One Mile Creek Watershed Strategy Final Report

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Prepared For:

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Overview

One Mile Creek Watershed is located within the Town of Niagara-On-The-Lake (NOTL) with its outlet located about 3.5 km to the west of the Niagara River outlet to Lake Ontario. The watershed is relatively small, with a drainage area to the creek outlet being approximately 5.2 km2. The creek drains a highly urbanized watershed area and flows in a northwesterly direction. Land uses within the watershed are not expected to change drastically in the future. The construction of the Epp Drain upstream of John Street diverts the majority of the headwater flows (about 30% of the drainage area) easterly to the Niagara River. Major event flows (near the regional flood flow) overflow the Epps Drain and spill into One Mile Creek. The Williams Street Pumping Station was constructed to convey flows from a portion of NOTL served by combined sewers, to the regional Water Pollution Control Plant. An overflow from the Pumping Station outlets to One Mile Creek downstream of Nassau Street. There are about 16 storm sewer outlets discharging to One Mile Creek. There are no stormwater management facilities within the watershed.

The Niagara Peninsula Conservation Authority (NPCA) completed a Watershed Flood Damage Assessment Study (1988) which evaluated flood damages throughout the Authority's jurisdiction. One Mile Creek was identified as having flood damage potential, and to date non-structural measures such as flood forecasting and flood plain management policies have been applied to the One Mile Creek Damage Centre. More recently, NPCA completed a Floodplain Mapping Study (2004) that identified the limits of the regional floodplain, surveyed existing watercourse crossings and identified potential barriers to flood conveyance for storm events with various return frequencies up to the regional storm.

One Mile Creek flows through portions of historic NOTL and has a rich cultural and archeological history dating to habitation by Native Peoples over 10,000 years ago. A portion of the creek flows along the boundary of the Parks Canada historic site that includes Fort George and the Commons that have a rich military history dating to the War of 1812 and the times of Butler's Rangers. Landsdowne Pond, a small wetland/pond at the mouth of One Mile Creek is separated from Lake Ontario by a barrier beach that forms and re-forms in response to wave action and creek flows. Landsdowne Pond also has a rich history associated with it. The Pond was once used for boating and access to Lake Ontario by the Hotel Chautauqua, an historic landmark, built in the 1920's.

For a number of years, landowners abutting the creek and other interested individuals have raised concerns regarding the condition of the creek and associated Landsdowne Pond, and have worked with NPCA to implement a number of stewardship projects. They formed the Friends of One Mile Creek Community Group (FOMC). The FOMC has held ongoing meetings and has been active in developing projects within the watershed with support from the NPCA. The FOMC has advocated the need for a Watershed Plan for One Mile Creek in order to comprehensively address the variety of issues associated with the Creek and develop a long term strategy for correcting these concerns. The Watershed Plan would also provide a framework for a variety of undertakings to restore One Mile

Creek and Landsdowne Pond and would provide the necessary technical background for various funding projects developed by the FOMC and NPCA.

The study area includes all of the lands draining to One Mile Creek, excluding the lands draining to the Epp's Drain. It also includes Landsdowne Pond and the area of the storm sewer network discharging to One Mile Creek. The total area of the watershed within the study is about 3 km2 (excluding Epp Drain).

The watershed plan was coordinated by NPCA and developed in consultation with a steering committee consisting of representatives of the following organizations / departments:

- NOTL Council
- NPCA
- NOTL Staff
- FOMC / Local Citizens
- Region of Niagara
- NOTL Irrigation / Drainage Committee

Recommended Plan

The Recommended Watershed Plan is summarized in Table 1. These measures represent the suite of capital works, programs and stewardship measures that are recommended to restore the One Mile Creek Watershed to a healthy state.

Table 1. Implementation Plan Components

Recommended Management Actions		
SOURCE CONTROLS		
M1a	**Action:**	**Downspout Disconnection /Soak-away Pits**
	Implementation:	Landowner, Conservation Authority, Municipality
	Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
	Priority:	Short and Medium Term
M1b	**Action:**	**Rainbarrel Program**
	Implementation:	Municipality
	Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
	Priority:	Medium and Long Term
CONVEYENCE CONTROLS		
M2	**Action:**	**Perforated Pipe / Infiltration Techniques(as roads improved)**
	Implementation:	Municipality

Recommended Management Actions	
Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
Priority:	Medium / Long Term
END OF PIPE CONTROLS	
M4 Action:	**Stormwater Management Pond**
Implementation:	Landowner, Municipality, Conservation Authority, Landowner, Federal Government
Options:	Possible locations include the Commons, Peller Estates
Benefits:	Baseflow augmentation, reduced flooding, water quality enhancement, community amenity
Priority:	Short / Medium Term
CULVERT IMPROVEMENTS	
M5 Action:	**Culvert Replacement/Upgrade** (Nassau, Dorchester, Victoria, Regent, Gate, Gage)
Implementation:	Municipality, Conservation Authority, Landowner
Benefits:	Reduced flooding
Priority:	Medium and Long Term
STREAM RESTORATION/HABITAT ENHANCEMENT	
M6 a) Action:	**Stewardship (How To) Manual**
Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
Benefits:	Assist landowners by providing information on how to improve instream habitats, improve streamside habitats, and improve instream flows
Priority:	Short Term
M6 b) Action:	**Technical Assistance Program**
Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
Benefits:	Assist landowners by providing technical advice, concept designs for improving instream habitats, streamside habitats, and instream

Recommended Management Actions		
		flow conditions
	Priority:	Short Term
M7	**Action:**	**Stream Clean Up Program**
	Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
	Benefits:	Provide assistance to landowners to remove leaf litter and debris from streams
	Priority:	Short Term
M8	**Action:**	**Instream Habitat Enhancement**
	Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
	Options:	Remove Barriers / Channel Constrictions; Naturalized Stream Rehabilitation, MNR
	Benefits:	Improved instream habitats, improved flow conveyance
	Priority:	Short and Medium Term
M9	**Action:**	**Streamside Habitat Enhancement**
	Implementation:	Conservation Authority, Landowner, Community Group, MNR
	Options:	Tree/Shrub Plantings; reduced lawn maintenance along stream
	Benefits:	Improved habitat, stream shading, water quality enhancement
	Priority:	Short and Medium Term
LANDSDOWNE POND		
	M10 a) Action:	**Detailed Assessment of Pond**
	Implementation:	Conservation Authority, Municipality, Landowner, Provincial/Federal agencies
	Benefits:	Develop long term plan to improve water quality and reduce stagnation
	Priority:	Short Term
	M10 b) Action:	**Weir Modifications – Niagara Blvd.**
	Implementation:	Conservation Authority, Municipality, Provincial/Federal agencies
	Benefits:	1) Improved flow conveyance; 2) improved fish passage
	Priority:	Short Term

Recommended Management Actions	
M10 c) Action:	**Habitat Works /Outlet Modification (downstream of Niagara Blvd.)**
Implementation:	Conservation Authority, Municipality, Landowner, Community Group
Benefits:	Improve channel characteristics, enhance aquatic habitat
Priority:	Short Term
EROSION REMEDIATION	
M11 Action:	**Erosion Remediation**
Implementation:	Landowner, Conservation Authority, Municipality, Ministry of Natural Resources, Ministry of the Environment
Benefits:	Eliminate erosion of landfill
Priority:	Short Term
Environmental Monitoring	
M12 Action:	**Comprehensive Environmental Monitoring Program**
Implementation:	Conservation Authority, Friends of One Mile Creek, Ministry of Natural Resources, Municipality
Benefits:	Documents in progress in implementing the plan and restoring environmental health of watershed
Priority:	Short and Medium Term
M13 Action:	**Environmental Awareness Programs**
Implementation:	Conservation Authority, Friends of One Mile Creek, Ministry of Natural Resources, Municipality
Benefits:	Greater support for implementation of measures; commitment to improve watershed health
Priority:	Short and Medium Term

Plan Administration

In order to be effective, an implementation committee is needed to ensure that responsible agencies, groups and individuals are fulfilling their roles. For One Mile Creek, it is recommended that an Implementation Committee be formed to meet annually to assess progress. The committee should be made up of the following:

- FOMC

- NPCA
- NOTL
- Parks Canada
- MNR

The committee should report annually on progress and identify actions that should be undertaken for the upcoming year. Key initial priorities are as follows:

- Initiate studies for Landsdowne Pond
- Complete the Stream Restoration Manual
- Initiate discussions with Parks Canada for the Stormwater Pond
- Develop a roof downspout disconnection program and change the NOTL bi-law on downspout connections to storm sewers
- Plan a fall stream cleanup program

1.0 INTRODUCTION

1.1 General

One Mile Creek Watershed is located within the Town of Niagara-On-The-Lake (NOTL) with its outlet located about 3.5 km to the west of the Niagara River outlet to Lake Ontario (Figure 1). The watershed is relatively small, with a drainage area to the creek outlet of approximately 5.2 km^2. The creek drains a highly urbanized watershed area and flows in a northwesterly direction. Land uses within the watershed are not expected to change drastically in the future. The construction of the Epp Drain upstream of John Street diverts the majority of the headwater flows (about 30% of the drainage area) easterly to the Niagara River. Major event flows (of magnitudes nearing the regional flood flow) overflow the Epp Drain and spill into One Mile Creek. The Williams Street Pumping Station was constructed to convey flows from a portion of NOTL served by combined sewers, to the regional Water Pollution Control Plant (located west of the study area). An overflow from the Pumping Station outlets to One Mile Creek downstream of Nassau Street. There are about 16 storm sewer outlets discharging to One Mile Creek. There are no stormwater management facilities within the watershed.

The Niagara Peninsula Conservation Authority (NPCA) completed a Watershed Flood Damage Assessment Study (1988) that evaluated flood damages throughout the Authority's jurisdiction. One Mile Creek was identified as having flood damage potential, and to date non-structural measures such as flood forecasting and flood plain management policies have been applied to the One Mile Creek Damage Centre. More recently, NPCA completed a Floodplain Mapping Study (2004) that identified the limits of the floodplain (based on the 100 year event), surveyed existing watercourse crossings and identified potential barriers to flood conveyance for storm events with various return frequencies up to the 100 year storm.

One Mile Creek flows through portions of historic NOTL and has a rich cultural and archeological history dating to habitation by Native Peoples over 10,000 years ago. A portion of the creek flows along the boundary of the Parks Canada historic site that includes Fort George and the Commons that have a rich military history dating to the War of 1812 and the times of Butler's Rangers. Landsdowne Pond, a small wetland/pond at the mouth of One Mile Creek is separated from Lake Ontario by a barrier beach that forms and re-forms in response to wave action and creek flows. Landsdowne Pond also has a rich history associated with it. The Pond was once used for boating and access to Lake Ontario by the Hotel Chautauqua; a historic landmark, built in the 1920's.

For a number of years, landowners abutting the creek and other interested individuals have raised concerns regarding the condition of the creek and associated Landsdowne Pond, and have worked with NPCA to implement a number of stewardship projects. They formed the Friends of One Mile Creek (FOMC). The FOMC has held ongoing meetings and has been active in developing projects within the watershed with support from the NPCA. The FOMC has advocated the need for a Watershed Plan for One Mile Creek in order to comprehensively address the variety of issues associated with the Creek and develop a long term strategy for correcting these concerns. The Watershed Plan would

also provide a framework for a variety of undertakings to restore One Mile Creek and Landsdowne Pond, including the necessary technical background for various funding projects developed by the FOMC and NPCA.

