte West, but there is some interest in schools. For more information on the Stream of Dreams program visit www.streamofdreams.net.



Figure 13: Another example of a Stream of Dreams installation along a school fence.

4.3 *Identification of information gaps/needs*

With respect to inventory and mapping of existing drainage infrastructure, there are no significant information gaps identified for Trenton.

As with Belleville, regular monitoring of discharges to the Bay from storm outfalls is needed to help monitor system performance and ensure that any contamination problems are being addressed. Further discussion is provided below as part of recommendations for action.

4.4 *Recommendations for action*

The following recommendations are put forward for consideration by City of Quinte West for reduction of pollutant loading entering the Trent River and Bay of Quinte from the storm drainage system in Trenton.

4.4.1 *Priorities for Dry-weather Source Investigations in Trenton:*

Dry-weather contamination of storm outfall discharges should be investigated and corrected. Priority outfalls are listed below in Table 12. For outfalls showing significant dry-weather bacteriological contamination, then the immediate action required is for investigation within the tributary storm pipe or ditch system to attempt to locate sources.

Investigative work would consist of:

- Review of engineering drawings with municipal operations staff to identify any possible locations where sewer cross-connection might exist. Are there, for example, locations within sanitary sewer system at which the sanitary system can overflow into the storm pipe system?
- Sampling at various manholes within the storm pipe system to try to narrow down the area that the contamination is coming from.
- Potentially the use of dye testing to check for direct plumbing connections into the storm sewer system.

Table 12: Priorities for dry-weather source investigation in Trenton, Ontario

Outfall	Service area	Notes
TC - Dixon Drive 66" storm outfall pipe	Approximately 128 hectares, mixed urban uses.	DW bacterial contamination
TF – McGill Street	Approximately 65 ha, primarily residential land use	DW bacterial contamination

4.4.2 **Priorities for Control of Wet-weather Discharges:**

As in Belleville, the wet-weather data are limited and do not include bacteriological indicators. It is nonetheless reasonable to expect, based on data from the 1997 Belleville PCP study and data from many urban areas, that most storm events will result in bacteriologically contaminated runoff (i.e. *E.coli* > 100 #/100 mL) from urban catchments.

The top priority in Trenton for addressing wet-weather discharges is the Dixon Drive storm outfall:

Outfall	Drainage area	Concerns
TC - Dixon Drive 66" storm outfall pipe	128 ha	Large outfall serving 128 ha, with dry-weather bacterial contamination.

Previous consideration of this outfall has indicated that end-of-pipe treatment for this large drainage area is not feasible due to space constraints; and furthermore, that the cost-benefit evaluation may not justify end-of-pipe treatment at this location. Refer to the 1998 PCP report for Trenton for further details.

It is recommended that within this service area, the City of Quinte West should conduct a detailed review to determine what measures may be feasible to provide runoff reduction on municipal rights-of-way and other areas over which the City has control. As well, the review could include review of practices on private properties (e.g. property maintenance and containment of runoff from contaminated areas such as bulk storage areas, truck loading areas, etc.) to determine if property owners and managers need to be prompted to improve current practices so as to minimize contamination of surface runoff from individual properties.

The City should also review its current sewer use by-law with respect to storm sewers, and determine if the by-law is appropriate and whether it can be used as a mechanism to allow the City to encourage better runoff control from individual properties.

After catchment review and consideration of current sewer use by-law, it is recommended that the City determine whether some targeted public information campaign is warranted to prompt individual property owners to be better mindful of potential contamination of surface runoff from their properties and the potential environmental impact on the Trent River and the Bay of Quinte. This would build on the considerable public information program that was part of the BQRAP implementation, and serve as a reminder to urban property owners that they need to remain mindful of this issue.

4.4.3 Review Existing Programs, Policies and Actions:

The City needs to conduct a review of its existing programs and clarify some aspects of current policies and actions plans. The following points and issues need to be considered:

1. Cash-in-lieu program. Municipality is collecting cash instead of having developers build small facilities but does not intend to build retrofit ponds. This is inconsistent. The City needs to formalize an action plan for how cash-in-lieu funds will be used to reduce stormwater pollutant loadings in the most cost-effective manner.
2. Catchbasin cleanout is only once every other year. This is not adequate. It appears resource limitations and a perception of financial/legal obligation exceeding municipal capacity for ongoing maintenance are the two major reasons municipality is not making more progress on retrofit ponds and catchbasin cleanout. Is there any feedback loop from the cleanout crews that indicate if the sumps are full each time they are cleaned out? The cleanout frequency should be adapted by that information.
3. If municipality will accept OGS unit as quality controls for retrofits – would they then plan to install them? Would OGS units be an acceptable alternative to higher level of treatment potential of ponds? The BQRAP stormwater management guidelines would accept that alternative.
4. Would the municipality increase their cleanout frequency of OGS units to ensure they continue doing their job? Who makes sure they are functioning if a serious approach is not taken by municipality?

5. PICTON

Picton is now a community within the municipality of greater Prince Edward County. It is the largest population centre within 'the County' as it is known. Picton was identified as a community in need of a Pollution Prevention and Control Plan during the 1990s, but until now did not go forward to develop a plan.

5.1 Existing Conditions

5.1.1 Existing Drainage System in Town of Picton

The 'Bay of Quinte Remedial Action Plan Pollution Control Planning for Picton, Napanee and Deseronto – PCP Template' (XCG, 2005) provided a Town of Picton drainage system map. This map identified the drainage outlet and the drainage boundaries of each subcatchment. XCG delineated the sub-catchments based on 1:10, 000 scale Ontario Base Mapping (OBM) and a reconnaissance site survey.

The XCG 2005 report indicated that the primary information item required to complete a PCP for the town is details of the storm sewer and drainage infrastructure. Consequently, in 2009, QC staff undertook a storm sewer mapping project. Existing engineering plan and profile drawings were obtained from PEC staff. Upon review of the drawings, gaps in the coverage of storm sewer information throughout Picton were highlighted. Site surveying was undertaken in areas of Picton that had insufficient information. Using data obtained from the available storm sewer drawings and the site surveying, a GIS map was developed. This map shows a plan view of the storm sewer system and includes information on the trunk sewers including slope, length, material and diameter of the storm sewers, the upstream and downstream geodetic invert of each storm sewer segment between manholes, and identification of the type of manhole (i.e. catchbasin manhole or manhole).

Under the auspices of the Hospital Creek Master Drainage Plan, which is being completed concurrently with the PPCP project, contour mapping based on laser-based high resolution LIDAR (Light Detection and Ranging) was completed. The areal coverage includes the entire P6 drainage area, and portions of P1A, P2, P3, P4, P5 and P7 drainage areas per the XCG 2005 Picton Drainage Area figure. LIDAR generated contours have a high degree of map resolution (vertical ~15 cm and horizontal ~30 cm). The portions of Picton covered with LIDAR generated contours will facilitate the refinement of the original drainage area delineations since the LIDAR produces contours at as low as 0.15 m intervals as opposed to the OBM 5-metre contour intervals.

Based on the findings of the storm sewer mapping project and the LIDAR generated contours, the XCG 2005 drainage area figure was updated. The areal extents of drainage areas were modified and in some cases omitted altogether. Refer to Figure D-3 (Appendix D) for the updated Town of Picton Drainage Area map. Also see Figure 14. Table 13 provides a summary of the characteristics of each drainage area.

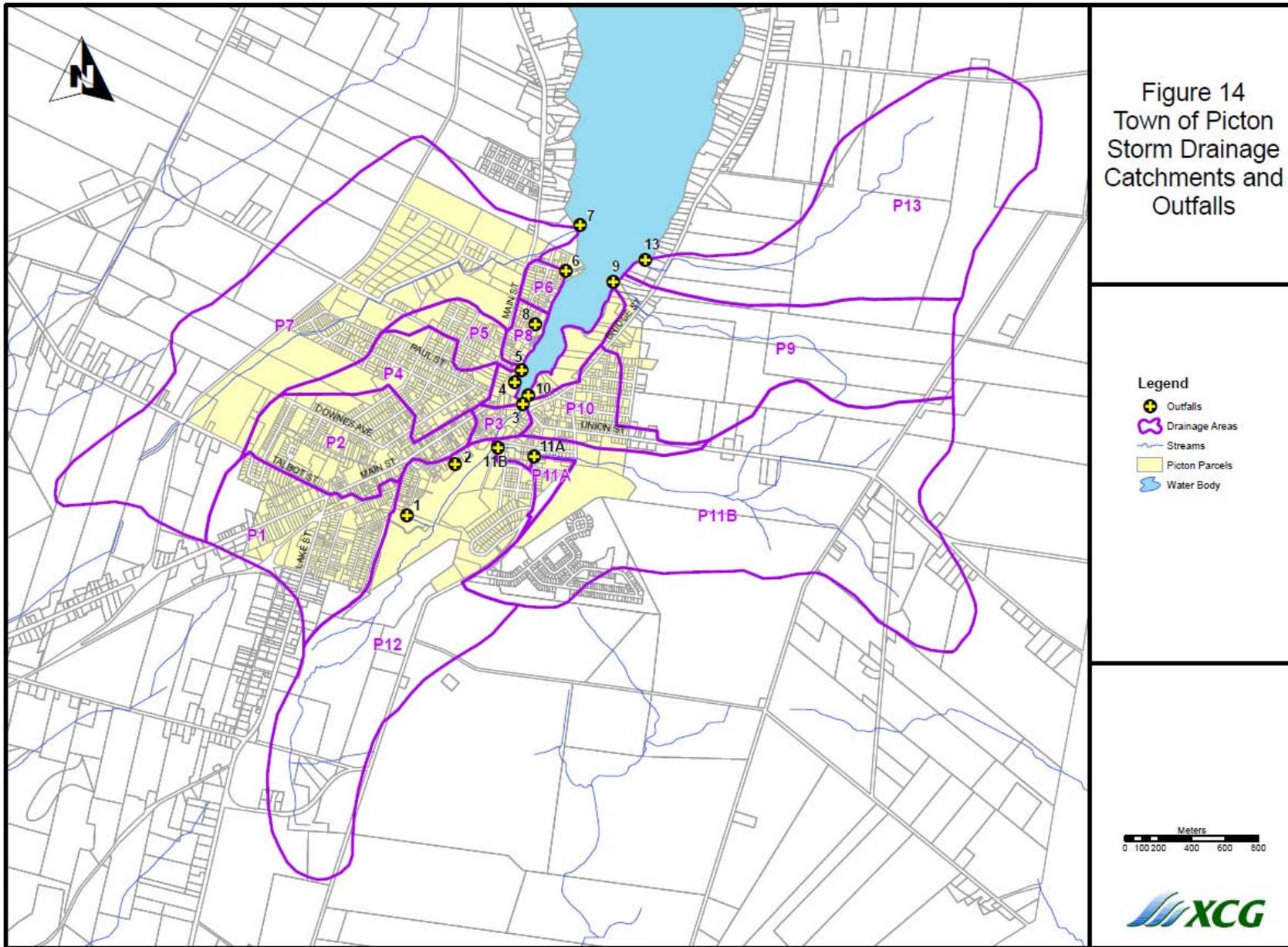


Table 13: Storm Drainage Catchment and Outfalls, Picton, Ontario

Catchment & type of Drainage System	Outfall ID & Location	Area (ha)	Outfall Storm Sewer Data	Runoff Coefficient	Land Use	Existing Stormwater Treatment System (s) (y/n)
P1 Storm Sewer	1 Marsh Creek	67.7	825 mm dia. CSP @ 9.1 %.	0.40	Commercial/Residential/Agricultural	N
P2 Storm Sewer & Ditch	2 Marsh Creek	56.5	1400 mm dia. CP @ 2.6%. Outlets to flow diversion structure. Low flows enter a SWM pond and ultimately outlet to Marsh Creek. High Flows outlet directly to Marsh Creek.	0.50	Commercial/Residential	Y A water quantity/quality control wetpond serving approx. 3.0 ha of the Talbot Meadows Subdivision designed to a Level 1 'Enhanced' water quality control standard. A water quality wetpond serving entire drainage area. Insufficient permanent pool and extended detention storage to provide Level 1, 2, or 3 water quality control.
P3	3 Picton Bay	6.5	375 mm dia. CP @ 4.0%	0.45	Light Commercial/Residential	N
P4 Storm Sewer	4 Picton Bay	38.4	1400 mm dia. CP @ 1.0%	0.45	Commercial/Residential	N
P5	5	15.8	600 mm dia. CP @ 2.8 %	0.50	Commercial/Residential	N

