COMMITTEE OF THE WHOLE – WORKING SESSION – JANUARY 12, 2009

STORM WATER MANAGEMENT RETROFIT STUDY

Recommendations

The Commissioner of Engineering and Public Works recommends:

1. That this report and associated presentation be received for information purposes;

2. That the conclusions and recommendations of the City-Wide Storm Water Management Retrofit Study be considered in the Storm Drainage and Storm Water Management Master Plan Study;

3. That staff examine funding models for the implementation of a Storm Water Management Retrofit Program and report back to a future Committee of the Whole meeting with a recommended implementation strategy; and

4. That a copy of this report be forwarded to the Toronto and Region Conservation Authority.

Economic Impact

There are no immediate economic impacts resulting from the adoption of this report.

Communications Plan

There is no specific communication plan associated with this report.

Purpose

The purpose of this report is to inform Council of the conclusions and recommendations of the City's Storm Water Management Retrofit Study and to request Council's endorsement in principal of the need to consider a City-Wide Storm Water Management Retrofit Program as a component of the Storm Drainage and Storm Water Management Master Plan work.

Background - Analysis and Options

Prior to the 1980's, urban storm water management activities were simply focused on the prevention of flooding on a site specific basis. Storm drainage systems were designed to quickly and efficiently remove storm water run-off from urbanized areas. This era was symbolized by the creation of vast impervious urban landscapes including the construction of concrete lined channels to replace natural stream systems. As a result, urbanized areas throughout the City developed prior to 1980 contain storm drainage systems designed to quickly release storm water run-off with no consideration for current quantity or quality control requirements.

In the early 1980's, a new era in storm water management began centering on the prevention of downstream flooding and erosion concerns. During this period dry ponds were constructed and parking lot and rooftop controls were implemented to reduce peak flows to pre-development levels. By the late 1980's it became obvious that the impacts of urban runoff on water quality in receiving watercourses was serious and also required mitigation. As a result, in the 1990's, storm water quality controls were introduced and examined from an ecosystem-based perspective. These water quality design components include fisheries and aquatic habitat protection, maintenance of baseflow and temperature, infiltration and monitoring activities.

Current storm water management initiatives have further evolved to include analysis of watercourse geomorphology, ground water balance, terrestrial habitat protection and consideration for other environmentally significant components such as wetlands, woodlots,

environmental significant areas (ESAs) and areas of natural and scientific interest (ANSIs). The evolution of storm water management practice in Ontario has been graphically illustrated in Attachment No. 1.

Urbanization has grown rapidly throughout the City since the early 1980's. As a result, various levels of storm water management controls have been implemented. The Toronto and Region Conservation Authority (TRCA), through its completion of various master plan studies for the Don and Humber River watersheds, has identified that storm water management is an important indicator in assessing and maintaining the health of these rivers and their tributaries. As a result, the enforcement and implementation of current Ministry of the Environment guidelines related to storm water management quantity and quality controls has been identified by the TRCA as a key action item for all municipalities to assist in reducing the quantity and improving the quality of storm water reaching the rivers. The overall goal is to improve the health of the watershed.

In the early 1990's, the Toronto and Region Remedial Action Plan Committee identified an action plan to restore the polluted waterways and waterfront in the Toronto area, from Etobicoke Creek in the west to the Rouge River in the east. The key recommendations outlined in this plan included the need to implement storm water quality control ponds, the use of wetlands for pollutant removal, the reduction of sedimentation through erosion control, and the development of an implementation strategy for storm water quality programs. As a first step, and in response to these recommendations, the TRCA identified the need for all municipalities within their jurisdiction to undertake storm water management retrofit studies.

In 2001, the TRCA completed Phases 1 and 2 of a Storm Water Management Retrofit Study, for each municipality in their jurisdiction including Vaughan. The key objectives of this study were two-fold:

1. To identify the retrofit potential of existing storm water management facilities (such that existing dry ponds providing only quantity control may be enhanced with water quality controls as well); and

2. To identify the potential for new storm water management facilities within existing uncontrolled urban areas.

Phase 1 of this study included the establishment of base mapping and background data collection related to existing facilities, soils and geology information and sewer-shed data. Phase 2 included the preliminary assessment of retrofit opportunities, identification of new facilities and field verification.