1.2 Study Area

The study area includes all of the lands draining to One Mile Creek, excluding the lands draining to the Epp's Drain. It also includes Landsdowne Pond and the area of the storm sewer network discharging to One Mile Creek. The total area of the watershed within the study is about 3 km^2 (excluding the Epp Drain) (Figure 1).

1.3 Study Purpose and Organization

As identified in the Terms of Reference for the One Mile Creek Watershed Study, the intent of the study is to produce a Watershed Management Plan, in consultation with appropriate government agencies, landowners and interest groups, that assists with the management of the water, land/water interactions, aquatic life and aquatic resources to protect and improve the health of the ecosystem. It will recommend direction and strategies that will allow the community to care for the watercourse with the objectives of preserving and restoring the channel and its floodplain area to a state which balances both the needs of the landowners and the watercourse ecosystem.

By far, the most important component of the study is consultation with landowners, interest groups and others prior to and during all phases leading to the final plan. Most of the study area is privately owned and accordingly, the input from landowners is vital to producing an acceptable and workable plan. A total of four public meetings were held in order to solicit broad public input at various stages in the development of the Watershed Plan and Implementation Strategy (Appendix A).

The Watershed Plan focuses specifically on restoring and rehabilitating One Mile Creek with consideration of input and issues brought forward through public consultation and technical studies. The Plan and Implementation Strategy considered the following:

- Recommendations on stream rehabilitation and restoration measures, both structural and non-structural, municipal and regional policies, educational and outreach programs, and long and short term objectives;
- Current activities of groups such as the FOMC and any projects/programs currently underway;
- Recommendations on the Epp Drain and the outlet to Lake Ontario including required changes to facilitate the implementation of the Watershed Plan;
- Where applicable, all recommendations shall be separated as to ownership, whether publicly owned (Municipality or Region) or private;
- A priority list including estimated costs for projects, activities, policies or other recommendations that are developed by the Plan;
- Recommendations regarding a monitoring program and performance indicators to assist in determining the effectiveness of Watershed Plan implementation;

- Recommendations for financial and information assistance programs that could be considered to assist in implementation of the Watershed Plan.

The watershed plan was coordinated by NPCA and developed in consultation with a steering committee consisting of representatives of the following organizations / departments:

- NOTL Council
- NPCA
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2.0 EXISTING CONDITIONS

2.1 Physiography and Soils

Surficial geology of the area is shown in Figure 2. The overburden is composed primarily of fine grained lake deposits from historic glacial lakes with some coarser material related to glacial activity or historic lake shorelines. Two general geologic formations occur:

- Type 8/8a: virtually the entire watershed is covered with fine grained, laminated glaciolacustrine deposits; and
- Type 9/9a: a headwaters area (generally south and west of King Street) covered in coarse textured glaciolacustrine deposits.

A small area immediately adjacent to the Lake Ontario shore is also composed of coarse textured glaciolacustrine deposits. It is notable that the majority of the Epp Drain watershed is also composed of fine grained, laminated glaciolacustrine deposits. In general Type 8/8a deposits have a low permeability and do not represent potential recharge areas; Type 9/9a deposits have a higher permeability and may represent potential recharge areas depending on the overlying soils. A regional groundwater study (Waterloo Hydrogeologic Incorporated *et.al.* , 2005) has recently been completed for NPCA that corroborates these observations. The level of detail in the regional study for the One Mile Creek is generally insufficient to provide additional information, due to the lack of water well and other supporting information.

Similar to the lack of groundwater data, information on surficial soils within the One Mile Creek Watershed is generally lacking. The following information is provided in the report “Restoring One Mile Creek” (Diermair *et.al.* 2003) and is consistent with general observations made in this study. Regional soils mapping is available for Two Mile Creek and other areas adjacent to One Mile Creek. This mapping indicates that the predominant soil has its origins as glaciolacustrine marine deposits composed mainly of silty clay and silty clay loam textures, occasionally overlain by loamy sediments. These soils are considered imperfectly drained, with low hydraulic conductivity and a medium saturation

period. These soils generally have low permeability and therefore represent low recharge potential.

2.2 Stream Morphology and Erosion

One Mile Creek is a small watercourse with a drainage area of about 3 km^2 (excluding the drainage area of the Epp Drain which is about 2 km^2). There is evidence of several small drainage features entering the main channel (Figure 3):

- King and John Street: drainage along the former rail line; drainage through Memorial Park and across the "Barracks" area
- Downstream of Nassau Street: drainage through the "park" behind William Street Pumping Station

It is likely however that these features represent intermittent watercourses and primarily conveyed surface drainage. Based on the existing drainage network, One Mile Creek would be classed as a 1st Order Stream, possibly becoming a 2nd Order Stream north of Nassau Street. The general channel and valley characteristics of the Creek were also examined, and the Creek was divided into 3 zones as follows (Figure 3):

- Zone 1 (2 stream km): headwaters zone, upstream of King Street – the creek lacks any valley characteristics, and has a poorly defined channel bed and banks. Channel characteristics have been altered by straightening, widening and in some cases the channel may have been relocated to facilitate access to the land, road construction or drainage improvement.
- Zone 2 (4 stream km): middle zone, from King Street to Butler Street – the creek has a defined channel and bed, but lacks any valley characteristics. The channel has been extensively modified by landowners, but its original course appears to have been generally preserved.
- Zone 3 (1.9 stream km): lower zone, from Butler Street to the confluence of Lake Ontario, including Landsdowne Pond. The channel is well defined, exhibits a meandering morphology with well developed pool:riffle morphology and flows within a well defined valley.

In simple terms these 3 zones also correspond to the following generalized zones describing the sediment regime:

- Zone 1: Source or sediment supply zone, where sediments from the land are delivered to the stream by overland transport for transport downstream;
- Zone 2: Transport or erosion zone, where sediments in the channel and floodplain are transported downstream
- Zone 3: Deposition zone, where sediments from upstream are deposited in the channel and floodplain (a portion of the sediments may be carried out into Lake Ontario)

While these zones generally describe the sediment regime of the stream, it is important to note that all three zones supply sediment to the watercourse. This is particularly evident in zones 1 and 2, where the storm sewer system and associated road infrastructure

provide an efficient sediment delivery mechanism for sediments generated within this zone.

The interaction and dynamic equilibrium established between the flow regime (frequency and duration of stream flows – see Section 2.3) and the sediment regime (as described above) ultimately characterize the aquatic habitats and stability of the stream and its adjacent floodplain. Changes in the sediment supply or changes in the flow regime will result in changes in the stream channel characteristics including the composition of the stream bed material at various points along the channel in each of the three zones. The presence of obstructions and grade constraints (for example, undersized culverts, drop structures, etc.) also disrupts the sediment transport process, causing localized sediment deposition and bank erosion.

The physical characteristics of One Mile Creek have been significantly influenced by the surrounding human environment. Much of the creek channel winds its way through residential areas and receives runoff from storm-sewer outfalls at many road crossings. Modification and control of the aquatic environment by built structures have likely limited various channel adjustments throughout much of the watercourse. Indeed, its winding course does not appear to be significantly controlled by recent channel processes, particularly upstream of Nassau Street. Through field investigations, the watercourse was assessed to provide insight into existing channel form and contributing processes. Observations were made at a number of flow stages ranging from no flow to full bankfull flow conditions.

Upstream of King Street (Zone 1) the channel was generally ditch-like with some stagnant wetland-like sections. Downstream of King Street (Zone 2) the channel became better defined as it flowed through woodlots and residential properties. Some localized ditch-like sections occurred within the residential areas. The channel was well defined downstream of Nassau Street (Zone 3), and is associated with a forested floodplain and defined bed features. Channel form became poorly defined upstream of Lansdowne Pond where excess accumulation of sediment had occurred and channels were opportunistic (i.e., following depressions) and appeared to have been easily deflected by organic debris.

During the field investigations, it became apparent that conveyance of flow through the watercourse in Zones 1 and 2 was fragmented. That is, there were several on-line pools which formed as a result of land owner activity. In addition, in early June, 2005, the channel became dry downstream of Mississauga Road and remained dry to the crossing at Butler Road. Downstream of Butler Road, isolated ponds were observed and by Dorchester / Nassau Streets, flow fully occupied the channel again. The cause for this fragmentation in flow was not readily discerned. Where flow did fully occupy the channel, it appeared to have minimal velocity and appeared to be under backwater influences from downstream obstructions.

Channel substrate was generally fine material (e.g., clay, silt), with some local occurrences of sand and gravel. Cobble sized material was usually coincident with stone bank-protection for private property or roadway crossings. Downstream of Nassau Street, coarse substrate such as gravel and cobble became more abundant and typically

corresponded to riffle type features. Further downstream, towards Lansdowne Pond, bed materials became fine grained again. Accumulations of fine sediment (silt, sand) were observed in the channel and typically occurred upstream of culverts (e.g. just upstream of the culvert at Butler St.). The abundant presence of fine sediment within the watercourse is a function of local geology and the low average channel slope (on average was ~ 0.003 m/m) (Figure 4). It is also the result of overland sediment supplies delivered through the storm sewer network, and from adjacent lands during both frequent (small) and infrequent (large) flow events, as well as spring runoff.

Along the entire length of One Mile Creek, the channel generally lacked a well-developed bed morphology, particularly in Zones 1 and 2. Only subtle variations in bed morphology were observed, particularly upstream of Nassau Street. A pronounced drop in bed elevation occurred at King Street.

Channel size (i.e. width, depth, area) increased progressively downstream as expected given the corresponding increase in flow volume. Field measurements revealed some variation in this general trend which can be accounted for by other controlling factors such as riparian vegetation, private landscaping activities, and floodplain topography. For example, reaches associated with woodlots (e.g. between Victoria St. and Regent St.) tended to be wider and shallower than reaches dominated by grass vegetation on both banks (e.g. between Gage St. and Gate St.). This tendency occurs due to the fact that densely rooting grasses increase resistance of bank materials such that channel widening tends to occur more gradually when compared to shaded forest conditions with more exposed bank materials.

Much of the watercourse was well connected to the floodplain on one or both sides of the channel. Better connection to the floodplain tends to allow some of the stream's energy to dissipate on the floodplain, reducing erosive forces in the channel. The reach between Victoria Street and Regent Street appeared to have the most access to its floodplain. Downstream of Nassau Street (Zone 3), One Mile Creek enters a valley and is located adjacent to the east valley wall over a 35 metre length. This site of valley wall contact has resulted in erosion of the slope toe and exposure of material from a former landfill.

Vegetation within the floodplain and along the channel banks varied throughout the watercourse with some areas dominated by grasses, while others were associated with trees and herbaceous groundcover. Along private properties, manicured lawns or landscaped gardens commonly extended to the edge of both banks. Over many reaches, significant in-channel vegetation was also observed, such as grasses or wetland plant species. The observed lack of baseflow over dry seasons likely enables vegetation, such as grasses, to become easily established in the channel. In-channel vegetation tends to affect channel flow processes by decreasing the stream's energy and encouraging localized sedimentation.

The occurrence of in-channel vegetation may have both positive and negative implications over the watercourse. Encouragement of vegetation in the channel may promote the health of aquatic habitat by providing shade and organic matter, and may also prolong moist conditions within the channel. Dense in-channel vegetation will,

however, interfere with the channel's ability to conduct flow, increasing the tendency for floodplain inundation. Further, the roughness exerted on the flow by in-channel vegetation can induce significant fine sediment accumulation which may have adverse consequences with respect to channel capacity and aquatic habitat.