Table 13: Storm Drainage Catchment and Outfalls, Picton, Ontario

Catchment & type of Drainage System	Outfall ID & Location	Area (ha)	Outfall Storm Sewer Data	Runoff Coefficient	Land Use	Existing Stormwater Treatment System (s) (y/n)
	Picton Bay					
P6	Picton Bay	5.8	300 mm dia. HPE @ 3.7%	0.50	Commercial/Residential	N
P7 (Hospital Creek Watershed)	7 Picton Bay	247.4	Open Ditch		Commercial/Residential/ Industrial/Agricultural	N
P8	P8 Picton Bay	6.6	Unknown	0.50	Commercial/Residential	N
P9	9 Watercourse No. 2	139.2	Open Ditch	0.20	Rural	N
P10	10 Picton Bay	22.7	750 mm dia. CP @ 1.65%	0.50	Light Commercial/Residential	Y A water quantity/quality control dry pond serving approx. 1.9 ha of the Phase 2 Red Gate Subdivision. A water quantity/quality control wet pond serving approx. 3.0 ha of Phase 1 and 2 Red Gate Subdivision. The dry pond is tributary to the wet pond. Overall, pond system designed to a Level 1 'Enhanced' water quality control standard.

Table 13: Storm Drainage Catchment and Outfalls, Picton, Ontario

Catchment & type of Drainage System	Outfall ID & Location	Area (ha)	Outfall Storm Sewer Data	Runoff Coefficient	Land Use	Existing Stormwater Treatment System (s) (y/n)
P11A (Macaulay Creek Watershed)	11A Macaulay Creek	5.4	Open Ditch	0.50	Light Commercial/Residential	N
P11B	Overland Macaulay Creek Outlet to Marsh Creek	264.9	Open Ditch	0.20	Rural	N

TABLE 14: Storm Outfall Sampling Summary for Picton, Ontario, from 2008-2009 sampling program

**TABLE 14
SUMMARY OF 2008-2009 STORM OUTFALL SAMPLING IN PICTON, ONTARIO
conducted by Quinte Conservation and Lower Trent Conservation Authority**

Location	Outfall ID	Location Description	Estimated drainage area	Pipe	Land use	Location Coordinates Obtained by	Bacteriological																Metals									
							TSS		TS		TP		E.coli GM		FS		Cu		Fe		Cd		Pb		Ni							
							Target level >>		General guideline		0.03 PWQG		100 PWQG				5.00 PWQG		300 PWQG		0.10 PWQG		5.00 PWQG		25.00 PWQG							
							No. of samples		AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY				
		Wet	Dry	mg/L	mg/L	mg/L	mg/L			#/100mL	#/100mL	#/100mL	#/100mL	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L									
PICTON																																
P1	P1	Chapel Street to Marsh Creek	69.9	825 mm / Corrugated Steel Pipe	Residential	Per Hand held GPS	2	1	73	9	324	741	0.22	0.01	No data	4	No data	84	7.09	1.52	901	41	0.33	0.62	7.72	4.30	1.72	1.33				
P2	P2	Elizabeth Street to Marsh Creek via SWM pond	51.8	375 mm / PVC pipe	Mixed urban	Per Hand held GPS	5	4	30	7	457	780	0.10	0.02	No data	6	No data	38	5.94	2.21	360	45	0.68	1.32	5.38	1515.37	0.89	0.67				
P4	P4	Mortin Street to Picton Bay	38.4	1370 mm / conc. Pipe	Mixed urban	Per Hand held GPS	4	6	8	18	487	3,619	0.05	0.15	No data	729	No data	200	2.79	9.55	139	95	0.56	3.18	2.03	14.42	0.58	1.21				
P6	P6	Spencer Street/Hwy 49 to Picton Bay	4.7	300 mm / HDPE pipe	Open and low-density residential	Per Hand held GPS	4	2	35	No data	124	No data	0.13	No data	No data	0	No data	No data	4.44	No data	519	No data	0.81	No data	4.25	No data	1.24	No data				

5.1.2 Results of 2008-2009 outfall sampling

Table 14 summarizes the storm outfall sampling results for Picton.

The data are very limited, but do show instances of dry-weather contamination (bacteriological and metals) and wet-weather contamination by metals.

5.2 Identification of information gaps and needs

Personal Communication with PEC staff (D. Tone/P. Parkinson) has identified the factors affecting storm drainage quality in the Town of Picton:

- There is no program or funding to perform SWM pond cleanouts. Consequently, pond cleanouts have not been performed to date;
- Catchbasin cleanouts occur on an 'as needed' basis to mitigate a drainage issue when it arises;
- There does not exist a program to eliminate sanitary sewer or lateral-to-storm sewer cross-connections. PEC staff attempt to remove cross-connections upon discovery or when road reconstruction occurs; and
- A 'stoop and scoop' by-law is in place putting the responsibility of the owner of a dog to remove any excrement left by the dog on any publicly or privately owned land within the County of Prince Edward.

Furthermore, a By-Law pertaining to the Control of Discharges to Municipal Sewers in the County of Prince Edward stipulates (among other items) that:

- A property owner can be required to make improvements to storm water quality from the property at the property owner's expense;
- The direct connection of any drainage works, including foundation drainage and roof water leaders, to the municipal storm sewer system is prohibited unless in the opinion of the Commissioner, there is no practical alternate means of drainage available; and
- Property owners are responsible to work with the municipality to ensure that the runoff and storm water from their property is entering the system in an acceptable manner.

During the field work activities, observations were made regarding the condition of storm sewer manholes and stormwater management ponds. In general, sediment levels in manholes that were surveyed were not excessive, and recent catchbasin cleanout activities were evident. However, sediment levels in some storm sewer manholes along the portion of Main Street north of Paul Street are excessive and require cleanout. Where sediment accumulations were found, sediments were generally sand and grit mixed with decaying organic matter (leaf litter).

The fact that there is no stormwater management cleanout program is evident in the degree of sedimentation in the P2 drainage area end-of-pipe wet pond facility located near Marsh Creek. Observations made by QC staff indicated that there are excessive levels of sediment built-up in the

vicinity of the outlet structure. Sediment was observed to be near-flush with the bottom of the stoplogs. Based on the sediment levels near the outlet structure, it is reasonable to infer that the sediment forebay and the rest of the pond have excessive amounts of built-up sediment. The loss of permanent pool and forebay storage has most likely impaired the treatment effectiveness of the pond.

Sewer cross-connections are suspected in the northeast quadrant of Picton along Maitland, Owen and Robinson Streets, and in the northwestern quadrant along Elm Street and a portion of Paul Street immediately south of the Elm Street intersection. Further investigation of these areas is recommended.

- The Town should maintain accurate information on the physical condition and status of Picton's storm drainage system, since this will assist with explaining and correcting problems when they occur. Accurate information on the drainage system and underground infrastructure is needed to help ensure that sewer cross-connections and other forms of avoidable storm sewer contamination are being controlled and eliminated. Appendix D provides some mapping indicating the extent of detail current available with respect to mapping and inventory of Picton's drainage system. It is recommended that this information base be further reviewed to make sure it contains all pertinent details. Missing information may include accurate mapping and sizing information for all oil-grit separator units in place within the Town.
- It is further recommended that the available information on the storm drainage system in Picton be stored and maintained within an easily accessible GIS mapping/database framework. Much of the current information has been assembled and mapped using CAD software tools. Migrating the information to a GIS platform consistent with other GIS data in use at County of Prince Edward is recommended as a more practical approach to maintaining the data, and facilitating routine and easy data access by County staff. Making the system inventory and status data easier to access and manage is required to help ensure that the system is maintained and monitored.
- It is recommended that the Town carry out a general review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction. This review should examine the potential to implement stormwater pollution prevention measures that are described in the 'Stormwater Management Planning and Design Manual' (Ontario Ministry of Environment, 2003). Property review status information (e.g. downspout connectivity status) can be integrated within a GIS-based drainage system inventory.
- The existing Quinte RAP stormwater guidelines continue to be applied to new development proposals

5.3 Existing Priorities, Constraints and Opportunities

Wet-weather loadings from storm outfalls to Picton Bay are considered to be an issue, as identified in the BQRAP action plan. Also, from the point of view of source protection, the Town's storm drainage system is a potential pathway for contaminants to reach Picton Bay, in which the Town's water supply intake is located.

Retrofit end-of-pipe treatment can be considered for any and all outfalls within the Town. However, there are significant constraints that limit feasibility. The identification of storm outfalls that should be considered as priorities for installation of stormwater quality controls needs to be based on considering various factors including the extent of individual property runoff controls within the service catchment, the type of land use and commercial/industrial activity within the catchment, and available outfall sampling results, and the contributing drainage area size. As well, the physical opportunities and constraints at each outfall location need to be carefully examined to determine if end-of-pipe treatment, especially at larger outfalls, is even possible.

The overall Picton drainage system is comprised of individual catchments that vary in size from 3 hectares to 210 hectares. From an annual contaminant loading perspective and all factors considered the same, the larger catchments will contribute a higher annual contaminant loading to the Bay of Quinte than the smaller catchments. Following is a review of a number of the individual catchments; refer to Figure 14.

5.3.1 Catchment P1

Catchment area P1 has a drainage area of 67.7 hectares and drains primarily developed lands with commercial and residential land uses. The total suspended solids (TSS) and total phosphorous (TP) average readings for the wet outfall sampling were 73 mg/L and 0.22 mg/L, respectively, which are regarded as relatively high values, especially with respect to TP. Given that this outfall serves a relatively large catchment area, stormwater quality controls for P1 are recommended. The storm sewer outlets to a drainage swale that conveys flow approximately 150 meters within an incised ravine prior to discharging to Marsh Creek, and is located within the Glenwood Cemetery property. As the Town does not own any land in the immediate vicinity of the outlet at Marsh Creek, locating an end-of-pipe facility would require the Town to purchase land to construct the facility. Further discussions of the options to provide water quality controls for the P1 drainage area are provided in Section 5.4.

5.3.2 Catchment P2

Catchment P2 is comprised of commercial and residential development with an overall drainage area of 52 hectares. Stormwater quality controls for the runoff generated from the P2 drainage area is currently being addressed primarily via a wetpond facility located adjacent to Marsh Creek. However, as noted previously, the wetpond is undersized based on the contributing drainage area, which reduces the ability of the pond to remove sediment solids (among other contaminants) from the influent. The performance of the pond is further worsened by the excessive sediment built-up in the forebay and main cell of the pond. Therefore, further water quality control measures are recommended to reduce the contaminant loading at this outfall.

5.3.3 Catchment P4

The P4 catchment area has a contributing drainage area of approximately 39 hectares that is comprised of commercial and residential lands. Given that the outfall pipe discharges to Picton Bay off a steep embankment with very limited space opportunity, an end-of-pipe facility is not considered feasible. An option would be the installation of multiple oil-grit separator units at locations further upstream within the storm sewer system; however, available sampling shows low TSS readings in both wet and dry-

weather discharges, meaning that the installation of OGS units is difficult to justify and cannot be recommended for this catchment.