This work was initiated and fully funded by the TRCA to provide the framework for a long-term comprehensive strategy to implement storm water quantity and quality controls throughout all existing urbanized areas within their jurisdiction. It was recognized that the continuation of development review and associated storm water management retrofit on a site by site basis would lead to a proliferation of small storm water management facilities throughout municipalities and ultimately to an increase in construction and future maintenance costs. This comprehensive retrofit approach would result in a more efficient storm water management system, addressing the issues of storm water management on a city-wide basis and using an ecosystem approach.

The results of TRCA's Phase 1 and 2 Study (as completed in 2001), identified 10 existing "quantity only" control ponds within Vaughan with retrofit potential; and 23 uncontrolled storm sewer outfall locations where new ponds could potentially be constructed.

In addition to the identification of potential retrofit locations, the following key recommendations were presented:

1. The initial group of ponds considered for retrofit should include those in the Black Creek and Rainbow/Robinson Creek sub-watersheds;

2. A more detailed Phase 3 Study should be carried out by individual municipalities addressing the optimization of existing ponds, including retrofit design criteria, cost estimates and prioritization; and

3. Funding sources and partnerships need to be established to ensure implementation of all feasible retrofit projects.

As a result of this work and the emerging industry awareness of increasing environmental considerations related to the design, operation and maintenance of storm water management ponds, a number of City driven initiatives have been completed, while others are currently under way.

Storm Water Management Initiatives by Vaughan

In addition to storm water management retrofit requirements discussed above and pursuant to Ministry of Environment (MOE) Certificate of Approval (COA), owners' of storm water management facilities are responsible for maintaining ponds in proper working condition and in accordance with original design specifications.

Since the completion of TRCA's Phase 1 and 2 Retrofit Study, the City has proceeded to complete its own detailed inventory and maintenance assessment status report of all existing and assumed storm water management facilities throughout the City. In 2004, a comprehensive Storm Water Management Facility Inventory and Maintenance Database Study was completed by Clarifica Consulting on behalf of the City. The primary objective of this Study was assemble a detailed inventory and assessment of each facility from an operating and maintenance, and to identify and prioritize specific maintenance requirements and associated costs. A further requirement of the Study was to create a user-friendly database management system which could ultimately be incorporated into the City's corporate GIS system. Staff have been updating and maintaining the storm water management database system with current information as it becomes available. In addition, priority maintenance works related to existing ponds have been budgeted for and are programmed for completion on an annual basis.

Other significant initiatives currently underway include the City-Wide Drainage and Storm Water Management Criteria Study, and the Black Creek Optimization Study. The deliverables of these studies include an assessment of on-going flooding concerns throughout the City, a review of storm drainage and storm water management related design criteria, a review of existing conditions within the Rainbow / Robinson Creek sub-watersheds, and the completion of a master storm water management optimization plan for the Black Creek sub-watershed.

Phase 3 Retrofit Study

In 2006, Aquafor Beech Limited was retained by the City to complete the Phase 3 Storm Water Management Retrofit Study. It has expanded upon the information gathered from TRCA's Phase 1 and 2 Study and includes a more detailed assessment, prioritization and preliminary costing exercise for the proposed retrofit works.

The principal objective of this study was to prepare a prioritized list of the potential storm water retrofit sites to be used as a Master Plan for the ultimate implementation of a City-Wide Retrofit Program by the municipality. The key tasks completed include:

1. The development of a screening and prioritization protocol for the assessment of dry ponds and uncontrolled storm sewer outfalls throughout the City. The protocol incorporates logistical constraints (e.g. land for pond enlargement) and integrates the following environmental components:

    i. the ecological significance of the receiving watercourse / stream,

ii. the potential erosion control benefit,
iii. the potential water quality benefit, and
iv. the potential to maintain / improve the flood control function of existing facilities.

2. A detailed review of all existing pond information and undertake field assessments to confirm the potential for retrofit;

3. A detailed assessment of the retrofit potential for each pond and/or outfall based on technical and environmental considerations;

4. Feasibility level cost estimates for retrofitting each potential facility;

5. Ranking the retrofit priority of the ponds based on technical feasibility, environmental, social and financial factors;

6. The identification and evaluation of alternative storm water management measures which could be implemented as part of an overall strategy; and

7. The identification and examination of alternative retrofit funding mechanisms.

As a result of the more detailed analysis work completed by Aquafor Beech, the number of "quantity only" control ponds within Vaughan with retrofit potential, and the number of uncontrolled outfall locations has now been reduced to 9 and 22 respectively. These sites have been graphically identified on Attachment Numbers 2 and 3.