Channel processes are influenced by changes in stream-energy, which is a direct function of energy grade or slope. One Mile Creek is generally characterized as a low energy system. While the average slope influences overall watercourse functions, localized variation in channel slope can have significant implications for channel processes (Figure 4). Along One Mile Creek there are numerous local influences on channel slope which appear to interfere with natural channel processes. In some cases, large obstructions (e.g. large stone, woody material, or foot-bridge pilings) were situated in the channel, which induce backwater effects. The most significant grade controls noted within the One Mile Creek profile were the numerous culverts under road crossings. However, with one exception (private drive between Nassau and Dorchester Street), none of the existing culverts appear to be perched (higher than the creek bed) (NPCA 2004).

The effect of culverts on channel processes was apparent both upstream and downstream of each crossing. Upstream of the crossing, high culvert inverts and undersized capacity was associated with backwater effects during both low and high flows (Figure 3). The ponding and slowing of stream velocities tend to induce flooding and sedimentation upstream of the crossing. Downstream of the crossing, the channel may experience scour, particularly if associated with a sudden increase in channel slope/energy and the addition of water from storm-sewer outfalls.

Downstream of Nassau Street (Zone 3), the channel shows evidence of instability in the form of several abandoned channels, valley contact erosion along an old landfill site and downcutting of the channel bed in the order of 30-40 cm (Figure 3). In the lower section of One Mile Creek (downstream of Palatine Place, Zone 3), the watercourse was unstable. Natural channel processes appeared to be significantly impaired leading to a poorly defined channel and excessive sediment loading and erosion of floodplain vegetation. This condition is attributable to effects from Lansdowne Pond and Lake Ontario. The outlet of One Mile Creek was blocked by a large gravelly bar which has presumably originated from Lake Ontario wave action.

While the relationship between Landsdowne Pond water levels and those of Lake Ontario are complicated by the presence of the gravelly, barrier beach, it is clear that Landsdowne Pond represents an area of deposition for sediments generated in the watershed.

2.3 Surface Water Flows and Flooding

The total drainage area of One Mile Creek is about 5.4 km^2, including 1.7 km^2 (about 31% of total drainage area), which is diverted into the Epp Drain (Figure 3). Time series flows for One Mile Creek at the mouth are shown in Table 2.1. Based on the estimated 2 year flow, the bankfull flow (the flow that exerts the greatest influence on channel morphology. Bankfull flow is defined as the flow that completely fills the stream channel

without overflowing banks) is about 6.7 m^3/s. Based on a floodplain mapping study completed by NPCA (2004), about 1 m^3/s (about 50% of total flow) discharges back into One Mile Creek from the Epp's Drain under the 100 year flow. Based on observations that there is about a 1.5 m elevation difference between the bed of Epp's Drain and the bed of One Mile Creek at the diversion point, it is unlikely that any flow from the Epp's Drain occurs during events less than the 100 year event.

Table 2.1 Time Series Flows at the Mouth of One Mile Creek

Return Frequency	2 year	5 year	10 year	25 year	50 year	100 year
Flow (m3/s)	8.38	10.55	12.4	15.4	17.63	20.63

Estimates of the 2year and bankfull flows for each of the 3 Management Zones are shown in Table 2.2.

Table 2.2 Estimates of the 2 Year and Bankfull Flows for Each Management Zone

Management Zone	**Zone 3**	**Zone 2**	**Zone 1**
Location	Mouth	Dorchester Street	John Street
2 Year Flow (m3/s)	8.38	5.8	1.5
Bankfull Flow (m3/s)	6.7	4.6	1.2

During the dry weather survey, both the Epp Drain and One Mile Creek in the vicinity of the diversion were dry. As noted in Section 2.6, a small baseflow occurs in One Mile Creek beginning in the vicinity of King Street, then disappears and reappears throughout its length. Only the storm sewer at Palatine Place had baseflow during the dry weather survey. Dry weather flow at the mouth of One Mile Creek was very low; in the order of a few l/s.

As noted previously, a portion of One Mile Creek has been designated as a Flood Damage Centre and the NPCA report (2004) provides floodplain mapping throughout the watershed for the 100 year regulatory flood elevations. A total of 17 structures are within the 100 year regulatory flood lines. One Mile Creek was identified as having flood damage potential, and to date non-structural measures such as flood forecasting and flood plain management policies have been applied to the One Mile Creek Damage Centre.

The majority of the culverts and bridges crossing One Mile Creek, beginning at John Street are considered to be undersized and may aggravate both nuisance flooding and potentially the regional flood elevations (NPCA 2004). Major barriers to flows are considered to be the crossing structures at Niagara, Nassau, Johnson / Gate, and Regent Streets. Based on a limited review of culvert capacities, it would appear that the capacity of most culverts is limited to flows between the 2 and 5 year return frequency. The impact of undersized culverts on nuisance flooding can be seen in Figure 5, which shows the effect on the 5 year flood elevation of enlarging culverts at Butler, Mississauga,

Johnson and Gate Streets to accommodate the 5 year event. In this example, 3 dwellings would no longer fall within the 5 year flood elevation.

The backwater effect of these culverts also has implications on the sediment regime and stream morphology as discussed in section 2.3. Localized deposition of sediments on the floodplain and also within the channel bed may result.

While it would appear, based on the dry weather survey, that the headwaters diversion into the Epp Drain has had little impact on baseflows, it has reduced the magnitude of various return frequency flows from the bankfull flow up to the 50 year flow. On the one hand, this has reduced the frequency and extent of nuisance flooding, but on the other hand, it has also reduced the ability of the One Mile Creek to transport sediment and to maintain its channel form (bed and banks, pool and riffle features). The diversion has also partially offset the hydrologic impacts of urban development. While urban development has increased the magnitude of runoff events, the diversion has reduced the magnitude of these events.

Figure 6 shows the existing Storm Sewer system that outlets to One Mile Creek, representing about 8.6 km of roads. Historically, several combined sewer overflows (CSO) existed in the watershed. These have been eliminated, with the exception of an overflow from the William Street Pumping Station. While historically overflows from the Pumping Station were more frequent, currently overflows occur about once annually (Johnson, pers. com 2004). Overflows, when they occur have resulted in concerns with respect to odour and algal growth in lower One Mile Creek and Landsdowne Pond. Localized erosion of the watercourse may also result.

2.4 Landsdowne Pond

There are historical accounts indicating that Landsdowne Pond was once a more substantial body of water, used for recreation by visitors to the Chautauqua Hotel in the 1920s and also used to launch schooners from a ship building business that operated on the shore of the Pond. Presumably these boats had access to Lake Ontario from the Pond. There are also anecdotal reports that there was evidence of groundwater discharge into the pond, and there is current evidence provided by local landowners that the water table elevations may be near the stream bed in this vicinity. Based on Diemier *et.al* (2003), there was also another pond/wetland feature in the vicinity of Landsdowne Pond that was filled in the 1960s.

The following information on landownership of the Landsdowne Pond was obtained from municipal staff (S. Dunsmore, pers. com. 2005). Based on available property information, the shoreline of Landsdowne Pond is privately owned by adjacent landowners. Individual landowners own the shoreline on either side of the creek downstream (to the north) of Niagara Blvd. to Lake Ontario. Upstream (to the south) of Niagara Blvd., lands were originally severed for development in the early 1930's. At this time severances used the shoreline of Landsdowne Pond as the ownership limit, with the lands under the pond remaining with the original owner rather than being transferred to the town or NPCA (as would typically occur today). NOTL does not list a roll number

for the lands under the pond, thus the land ownership is not known. Since there is no roll number for the property, it is unlikely that the Region of Niagara Assessment Office would have a record of ownership. The Assesment office does not provide property ownership information without a roll number reference and the landowner's approval. A number of the landowners around the pond (south of Niagara Blvd.) contend that their properties extend to the mid-point of the pond, however this does not appear to be the case.

Based on the 2003 report (Diermair *et al* 2003), the current area of the Pond is about 0.57 ha. with 19% (0.11 ha.) of the total area located north of Niagara Blvd. Average water depth of the north pond is about 0.55 m and the south pond has an average depth of about 0.4 m. The total volume of sediment in the Pond was also estimated by probing the sediment depth to refusal. The total volume of sediment was estimated to be about 4,000 m^3 with average sediment depths of 0.8 m (south pond) and 0.25 m (north pond), and consisted primarily of clayey silt material with a high organic content. The maximum sediment depth approached 2 m.

Long time residents report that sediment accumulation began gradually changing the character of Landsdowne Pond from a proper pond to its current state, principally a wetland, in the early 1980s. A common concern expressed at the public open houses was a general desire to see the pond restored to its historic "pond-like" state in order to eliminate the poor aesthetics resulting from the septic odour and unsightliness of decaying plants/algae, exposed organic muck and stagnating water.

Based on field survey work and review of background information and discussions with staff at Ministry of Natural Resources, there are a number of changes within the watershed and at the mouth of the creek that may have contributed to changes in the sediment regime of the creek and Landsdowne Pond as noted below.

1. the construction of the Epp Drain in the late 1970s which diverted all flows up to the regional flood from about 30% of the watershed, reduced the volume of storm induced flows. This may have reduced the stream's ability to "flush" sediments out of the watershed and to periodically disrupt the barrier beach formed across the creek mouth by Lake Ontario wave action.
2. the urbanized portion of the watershed increased from about 30% in 1985 to about 60% today representing a period of increased sediment loading as a result of construction. In addition, there has also been an increase in the length of roads served by storm sewers versus roadside swales, that may also lead to more rapid runoff rates carrying materials used for road maintenance.
3. the capacity of the culvert under Niagara Blvd., which is already undersized, has been further reduced by the placement of a small riprap weir. This weir is aggravating the backwater effect in the South Pond which has an impact on sediment deposition in the Pond;
4. Lake Ontario water levels for the period 1970 -2003 are shown in Figure 7. While a trend is difficult to identify, it appears that water levels (particularly annual low water levels) in the past several years are marginally lower than they were in the mid 1980s. Average water levels are about 74.75 m (asml) with highs around 75.5 m and lows

around 74.5 m. An elevation of 75.5 m corresponds approximately to the upstream end of Landsdowne Pond within about 400 m of Palatine Place. Fluctuating lake levels may therefore have an impact on the sediment accumulation within Landsdowne Pond.

5. Observations of the One Mile Creek channel downstream of Nassau Street indicate that the channel bed has downcut in the order of about 40 cm, although it is difficult to estimate the time period during which this occurred. This downcutting of the channel immediately upstream of Landsdowne Pond has likely had the effect of reducing the gradient of the stream, thus creating a depositional environment upstream of the original confluence of One Mile Creek with the Pond. Local landowners in this area have reported increased sedimentation in this area.
6. Armour stone revetments have been constructed on both sides of the mouth of One Mile Creek by the adjacent landowners. Contact with MNR indicates that prior to the early 1980s, MNR did not provide approvals for shoreline protection works in this part of Lake Ontario. Beginning in the early 1980s, MNR has provided location approval only for such works and has not provided a technical review of the supporting engineering studies. It appears that these works were constructed in the early 1980s and based on observations at the mouth, these works may have affected the formation / composition of the barrier beach across the mouth of the creek. In June 2005, when water levels were near their maximum, the beach was holding the elevation of Landsdowne Pond about 30 cm above lake level. The mouth of the Creek appears to by less exposed to wave action with the construction of the armour stone revetments which could mean that either the barrier beach is more permanent (less likely to be breached during severe storm events) or composed of finer materials that make the beach less permeable and therefore able to act as a small dam at the Creek mouth.