However, the sampling results for P4 showed that the P4 outfall has dry-weather discharges that are bacteriological contaminated (i.e. E. coli levels greater than 100 per 100 mL), an indicator that sanitary laterals/sewers are connected to the storm sewer system in one or more places. The sampling results correlated well with the suspected presence of sewer cross-connections along portions of Elm Street and Paul Street. Further investigation of the storm sewer system to identify portions of the storm sewer system where cross-connections exist is recommended. Identified cross-connections should be disconnected. Further sampling during dry-weather periods at various nodes in the system can be used to narrow down the portion(s) of the system that are causing the bacteriological contamination.

5.3.4 Catchment P7

The majority of catchment P7, which represents the Hospital Creek watershed, is undeveloped except for industrial and commercial development north of Johnson Street. Further residential development is anticipated south of Johnson Street and industrial/commercial development is proposed north of Johnson Street. Water quality controls for the future development is addressed via the Hospital Creek Master Drainage Plan (submitted to the County under separate cover). Under the MDP, water quality controls for future residential developments will be achieved on a site-by-site basis via oil-grit separators, etc. Future development within the Picton Industrial Park (north of Johnson Street) is being addressed via a recently constructed centralized stormwater pond. Additional developments north of Johnson Street not tributary to the said pond will achieve water quality controls on a site-by-site basis. Therefore, further stormwater quality controls in addition to the recommendations made in the MDP are not recommended.

5.3.5 Catchment P10

Sampling was not completed for the P10 outfall; however, sanitary-to-storm cross-connections within the storm sewer system are highly suspected. Further investigation of the storm sewer system to identify portions of the storm sewer system where cross-connections exist is recommended. Identified cross-connections should be disconnected. Further sampling during dry-weather periods at various nodes in the system can be used to narrow down the portion(s) of the system that are causing the bacteriological contamination. Given that the P10 storm sewer system outlets directly to Picton Bay and that there is very little property available for facility installation, end-of-pipe facilities to mitigate contaminant loading are not considered feasible.

5.3.6 Catchment Areas P8, P9B, P11B and P12

Catchment areas P8, P9B, P11B and P12 are considered have relatively large contributing drainage areas; however, the majority of the lands are undeveloped (not urbanized). Therefore, stormwater quality controls are not recommended for these catchment areas.

In general, the situation in Picton is that there is minimal opportunity to install end-of-pipe stormwater treatment to reduce wet-weather pollutant loadings to Picton Bay from the storm pipe system.

However, there are various portions of the system where sewer cross-connections are suspected to exist and be active. This represents the priority issue and priority opportunity in Picton.

5.4 Options and Alternatives Considered

This section then provides further discussion on various alternative measures or options that have been considered as practical and feasible within specific catchment areas within the Town of Picton storm service area.

5.4.1 Stormwater Treatment for Catchment "P1"

As indicated in Section 5.3, implementation of stormwater quality controls for the P1 drainage area is recommended. The drainage area has an existing impervious level of approximately 35% and a drainage area of 67.7 hectares. As per the Bay of Quinte Remedial Action Plan – Stormwater Management Guidelines (2006), an acceptable treatment level would be "Level 2" (70% long-term suspended solids removal); however, treatment to "Level 1" (80% long-term suspended solids removal) is recommended, if feasible.

The use of oil-grit separator (OGS) units was screened as a potential control measure. Due the size and impervious level of the drainage area, at least three Stormceptor (STC 14000) units or equivalent would be required to meet Level 2 water quality criteria. These units would need to be located at specific points in the storm sewer system to capture the runoff generated from appropriately sized areas. Smaller units could be used but the contributing drainage area to each unit would need to be reduced accordingly, which would increase the number of units required. The estimated total cost for the three STC 14000 units (supply only) would be approximately \$355,000; total cost for supply and installation could be as high as \$700,000.

The use of an end-of-pipe stormwater management (SWM) pond was also examined. SWM ponds are typically wetponds or wetlands with the depth of the permanent pool being 1 to 3 metres for wetponds and 0.15 to 0.30 metres for wetlands. The following table provides storage values, land size requirements, and estimated costs for various pond type and water quality treatment levels.

**Table 15: Town of Picton P1 Drainage Area
SWM Pond Alternatives**

Water Quality Protection Level	Wetpond				Wetland			
	PP Volume (m ³) ¹	ED (m ³) ²	Land Area (ha) ³	Estimated Cost ⁴	PP Volume (m ³) ¹	ED (m ³) ²	Land Area (ha) ³	Estimated Cost ⁴
Level 1	6990	2800	1.3	\$540,000	2800	2800	1.6	\$310,000
Level 2	3500	2800	0.9	\$350,000	1400	2800	0.9	\$230,000
Level 3	1400	2800	0.9	\$230,000	1400	2800	0.9	\$230,000

Notes: 1. Permanent Pool Volume based on 35% impervious level and Table 3.2 of SWM Planning & Design Manual (MOE, 2003)

2. Extended detention volume based on 40 m³/ha o drainage area.

3. Land Area incorporates area required for storage (includes permanent pool, extended detention and freeboard of 0.3 metres), access road and property line setbacks. Permanent pool depth is assumed to be 1.0 metres and 0.30 metres for wetponds and wetlands, respectively.

4. Cost estimate based on findings indicated in the Potter Creek Master Drainage Plan (XCG Consultants, 2007) where pond construction costs in Toronto ranged from \$50 to \$60 per m³ of design storage volume. This price range incorporates the costs pertaining to all construction items including excavation, erosion control, outlet control structure, final grading and landscaping but does not include any land acquisition, engineering and contingency costs.

As indicated in Section 5.3, land acquisition by the Town from Glenwood Cemetery would be required to locate a SWM pond at the outlet of the storm sewer. Refer to Appendix F (Figure F-1) for property ownership information in the vicinity of the P1 outfall. Since the distance between the outfall of the storm sewer and Marsh Creek is approximately 150 metres, the overall length of pond must be less than 150 metres. A wetpond with a length of 135 metres and width of 45 metres could be located within a 0.9 hectare land area and achieve Level 2 water quality control. This pond location represents scenario 1 shown on **Figure F-1** and **F-2** (see Appendix F).

To avoid the need for the Town to acquire land but still construct a SWM pond, an alternative is to pipe the stormwater in a northerly direction to property owned by the Town and located just north of the Glenwood Cemetery property line and west of Marsh Creek. Refer to Appendix F (Figure F-2), which shows the SWM pond location for this scenario. Due to topographic constraints, a new storm sewer would need to be installed approximately half way downstream of the existing catchbasin manhole on Ferguson Street (the last catchbasin manhole in the P1 storm sewer system) and be directed southeast approximately 150 meters to the SWM pond. With the existing manhole on Ferguson Street having a storm sewer invert of 85.91 m (geodetic) and a storm sewer slope of about 9.1% to the outfall, the proposed manhole would have an invert of about 80.9 m. The proposed permanent pool elevation in the pond would be set at about 80.2 m thereby enabling the length of proposed storm sewer to be constructed at about a 0.3% slope. However, the Feasibility Study for a Rehabilitation Project on Marsh

Creek by J.D. Paine Engineering Inc. (1995) indicated that there is an abandoned domestic waste landfill located where the pond would be constructed. Therefore, the impacts of the landfill on the construction feasibility and cost of the pond would need to be examined prior to the selection of this option.

Overall, employing OGS units to achieve water quality treatment would avoid the property ownership issues and/or additional pipe requirements associated with using a SWM pond, as noted previously. In addition, by selecting the locations where the OGS units would be installed, the Town can control the amount of units required in an effort to reduce maintenance costs. Furthermore, the Town could spread the cost of OGS units over multiple years by first installing OGS units in areas within the P1 drainage area suspected of causing substantial water quality degradation.

Although the use of OGS units provide the aforementioned advantages, , a study sponsored by the Ministry of the Environment's Stormwater Assessment Monitoring Program that compared the performance of SWM ponds and OGS units via load-based total suspended solids (TSS) removal rates concluded that SWM ponds have higher removal rates than OGS units. Furthermore, OGS units were more susceptible to the occurrence of sediment blow out (captured sediment being discharged primarily due to lack of cleanout than SWM ponds). Therefore, if the issues pertaining to the construction of a SWM pond (noted previously) can be overcome, it is recommended that a SWM pond be constructed for the P1 drainage area.

5.4.2 Stormwater Treatment Maintenance for Catchment "P2"

It is recommended that the County implement a regular sediment cleanout program to restore the water quality treatment performance of the existing P2 SWM pond.

5.4.3 Source Investigations in Catchments "P4" and "P10"

Investigation of the storm sewer system within the P4 and P10 for sanitary lateral/sewer to storm sewer cross-connections is recommended due to observations made in the field and evidence of bacteriological contamination based on the water sampling results in P4, and strong suspicion of presence of cross-connections in the pipe network within catchment P10.

5.5 Recommendations for action

Following is a summary of the recommended actions within Town of Picton, per the discussion provided above.

5.5.1 Information Management

- It is recommended that the available mapping and inventory information on the Town's storm drainage system (pipes, catchbasins, ditches, oil-grit separators, stormwater ponds, outfall structures) be further reviewed to make sure it contains all pertinent details. Missing information may include accurate mapping and sizing information for all oil-grit separator units in place within the Town.
- It is further recommended that the available information on the storm drainage system in Picton be stored and maintained within an easily accessible GIS mapping/database framework.

Migrating the information to a GIS platform consistent with other GIS data in use at County of Prince Edward is recommended as a more practical approach to maintaining the data, and facilitating routine and easy data access by County staff.

- It is recommended that the Town carry out a general review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction. This review should examine the potential to implement stormwater pollution prevention measures that are described in the 'Stormwater Management Planning and Design Manual' (Ontario Ministry of Environment, 2003). Property review status information (e.g. downspout connectivity status) can be integrated within a GIS-based drainage system inventory.

5.5.2 Sewer Cross-connection Elimination

There are a number of areas within the Town's sewer system where sewer cross-connections (sanitary to storm sewer cross-connection, or sanitary service connections to storm pipe) are suspected to exist and be active. This is considered to be a priority issue because of the potential for contamination of storm drainage systems discharges to Picton Bay.

Based on available sampling, albeit limited, the top priority is catchment area "P4" which drains to the Mortimer Street outfall to Picton Bay. As well, catchment "P10" is considered to be a priority because of suspicion of sewer cross-connections within this area.

- It is recommended that PEC undertake investigations of these two systems in an endeavour to confirm and locate any cross-connections, and eliminate them. Further investigation could include sampling during dry-weather periods at various manholes in the system to narrow down the portion(s) of the system that are subject to bacteriological contamination. Sewer inspection by closed-circuit video camera (CCTV) can also help to locate inappropriate connections to the storm pipe system.

5.5.3 Sewer System Monitoring

Some of the cross-connections within the sewer pipe system in Picton may be locations at which the sanitary pipe system is allowed to overflow if needed into the adjacent storm sewer, to protect local properties from basement flooding by surcharged sanitary sewers. Such cross-connection points may have been created in the past as an immediate solution to a wet-weather problem.

If such cross-connections exist and cannot be eliminated without risk of causing basement flooding, then PEC should install liquid level monitors on the upstream (sanitary) side of such overflows, to provide monitoring of activity at those locations. Such monitoring will help to identify which overflow locations remain active, and what amount or severity of wet weather is needed to trigger an overflow. Such information is invaluable in sorting out where real problems are located, and what solution approaches may be required.

5.5.4 End-of-pipe Stormwater Outfall Retrofit Treatment

- It is recommended that the County of Prince Edward consider and review the options presented here for installing stormwater treatment in catchment P1. Two general options have been presented in this report, including preliminary costing (see above). Appendix F provides preliminary design concepts.

5.5.5 End-of-Pipe Stormwater Facility Maintenance

- It is recommended that the County implement a regular sediment cleanout program to restore the water quality treatment performance of the existing stormwater pond that serves catchment P2.

6. NAPANEE

6.1 Existing Conditions

6.1.1 Existing Drainage System in Town of Napanee

Information and mapping of the storm drainage network in Napanee has been assembled, and GIS mapping/database has been prepared.