The retrofit works related to Pond No. 68 were completed through development within its tributary area. In addition, uncontrolled Outfall Site No. 33 was eliminated due to the negligible improvement benefits that would result from the introduction of a new pond at this location.

Prioritization of Proposed Retrofit Facilities

The final prioritization list of potential retrofit sites was based on a number of key evaluation criteria factors with specific weight parameters attached to each factor. The factors considered in the prioritization of the retrofit sites include the following:

- Environmental Benefits (habitat, water quality and erosion improvement potential)
- Preliminary Cost Estimates
- Social Considerations (public safety, adjacent land uses, restoration benefits, aesthetics)
- Site Access For Construction, Maintenance and Operations
- Land Status

Upon combining all the above noted factors, a final ranking of sites and associated cost estimates has been included in Attachment No. 4.

Cost estimates for the proposed retrofit works were based on recent construction costs for similar facilities and on discussions with several other municipalities. Land ownership mapping was not available for review in conjunction with the preparation of cost estimates and therefore land cost requirements are not included in the final estimates. Land cost components must be considered at the time of construction based on current market values. Further, in prime development areas where new ponds are required, the land component for a potential retrofit site will most probably become the ultimate deciding implementation factor. As a result, the current prioritization list included as Attachment No. 4 should only be considered preliminary at this point, as it will change based on land status and development interests at the time of implementation. These factors will be flushed out in detail through further pre-screening and the Class Environmental Assessment process required prior to detail design and construction of a storm water management retrofit project.

Alternative Storm Water Management Measures

Storm water management pond facilities represent only one form of Best Management Practices (BMPs) for storm water control. Alternative BMPs are typically grouped into three categories, depending on where the treatment occurs. These groups include source controls, conveyance controls, and end-of-pipe controls.

Source controls are applied at the lot level and are considered to be the first set of controls in the storm water runoff control hierarchy. They serve to reduce runoff rates and pollutant loadings, and may be used to preserve the natural water balance through improved infiltration. Examples include:

- disconnection of roof leaders and redirecting roof runoff to grassed areas
- capture of roof runoff with rain barrels or underground cisterns
- flatter lot grading slopes
- soakaway pits
- infiltration trenches
- pervious pavement driveways

Conveyance controls represent opportunities to treat storm water via the storm sewer system. These include filtration and ex-filtration systems such as the clean water collector system used throughout key areas of Block 12.

End-of-pipe controls receive and treat storm water from the conveyance system before releasing to local watercourses or other receiving systems. Storm water management ponds are the main form of end-of-pipe controls.

All of the proposed retrofit sites within Vaughan fall under the end-of-pipe control category. Some alternative source controls may be less expensive than the average retrofit costs identified in Attachment No. 4. However, the typical predicted rates of voluntary participation by the public are quite low with the exception of residential roof leader disconnection. Further, in terms of effectiveness and maintenance requirements, the proposed centralized retrofit sites controlled by the City would be more desirable than multiple onsite controls located on private property. Alternative BMPs should not necessarily be looked at as potential replacements for the proposed centralized facilities, but they could be incorporated via design criteria and other programs, in conjunction with pond retrofits to provide enhanced controls. These alternatives will be investigated in more detail prior to implementation on a site specific basis at the Class Environmental Assessment stage.

Funding Alternatives

Preliminary cost estimates prepared for each of the potential storm water retrofit locations as identified on Attachments Number 2 and 3 total approximately $42 Million (excluding land costs where applicable). A breakdown of the individual retrofit location costs has been included in Attachment No. 4. As a result of the significant cost implications to municipalities, sources of funding in addition to traditional general revenue sources such as sewer / water rates and taxes, have been explored by municipalities throughout southern Ontario. Potential sources of funding include:

- Development Charges
- Cash-In-Lieu Policies
- Storm Water Rates
- Perpetual Maintenance Fees

Engineering and Public Works staff participate in a quarterly Storm Water Management Discussion Group. This group involves representatives from many municipalities in the southern Ontario area and meets regularly to discuss emerging issues and trends related to all aspects of

storm water management. Funding alternatives to support the increasing budgetary demands associated with operation, maintenance and retrofit of storm water management facilities continues to be one of the key discussion topics at these meetings.