Sediment Sources

The issue of identifying and quantifying the sediment sources contributing to the accumulated sediment in Landsdowne Pond was raised in the Open Houses. As noted above, there are numerous factors that have contributed to sediment accumulation in the pond, either by acting as sources of sediment or by acting to change the characteristics of flows entering or leaving the pond. As a result, it is difficult to estimate volumes of sediment that may have been deposited in the pond from various sources.

The movement of sediment from sediment sources located on the tablelands, on the flood plain, in the stream banks, and within the stream is controlled by many factors, and complicated by the fact that this sediment is continually being eroded, transported and deposited as it makes its way from the tablelands, ultimately to the mouth of the creek. In general, most sediment is moved during high flow events, particularly during spring runoff. The general pattern of sediment movement is one where sediments may be moved from the tableland into the stream/floodplain during spring runoff (or a large storm). Some of this material may be carried downstream by the stream; some may deposit on the floodplain, and some on the bed of the stream. At the same time, material already in the stream, in the stream banks and on the floodplain may also be "picked up" by the large flow and moved downstream. The presence of constrictions in the stream or

flood plain (such as road culverts) or other instream obstacles (weirs, dams, log jams) act to trap sediment that would otherwise move downstream. When sediment is trapped in this manner, it can take many years for this sediment to move downstream towards the mouth of the stream. When the next major event occurs (the next spring melt, for example), more sediment is added to the stream and sediment deposited during previous storm events may be moved further downstream. The rate of this sediment movement is highly variable, sometimes ranging from months to years to decades depending on the size and slope of stream, nature of the sediments, size and number of instream obstacles (dams, road crossings, etc) and characteristics of the runoff events (major storms and spring runoff events). Other factors can accelerate both the amount and rate of movement of sediment from sources to the stream. Examples include:

- Removal of vegetation from land surfaces and stream banks (for example, during cultivation of agricultural lands or during construction of urban areas);
- Straightening or "hardening" of streams (for example, putting streams in concrete channels)
- Increasing surface runoff rates by paving surfaces, building roads and storm sewer networks, etc.

These types of activities, not only can increase the amount and rate of sediment entering the stream from the table lands and flood plains, but they can also accelerate the rate of stream bank erosion, another source of sediment to the stream.

Once in the stream, sediment is moved downstream by the force of flowing water. Generally the "sediment load" is moved by water in two ways:

- Suspended sediment: this is very fine material that is suspended in the water column and may be moved even by small runoff events
- Bedload sediment: this is the coarser sediment that can only be moved by larger runoff events, and tends only to move a short distance at a time. It is generally described as material that "rolls or bounces" along the stream during these events

With respect to Landsdowne Pond, both suspended and bedload sediments from upstream will have accumulated in the pond, however the proportion of each of these would vary as the pond filled in over the years. In addition, decaying plant material (from aquatic plants and also leaf litter), and sediment from along the pond shoreline and the properties immediately adjacent to the pond represents another source of sediment to the pond. The presence of emergent aquatic vegetation, particular the yellow iris, serves as a "sediment trap" by reducing water depths and serving to bind sediments with their root systems.

The volumes and fate of various sediment sources from within the One Mile Creek Watershed in relation to Landsdowne Pond are controlled by the factors discussed above. The role of each source is difficult to quantify, however some general points can be made, based on field observations and professional judgment:

- Streambank erosion: There is evidence of stream bank erosion within the watershed, however this is primarily limited to Zone 3. Because of the extensive bank treatments that exist in the upper watershed (Zones 1 and 2), it is unlikely that streambank erosion represents a significant sediment source currently. On the other hand, clearly

there have been fairly extensive stream works undertaken, likely over at least several decades, and construction associated with these works likely contributed sediment loads to the creek;

- Agriculture: The Epp Drain (constructed in the late 1970s) has diverted the headwaters of the creek and with it the majority of sediment that may be generated by agricultural land use practices. Currently, agriculture would not be considered to represent a significant sediment source. However, there is a significant amount of sediment both within the flood plain and within the stream, that may still be of agricultural origin. This is a reasonable assumption, based on the backwatering affects of the roads and culverts crossing the stream. While some of this sediment from agricultural lands has historically reached the pond, some material from that time period may still be moving through the system.

- Urban construction: As noted, about 30% of the watershed has urbanized over the past 3 decades, and sediment generated during construction represents a potential source of sediment. Similar to historical agricultural sediment sources, sediment from urban construction activities represents both a historic source of sediment to the pond and an ongoing one.

- Storm sewers: Storm sewers carry sediments from road surfaces, driveways and direct drainage to the road system directly to the stream. This material can represent a significant and ongoing source of sediment to the stream and is gradually moved toward the pond. There are approximately 8 km of roads served by storm sewers discharging to the creek. In a mature, urban neighbourhood, this may be one of the only remaining sources of sediment to the stream.

- Current Construction: There are examples of ongoing construction activities within the watershed, including single lot redevelopments, road (and other infrastructure) maintenance, and minor activities related to maintenance of properties adjacent to the creek. All of these activities have potential to generate sediment that can enter the creek. With proper sediment controls, these activities should represent only minor sources of sediement, however, if not controlled they can be of concern. This would include activities along the shoreline of Landsdowne Pond as well.

- Decaying plant material: Both aquatic vegetation and leaf litter represent another source of accumulating material in the pond. The role of aquatic vegetation in trapping sediment and gradually reducing the “open water” areas in the pond increases as the pond depths gradually decrease. Leaf litter and other debris introduced from around the pond as well as from upstream, also acts as a sediment trap. Regular stream clean ups can assist in reducing this source.

These represent the major sources of sediment loading to One Mile Creek and ultimately, to Landsdowne Pond. While dredging of the pond may represent part of the solution to its restoration, control of these sediment sources is also imperative to ensure that the pond does not simply fill back in.

2.5 Epp Drain

Epp Drain was constructed in the late 1970s to alleviate periodic flooding occurring downstream in One Mile Creek (Proctor and Redfern 1977). The drain diverted about 30% of the watershed area of One Mile Creek away from the creek and into the Niagara River (Figures 1 and 3).

As indicated previously, all flows up to the 100 year storm event were diverted from One Mile Creek. The impacts of this diversion on One Mile Creek can be summarized as follows:

- The volume of more frequent events that lead to nuisance flooding has been reduced, thus reducing the frequency of nuisance flooding;
- The subsequent reduction in the volume of frequent events may also have partially offset increased runoff that results from urban development that has occurred between the early 1980's to the present; and
- This may also have affected the frequency of flushing of Landsdowne Pond and the ability of creek flows to breach the barrier beach at the creek mouth.

The Epp Drain is not part of NOTL's irrigation system. It is a separate municipal drain. The NOTL irrigation system crosses East West Line at Concession 2, which is several km west of the point where the Epp Drain crosses East West Line. At this time, there are no plans to connect the Epp Drain to the NOTL's irrigation network (Stantec 2004). However, water from the irrigation network may be introduced into the drainage area of the Epp Drain by some landowners who irrigate their lands, located in the Epp Drain watershed with irrigation water from the NOTL network. Because of this irrigation activity, there may be occasions when there are flows in the Epp Drain that otherwise would not occur. Under normal dry weather conditions, the Epp Drain is dry, except for a small local discharge from Peller Estates, that pumps foundation drain water from its buildings through a small pond and into the drain (Berti, pers. com., 2004).

Currently the elevation of the bed of the Epp Drain where it crosses John Street (at the confluence of the diversion to One Mile Creek) is about 1.5 m below the elevation of the bed of One Mile Creek (88.5 m versus 90.5 m). The elevation of the bed of One Mile Creek, where it runs adjacent to John Street, is about 86.5 m.

2.6 Groundwater Resources

A regional groundwater study prepared for the NPCA was recently completed (Waterloo Hydrogeologic *et.al.* 2004) and outlines generalized groundwater characteristics. Unfortunately no information is available for the drainage area of One Mile Creek south of Nassau Street. Based on a review of groundwater table elevations from the report (Figure 8), it would appear that groundwater flow is generally in a south to north-northwest direction toward Lake Ontario. Water table elevations are at 85 m (masl) at King Street and decline to about 80 m between Nassau and Dorchester Street (inferred) and 75 m in the vicinity of Palatine Place. Based on available topographic mapping, these water table elevations appear to be close (within metres) to the elevation of the

creek bed at these locations. This is supported by one resident's observation that dredging a portion of the creek in the vicinity of Palatine Place, and lowering the bed elevation in the order of 1 – 1.5 m intersected the water table (Moehl, pers. com. 2004).

The majority of the water well records from the area are founded in bedrock indicating that the above water table elevations likely follow the corresponding bedrock elevations. Queenston shale forms the dominant bedrock in the area. There is no evidence of shale outcroppings in the creek.

During dry conditions, flows in the creek are reduced to near zero. As noted in Section 2.2, flow was observed in the channel in the vicinity of King Street, however the channel was dry at the Mississauga Street crossing. Flow gradually returned to the channel, such that a small base flow was again observed at Butler Street, which gradually increased through to Nassau Street. A small base flow was also observed at the storm sewer outlet at Palatine Place. Flows at the mouth of the Creek (through the barrier beach formation) appeared similar in magnitude to the combined flow at Nassau Street and the Palatine Place storm sewer outlet. The return of base flows downstream of Mississauga Street may represent groundwater discharge through this segment of the stream. The disappearance of flow at Mississauga Street may be the result of water taking by residents or possibly local recharge through the stream bed in this vicinity (groundwater recharge through the stream bed or banks is not uncommon and is often referred to as a "losing" stream reach).

The observations of local groundwater discharge to the creek, support local residents' claims that there was a constant baseflow in the creek and that historically these baseflows were greater than current observations. It is also possible that the observed dry weather flow from the Palatine Place storm sewer outlet is from a groundwater source. A typical impact of urban development is the lowering of the local water table since less water is infiltrated into the ground and more occurs as runoff directly to the stream through the storm sewer network.

2.7 Water Quality

Water quality information is not available on One Mile Creek. However, the major sources of water quality impairment can be summarized as follows:

- Storm sewer runoff carrying nutrients, bacteria, trace metals, chloride (road salt) and suspended sediments;
- Overland runoff from urban areas (private and public lands) carrying nutrients, bacteria, possibly pesticides and suspended sediments;
- Infrequent discharges from the William Street Pumping Station, carrying nutrients, bacteria, suspended sediments, and trace amounts of metals and organic contaminants;
- Garbage, litter and landfill debris, from an old landfill behind the William Street Pumping Station; and

- Decomposition of aquatic plants, leaf litter, organic debris, yard wastes and deposited sediments that accumulate throughout the watercourse, particularly in Landsdowne Pond.

Based on studies of water quality in urban watersheds, in particular information summarized in the Region of Niagara's Water Quality Protection Strategy (2003), water quality conditions in One Mile Creek can be considered to be moderately degraded with the following characteristics:

- Temperature - (midsummer maximum < 32 C) and dissolved oxygen (< 4 mg/l) concentrations that are generally suitable to support warmwater fish communities
- Nutrients - (represented by total phosphorus) generally exceeding provincial standards during dry weather conditions, with wet weather concentrations exceeding provincial standards by an order of magnitude;
- Bacteria - (represented by *E.coli*) generally exceeding provincial standards by an order of magnitude during dry weather conditions, with wet weather concentrations exceeding provincial standards by a factor of 10 to 20;
- Suspended Sediments - (represented by Total Suspended Solids) generally low during dry weather conditions (less than 5 mg/l), with wet weather concentrations typically exceeding 100 mg/l (levels that may cause stress to aquatic life);
- Trace metals - (represented by copper, lead, zinc) generally meeting provincial standards during dry weather conditions, with wet weather conditions exceeding provincial standards by an order of magnitude;
- Trace organics - (represented by a suite of different organic compounds found in pesticides, household, agricultural and industrial hazardous wastes, atmospheric fallout, materials accumulating on transportation corridor surfaces) generally only found intermittently, in trace amounts that generally meet provincial standards with localized exceptions.