Figure 15 present mapping of the storm drainage catchment areas and the outfall locations. Additional mapping is included in Appendix D that shows the extent of inventory of the storm pipe system.

Outfall ID	Location description	Pipe Size (mm) / material	Estimated drainage area (ha)
6.14	Robinson St Outfall	1470 X 1910mm / Corrugated Steel Pipe	123.4
6.14b	See Figure 15	1500mm x 1900mm / Elliptical CSP	120
6.2	Ginger Street Outfall	1725 X 1090mm / Elliptical Pipe	67.8
6.2b	See Figure 15	2 - 1200mm X 900mm elliptical pipes	36.4
6.5	King Street Outfall	900mm / Corrugated Steel Pipe	27.1
6.5b	Unknown	600 mm pipe	22.8
6.18	Hwy 41/Centre St Outfall	675mm / Pipe of Unknown Material	8.9
6.13	West Street Outfall	675mm / Pipe of Unknown Material	18.1
6.15	Richard St Outfall	675mm / Pipe of Unknown Material	16.6
6.10	John Street Outfall	450mm / Corrugated Steel Pipe	7.5
6.8	Dundas Street Outfall	450mm / Pipe of Unknown Material	7.1
6.19	Jim Kimmet Side Road east of Hwy. 41	Open ditch	42.8
6.21	Palace Road south of Cardiff Lane	1000 mm pipe	20.3

Note: Napanee outfall numbering system from Town of Napanee's 'Napanee Drainage Study' (1996).

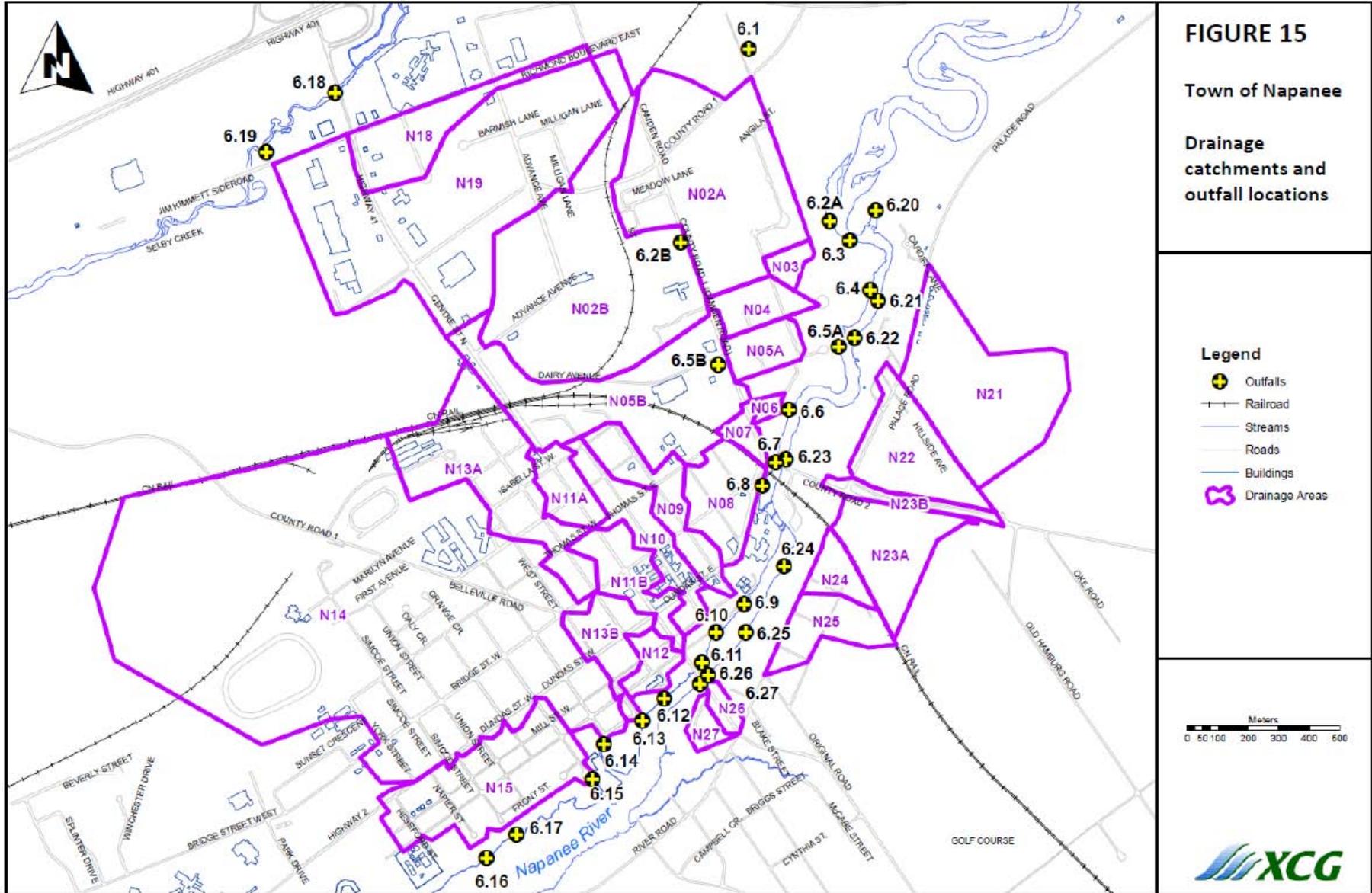


TABLE 17: Summary of storm outfall sampling, 2008-2009, in Napanee and Deseronto, Ontario

**TABLE 17
SUMMARY OF 2008-2009 STORM OUTFALL SAMPLING IN NAPANEE AND DESERONTO, ONTARIO
conducted by Quinte Conservation**

Location	Outfall ID	Location Description	Estimated drainage area	Pipe	Land use	Location Coordinates Obtained by	No. of samples		TSS				TS				TP				Bacteriological				Metals															
							Target level >>		25		General guideline		0.03		PWQG		100		PWQO		5.00		PWQO		300		PWQO		0.10		PWQO		5.00		PWQO		25.00		PWQO	
							Wet	Dry	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY	AVG WET	AVG DRY		
NAPANEE																																								
N62	6.2	Ginger Street Outfall	67.8	1725 X 1090mm / Elliptical Pipe	Residential	Per Hand held GPS	3	1	18	4	394	710	0.08	0.04	No data	No data	No data	No data	2.45	1.67	270	62	0.55	0.98	3.27	2.59	1.29	1.07												
N62b	6.2b	Camden Rd., south of Meadow Lane	36.4	2 - 1200mm X 900mm elliptical pipes	Industrial	From map take-off	2	1	39	24	354	707	0.10	0.07	No data	No data	No data	No data	4.35	4.46	867	412	0.57	0.56	2.48	0.99	1.45	1.73												
N65	6.5	King Street Outfall	27.1	500mm / Corrugated Steel Pipe	Residential & commercial	Per Hand held GPS	4	1	21	2	471	659	0.16	0.09	No data	No data	No data	No data	3.14	1.47	412	77	0.77	0.43	3.38	0.99	1.12	0.70												
N65b	6.5b	Dairy Ave. just west of Camden Rd	22.8	600 mm pipe	Industrial	From map take-off	2	1	15	16	392	641	0.24	0.15	No data	No data	No data	No data	3.09	2.55	485	681	0.46	0.76	5.18	8.15	1.77	2.01												
N610	6.10	John Street Outfall	7.5	450mm / Corrugated Steel Pipe	Urban core	Per Hand held GPS	3	2	98	No data	746	No data	0.25	No data	11.08	No data	960	No data	1.63	No data	17.27	No data	2.78	No data																
N613	6.13	West Street Outfall	16.1	875mm / Pipe of Unknown Material	Urban core	Per Hand held GPS	2	1	61	1	513	540	0.15	0.09	No data	No data	No data	No data	44.20	1.67	868	19	1.04	0.43	22.85	1.49	2.44	0.55												
N614	6.14	Robinson St Outfall	123.4	1470 X 1910mm / Corrugated Steel Pipe	Urban core	Per Hand held GPS	4	6	32	2	265	675	0.14	0.10	No data	391	No data	9,708	3.65	2.52	744	162	0.59	0.98	4.18	3.56	1.38	1.05												
N618	6.18	Hwy 41/Centre St Outfall	6.9	675mm / Pipe of Unknown Material	Highway commercial	Per Hand held GPS	4	2	213	No data	685	No data	0.20	No data	No data	0	No data	No data	18.50	No data	2,194	No data	1.48	No data	19.29	No data	5.06	No data												
N619	6.19	Jim Kimmet Side Road east of Hwy. 41	42.8	Open ditch	Commercial / industrial	Per Hand held GPS	2	3	29	22	218	804	0.41	0.58	No data	345	No data	1,690	5.73	3.23	646	561	0.46	0.71	4.79	1.46	1.34	2.24												
N621	6.21	Palace Road south of Cardiff Lane	20.3	1000 mm pipe	Residential & commercial	Per Hand held GPS	3	2	No data	No data	No data	No data	No data	No data	No data	0	No data	No data	No data	No data	No data	No data	No data	No data																
DESERONTO																																								
D1	D1	Main Street, Deseronto	196.0	1725mm X 1090mm CSPA	Mixed urban	Per Hand held GPS	1	1	95	2	303	515	0.25	0.05	No data	16	No data	32	5.21	1.07	1,420	50	0.52	0.54	11.90	2.99	2.98	0.21												
D2	D2	Dundas St, Deseronto	309.0	Box Culvert 1.85m x 1.25m	Rural	Per Hand held GPS	1	-1	690	No data	1,020	No data	2.15	No data	No data	0	No data	No data	5.10	No data	1,610	No data	0.68	No data	2.02	No data	3.76	No data												

6.1.2 Results of 2008-2009 outfall sampling

Table 17 summarizes the storm outfall sampling results obtained from the 2008-2009 program.

As with Picton, the data are limited in terms of number of samples gathered at each outfall. The data indicate not unexpectedly that there is some contamination of wet-weather discharges by TSS, TP and metals. Dry-weather discharges were observed at a number of outfalls.

6.2 Identification of information gaps and needs

The drainage infrastructure inventory and mapping assembled for Town of Napanee appears to be reasonably complete. However, it is unknown whether the available inventory includes all relevant details including location of sanitary-to-storm pipe cross-connections or wet-weather overflows from sanitary to storm sewer that are intended to protect against local basement flooding.

The system mapping/inventory needs to be reviewed in detail by the Town, including review by operations/maintenance staff, to ensure that the information is complete and accurate, and can therefore be relied upon to guide maintenance and monitoring activities.'

The information base and mapping assembled to date has been consolidated within a GIS framework. This is considered the best approach for information management and tracking. The existing GIS should be further developed to allow easy access to it by Town staff, and to allow for new data to be entered so that there can be structure documentation of ongoing investigations and actions, including such activities and locating cross-connections, inspection of storm outfalls and pipe systems, investigation of drainage conditions on individual properties, and other ongoing activities related to managing the system and minimizing opportunities for drainage water contamination.

6.3 Existing Priorities, Constraints and Opportunities

Based on the available sampling data, two storm catchment areas have been identified as priorities for investigation of bacteriological contamination of dry-weather discharges:

Table 18	
Dry-weather priorities for source investigation in Napanee	
Outfall	Notes
Napanee N614: Robinson St	DW bacterial contamination
Napanee: N619: Jim Kimmet Side Road	DW bacterial contamination

The situation here is similar to that at Picton. It is recommended that the Town carry out investigations to determine if sewer cross-connections may be present, and inventory/map all such cross-connections to allow future tracking of activity and status. Also, the investigative work should consider if there are other potential sources (such as wildlife) that may be accounting for or contributing to the observed dry-weather contamination.

As recommended for Picton, if there are sewer cross-connections that are intended to protect against basement flooding (i.e. overflow openings from sanitary pipe system into storm pipe system), and it is determined that such overflows cannot be eliminated without risk of causing basement flooding, then the Town should install liquid level monitors on the upstream (sanitary) side of such overflows, to provide monitoring of activity at those locations.