Storm water management systems represent valuable public assets that provide health and safety benefits for the public and the environment. Neighbouring municipalities including Markham, Richmond Hill and Brampton have also completed independent Phase 3 Storm Water Management Retrofit Studies and have introduced implementation programs as a component of their long-term strategy for storm water flooding and erosion control.

Retrofitting existing dry ponds and uncontrolled outfalls is considered a long-term strategy that can be implemented through the prioritized list of retrofit sites. The Town of Richmond Hill has further prioritized their retrofit works to include consideration for other overall storm water management components including regular maintenance and operating requirements.

Many municipalities are struggling with the identification of funding sources to cover these costs and are currently undertaking further investigation in this regard. In addition, municipal storm water management costs have escalated in recent years due to new statutory and regulatory requirements. Despite these new regulations, there are no specific federal or provincial funding sources to assist municipalities with increased budgeting pressures.

The municipalities of Hamilton, Mississauga, Richmond Hill and Markham have implemented a development charges approach to fund new ponds, retrofit existing ponds and undertake stream restoration works. Typically the works are funded partially by the general tax base (for operational and maintenance costs) within existing urbanized areas and in part by development charges in proposed development areas. In Vaughan, developers are responsible for constructing new storm water management facilities and retrofitting existing facilities where appropriate. In addition, special area development charges have been used to fund stream restoration works and the TRCA continues to collect cash-in-lieu of quality control measures from infill and re-development sites on behalf of the City. These cash-in-lieu funds are specifically earmarked for proposed storm water facility retrofit projects within the City.

Storm water rates are common in the Unites States. Some municipalities in Canada have also recently enacted storm water rates. These include London, St.Thomas, Edmonton and Regina. Rates generally range between $4 and $10 per month per household based on impervious land areas. The City of London collects a Storm Drainage Charge using its “Sewer System Charges By-law” while the Town of Aurora charges a storm sewer flat charge per annum for residential, commercial and industrial properties. Other municipalities including Kitchener, Waterloo and Stratford are currently undertaking storm water management rate studies in hopes of implementing an appropriate rate formula in the near future. The City of Kitchener has implemented a Cash-In-Lieu Policy applicable to infill or redevelopment applications in order to upgrade and maintain storm water management facilities in the future.

The City of Brampton and the Town of Halton Hills have established perpetual maintenance fees used for the operation and maintenance of storm water ponds. The fees are collected from new developments prior to assumption.

It is clear that many storm water management funding models exist. Further investigation is required to determine what model is best suited for Vaughan.

Toronto and Region Conservation Authority Participation

TRCA staff has worked closely with the Engineering Department throughout the completion of the Phase 3 Retrofit Study by Aquafor Beech. In addition, the TRCA continues to collect cash-in-lieu from infill and re-development applications on behalf of municipalities in their jurisdiction, where retrofit funding programs have not yet been implemented.

To date, the TRCA has collected approximately $166,000 for retrofit works in the Humber River Watershed and $492,000 for retrofit works in the Don River Watershed (Total of $658,000). These funds will be made available to the City as required for use in implementing priority retrofit projects.

TRCA is satisfied with the conclusions of the Phase 3 Retrofit Study. Accordingly, it is recommended that a copy of this report be forwarded to the TRCA for information purposes.

Retrofit Works Completed To Date

Pond retrofit works throughout the City have been completed over the last several years. Two existing storm water management quantity control ponds within urbanized areas have been retrofitted with water quality components through development within their tributary areas. These include Pond No. 68 in Block 37 located south of Vaughan Mills Mall and Pond No. 89 in Block 45 north of the Board of Trade Golf Course. These construction projects were fully funded by the benefitting developments.

Next Steps

The City is currently undertaking a water and sewer rate study. This study will review current and future infrastructure operating and capital costs, in order to establish future rate and reserve requirements. The conclusions of the Study will provide the City with a plan to financially sustain the City's infrastructure system, consistent with the requirements of the Sustainable Water and Sewage Systems Act and Safe Drinking Water Act.

Staff has provided the City's Rate Study consultants with estimated operational, maintenance and retrofit costs associated with storm water management facilities. As a result, alternative funding solutions and impacts on current and future water and sewer rates with respect to storm water management will be factored into the considerations and conclusions of the Rate Study. This will also allow the City to better understand the impact on existing rates as a result of a retrofit program.