In One Mile Creek, while the above conditions represent typical water quality conditions, the current flow regime and morphology of the creek serves to aggravate these moderately degraded water quality conditions which are expressed by the following:

- Areas of stagnant water and accumulated sediment that create environments for algal growth leading to septic odours and poor visual aesthetics;
- Sediment accumulation in the creek that eliminates stream bed variability, in particular riffle areas that help to re-oxygenate the water reducing potential for stagnation effects;
- Lack of a well vegetated, shrubby, riparian area adjacent to the creek as a result of frequent flooding, shading by mature trees, clearing/manicuring by landowners to provide water quality attenuation by trapping sediment, nutrients, bacteria and pesticides before they enter the creek; and
- Rapid runoff through the storm sewer network that delivers nutrients, sediments and other contaminants directly to the stream without any opportunity for attenuation

While these sources of water quality result in localized degradation of aquatic habitats within One Mile and Landsdowne Pond, the creek is also a source of contamination to Lake Ontario, which includes important recreation areas such as Ryerson Park Beach.

2.8 Aquatic Resources

Diermair *at al* 2003 captured fathead minnows, pumpkinseed sunfish and threespine stickleback in Landsdowne Pond; all warmwater fish species that are moderately tolerant of water quality and habitat impairment. A recent survey by MNR (2004) failed to capture any fish and fish sampling for this study yielded pumpkinseed sunfish, white sucker and creek chub in Landsdowne Pond, and creek chub at four other locations in the Creek upstream as far as King Street. No fish were captured upstream of King Street. Landowners report that historically suckers from Lake Ontario also migrated into One Mile Creek to spawn.

MNR Vineland Area has classified One Mile Creek as Type 3 fish habitat. This designation is applied within the jurisdiction of the Vineland Area to watercourses and waterbodies that are considered to support marginal fish habitat. Type 3 watercourses generally are intermittent in nature and provide supporting habitat to fish communities downstream. They are generally too small to support "fishable" populations, but may provide permanent or seasonal habitat for a variety of small minnows. Landsdowne Pond is considered by MNR to represent an important link to Lake Ontario fish populations, since it offers potential to provide nursery habitat for Lake Ontario resident species, such as white suckers.

Type 2 habitats are considered to represent Important Fish Habitat or aquatic habitats that provide generalized habitat to support fish. This may include both permanent and intermittent watercourses. Type 3 habitats are considered to represent Critical Fish Habitat and are generally considered to be vital to sports fish populations to complete portions of their life cycle. They are generally permanent watercourses and typically include spawning and nursery habitats.

Aquatic habitats consist of the following: the lake-like habitat of Landsdowne Pond with its partially obstructed link to Lake Ontario; and a small-stream habitat of the upper part of Zone 3 and Zone 2 (Figure 9). Habitat limitations for each Zone are discussed below.

Zone 1: This zone supplies a source of water to support fish habitats downstream and does not provide fish habitat. The watercourse has been extensively modified, straightened and/or enlarged. Flows are generally insufficient to maintain a channel the existing watercourse exists as a grassed swale (near the diversion of the Epp Drain), a roadside ditch (along John Street) or a riparian wetland (across the Commons).

Zone 2: This zone provides small stream habitat that may support a moderately tolerant warmwater fish community, typically including species such as white sucker, fathead minnow and creek chub. A defined channel exists; however it has been extensively modified with various materials and incorporated into the urban landscaping of each landowner's property through which it passes. As noted in Section 2.2, there are numerous small obstructions within the channel and riparian zone and the road culverts create backwater effects. In some locations where the stream appears in a more natural

state, it lacks a defined channel and forms a riparian wetland feature. The major limitations to fish habitat are as follows:

- Lack of baseflow;
- Partial or complete barriers to fish movement;
- Lack of instream habitat diversity, in particular refuge pools and riffle features; and
- Poor water quality, primarily as a result of lack flows, lack of shrubby riparian vegetation along stream banks and accumulation of fine sediment.

Zone 3: This zone consists of a segment of small stream habitat in the upper reaches and Landsdowne Pond in the lower reach. The upper reach is characterized by a more natural morphology with coarser substrates than Zone 2, a meandering pattern and some pool:riffle development. The channel is unstable and eroding in some areas (behind the William Street Pumping Station), but it is depositional in other areas as a consequence of some of the factors identified in Section 2.4. There are some partial barriers to fish movement and, channel instability, combined with lack of baseflow, may restrict fish to isolated reaches of the stream. Landsdowne Pond offers potential habitat to a wider variety of warmwater fish including species such as pumpkinseed sunfish and bass. However, both nursery habitat and adult habitat is limited because of inadequate, open-water habitat. The major limitations to fish habitat are essentially the same as for Zone 2, however this zone has greater potential to support fish populations.

2.9 Terrestrial Resources

Forest and wetland habitat is limited within the One Mile Creek Watershed (Figure 9). Upland forest blocks are primarily coniferous plantations with the only remnant deciduous forests occupying valleylands in the lower reaches (downstream of Butler Street) and on private properties on either side of Regent Street. In addition, however, both street trees and properties are well vegetated with mature species that provide habitat for urban wildlife. Dominant native trees include white, black and red oak, white ash, black cherry, and sugar and red maple.

Wetlands are limited to some deciduous swampland, Landsdowne Pond and scattered riparian wetland features (on private lands). Landsdowne Pond provides habitat for a variety of waterfowl, including least bittern, mallard and wood duck.

Reports of other wildlife include amphibians (frogs, and bluespotted salamander), painted and snapping turtles. Urban wildlife is also found in the watershed including white tail deer, fox, coyote, skunk and raccoon.

The forested valley downstream of Nassau Street and Landsdowne Pond has been impacted by invasive species including Norway Maple, Manitoba Maple, garlic mustard, European Black Alder and yellow iris. While the Landsdowne Pond and associated riparian woodlands are not given special status by MNR, MNR has identified the area as an important spawning and nursery are for Lake Ontario fish communities, and habitat

for waterfowl including mallard and least bittern. It is also the only known site for Scarlet Oak, although its current status is unknown (Diemair *et.al.* 2003).

A woodlot located at the confluence of the Epp Drain and One Mile Creek (located primarily on the Parks Canada lands), known as Paradise Grove has been identified as a remnant black oak savannah (Ritchie, pers. com. 2005). This woodlot is about 30 ha in area and is currently being assessed by the Niagara Parks Commission under the Niagara River Corridor Ecosystem Management Plan, with support from the Great Lakes Sustainability Fund. This project is focusing on lands owned/managed by the Niagara Parks Commission.

Recently, the Region of Niagara (2005) released its draft environmental policies and Natural Heritage mapping for its jurisdiction. The Draft Core Natural Heritage Map identifies One Mile Creek as fish habitat and the Landsdowne Pond and forested valley as Environmental Conservation Area (Figure 10). The Region's policies with respect to Environmental Conservation Areas and Fish Habitat require a detailed evaluation (in the form of an Environmental Impact Statement) of lands within and adjacent to these features before any development proposal can be considered. The policies allow existing uses within such areas to continue.

The Draft Core Natural Heritage Map (2005) also designates a Natural Heritage Corridor along the Lake Ontario shoreline between the Two Mile and Four Mile Creek valleys and extending up both of these valleys (Figure 10). At the headwaters of Two Mile Creek, the Corridor extends along East West Line and follows the Epp Drain linking the forested areas within Queen's Parade. From here, the Corridor continues along the Niagara River shoreline. While One Mile Creek is not part of this Corridor, it may provide a support role as a secondary link between the Lake Ontario shoreline and Queen's Parade.

2.10 Archeological and Cultural Heritage Resources

The One Mile Creek Watershed has a rich cultural and human heritage history because of its strategic location at the mouth of the Niagara River. This includes recent events related to the military reserve lands and activities surrounding the War of 1812. It also includes artifacts from habitation by Native Peoples dating back 10,000 years.

In particular the Commons was believed to be a historic meeting place for Native Peoples who utilized the Niagara River for hunting and fishing. More recently, of course, the site was a military establishment and provided facilities for Butler's Rangers. Parks Canada owns and manages significant lands within NOTL, including the Commons and Fort George and the area between the Fort and Two Mile Creek is the site of one of the significant battles in the War of 1812.

Landsdowne Pond also has a rich history surrounding it. The Hotel Chauteauqua, built in the 1920s, was an important landmark, that was also linked to the Pond. During this period, Landsdowne Pond was the site of a ship building facility and schooners were launched from the Pond.

The 1928 airphoto (taken by Billy Bishop, a renowned World War 1 pilot) reflects land use of that time (Figure 11). Close inspection of the photograph also indicates that the course of One Mile Creek has changed very little since then.

This rich cultural history provides an added dimension to the protection and restoration of One Mile Creek, since the Creek (including Landsdowne Pond) was an integral part of the landscape throughout the settlement and presettlement periods and may have served at least a minor role in the historical events that transpired. The promotion of the natural and cultural heritage value of the Creek represents an opportunity to build a partnership for restoration efforts.

NOTL has recently completed a Master Plan of Archeological Resources (2001). This study summarizes the cultural history of the area which began about 10,000 years ago. Due to the richness of its natural environment, the region has attracted human habitation from the time of the first peopling of Ontario. The archeological sites that are the physical remains of this lengthy settlement represent a fragile and non-renewable cultural legacy. NOTL completed a master planning study, with 3 main goals:

- Compilation of inventories of registered and non-registered archeological sites within NOTL with an overview of settlement history;
- Development of an archeological site potential model; and
- A review of provincial planning and management guidelines and recommendations for a management strategy for known and potential archeological resources within NOTL

A key recommendation of the study was for NOTL to develop an Official Plan Amendment that requires all future development applications to complete an archeological resource assessment.

2.11 Land Use

Land use within the One Mile Creek watershed is predominantly urban (Figures 1 and 12). Agricultural land uses predominate in the Epp Drain watershed. Approximately 30% of the watershed has become urbanized in the last 3 decades and currently there is limited potential for additional development. Currently single lot redevelopments appear to be the main activity.

The significance to the watershed of current and future land use change, is that there will be limited opportunities within new development areas to protect and restore natural watershed features and functions. The majority of measures will need to focus on areas of existing development, which will require effort primarily on the part of the town, private landowners and NPCA. Other agencies such as the Region of Niagara, MNR and Parks Canada may also play a role and community groups, such as the Friends of One Mile Creek will be of key importance.

3.0 ISSUES, OPPORTUNITIES AND CONSTRAINTS

The following list of issues were identified through the technical studies and based on input received from the public Open Houses:

- Lack of baseflow (groundwater linkages),
- Diversion of flows (Epp Drain),
- Sanitary Sewer Pumping Station overflows,
- Erosion,
- Private property flooding,
- High flows and pollutants from urban storm sewers,
- Lack of riparian vegetation,
- Alteration of stream,
- Landsdowne Pond (odour and water quality),
- Siltation within the creek,
- Debris,
- Lack of access,
- Health issues with deposits in creek (including West Nile risks),
- Loss of natural stream functions,
- Impact on agricultural lands,
- Wildlife impacts,
- Agency / Landowner responsibilities (Who does what?), and
- Impacts on Lake Ontario (beaches).