6.3.1 Priorities for Control of Wet-weather Discharges:

The following Table 19 is a preliminary list of outfalls that should be considered as priorities for addressing wet-weather discharges, based on considering the size of the respective drainage areas and the available wet-weather sampling data.

Wet-weather control could be achieved by retrofit measures such as installation of end-of-pipe treatment facilities (settling ponds or tanks), or through runoff reduction measures within respective catchment areas. Elimination of sources of dry-weather contamination will help reduce wet-weather pollutant discharges.

Outfall	Drainage area	Concerns
Napanee N614: Robinson St	123 ha urban core area	Large outfall. Nutrient, bacterial and metals loadings to river from urban core area
Napanee: N62: Ginger Street outfall	68 ha residential and industrial/commercial area	Large drainage area. Potential source of nutrient, bacterial and metals loadings to Napanee River

6.4 Options and Alternatives Considered

Within the Town of Napanee, there are very limited and constrained opportunities for installing stormwater treatment facilities.

For the two priority outfalls identified above, constraints on space availability to develop facilities of adequate size to accommodate the relatively large catchment areas, mean that at this stage it is not considered feasible to consider end-of-pipe facilities at those outfalls.

It is nonetheless that a detailed review of opportunities needs to be undertaken by the Town to ensure that any available opportunities to provide stormwater treatment are identified and to the extent possible protected for future implementation.

6.5 Recommendations for action

The following summarizes the recommendations that are made at this stage for the Town of Napanee. These recommendations are put forward for the Town's review and consideration.

6.5.1 Information Management

- It is recommended that the available mapping and inventory information on the Town's storm drainage system (pipes, catchbasins, ditches, oil-grit separators, stormwater ponds, outfall structures) be further reviewed to make sure it contains all pertinent details. Missing information may include accurate mapping of all sewer cross-connection or sanitary-to-storm overflow locations, or locations of any oil-grit separator units in place within the Town.
- It is further recommended that the available information on the storm drainage system in Napanee be maintained within an easily accessible GIS mapping/database framework. The information assembled to date has been placed with a GIS structure using ArcGIS. This is recommended as the most practical approach to maintaining the data, and facilitating routine and easy data access and data updating by Town staff.
- It is recommended that the Town carry out a general review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction. This review should examine the potential to implement stormwater pollution prevention measures that are described in the 'Stormwater Management Planning and Design Manual' (Ontario Ministry of Environment, 2003). Property review status information (e.g. downspout connectivity status) can be integrated within the GIS-based drainage system inventory.

6.5.2 Sewer Cross-connection Elimination

The Town needs to investigate and confirm where there are sewer cross-connections or overflows within the sewer pipe system. This is considered to be a priority issue because of the potential for contamination of storm drainage system discharges to the Napanee River and Bay of Quinte.

Based on available sampling, albeit limited, the top priority for investigations are catchment area s draining to outfalls N614 (Robinson St) and N619 (Jim Kimmett Side Road).

- It is recommended that the Town undertake investigations of these two systems in an endeavour to confirm and locate any cross-connections, and eliminate them. Further investigation could include sampling during dry-weather periods at various manholes in the system to narrow down the portion(s) of the system that are subject to bacteriological

contamination. Sewer inspection by closed-circuit video camera (CCTV) can also help to locate inappropriate connections to the storm pipe system.

6.5.3 Sewer System Monitoring

- There may be cross-connections within the sewer pipe system in Napanee at which the sanitary pipe system is allowed to overflow if needed into the adjacent storm sewer, to protect local properties from basement flooding. If such cross-connections exist and cannot be eliminated without risk of causing basement flooding, then the Town should install liquid level monitors on the upstream (sanitary) side of such overflows, to provide monitoring of activity at those locations, to monitor which overflow locations remain active, and what amount or severity of wet weather is needed to trigger an overflow.
- The Town should implement a program of routine inspection of all storm outfalls, including routine sampling of dry-weather discharges. If any evidence of contamination, especially sewage contamination, is detected either by direct observation or from sampling results, then the Town should follow-up with investigation of the tributary pipe system.
- All information gathered through such routine inspection, sampling and investigation should be recorded within the GIS system database inventory, to allow ongoing tracking of system status and tracking of actions taken by the Town.

6.5.4 End-of-pipe Stormwater Outfall Retrofit Treatment

It is recommended that the Town conduct a detailed review of opportunities for installing retrofit end-of-pipe treatment, especially for the outfalls serving relatively large drainage areas. The review should include considerations of:

- Property availability for installation of adequately sized end-of-pipe treatment systems. The BQRAP stormwater guidelines (2006) provide guidance, as does the MOE's 2003 Stormwater Management Planning & Design Manual.
- Future land-use planning, with consideration of whether there are opportunities to install facilities that could treat existing urban drainage while also accommodating new urban development.
- Analysis for smaller catchment areas as to whether cost-effective stormwater treatment could be provided by strategically located oil-grit separators, recognizing the commitment for regular maintenance that such devices require to remain effective.

7. DESERONTO

Deseronto is a small community on the north shore of the Bay of Quinte between Belleville and Napanee. The RAP recommendation #23 lists Deseronto as a community in need of a PPCP, however, there is no formal PPCP in place for Deseronto. In the Status Report for Pollution Control Planning Bay of Quinte Municipalities (XCG, 2003), the Town of Deseronto was reviewed. The following action was suggested to be taken including:

Deseronto undertake the first stages of a PCP by documenting the sanitary and storm sewer systems and monitoring storm outlets for contamination. For program efficiency it is recommended that this be done co-operatively with other interested municipalities or agencies.

In 2005 XCG completed further background work for the PPCP in Deseronto. At that time they concluded the following:

In the case of Deseronto, there is not adequate information on all known or suspected outfall locations and associated drainage areas to establish priorities for stormwater control. The action required at this stage is to acquire more information on existing storm drainage systems and outfall locations within the main built-up Town area.

In both studies (2003 and 2005) a map of sewer systems could not be found. As the current study neared completion the Greater Napanee Water Board staff uncovered a copy of a map of Deseronto storm and sanitary sewer systems, dating to 1997; see Appendix D. The map was useful to confirm drainage catchment boundaries for the individual sewer systems.

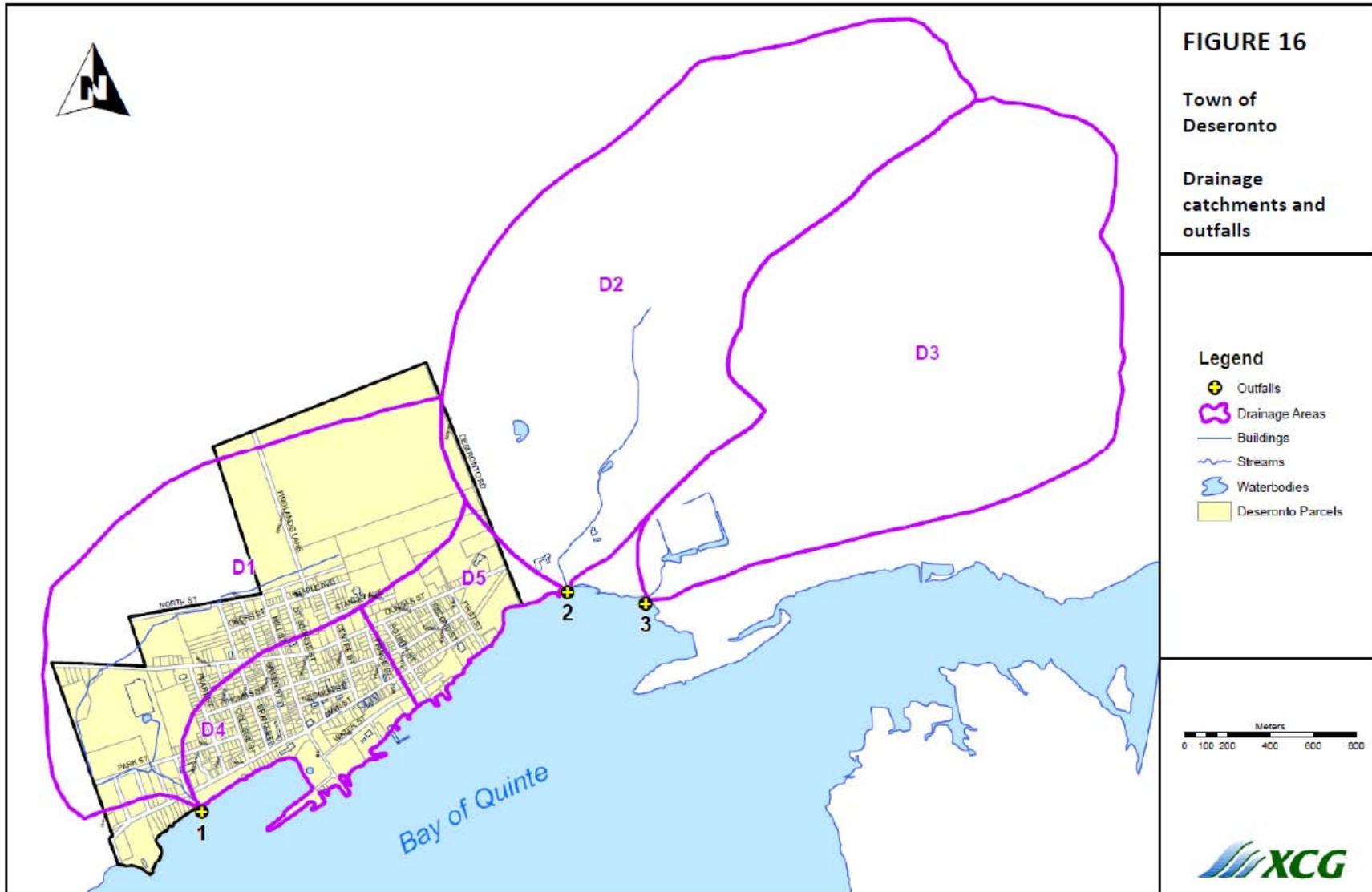
Deseronto is a unique case because it has a small urban footprint, a low percentage of impervious area and limited plans for growth. This would suggest there is little opportunity or need to engage in an extensive PPCP program. Nevertheless, some basic data has been gathered and analyzed.

7.1 Existing Conditions

7.1.1 Existing Drainage System in Deseronto

From observations by project members, the storm sewer system services the downtown core and some of the residential area. The storm drainage system is a combination of underground piping and overland ditches. From observations and using the Province's 5 m DEM contour mapping, general catchment areas were derived for the sewer system outfalls (Figure 16).

Two major storm outfalls were noted (D1 and D2). D1 is characterized as having some urban land use with rural predominating. Some of the system is a combination of open ditch and appears to receive input from a small tributary. D2 is on the east side of the Town and is predominantly rural with open ditch and natural tributary. D3 is another large rural catchment that collects drainage from an area east of D2. It is an open ditch and natural tributary having only road crossings in the form of culverts. D4 and D5 are urban catchments drained mostly by smaller storm sewer systems. They have multiple small pipe outlets to the bay.



Two major sewer systems outletting to the Bay of Quinte were selected for sampling. These are shown as D1 and D2 and are discussed in Section 7.1.3.

7.1.2 Current Programs

7.1.2.1 Source Controls

Deseronto carries out road and storm sewer maintenance on a regular basis. Their schedule for street sweeping is a minimum of twice per year and more often if needed. At the same time they carry out street sweeping activities the catch basin sumps are also cleaned. Again, sumps may be cleaned more often if some drainage issues arise from blockages.

There is a stoop and scoop by-law in Deseronto and they have a program in place which provides waste containers for dog litter in all the public parks. This is in an effort to reduce bacteriological waste on roads, parklands and from entering the Bay of Quinte. Deseronto staff indicate the program would benefit from increased enforcement of the by-law.