In addition, in conjunction with the City's on-going Growth Management Strategy and Official Plan Review process, engineering staff will be retaining a consultant to complete a Storm Drainage and Storm Water Management Master Plan Study over the next year. This Study will comprehensively plan for all aspects related to storm drainage and storm water management throughout the City, for existing urbanized areas and future growth areas.

Implementation of Storm Water Management Retrofit Projects

As funding becomes available for the "next" retrofit project, a series of further environmental and design studies for that specific site will be required. The basics steps to ultimately implement retrofit work on a site specific basis are outlined below:

- Further Pre-Screening
- Municipal Class Environmental Assessment – Schedule 'B'
- Property Acquisition
- Detailed Design
- Approvals and Permits
- Tender and Construction

Relationship to Vaughan Vision 2020

In consideration of the strategic priorities related to Vaughan Vision 2020, the recommendations of this report will assist in:

- Enhancing and ensuring Community Safety, Health and Wellness;
- The pursuance of excellence in service delivery;
- Demonstrating leadership initiatives, promoting environmental and financial sustainability;
- Effective governance;
- Enhancing productivity, cost effectiveness and innovation;
- Maintaining assets and infrastructure; and
- Planning and managing growth, and economic vitality.

This report is therefore consistent with the priorities previously set by Council.

Regional Implications

There are no immediate Regional implications resulting from the adoption of this report.

Conclusion

The evolution of storm water management requirements over the past three decades, together with the rapid rate of growth, has led to the need for storm water management retrofit projects throughout all municipalities within southern Ontario.

A prioritized list of potential storm water management retrofit sites throughout the City has been prepared. This list includes 9 existing “quantity only” control ponds and 22 uncontrolled storm sewer outfall locations. The total preliminary cost estimate to complete the required retrofit works at all locations is approximately $42 Million (excluding land costs where applicable).

Implementation of these storm water management retrofit projects is a long-term process and must be coordinated with other on-going initiatives including the City’s Storm Drainage and Storm Water Management Master Plan and overall Growth Management Strategy. Accordingly, it is recommended that the conclusions and recommendations of the City-Wide Strom Water Management Retrofit Study be considered in this work.

Funding alternatives and associated models to support the increasing budgetary demands resulting from the operation, maintenance and retrofit of storm water management facilities, continues to be an increasing challenge to many municipalities. The conclusions of the City’s on-going Rate Study will provide valuable insight into potential funding alternatives for storm water retrofit projects. Further investigation will be required to determine what funding model is best suited for Vaughan such that a Retrofit Program could ultimately be implemented. Accordingly, it is recommended that staff examine funding models for the implementation of a Storm Water Management Retrofit Program and report back to Council with a recommended implementation strategy.

Attachments

1. Evolution of Storm Water Management Practice in Ontario
2. Potential Storm Water Management Retrofit Locations (West)
3. Potential Storm Water Management Retrofit Locations (East)
4. Prioritization Concept of Potential Retrofit Locations