While not all of these issues were considered to be of equal importance, many can be linked under the same general headings. The variety and complexity of the issues demonstrates the need to establish true "ecosystem" goals and objectives in order to ensure that all issues are considered. At the outset of the study, many of the concerns related to Landsdowne Pond including the need to encourage landowners to implement measures that would address observed changes in the Pond. However, it became apparent that in most instances, changes in the Pond are simply an expression of changes occurring throughout the watershed.

By taking an ecosystem approach, the focus of the management actions is on addressing the source of the problems, not just on correcting effects of the problems. The issues were used to help develop watershed plan goals and objectives (Section 4) and also to develop a long list of possible management actions to address them (Section 5).

4.0 WATERSHED GOALS AND OBJECTIVES

4.1 Goal and Objectives

A key component of the study was to prepare the Watershed Plan goal and objectives that define the scope of the plan and provide the basis for the development of the recommended management actions. The goal and objectives are also critical to evaluating the success of plan implementation, because they can be used as the measures of success to achieve a healthy One Mile Creek Watershed. Table 4.1 shows the Goal and Objectives that were developed based on input from the Steering Committee, NPCA staff and the public at the first Open House. The objectives have been further grouped into broad categories related to ecosystem components or to socio-economic conditions.

Following each set of Objectives are detailed Indicator Parameters and Targets (Table 4.1). These provide the actual standards that will be used to determine whether the management actions that are implemented achieve the stated Goal and Objectives.

4.2 Measuring Sticks: Measurable Parameters, Indicators and Targets

In order to effectively measure when the watershed objectives are achieved, a more detailed and technical set of indicators, measurable parameters and targets was developed for each of the Objectives (see previous section) that could be used to evaluate how successful alternative watershed management strategies are in achieving the stated objectives.

These terms are defined as follows:

Indicators: An indicator is a piece of information, clue or attribute of the ecosystem that describes the current condition of the ecosystem, or one of its components. Examples: temperature, total suspended solids, *E. coli*, aquatic community abundance, instream erosion potential

Measurable Parameter: A measurable parameter is a quantitative or qualitative way to measure progress toward achieving the indicator and several measurable parameters may be used for assessing each indicator. Examples: midsummer maximum temperature, 5 day geometric mean *E. coli* count, biomass/density of fish, cumulative excess stream power (erosion potential)

Target: A target is a specific aim that will be achieved in the future. The targets will serve as a basis for evaluating alternatives. Targets can be set for the short, medium and long term. Targets represent an integrated set of biological, physical and chemical values. A baseline condition needs to be established before targets can be developed. Targets should allow for stepwise improvements to be achieved as interim steps to reaching the ultimate target. Examples: 26 C (for coldwater fish), less than 100 *E. coli*/100 mls, 5,000 g fish/100m^2 habitat, reduction of cumulative excess stream power to 25% of current values.

The primary considerations for developing indicators and targets for the One Mile Creek Watershed include:

- improving water quality levels toward the achievement of PWQO to protect public health and ecosystems;
- improving bacteriological and nutrient levels to sustain healthy aquatic habitats, and improve aesthetics;
- reducing the toxicity of contaminants in water and the concentrations of nutrients in water by eliminating the source of these materials, to sustain healthy aquatic communities;
- re-establishing the water cycle (groundwater recharge, stream flows, water levels and precipitation/runoff characteristics) toward a more natural condition to protect natural stream characteristics, aquatic habitats and human water uses;
- re-establish the water cycle (as above) and reduce the erosive forces of instream flows to more natural levels to minimize erosion and flooding, and protect life and property; and
- improve the quality and quantity of terrestrial and aquatic habitats that native flora and fauna depend on for their life cycle functions.

These indicators, measurable parameters and targets are listed in the previous section following each category of objectives. Note that the targets for Communications, Education and Socio Economic Objectives are more qualitative. It is important to recognize that these are long term targets that may take many years to achieve, however, they represent benchmarks that can be used to assess progress towards achieving a healthy state for the watershed.

Table 4.1 Watershed Goal and Objectives

Goal: To produce a Watershed Management Plan developed in consultation with the appropriate government agencies, landowners and interest groups that assists with the management of water, land/water interactions, aquatic life and aquatic resources to protect and improve the health of the ecosystem.

Objectives

Communication and Education

1. Demonstrate and promote awareness of the linkages between healthy water, healthy lifestyle and economic viability of rural and urban land uses.		
2. Promote the wise use of surface and ground waters having regard to both human, agricultural and ecologic needs		
3. Promote the need for environmental stewardship and better understanding of the importance of ecologic functions of the One Mile Creek watershed		
Indicator	**Measurable Parameter**	**Target**
Landowner/Public Involvement	Annual Flyer Distribution	75% of Landowners contacted annually
	Promotion of Demonstration Projects	Newsletter/tours of successful projects
	Landowner Recognition	Annual award for participation
	Annual Stream Cleanup	75% of Landowners involved
	Landowner participation in good stewardship practices	75% of Landowners involved

Water Quantity

4. Manage flooding risks to human life and property to within acceptable limits		
5. Maintain, enhance or restore stream processes to support human uses, agricultural needs and natural habitat functions		
6. Manage stream flow to reduce erosion impacts on habitats and property		
Indicator	**Measurable Parameter**	**Target**
Flood risk	Current floodplain policies	Maintain current practices
Nuisance Flooding	2 year and 5 year events	Reduce runoff volume by 15%
Stream Flow	Base flow	Maintain minimum flow at mouth of 15 l/s
Vegetated stream banks	Percent of Banks vegetated	50% of streambanks vegetated within each property
Instream sediment	Sediment load	Reduce sources of sediment to stream

Table 4.1 Watershed Goal and Objectives (continued)

Water Quality

7. Maintain or improve water quality conditions within the Creek in order to support ecologic and human functions		
8. Reduce or eliminate objectionable deposits, nuisance algae growth, turbidity and odour in order to improve aesthetics of the watershed's surface water		
Indicator	**Measurable Parameter**	**Target (75% of samples)**
Nutrients in surface water	Total Phosphorus	< 0.03 mg/l
Bacteria in surface water	*E. coli*	< 100 counts/100 ml
Metals in Surface water	Copper	< 0.005 mg/l
	Lead	< 0.025 mg/l
	Zinc	< 0.02 mg/l
Suspended sediments in surface water	Total Suspended Sediment	< 5 mg/l (dry weather); <100 mg/l (wet weather)

Aquatic Communities and Habitats

9. Protect, enhance or restore populations of native aquatic species and their habitats		
Indicator	**Measurable Parameter**	**Target**
Healthy Fish Communities	Maintain diversity of fish in Zones 2 and 3	Creek Chub, Fathead Minnow, Pumpkinseed Sunfish, Stickleback all present
Naturalized Streambanks	Woody vegetation along streambanks	50% of streambanks vegetated within each property
Fish Migration	Unobstructed movement of fish through zones 2 and 3	Elimination of barriers to fish movement
Naturalized stream channels	Pool and Riffle habitat	Create natural pools and riffles in 50% of stream length between road crossings
Landsdowne Pond aquatic habitats	Fish migration	Restore linkage to Lake Ontario
	Aquatic habitats	Increase open water (2 m deep) habitat to 25 – 50% of pond area

Table 4.1 Watershed Goal and Objectives (continued)

Terrestrial Communities

10. Protect, enhance or restore the stability, diversity and linkages between habitats that support terrestrial species and communities.		
Indicator	**Measurable Parameter**	**Target**
Natural Features	Existing Features on public and private lands	All remaining features protected
Restoration of Native vegetation	New plantings of native species	Plant native species along streambanks
Non-native plants	Occurrence of non-native species	Reduce the spread of non-native species in existing natural areas
Landsdowne Pond aquatic habitats	Aquatic vegetation	Increase diversity of native aquatic vegetation

Social/Economic

11. Identify and promote the social and economic benefits of a healthy watershed system		
Indicator	**Measurable Parameter**	**Target**
To be developed during implementation of plan		

4.3 Public Consultation Summary

A total of 4 Open Houses were scheduled to provide opportunities for public involvement and to solicit input at key milestones in the project as follows:

- Open House #1: Introduce the study and obtain feedback on Study Goals, Objectives and Issues
- Open House #2: Provide input on the long list of Management Actions and suggest priorities and evaluation criteria for coming up with a recommended plan Open House #3: Provide input on the Recommended Management Actions in the Recommended Watershed Plan and provide input on implementation considerations Open House #4: provide input on Implementation

A summary of each open house is provided below and additional information is provided in Appendix A. In general, open houses were very well attended, with a large proportion of the attendees being landowners whose properties are crossed by the creek. There was general support for the recommended plan and implementation strategy and recognition that:

- Solutions would take many years to address
- Landowners were generally willing to do their part but require technical information and technical guidance (from NPCA) in order to do their part
- Measures should be implemented in a cost effective way
- Agencies need to be more proactive in addressing impacts to the creek and provide more assistance to landowners
- Measures need to be implemented throughout the watershed to control sediments, management flows and improve water quality, before undertaking major work within Landsdowne Pond

Open House #1

Meeting Purpose: This workshop was held to introduce the One Mile Creek Watershed Study and key personnel to the community, and seek feedback on key issues, study goals and objectives and existing conditions.
Open House: Participants were invited to review a series of displays that focused on existing conditions and draft goals and objectives for the study.
Participants: A total of 15 representatives from 5 organizations participated in the workshop. A complete list of participants is included in Appendix B.

Summary: Key issues identified included:

- Additional focus on the Epp Drain
- Erosion and high water flows from rainfall events
- Flooding, and sedimentation
- Lack of base flow
- Lack of public access
- Concern about impacts on wildlife
- Concerns regarding the old landfill near the Williams Street Pumping Stations

- Impacts of *E.coli* on creek and beach users
- Lack of information on linkages between the creek and groundwater
- Clarification of agency roles and responsibilities

Overall the participants agreed with the proposed goal and objectives

It was suggested that Friends of One Mile Creek could improve attendance at workshops, by volunteering to distribute flyers. Other methods included posting articles in local paper prior to open house and invite other interested groups.

Open House #2

Meeting Purpose: This workshop was held to identify alternative strategies and approaches for the One Mile Creek Watershed Plan; and to identify evaluation criteria for defining the alternatives.
Open House: Participants were invited to review a series of displays that focused on the Niagara Peninsula Conservation Authority's recent floodplain mapping program, maps indicating areas that could be flooded during a heavy storm, and that indicated historic and current land use activities.
Participants: A total of 30 representatives from 5 organizations participated in the workshop. A complete list of participants is included in Appendix B.

Summary

Participants were asked to discuss and work through the following focus questions:

1. Identify the importance of each management action on public lands;
2. Rank the importance of each of the barriers in implementing the following management measures on private lands; and
3. Look at the draft evaluation criteria and indicate the level of importance.

Question 1: In general, people supported all of the management actions including actions focused on the watershed, as well as actions focused specifically on Landsdowne Pond. Management actions with the greatest overall support included:
- Headwater wetland creation (King and John Street area) to provide baseflow augmentation;
- Culvert improvements to help alleviate flooding concerns; and
- Continue to reduce potential overflows from the William Street Pumping Station and potential contamination from cross connected storm sewers

Question 2: Generally most people were willing to implement management actions on their properties, provided that the actions would be effective in address problems in the creek. Lack of information on "how to" improve the stream through their property; lack assistance in undertaking works; and insufficient funds were generally perceived to be the major barriers to landowners implementing management actions on their property.