7.1.2.2 New Development

There is little new development in the Town and therefore stormwater management controls have not been applied. New development would be subject to the Bay of Quinte Remedial Action Plan Stormwater Management Guidelines (Appendix C) and the Ministry of the Environment's Stormwater Management Planning and Design Guidelines, 2003. These documents state that all development in the Deseronto area would be subject to Level 1 ("Enhanced") water quality objectives. This is the highest category and is intended for sensitive areas or areas with cold water fish species. The Area of Concern designation on the Bay of Quinte has triggered the Enhanced category for all municipalities fronting on the Bay of Quinte.

7.1.2.3 Existing Development

The small size of the urban area of Deseronto and their very limited budget means that it would not be practical to plan and build retrofit stormwater management facilities to attempt end-of-pipe remedial stormwater treatment for the existing built up area. For the same reasons it would not be feasible for them to operate and maintain such a facility. From the standpoint of the Bay of Quinte, it would be difficult to justify a large investment in a remedial stormwater quality treatment facility in Deseronto when compared to gains in quality improvement that could be achieved in larger urban centres on the bay that would yield a more significant return on investment.

To date no retrofit facilities have been entertained or constructed.

7.1.2.4 Cross-Connections

Cross-connections between stormwater and sanitary system present issues for water quality control. One type of cross-connection can result in large volumes of stormwater combining with the sanitary system that can lead to surcharging of the sanitary treatment plant. This is called a combined sewer overflow. These may be in the form of illegal connections downspouts and sump pits to sanitary services. In some cases, catchbasin leads have been mistakenly or incorrectly connected to sanitary

sewer pipes. Smoke testing or camera inspections can reveal these cross-connections. Storm sewer systems may also have input from sanitary systems. These may be discovered by reviewing bacteriological concentrations during storm events and dry weather events. When road maintenance work is being undertaken, cross-connections should be corrected.

7.1.3 Results of 2008-2009 outfall sampling

Table 17 presents the very limited sampling data collected in Deseronto as part of the 2008-2009 sampling program undertaken by Quinte Conservation. The results provide some limited evidence of wet-weather contamination of stormwater discharges from the Town.

7.2 Recommendations for action in Deseronto

7.2.1 Information Management

- It is recommended that the recently located paper plan showing the storm and sanitary sewer systems in Deseronto be converted into GIS-based mapping and database inventory. A GIS database will allow for regular updating of system information, and will also allow for logging and documenting ongoing maintenance activity and any corrective or remedial actions taken.
- It is recommended that the Town undertake a detailed review of the existing storm and sanitary sewerage systems to confirm whether there are any cross-connection or sewer-to-sewer overflow locations. All such locations should be documented within the GIS database, include precise mapping coordinate locations, to allow for ongoing tracking.
- It is recommended that the Town carry out a general review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction. This review should examine the potential to implement stormwater pollution prevention measures that are described in the 'Stormwater Management Planning and Design Manual' (Ontario Ministry of Environment, 2003). Property review status information (e.g. downspout connectivity status) can be integrated within a GIS-based drainage system inventory.

7.2.2 Sewer System Monitoring

- It is recommended that the Town should implement a program of routine inspection of all storm outfalls in Deseronto, including routine sampling of dry-weather discharges. If any evidence of contamination, especially sewage contamination, is detected either by direct observation or from sampling results, then the Town should follow-up with investigation of the tributary pipe system.
- All information gathered through such routine inspection, sampling and investigation should be recorded within the GIS system database inventory, to allow ongoing tracking of system status and tracking of actions taken by the Town.

8. IMPLEMENTATION OF PPCP ACTION PLANS

This section summarizes the recommended actions, and provides a discussion of how the recommended actions might be implemented by each respective municipality.

8.1 City of Belleville

The following recommendations are put forward for consideration by the City of Belleville.

8.1.1 Address Dry-Weather Outfall Contamination:

Observed dry-weather contamination of storm sewer discharges should be addressed. Priorities for action have been identified based on consideration of the sampling results, as well as consideration of the relative size of drainage area.

- BE100: Station St near Pinnacle St
- BQ30: Palmer Road
- BQ110 Farley Avenue
- BQ120 Bradgate
- BW40: Moira Street near CNR

For outfalls showing significant dry-weather bacteriological contamination, then the immediate action required is for investigation within the tributary storm pipe or ditch system to attempt to locate sources. Sources could include cross-connection with sanitary sewer pipes, or possibly wildlife activity within the pipes. Investigative work would consist of:

- Review of engineering drawings with municipal operations staff to identify any possible locations where sewer cross-connection might exist. Are there, for example, locations within sanitary sewer system at which the sanitary system can overflow into the storm pipe system?
- Sampling at various manholes within the storm pipe system to try to narrow down the area that the contamination is coming from.
- Potentially the use of dye testing to check for direct plumbing connections into the storm sewer system.

8.1.2 Control Wet-weather Discharges:

Priorities for retrofit stormwater treatment measures have been chosen based on considering size of drainage catchment, as well as the 2009-2010 outfall sampling results. Following is a list of outfalls that should be considered as priorities for addressing wet-weather discharges.

Outfall	Drainage area
BE10: Adam Street	150 ha
BQ30: Palmer Road	49 ha
BE70 & BE71: College Street outfalls	146 ha
BE80: Station Street	66 ha
BQ110: Farley Avenue and BQ120 Bradgate outfall	21 ha

Wet-weather control could be achieved by retrofit measures such as installation of end-of-pipe treatment facilities (settling ponds or tanks), or through runoff reduction measures within respective catchment areas. Elimination of sources of dry-weather contamination will help reduce wet-weather pollutant discharges.

The 1997 PCP report had identified location opportunities to install retrofit end-of-pipe facilities to treat weather discharges from the Adam Street outfall (BE10) along the east side of the Moira River, and the Farley Avenue (BQ110) and Bradgate (BQ120) outfalls along the East Bayshore waterfront. Refer to Figure 7 above.

It is recommended that the City review these opportunities in light of current planning, to determine whether or not these retrofits can proceed in future if resources become available. Consideration needs to be given to whether the proposed locations for retrofit SWM facilities need to be refined or better defined, and whether these locations need to be clearly referenced in current planning documents, so that opportunities are preserved and formally acknowledged.

8.1.3 Review Municipal Infrastructure Inventory and Mapping:

The City of Belleville should undertake a review of its existing database and GIS mapping of municipal drainage infrastructure (including all stormwater treatment or management facilities) to ensure that the existing inventory is complete and accurate. No significant deficiencies have been identified as part of this project; however, there may be some minor deficiencies such as incomplete mapping of existing oil-grit separator units, or incomplete mapping of known sanitary-to-storm pipe overflow locations.

8.1.4 Storm Drainage System Monitoring

The City of Belleville should undertake a program of routine inspection of storm outfalls and sampling of dry-weather discharges, in order to track current conditions and identify contamination problems if and when they arise. A monitoring program should be designed and implemented, possibly with assistance from Quinte Conservation. Procedures should be put in place to record and store all information gathered, and to document what actions are taken in response to any identified problems such as discharge contamination.

8.2 City of Quinte West (Trenton portion)

8.2.1 Priorities for Dry-weather Source Investigations in Trenton:

Dry-weather contamination of storm outfall discharges should be investigated and corrected. Priority outfalls are listed below.

Outfall	Service area
TC - Dixon Drive 66" storm outfall pipe	Approximately 128 hectares, mixed urban uses.
TF – McGill Street	Approximately 65 ha, primarily residential land use

Both of these outfalls have shown significant dry-weather bacteriological contamination. The action required is for investigation within the tributary storm pipe or ditch system to attempt to locate sources.

Investigative work would consist of:

- Review of engineering drawings with municipal operations staff to identify any possible locations where sanitary-to-storm pipe overflows or sewer cross-connections may exist. Are there, for example, locations within sanitary sewer system (manhole openings) at which the sanitary system can overflow into the storm pipe system?
- Sampling at various manholes within the storm pipe system to try to narrow down the area that the contamination is coming from.
- Potentially the use of dye testing to check for direct plumbing connections into the storm sewer system.

8.2.2 Priorities for Control of Wet-weather Discharges:

As in Belleville, the wet-weather data are limited and do not include bacteriological indicators. It is nonetheless reasonable to expect, based on data from the 1997 Belleville PCP study and data from many urban areas, that most storm events will result in bacteriologically contaminated runoff (i.e. *E.coli* > 100 #/100 mL) from urban catchments.

The top priority in Trenton for addressing wet-weather discharges is the Dixon Drive storm outfall:

Outfall	Drainage area	Concerns
TC - Dixon Drive 66" storm outfall pipe	128 ha	Large outfall serving 128 ha, with dry-weather bacterial contamination.

Previous consideration (1998 Trenton PCP Phase 2 Report) of this outfall has indicated that end-of-pipe treatment for this large drainage area is not feasible due to space constraints; and furthermore, that the cost-benefit evaluation may not justify end-of-pipe treatment at this location.

For this service area, it is recommended that the City of Quinte West conduct a detailed review to determine what measures may be feasible to provide runoff reduction on municipal rights-of-way and other areas over which the City has control. As well, the City should review practices on private properties (e.g. property maintenance and containment of runoff from bulk storage areas, truck loading areas, etc.) to determine if property owners and managers need to be prompted to improve current practices so as to minimize contamination of surface runoff from individual properties.

The City should also review its current sewer use by-law with respect to storm sewers, and determine if the by-law is appropriate and whether it can be used as a mechanism to allow the City to encourage better runoff control from individual properties.

After catchment review and consideration of current sewer use by-law, it is recommended that the City determine whether some targeted public information campaign is warranted to prompt individual property owners to be better mindful of potential contamination of surface runoff from their properties and the potential environmental impact on the Trent River and the Bay of Quinte.

8.2.3 Review Existing Programs, Policies and Actions:

It is recommended that the City conduct a review of its existing programs to clarify some aspects of current policies and approaches to stormwater infrastructure approval. The following points and issues need to be considered:

1. Cash-in-lieu program. The City is collecting cash instead of having developers build small facilities, but the City does not intend to build retrofit SWM ponds. The City needs to formalize an action plan for how cash-in-lieu funds will be used to reduce stormwater pollutant loadings in the most cost-effective manner.
2. Catchbasin cleanout is only once every other year. Cleanout frequency should be increased. It appears resource limitations and a perception of financial/legal obligation exceeding municipal capacity for ongoing maintenance are the two major reasons municipality is not making more progress on retrofit ponds and catchbasin cleanout. Is there any feedback loop from the cleanout crews that indicate if the sumps are full each time they are cleaned out? The cleanout frequency should be adapted by that information.
3. If municipality will accept oil-grit separator (OGS) unit as quality controls for retrofits – would they then plan to install them? Would OGS units be an acceptable alternative to higher level of treatment potential of ponds? The BQRAP stormwater management guidelines would accept that alternative.
4. Would the municipality increase their cleanout frequency of OGS units to ensure they continue doing their job? Who makes sure they are functioning if a serious approach is not taken by municipality?

8.3 Prince Edward County (Town of Picton)

Following is a summary of the recommended actions within Town of Picton.

8.3.1 Information Management

- It is recommended that the available mapping and inventory information on the Town's storm drainage system (pipes, catchbasins, ditches, oil-grit separators, stormwater ponds, outfall structures) be further reviewed to make sure it contains all pertinent details
- It is recommended that the available information on the storm drainage system in Picton be stored and maintained within an easily accessible GIS mapping/database framework. Migrating the information to a GIS platform consistent with other GIS data in use at County of Prince Edward is recommended as a more practical approach to maintaining the data, and facilitating routine and easy data access by County staff.
- It is recommended that the Town carry out a general review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction. This review should examine the potential to implement stormwater pollution prevention measures that are described in the 'Stormwater Management Planning and Design Manual' (Ontario Ministry of Environment, 2003). Property review status information (e.g. downspout connectivity status) can be integrated within a GIS-based drainage system inventory.