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Respectfully submitted,

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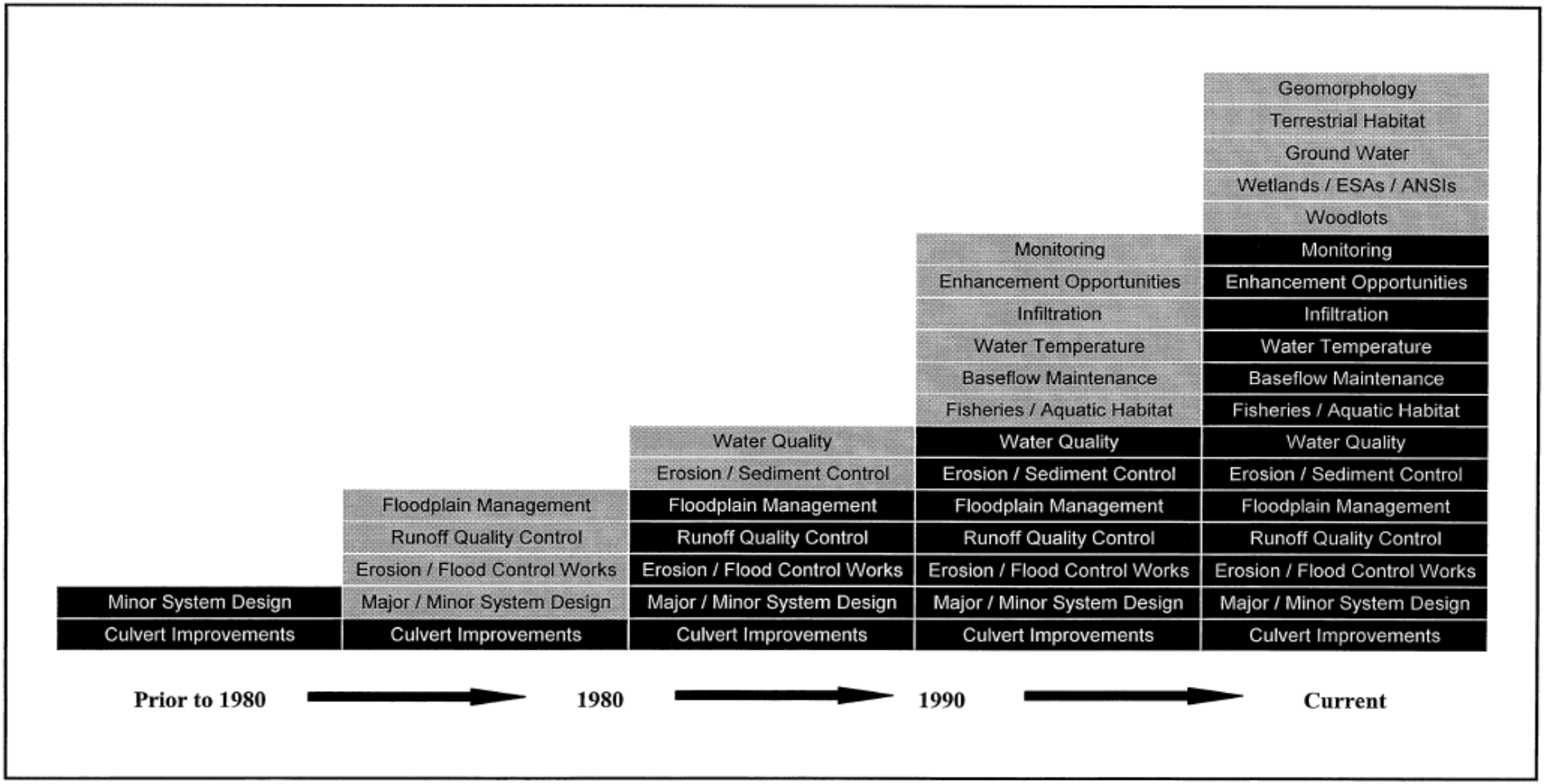
ATTACHMENT No. 1