Question 3: A number of evaluation criteria were developed that could be used to help select the preferred management actions. People were asked to rank these in importance. Results are shown below:

Level of importance of the draft evaluation criteria

Evaluation Criteria	Very important	Somewhat important	No opinion	Somewhat not important	Not important
Ability to meet study objectives and targets	6	7	2	0	0
Environmental benefits and impacts	15	2	0	0	0
Social impacts	4	6	4	2	0
Implementation considerations, including phasing	6	9	0	1	0
Cost	6	3	3	1	2
Stakeholder acceptance	10	6	0	0	0
Agency acceptance	7	7	2	0	0
Recreational and cultural impact	5	10	2	0	0

In summary, providing benefits and mitigating impacts on the environments, stakeholder acceptance and agency acceptance were seen as very important criteria.

Open House #3

Meeting Purpose: This workshop was held to seek community feedback on the Recommended Management Strategy for One Mile Creek (see Section 6), and to discuss the priorities for implementation.
Open House: Participants were invited to review a series of displays that focused on the One Mile Creek Watershed; specifically they were invited to review the Recommended Management Actions.
Participants: A total of 27 representatives from 5 organizations participated in the workshop. A complete list of participants is included in Appendix B.

Summary

Most participants indicated that they agreed with the recommended measures, and felt that they were all worth implementing. Participants were also asked to prioritize measures for implementation. While most measures received some support, the following list were most commonly cited as being most important:

- Stormwater Management – source controls, conveyance controls and Stormwater Management Ponds
- Source Controls
- Culvert Improvements and flood control
- Education and Follow-up

- Reduce/eliminate storm sewer inflow into One Mile Creek overall
- Stream restoration and habitat enhancement
- Landsdowne Pond: Study to assess the Pond and Habitat Works/Debris removal
- Spring/Fall Clean-up Program
- Erosion Remediation and creek cleanup (downstream of Nassau Street)
- Streamside Habitat Enhancement

Open House #4

Meeting Purpose: To review the draft watershed plan; provide feedback on the plan and implementation strategy; and explore opportunities for ongoing community involvement.
Open House: Participants were invited to review a series of displays that focused on the One Mile Creek Watershed. Specifically, they were invited to review the draft watershed implementation plan; provide feedback on the plan and implementation strategy; and, explore opportunities for ongoing community involvement after the plan is complete.
Participants: A total of 17 representatives from 5 organizations participated in the workshop.

Summary

Participants were invited to fill out worksheets on their own time to respond to the following focus questions:

1. Do you agree with the recommended measures presented?
2. How would you like to stay involved?
3. Additional Comments

Generally participants agreed with the recommended measures and wanted to see better communication and involvement by NOTL in promoting the recommendations of the study. The Friends of One Mile Creek were identified as the key group to maintain contact with the local community and provide a focal point for information about the ongoing implementation of the plan. The Chautauqua Residents Association could also assist through their quarterly newsletter. Finally the open houses were considered to provide a good means of educating the public about the issues facing the watershed and possible solutions. Interest was expressed in seeing some form of regular follow-up reporting on implementation progress.

5.0 ALTERNATIVE BEST MANAGEMENT PRACTICES

Because of the extensive proportion of the watercourse on private lands, the recommended plan is a Series of "Best Bets" and a strategy for how to implement them. Landowners will need to play a significant role in the implementation of many of the recommended actions. Each of the management actions is listed below followed by a description of the action and the problem it addresses.

M1 SOURCE CONTROLS

Action	Implementation Responsibility
Downspout Disconnection /Rainbarrels	Landowner, CA, Municipality

Problem: There are about 8.5 km of roads within the watershed that are served by storm sewers that outlet to One Mile Creek. This translates into about 700-850 houses. Based on a windshield survey of houses in the area, roughly 25% of homes have roof downspouts (100% in the new subdivision near John Street). The impact of this is that all of the runoff from roofs enters the storm sewer directly, where it rapidly outlets to One Mile Creek contributing to nuisance flooding and increased transport of sediments /nutrients.

Description: This measure involves disconnecting any downspouts within the watershed area served by storm sewers, so downspouts discharge onto grassed areas or into soak-away pits. The town would need to develop a program providing technical advice, free disconnect services or incentives to individual homeowners

M2/M3 CONVEYENCE CONTROLS

Action	Implementation Responsibility
M2) Perforated Pipe / Infiltration (as roads improved)	Municipality
M3) Enhanced Maintenance / Operations	Municipality

Problem: M2) The existing storm sewer system consists of non-perforated pipes and provides no opportunity for runoff entering the storm sewer to infiltrate back into the ground. As a result any runoff entering the storm sewer is discharged directly to the creek. M3) Current operations and maintenance practices include periodic cleanout of storm sewer catchbasins to remove accumulated sediment and annual removal of fine sediment from road surfaces by street sweeping. Without these practices, runoff from roads can deliver increased amounts of sediment and trace contaminants to the stream via the storm sewer network.

Description: M2) As roads are re-constructed within the watershed, infiltration devices consisting of perforated storm sewer pipes (within ditches or under roads) would be installed at the same time. M3) The frequency of street sweeping and catchbasin cleaning would be increased from its current level. This would also include inspection/cleaning of storm sewer outfalls and culverts.

M4 END OF PIPE CONTROLS

Action	**Implementation Responsibility**
Peller Estates (Low Flow Augmentation)	Landowner, Municipality, CA
The Commons (Flood Control)	Parks Canada, Municipality, CA
Butler's Park	Muncipality, CA

Problem: There is a lack of baseflow and also periods of nuisance flooding within One Mile Creek that contributes to sediment and loading, water stagnation and nuisance flooding. The construction of the Epp Drain has provided some relief, however these issues still remain.

Description: The construction of a wet pond or wetland pond at the confluence of the Epp Drain and One Mile Creek (at Peller Estates), on the municipally owned lands at the corner of King and John Streets (adjacent to the Commons) or at Butler's Park (near King and Nelles Streets) could provide these benefits and could also represent an aesthetic amenity for the local area. Increased baseflow and reduced nutrient and bacteria loading to the creek would result. Depending on location and pond size, some additional flood benefits may also be achieved.

M5 CULVERT IMPROVEMENTS

Action	**Implementation Responsibility**
List of Priority Upgrades	Municipality, CA, Landowners
Flood Protection Works	Muncipality

Problem: Undersized culverts result in backwatering and aggravate nuisance flooding throughout One Mile Creek. The culverts of most concern include those at Niagara, Nassau, Johnson and Gate, Victoria, Gage, Centre and Regent Streets.

Description: As roads are re-constructed or as culverts deteriorate, they would be replaced / twinned to provide convey larger events (eg up to the 5 yr event). Replacement would need to be carefully planned to ensure that replacement of one culvert does not further aggravate flooding downstream.

STREAM RESTORATION/HABITAT ENHANCEMENT

Action	**Implementation Responsibility**
M6 "How To" Manual/Technical Advice	CA, Landowners
M7 Spring/Fall Clean Up Program	CA, Landowners, Municipality
M8 Instream Environment	CA, Landowners
Address Barriers / Channel Constriction	
Selective Channel Widening	
M9 Streamside Environment	CA, Landowners
Selective Plantings	
Floodplain Issues	

Problem: Based on responses during Open House Workshops, most landowners are in favour of doing work on their lands to improve stream conditions. Lack of information

and assistance to do work were key obstacles. The stream currently has been altered by individual landowners and has lost its natural characteristics

Description: Several actions are proposed to assist landowners in implementing good stewardship practices on their lands:

- A "how to" stewardship manual/technical advice: This manual would be developed by NPCA and used as a guide for NPCA staff and landowners to use to undertake improvements to the creek and the streamside environment (riparian zone) to restore its natural functions and improve habitat
- Spring/Fall Clean Up Program: This would be a program designed to assist landowners in removing litter and debris from the creek on an semi-annual basis
- Instream and Streamside Environment: As part of the manual, templates showing how to improve the morphology of the stream by creating pools and riffle and removing barriers; and how to naturalize the stream banks and riparian zone would be developed.

M10 LANDSDOWNE POND

Action	**Implementation Responsibility**
Sediment Trap (downstream of Nassau St.)	CA, Municipality
Outlet Control Modification (at Niagara Blvd.)	CA, Municipality, Landowner
Habitat Works (downstream of Niagara Blvd.)	CA, Municipality, Landowner
Dredging of the Pond	CA, Municipality, MNR, DFO
Implement a Detailed Study of the Pond	CA, Municipality, MNR

Problem: Landsdowne Pond suffers from extensive sediment accumulation that is the result of a number of different factors that have affected the supply of sediment, the flow regime entering the Pond and the rate of flow and sediment transport from the Pond to Lake Ontario. Although dredging may appear to offer a simple solution, based on the possible sources of the problem, it only represents a "band aid" solution. Dredging also is constrained by land ownership and environmental approval issues that may preclude it as a viable option.

Description: Several alternative actions are identified:

- Construction of a sediment trap at the upstream end of the pond to trap sediments to be manually removed on a regular basis – this would be in the form of an online structure
- Modify the outlet at Niagara Blvd and the mouth of One Mile Creek to reduce backwater effects and improve sediment transport
- Dredging or selective dredging of the pond
- Implement a detailed study of the pond – this would include sediment profiling and dating, determining sediment contaminant levels, assessing the hydraulic function of the Pond in relation to its inflow and outflow, determining land ownership and developing a habitat enhancement plan. The plan may include enhancements for fish and wildlife habitat, including examining the benefits of selective dredging. The plan would need to address Environmental Assessment and permitting requirements.

M11 EROSION REMEDIATION

Action	Implementation Responsibility
Erosion Remediation (Landfill)	CA, Municipality

Problem: Minor bank erosion adjacent to an existing landfill downstream of Nassau Street is eroding material from an old landfill. Waste material, primarily garbage, is being deposited in the creek downsteam of the erosion site and the exposed face of the landfill is gradually becoming larger.

Description: Erosion works are proposed to address the erosion of the landfill and also to clean up debris that has accumulated along the creek bed and banks.

M12 Environmental Monitoring Program

Action	Implementation Responsibility
Environmental Monitoring Program	CA, Municipality, FOMC, Niagara College, MNR

Problem: Currently there is no comprehensive environmental monitoring program within the watershed. This lack of monitoring information means that the current state of the watershed and its resources is not known and there is no ongoing, regular assessment of watershed conditions to establish whether conditions are improving or getting worse. Without this type of information, it is difficult to measure/assess the impact that management actions are having on the watershed.

Description: Environmental monitoring can include monitoring a variety of indicators over time to measure the health of the watershed. Monitoring can include many components, measured over different time periods, including:

- stream flow, including groundwater flow
- water quality
- stream channel characteristics, including sediment movement
- aquatic habitats and species
- terrestrial communities and species

Comprehensive monitoring programs can be expensive and require specialized technical expertise that is beyond the capability of local groups and organizations. In the case of One Mile Creek, Niagara College students have taken an active interest in the watershed and there is an opportunity to seek their assistance with some of the watershed monitoring initiatives. NOTL, MNR and NPCA also could provide some assistance.

M13 Environmental Awareness Program

Action	Implementation Responsibility
Environmental Awareness Program	CA, Municipality, FOMC

Problem: there is generally strong interest among watershed residents and landowners whose properties abut the creek, to implement measures to improve environmental conditions. However, there is a need to increase awareness of how various issues may be address and a need for education programs to help and guide residents' efforts.