8.3.2 Sewer Cross-connection Elimination

There are a number of areas within the Town's sewer system where sewer cross-connections (sanitary to storm sewer cross-connection, or sanitary service connections to storm pipe) are suspected to exist and be active. This is considered to be a priority issue because of the potential for contamination of storm drainage systems discharges to Picton Bay.

Top priority is catchment area "P4" which drains to the Mortimer Street outfall to Picton Bay. As well, catchment "P10" is considered to be a priority because of suspicion of sewer cross-connections within this area.

- It is recommended that PEC undertake investigations of these two systems in an endeavour to confirm and locate any cross-connections, and eliminate them. Further investigation could include sampling during dry-weather periods at various manholes in the system to narrow down the portion(s) of the system that are subject to bacteriological contamination. Sewer inspection by closed-circuit video camera (CCTV) can also help to locate inappropriate connections to the storm pipe system.

8.3.3 Sewer System Monitoring

There may be overflow openings within the sanitary sewer pipe system in Picton that allow for emergency overflow from sanitary to storm pipe system, to protect local properties from basement flooding by surcharged sanitary sewers. Such cross-connection points may have been created in the past as an immediate solution to a wet-weather problem.

If such overflow locations exist and cannot be eliminated without risk of causing basement flooding, then PEC should install liquid level monitors on the upstream (sanitary) side of such overflows, to provide monitoring of activity at those locations. Such monitoring will help to identify which overflow locations remain active, and what amount or severity of wet weather is needed to trigger an overflow. Such information is invaluable in sorting out where real problems are located, and what solution approaches may be required.

8.3.4 End-of-pipe Stormwater Outfall Retrofit Treatment

- It is recommended that the County of Prince Edward consider and review the options presented here for installing stormwater treatment in catchment P1. Two general options (see Appendix F) have been presented in this report, including preliminary costing.

8.3.5 End-of-Pipe Stormwater Facility Maintenance

It is recommended that the County implement a regular sediment cleanout program to restore the water quality treatment performance of the existing stormwater pond that serves catchment P2.

8.4 Napanee

The following summarizes recommendations are put forward for the Town of Napanee.

8.4.1 Information Management

- It is recommended that the available mapping and inventory information on the Town's storm drainage system (pipes, catchbasins, ditches, oil-grit separators, stormwater ponds, outfall structures) be further reviewed to make sure it contains all pertinent details. Missing information may include accurate mapping of all sanitary-to-storm overflow locations.
- It is recommended that the available information on the storm drainage system in Napanee be maintained within an easily accessible GIS mapping/database framework. The information assembled to date has been placed with a GIS structure using ArcGIS. This is recommended as the most practical approach to maintaining the data, and facilitating routine and easy data access and data updating by Town staff.
- It is recommended that the Town carry out a review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction. Property review status information (e.g. downspout connectivity status) can be integrated within the GIS-based drainage system inventory.

8.4.2 Sewer Cross-connection Elimination

The Town needs to investigate and confirm where there are sewer cross-connections or overflows within the sewer pipe system. This is considered to be a priority issue because of the potential for contamination of storm drainage system discharges to the Napanee River and Bay of Quinte.

Based on available sampling, albeit limited, the top priority for investigations are catchment areas draining to outfalls N614 (Robinson St) and N619 (Jim Kimmett Side Road).

- It is recommended that the Town undertake investigations of these two systems to locate any cross-connections, and eliminate them. Investigation could include sampling during dry-weather periods at various manholes in the system to narrow down the portion(s) of the system that are subject to bacteriological contamination. Sewer inspection by closed-circuit video camera (CCTV) can also help to locate inappropriate connections to the storm pipe system.

8.4.3 Sewer System Monitoring

- There may be locations (e.g. manhole openings) within the sewer pipe system in Napanee at which the sanitary pipe system is allowed to overflow if needed into the adjacent storm sewer, to protect against basement flooding. If such overflows exist and cannot be eliminated without risk of flooding, then the Town should install liquid level monitors on the upstream (sanitary) side of such overflows, to provide monitoring of activity at those locations, to monitor which

overflow locations remain active, and what amount or severity of wet weather is needed to trigger an overflow.

- The Town should implement a program of routine inspection of all storm outfalls, including routine sampling of dry-weather discharges. If any evidence of contamination, especially sewage contamination, is detected either by direct observation or from sampling results, then the Town should follow-up with investigation of the tributary pipe system.
- All information gathered through such routine inspection, sampling and investigation should be recorded within the GIS system database inventory, to allow ongoing tracking of system status and tracking of actions taken by the Town.

8.4.4 End-of-pipe Stormwater Outfall Retrofit Treatment

It is recommended that the Town conduct a detailed review of opportunities for installing retrofit end-of-pipe treatment, especially for the outfalls serving relatively large drainage areas. The review should include considerations of:

- Property availability for installation of adequately sized end-of-pipe treatment systems. The BQRAP stormwater guidelines (2006) provide guidance, as does the MOE's 2003 Stormwater Management Planning & Design Manual.
- Future land-use planning, with consideration of whether there are opportunities to install facilities that could treat existing urban drainage while also accommodating new urban development.
- Analysis for smaller catchment areas as to whether cost-effective stormwater treatment could be provided by strategically located oil-grit separators, recognizing the commitment for regular maintenance that such devices require to remain effective.

8.5 Deseronto

Following are recommendations made for the Town of Deseronto.

8.5.1 Information Management

- It is recommended that the available paper plan showing the storm and sanitary sewer systems in Deseronto be converted into GIS-based mapping and database inventory. This will allow for regular updating of system information, and will also allow for logging and documenting ongoing maintenance activity and any corrective or remedial actions taken.
- It is recommended there be a detailed review of the existing storm and sanitary sewerage systems to confirm whether there are any cross-connection or overflow locations. All such locations should be documented within the GIS database, include precise mapping coordinate locations, to allow for ongoing tracking.
- It is recommended that the Town carry out a review of private and public properties to identify which properties might be candidates for simple measures such as downspout re-direction.

Property review status information (e.g. downspout connectivity status) can be integrated within a GIS-based drainage system inventory.

8.5.2 Sewer System Monitoring

- It is recommended that the Town should implement a program of routine inspection of all storm outfalls in Deseronto, including routine sampling of dry-weather discharges
- All information gathered through such routine inspection, sampling and investigation should be recorded within the GIS system database inventory, to allow ongoing tracking of system status and tracking of actions taken by the Town.

8.6 Implementation Considerations

8.6.1 Integration with Existing Municipal Policies, Programs and Operations

In determining if and how the recommendations can be acted upon, each municipality may need to address the following considerations:

1. How do PPCP recommendations get integrated with existing actions or initiatives such as updates to municipal Official Plans, Secondary Plans or other formal planning documents?
2. How do PPCP recommendations get incorporated into existing municipal design, operation and maintenance practices?
3. What role do other stakeholders or agencies (e.g. Conservation Authority, MOE) play in implementing specific recommendations?
4. What are the potential means of funding the various recommended actions, with reference to existing “cash-in-lieu” approaches that have been adopted by the local municipalities?

These considerations, and possibly a number of others that each municipality will be aware of, need to be explicitly considered and dealt with, in order to determine the practicalities of implementation.

It is recommended that each municipality develop a brief summary of how each recommendation made here will be acted upon, including description of which municipal department will be primarily responsible, how actions will be funded or staffed, what timeframe or schedule will be involved, and what implementation obstacles may be encountered.

8.6.2 Potential for Phosphorus Trading or Offsetting

As noted above, urban runoff carries what may be a significant load of phosphorus to receiving waters, and may therefore be contributing to problems associated with nutrient enrichment of the Bay of Quinte. Preliminary estimation of the average phosphorus loading associated with urban runoff from Belleville, Trenton, Picton, Deseronto and Napanee is included in Appendix A. This evaluation includes comparison with other major loading sources to the Bay.

This preliminary comparative assessment of average total phosphorus entering the Bay for the subject urban areas has indicated that in the summer period (June through September) the average mass loading of total phosphorus carried by runoff from these urbanized areas into the Bay may be nearly the same amount as the average June-September loading associated with the sewage treatment plants (STPs) serving these same urban areas (estimated at 1,000 kg). While the dominant source of phosphorus loadings to the Bay continues to be the tributary river systems (Trent River, Moira River, Salmon River and Napanee River, nonetheless, the preliminary analysis presented in Appendix A indicates that during the summer period, stormwater discharges from the subject urban areas may be of the same order of magnitude as that from the local STPs, indicating that urban stormwater runoff needs to be dealt with as part of the overall effort aimed at reducing nutrient enrichment within the Bay of Quinte.

This situation may present the rationale for allocating more resources to deal with urban stormwater. In particular, if an objective is to reduce the total phosphorus emanating from all urban sources (STPs and stormwater runoff) from each municipality, then it may be that the most cost-effective way to achieve further reductions is to turn some focus on stormwater.

One potential means of allowing this to happen is through the regulatory process overseen by the Ontario Ministry of Environment in which discharges from STPs are regulated, and by which discharges from storm drainage system are or can be similarly regulated under the Ontario Water Resources Act.

The basis for allowing so-called phosphorus trading or offsetting through the regulatory process is the fact that it may allow for greater reductions in phosphorus loads to receiving waters, at overall lower cost, at least over an interim period. It needs to be based on careful examination of the relative costs and relative certainty of achieving higher levels of phosphorus reduction at STPs, versus dealing with other sources such as urban storm sewer outfalls. If it can be shown that stormwater treatment is considerably less costly (in terms of per kg load reduction) than achieving ever higher levels of phosphorus reduction at STPs, then phosphorus trading may make sense. However, a number of factors needs to be considered, including seasonality of loadings, bioavailability of the different sources of phosphorus, the certainty and reliability of performance associated with conventional stormwater treatment methods such as settling ponds and constructed wetlands, the ability to measure and monitor outcomes, and the capacity of local municipalities to meet regulatory requirements inherent in any phosphorus trading system.

Very recently, the Ontario Ministry of Environment completed a “Water Quality Trading Feasibility Study” for the Lake Simcoe watershed (posted on the Province’s Environmental Registry in 2010). This study focused on the issue of phosphorus enrichment in Lake Simcoe, an issue very similar to that in the Bay of Quinte. A long-term load limit for phosphorus has been established for Lake Simcoe, and the WQT Feasibility Study examined whether phosphorus trading could help achieve that goal.

This study provides a very useful framework for examining the same possibility for the Bay of Quinte, in particular the potential for addressing the urban stormwater source through phosphorus trading or offsetting.

At this stage, further examination of this potential is needed for the Bay of Quinte urban areas. A number of considerations will be relevant, including:

- Current status with respect to regulatory load limits for existing STPs on the Bay, movement towards lower load limits and availability of estimates of costs to achieve lower load limits at each STP;
- The need for defensible information on the opportunity, cost and long-term performance of retrofit stormwater treatment measures within each of the urban areas, to allow for meaningful comparison with STP load reduction costs.
- Local municipalities understanding of and perspective on phosphorus trading as a potential means of reducing total phosphorus load from each municipality in a cost-effective manner, while continuing and potentially expanding the regulatory requirements that local municipalities will have to meet with respect to STP performance and performance of stormwater treatment systems.

At this stage, it is recommended that Quinte Conservation should coordinate efforts to further examine, in cooperation with the local municipalities and the MOE, the potential for phosphorus trading or offsetting particularly as it relates to urban stormwater sources. Since both sources are under direct regulatory control by MOE through the Ontario Water Resources Act, there may be opportunities for strategic offsets within an individual municipality in which stormwater treatment can be done very cost effectively. Or there could potentially be opportunities for “trades” between municipalities. However, a clear examination of the regulatory process and requirements is needed.