Evolution of Storm Water Management Practice in Ontario

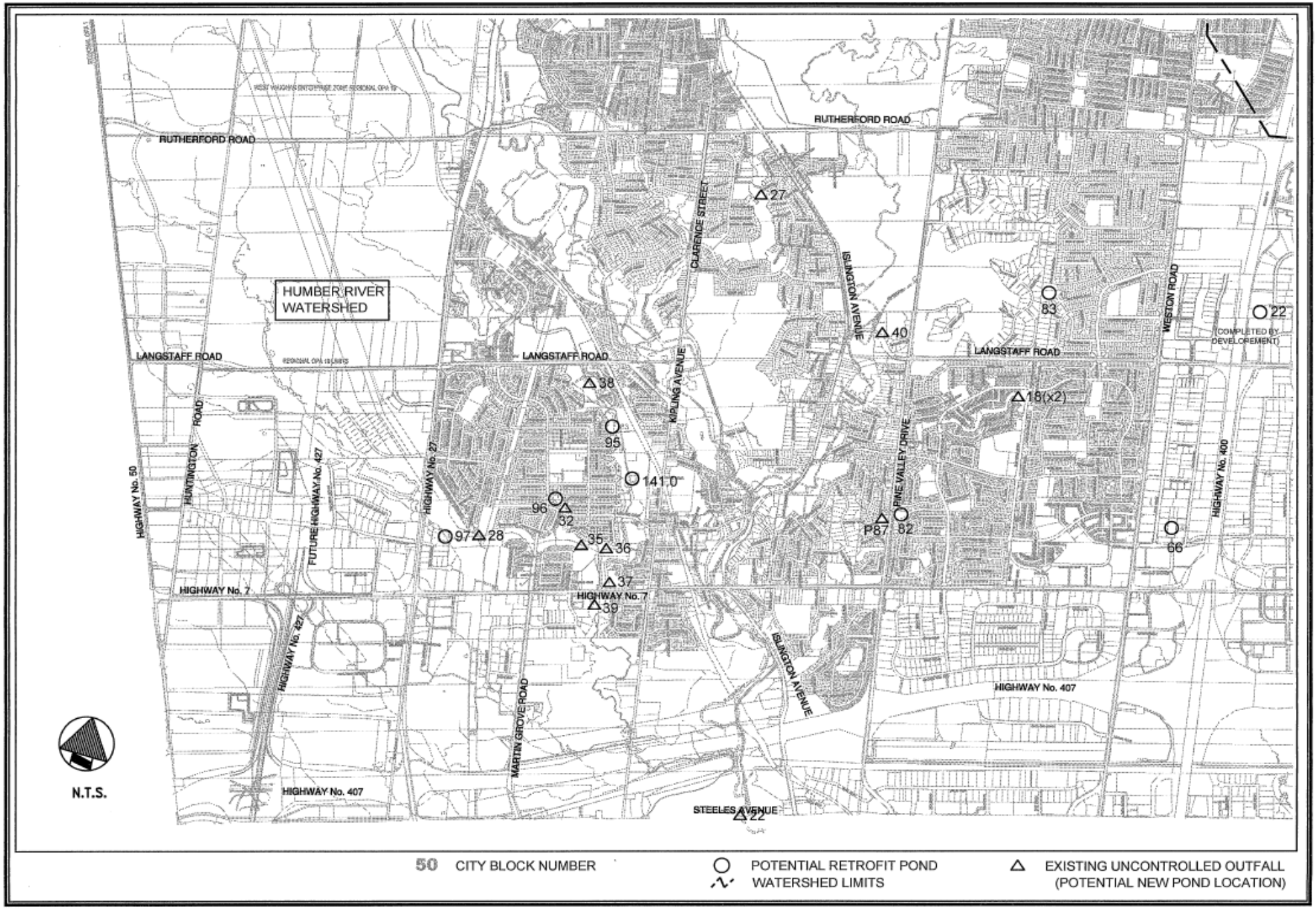


Sources: MOE Subwatershed Planning, June 1993

Low Impact Stormwater Management Manual - Draft, November 2008 (TRCA & CVC)

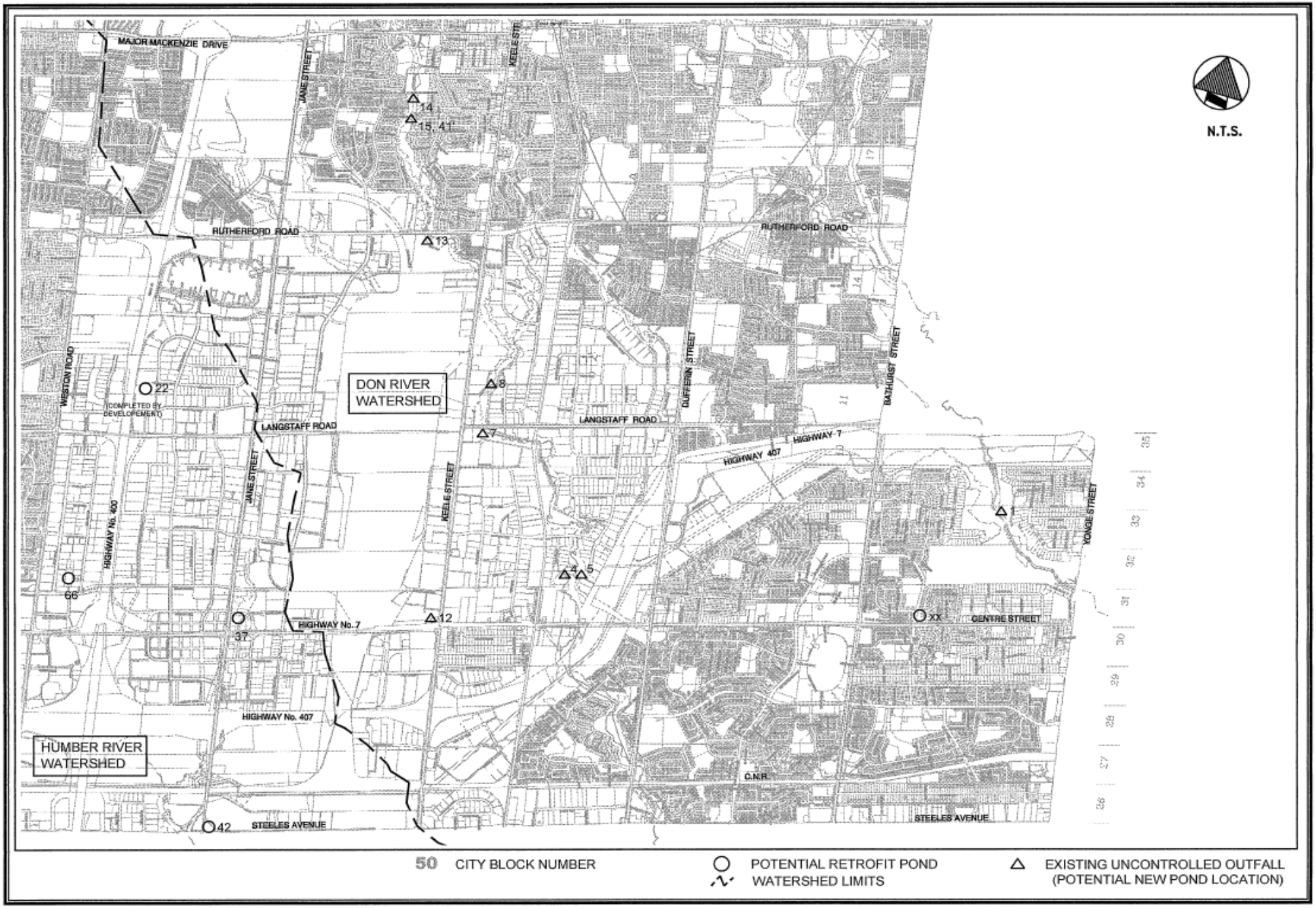
Potential Storm Water Management Retrofit Locations (West)

ATTACHMENT No. 2



Potential Storm Water Management Retrofit Locations (East)

ATTACHMENT No. 3



ATTACHMENT No. 4

Prioritization of Potential Retrofit Sites

Rank	Type	Site ID Number	Retrofit Cost Estimate	Watershed
1	Pond	37	$6,673,000	Humber River
2	Pond	97	$250,000	Humber River
3	Pond	66	$1,630,000	Humber River
4	Pond	83	$3,702,000	Humber River
5	Outfall	39 [4]	$2,194,000	Humber River
6	Pond	82	$966,000	Humber River
7	Outfall	87	$1,492,000	Humber River
8	Pond	96 [1]	$1,249,000	Humber River
9	Pond	95	$1,276,000	Humber River
10	Pond	XX	$401,000	Don River
11	Outfall	1	$250,000	Don River
12	Pond	141	$253,000	Humber River
13	Outfall	13	$250,000	Don River
14	Outfall	27	$250,000	Humber River
15	Outfall	12 [4]	$5,644,000	Don River
16	Outfall	15 [2]	$250,000	Don River
17	Outfall	38	$5,356,000	Humber River
18	Outfall	32 [1]	$1,249,000	Humber River
19	Outfall	4	$1,667,000	Don River
20	Outfall	18.1 & 18.2	$808,000	Humber River
21	Outfall	41 [2]	$250,000	Don River
22	Outfall	40	$250,000	Humber River
23	Outfall	35 [3]	$972,000	Humber River
24	Outfall	7	$474,000	Don River
25	Outfall	37	$739,000	Humber River
26	Outfall	14	$250,000	Don River
27	Outfall	36 [3]	$972,000	Humber River
28	Outfall	22 [5]	$2,475,000	Humber River
29	Outfall	5	$655,000	Don River
30	Outfall	28	$1,093,000	Humber River
31	Outfall	8	$250,000	Don River
Total Cost			**$41,719,000**	

Notes:

[1] Pond 96 and outfall 32 discharge to common proposed facility.

[2] Outfall 15 and outfall 41 discharge to common proposed facility.

[3] Outfall 35 and outfall 36 discharge to common proposed facility.

[4] Additional land requirements / prime development area.

[5] Coordination required with City of Toronto.