It is recommended that Quinte Conservation have further working discussions with the local municipalities and the MOE to enable local municipalities to develop a complete understanding of the regulatory obligations inherent in any phosphorus load offsetting or trading scenarios that might be acceptable to MOE as regulator. Such discussions will be helped if local municipalities can identify specific project opportunities to install or implement stormwater treatment, with identified costs and expected total phosphorus load reduction. If this type of information can be included within discussions held amongst Quinte Conservation, the MOE and the municipalities, it could help clarify the process by which phosphorus offsetting or trading could occur, with potential cost benefits to the municipality.

9. REFERENCES

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Appendix A Estimation of total phosphorus loadings from urban stormwater runoff from urban areas on the Bay of Quinte

Appendix B Storm Outfall Sampling Program Results, 2008 and 2009

STORM SEWER SAMPLING PROCEDURE AND SUMMARY OF SAMPLES TAKEN

Sampling Procedure

Conservation authority staff from both Quinte Conservation and Lower Trent Conservation were deployed for two years to collect both dry and wet weather samples from selected storm outfalls in five Bay of Quinte Communities. Sampling effort was guided by XCG Consultants out of Oakville using a procedural guideline developed by XCG. The guideline document included an example inspection sheet. The document is provided at the end of this appendix.

Staff completed inspection sheets for each event that included the location, date and time of sample retrieved, measurements of pipe, observations of flow depth and photos. Completed sheets were retained and summary reports were prepared for each sample event. These were too large for inclusion in the paper copy of the report, but are located in Appendix B of the CD in the back folder.

Sample Summary

Sampling teams were dispatched to retrieve samples of flowing outfalls for both wet and dry weather events. Table A-1 provides a summary of successful samples taken during the 2-year project spanning 2008 and 2009. A successful sample is indicated by a yellow field. In a couple of cases samples were taken from the wrong location. These are marked with red fields. Where no sample could be retrieved for varying reasons this is indicated by a blue field. Reasons include:

- Outfall was dry
- Outfall was covered by debris or could not be found by field staff
- Access was not safe

Sample locations are referenced to codes on the left column of Table A-1. Refer to maps located in Appendix D for the locations of the outfalls.

TABLE A-1: SUMMARY OF SAMPLES TAKEN BY MUNICIPALITY

	Dry						Wet					
	22-Aug-08	24-Sep-08	25-May-09	25-Jun-09	21-Jul-09	17-Aug-09	7-Jan-08	31-Mar-08	24-Jul-08	13-Nov-08	2-Jul-09	23-Jul-09
Belleville												
BE10												
BE70												
BE71												
BE80												
BE100												
BE120												
BQ10												
BQ20												
BQ30												
BQ80												
BQ85												
BQ110												
BQ120												
BW10												
BW40												
BW80												
BW100												
BW130												

Samples Taken
No Samples (eg. Dry or no access)
Sampled Wrong Location

	Dry						Wet			
	22-Aug-08	24-Sep-08	25-May-09	25-Jun-09	21-Jul-09	17-Aug-09	7-Jan-08	1-Apr-08	2-Jul-09	23-Jul-09
Napanee										
N62										
N62b										
N65										
N65b										
N68										
N610										
N613										
N614										
N614b										
N615										
N618										
N619										
N621										

	Dry						Wet				
	22-Aug-08	24-Sep-08	25-May-09	25-Jun-09	21-Jul-09	17-Aug-09	8-Jan-08	31-Mar-08	25-Nov-08	2-Jul-09	23-Jul-09
Picton											
P1											
P2											
P4											
P5											
P6											

	Dry					Wet				
	27-Aug-08	21-May-09	25-Jun-09	14-Jul-09	17-Aug-09	7-Jan-08	1-Apr-08	29-Mar-09	28-Apr-09	25-Nov-09
Trenton										
TA										
TB										
TC										
TD										
TE										
TF										
TG										

	Dry						Wet					
	17-Aug-09						23-Jul-09					
Deseronto												
D1												
D2												

SAMPLING PROCEDURE

Bay of Quinte Remedial Action Plan **Storm Outfall Grab Sampling**

Following guidelines have been prepared to assist with collection of grab samples of discharges from storm outfalls during wet weather.

General

The intention is to gather grab samples during a rain event at a sufficient time after rain began that we know with reasonable certainty that the discharge from the outfall is stormwater runoff flow caused by the rain.

At each outfall, an outfall site inspection sheet is to be completed. See the attached form.

Equipment

- Tape measure to confirm outfall pipe size
- Digital camera to take site photos
- GPS unit to confirm outfall geo-coordinates
- Sampling bucket (e.g. clean polyethylene bucket) and funnel
- Sample bottles with labels attached and preservatives added
- MOE LIMS Routine Sample Submission form (serves as chain-of-custody form)
- Cooler and ice packs for sample storage and transport
- Latex or nitrile gloves

Sample collection, labelling and storage

1. Collect samples at points where the stormwater flow (outfall discharge) is well mixed.
2. Avoid taking samples where there is floating debris. Samples should not include any floating debris or any sediment.
3. Prior to sampling the outfall flow, rinse the sampling bucket and funnel with the flow.
4. Generally, the method will be to use to dip the sampling bucket to take a sample of the flow, then use a funnel (or a spare sample bottle or measuring cup) to transfer sample from the bucket into the 500 mL sample bottle. In some cases, it may be possible to sample directly into the sample bottle. Ensure the sample is well mixed prior to transfer to lab bottles.
5. Each sample bottle must be clearly labeled with a Field Sample ID code and the appropriate Product Code.

Product code	Analysis
TOTNUT3367	Total phosphorus
TSD3188	Total suspended solids
MET3386	Metals

6. The Field Sample ID and the product codes will be entered onto the MOE*LIMS Routine Sample Submission form, which should be completed at the same time. See below.
7. Once samples have been labeled and MOE*LIMS submission form completed, store sample bottles in the cooler, with ice packs to keep sample cool.

Filling out the MOE*LIMS Routine Sample Submission Form

Please review the instructions that accompany the MOE*LIMS form. Below are instructions that pertain to this project:

1. Matrix code = "WS" (surface water sample)
2. Field Sample ID: A unique code must be used for each sample
3. Sample date/time (use 24-hour clock --- e.g.: 04 JAN 2008 14:15)
4. Site/Station ID and the Sample Location Description. See the attached list of Site/Station ID codes to use for this project
5. UTM location information: Easting and Northing, Collection method, etc. MOE generally requires this information to be included. Attached table has coordinates for outfalls in Napanee and Picton. For the Belleville outfalls, coordinates have not yet been determined. This could be done using a GPS unit, or can be obtained from mapping. If GPS will not be used, try to obtain this information prior to site visit.
6. Product: three product codes are to be entered on the MOE*LIMS form:
TOTNUT3367, TSD3188, MET3386

Sample submission to MOE laboratory

Samples will be submitted to the Ontario Ministry of the Environment (MOE)
125 Resources Road, Etobicoke, ON M9P 3V6, for analysis.

The MOE*LIMS forms for the samples should be put inside the cooler containing the samples, and then the cooler needs to be transported to the MOE Lab. If a courier is used, the courier waybill and delivery confirmation will be adequate to document chain of custody.

Bay of Quinte Remedial Action Plan
Storm Outfall Grab Sampling

Following are Site/Station ID codes.

BELLEVILLE

Outfall ID	Location description		Site ID code	UTM Northing	UTM Easting
Q10	Avondale/Wright Ave	42" pipe to ditch	BQ10		
Q30	Palmer Road	36" pipe to ditch	BQ30		
Q80	Foster Avenue	27" pipe (circa 1997; may since have been replaced by City)	BQ80		
Q110	Farley Avenue	36" pipe to ditch	BQ110		
Q120	Bradgate	42" pipe to ditch	BQ120		
W10	Tracey Street	66" pipe	BW10		
W80	Moira Street	42" x 42" box pipe	BW80		
W100	Catherine Street	43" x 68" pipe	BW100		
W130	Dundas St	42" pipe	BW130		
E10	Adam St	60" pipe	BE10		
E70	College Street	72" pipe	BE70		
E71	College Street	72" pipe	BE71		

UTM zone = 18; UTM coords need to be determined via GPS or map take-off

NAPANEE

Outfall ID	Location description		Site ID code	UTM Easting	UTM Northing
6.14	Robinson St Outfall	1470 X 1910mm / Corrugated Steel Pipe	N614	344,097.5	4,900,762.4
6.2	Ginger Street Outfall	1725 X 1090mm / Elliptical Pipe	N62	344,838.0	4,902,475.6
6.5	King Street Outfall	900mm / Corrugated Steel Pipe	N65	344,867.3	4,902,063.7
6.18	Hwy 41/Centre St Outfall	675mm / Pipe of Unknown Material	N618	343,215.6	4,902,894.9
6.13	West Street Outfall	675mm / Pipe of Unknown Material	N613	344,223.7	4,900,839.9
6.15	Richard St Outfall	675mm / Pipe of Unknown Material	N615	344,060.8	4,900,650.1
6.10	John Street Outfall	450mm / Corrugated Steel Pipe	N610	344,465.4	4,901,128.3
6.8	Dundas Street Outfall	450mm / Pipe of Unknown Material	N68	344,617.6	4,901,610.3

UTM zone 18; Collection method: Digitized from map ; UTM Map datum NAD83 ; UTM accuracy = 11-20

PICTON

Outfall ID	Location description		Site ID code	UTM Easting	UTM Northing
1	Chapel Street	900 mm / Corrugated Steel Pipe	P1	328,045.3	4,874,407.0
2	Elizabeth Street	900 mm / Reinforced Concrete	P2	328,332.7	4,874,713.2
6	Spencer Street/Hwy 49	N/A mm / Open Ditch	P6	329,084.5	4,876,159.4
4	Martin Street	Unknown mm / Unknown	P4	328,690.7	4,875,207.9
5	Johnson Street	Unknown mm / Unknown	P5	328,732.1	4,875,279.5

UTM zone 18; Collection method: Digitized from map ; UTM Map datum NAD83 ; UTM accuracy = 11-20

Bay of Quinte Remedial Action Plan

Storm Outfall Site Inspection Form

Outfall ID		Weather Conditions:
Date/time of site visit (DD-MMM-YYYY HH:MM)		
Inspected by:		

Outfall description:

Pipe shape Circular Rectangular (box) Other:	Pipe material Concrete Corrugated steel Other:	Pipe measurements: measure diameter, or width and height Coordinates from GPS (if possible)
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Inspection

Is there discharge from the outfall pipe? If yes, then please estimate flow depth in outfall pipe, or approximate % of pipe that is full	
Is the flow clear or cloudy or muddy?	
Is there sediment or debris accumulation in the outfall pipe? If yes, then what approximate depth of pipe is filled by sediment or debris?	
Is there any indication of oil and grease in the flow (for example, surface sheen)?	
Is there any odour? If yes, please describe.	
Is there any evidence of sewage contamination? If yes, please describe.	
Other observations or notes:	

Photos

Camera ID or name	
Please indicate photo numbers or other reference info:	

Flow Sampling

Number of samples gathered	
Please list all Field Sample IDs (for cross-reference to MOE*LIMS form)	

Appendix C BQRAP Implementation Area, Stormwater Management
Guidelines

Appendix D Mapping of storm outfall locations and drainage areas within each urban area:

Figure D-1: Belleville storm drainage system

Figure D-2: Trenton storm drainage catchments and outfalls

Figure D-3: Picton drainage catchments and outfalls

Figure D-4: Napanee drainage catchment and outfalls

Figure D-5: Deseronto drainage catchments and outfalls

Figure D-6: Picton storm sewer network

Figure D-7: Town of Napanee storm pipe network

Figure D-8: Town of Deseronto sewer pipe systems

Appendix E Reference document: “Bay of Quinte Remedial Action Plan - Advancement of Pollution Control Plans for Picton, Deseronto and Napanee - TEMPLATE FOR PCP DEVELOPMENT”, dated April 2006.

Appendix F Preliminary concepts for end-of-pipe treatment in Picton