Description: Through the course of the study, Friends of One Mile Creek have demonstrated their excellent capability of maintaining the profile of the study and getting the public and landowners involved through participation in Open Houses. While there are many ways of providing public awareness, the FOMC is already well organized in this regard. The following is a list of program components:

- continuing the FOMC as a community-based organization to provide a focus for implementation, a network of commited volunteers and a political voice for the protection and enhancement of the watershed resources
- annual/bi-annual stream cleanups
- promotion of success stories – examples of landowner initiatives to address implementation actions
- an annual newsletter addressing accomplishments that could be posted on NPCA's website

5.1 Other Management Actions

William Street Pumping Station Overflows – NOTL and the Region of Niagara continue to monitor the frequency of overflows at the Pumping Station and in the long term are working on reducing the frequency of overflows by focusing on property level measures (for example roof downspout disconnection).

Storm Sewer Outlet Controls – the above referenced source and conveyance controls will substantially reduce impacts of storm sewers on nutrient and sediment loading. Other than the identified End-Of-Pipe locations for stormwater ponds, the opportunity to retrofit existing storm sewers with these measures is severely limited by lack of space. Other than the opportunities identified, the only public lands offering any potential space would be the parkland around the William Street Pumping Station. At this time, source and conveyance measures and the End-of-Pipe measures upstream of King Street should be implemented first, before further stormwater management retrofit measures are considered. In addition, NOTL has been undertaking testing of individual properties in the areas of the Town served by combined sewers to develop property level solutions to CSO overflows. This program should be expanded, as budget permits, to test for cross connections to storm sewers outleting to One Mile Creek.

Table 5.1 lists the alternative Best Management Practices and provides an indication of relative cost and application to public or private lands.

Table 5.1. List of Alternative Best Management Practices and their application on private and public lands

Management Measure	Cost	Public Lands	Private Lands	1	2	3
Stormwater Management Measures						
- Source Controls	Low		x	x	x	x
- Conveyance Controls	Moderate	x	x	x	x	x
- End-of-Pipe Controls	Moderate	x		x		
Baseflow Augmentation Measures						
- headwater wetland creation (King and John area)	High	x		x		
- stormwater infiltration (roof downspouts, conveyance controls)	Low		x	x	x	x
Flood Control (2 – 5 year events)						
- Culvert improvements	Moderate	x		x	x	x
- conveyance controls	Moderate	x	x	x	x	x
- roof downspout disconnection	Low		x	x	x	x
- dry ponds	Low	x	x	x	x	
Fish habitat enhancements						
- barrier removal	Low	x	x	x	x	x
- instream measures (pool/riffle creation, gravel placement, instream cover)	Moderate		x		x	x
- streamside measures (riparian plantings, "softening" of banks)	Low - Moderate		x	x	x	x
Erosion Protection						
- selective protective works (lower zone) including protection of landfill	Moderate		x			x
Landsdowne Pond						
- dredging and sediment removal	High	x	x			x
- re-contouring and onsite sediment disposal	High	x	x			x
- sediment trap	Moderate	x	x			x
- outlet modification	Moderate	x	x			x
- detailed study	Low - Moderate	x	x			x
Water Quality						
- improve CSO performance	V. High	x				x
- identify and correct storm sewers with cross connections	Moderate		x	x	x	x

1. Headwaters zone – upstream of King Street
2. Middle zone – between King and Butler Streets
3. Lower zone – between Butler and Niagara Streets, including Landsdowne Pond

6.0 SELECTION OF A PREFERRED PLAN

Based on input from the open houses, a number of evaluation criteria were identified and evaluated. Table 6.1 summarizes the public input on evaluation criteria.

Table 6.1 Ranking of Evaluation Criteria by Public

Evaluation Criteria	Very important	Somewhat important	No opinion	Somewhat not important	Not important
Ability to meet study objectives and targets	6	7	2	0	0
Environmental benefits and impacts	15	2	0	0	0
Social impacts	4	6	4	2	0
Implementation considerations, including phasing	6	9	0	1	0
Cost	6	3	3	1	2
Stakeholder acceptance	10	6	0	0	0
Agency acceptance	7	7	2	0	0
Recreational and cultural impact	5	10	2	0	0

These results indicate that the following criteria were of most importance to the public in ranking management actions to be included in the Recommended Watershed Plan:

- environmental benefits and impacts
- stakeholder acceptance

The first two criteria were used to evaluate each of the actions and in general, all actions satisfied these criteria to some degree. The actions were also evaluated against the identified issues and are summarized in Table 6.2.

Table 6.2. Ability of Management Measures to Address Key Issues

	Flooding and high Flows	Erosion and Sedimentation	Landfill Debris / Erosion	Fish and Wildlife Impacts	Water Quality: bacteria, aesthetics	Baseflow and groundwater enhancement	Contaminated Sediments	Epp Drain *
Management Measure								
Stormwater Management Measures								
- Source Controls		x		x	x	x		
- Conveyance Controls	x	x			x	x		
- End-of-Pipe Controls	x	x		x	x	x	x	x
Flood Control (frequent/infrequent events)								
- Culvert improvements	x	x		x	x		x	
- conveyance controls	x	x		x	x	x	x	
- roof downspout disconnection		x			x	x		
- dry ponds	x	x						
Fish habitat enhancements								
- barrier removal		x		x	x		x	
- instream measures (pool/riffle creation, gravel placement, instream cover)		x		x	x			
- streamside measures (riparian plantings, "softening" of banks)		x	x	x	x			
Erosion Protection								
- selective protective works (lower zone) including protection of landfill		x	x		x		x	
Landsdowne Pond								
- dredging and sediment removal		x		x	x		x	
- re-contouring and onsite sediment disposal		x		x	x		x	
- sediment trap		x			x		x	
- outlet modification		x		x	x			
- detailed study		x		x	x		x	

	Flooding and high Flows	Erosion and Sedimentation	Landfill Debris / Erosion	Fish and Wildlife Impacts	Water Quality: bacteria, aesthetics	Baseflow and groundwater enhancement	Contaminated Sediments	Epp Drain *
Water Quality								
- improve CSO performance				x	x		x	
- identify and correct storm sewers with cross connections				x	x		x	
* wet pond to provide low flow into One Mile Creek								

Stakeholders (landowners) who attended the open houses were generally in favour of most measures and felt that technical considerations plus the environmental benefits and stakeholder acceptance were the key criteria to be used to determine which measures should be part of the recommended plan. With respect to implementation of measures on private lands, most landowners were willing to implement measures to improve and protect the creek, however lack of information, lack of technical advice and assistance, and to a lesser extent lack of funds were considered barriers to implementation (see Section 4.2).

Agencies (NOTL and NPCA) were generally willing to implement most actions within their budgetary / fiscal constraints and jurisdictional responsibilities. Similar to the public, agencies were willing to implement measures provided that there was sufficient technical justification to support them.

The final selection of the plan was based on individually reviewing and selecting the measures that could be technically justified based on available information. In this regard the selection process favoured measures that best met the evaluation criteria and that were implementable based on agency and landowner acceptance, instead of following a traditional Environmental Assessment approach which is a formal comparison of alternatives using traditional cost – benefit analytical approach.

7.0 RECOMMENDED WATERSHED PLAN AND IMPLEMENTATION STRATEGY

7.1 Recommended Plan

The Recommended Watershed Plan is summarized in Table 7.1. These measures represent the suite of capital works, programs and stewardship measures that are recommended to restore the One Mile Creek Watershed to a healthy state. A more detailed description of each measure, its expected benefits and target improvements is provided in Table 7.2. Figure 13 illustrates examples of these management actions and Figure 14 shows the general location where these measures would be implemented.

Table 7.1 Implementation Plan Components

Recommended Management Actions	
SOURCE CONTROLS	
M1a Action:	**Downspout Disconnection /Soak-away Pits**
Implementation:	Landowner, Conservation Authority, Municipality
Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
Priority:	Short and Medium Term
M1b Action:	**Rainbarrel Program**
Implementation:	Municipality
Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
Priority:	Medium and Long Term
CONVEYENCE CONTROLS	
M2 Action:	**Perforated Pipe / Infiltration Techniques(as roads improved)**
Implementation:	Municipality
Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
Priority:	Medium / Long Term
END OF PIPE CONTROLS	
M4 Action:	**Stormwater Management Pond**
Implementation:	Landowner, Municipality, Conservation Authority, Landowner, Federal Government

Recommended Management Actions	
Options:	Possible locations include the Commons, Peller Estates
Benefits:	Baseflow augmentation, reduced flooding, water quality enhancement, community amenity
Priority:	Short / Medium Term
CULVERT IMPROVEMENTS	
M5 Action:	**Culvert Replacement/Upgrade** (Nassau, Dorchester, Victoria, Regent, Gate, Gage)
Implementation:	Municipality, Conservation Authority, Landowner
Benefits:	Reduced flooding
Priority:	Medium and Long Term
STREAM RESTORATION/HABITAT ENHANCEMENT	
M6 a) Action:	**Stewardship (How To) Manual**
Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
Benefits:	Assist landowners by providing information on how to improve instream habitats, improve streamside habitats, and improve instream flows
Priority:	Short Term
M6 b) Action:	**Technical Assistance Program**
Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
Benefits:	Assist landowners by providing technical advice, concept designs for improving instream habitats, streamside habitats, and instream flow conditions
Priority:	Short Term
M7 Action:	**Stream Clean Up Program**
Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
Benefits:	Provide assistance to landowners to remove leaf litter and debris from streams
Priority:	Short Term

Recommended Management Actions	
M8 Action:	**Instream Habitat Enhancement**
Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
Options:	Remove Barriers / Channel Constrictions; Naturalized Stream Rehabilitation, MNR
Benefits:	Improved instream habitats, improved flow conveyance
Priority:	Short and Medium Term
M9 Action:	**Streamside Habitat Enhancement**
Implementation:	Conservation Authority, Landowner, Community Group, MNR
Options:	Tree/Shrub Plantings; reduced lawn maintenance along stream
Benefits:	Improved habitat, stream shading, water quality enhancement
Priority:	Short and Medium Term
LANDSDOWNE POND	
M10 a) Action:	**Detailed Assessment of Pond**
Implementation:	Conservation Authority, Municipality, Landowner, Provincial/Federal agencies
Benefits:	Develop long term plan to improve water quality and reduce stagnation
Priority:	Short Term
M10 b) Action:	**Weir Modifications – Niagara Blvd.**
Implementation:	Conservation Authority, Municipality, Provincial/Federal agencies
Benefits:	1) Improved flow conveyance; 2) improved fish passage
Priority:	Short Term
M10 c) Action:	**Habitat Works /Outlet Modification (downstream of Niagara Blvd.)**
Implementation:	Conservation Authority, Municipality, Landowner, Community Group
Benefits:	Improve channel characteristics, enhance aquatic habitat
Priority:	Short Term
EROSION REMEDIATION	
M11 Action:	**Erosion Remediation**
Implementation:	Landowner, Conservation Authority, Municipality, Ministry of

Recommended Management Actions	
	Natural Resources, Ministry of the Environment
Benefits:	Eliminate erosion of landfill
Priority:	Short Term
Environmental Monitoring	
M12 Action:	**Comprehensive Environmental Monitoring Program**
Implementation:	Conservation Authority, Friends of One Mile Creek, Ministry of Natural Resources, Municipality
Benefits:	Documents in progress in implementing the plan and restoring environmental health of watershed
Priority:	Short and Medium Term
M13 Action:	**Environmental Awareness Programs**
Implementation:	Conservation Authority, Friends of One Mile Creek, Ministry of Natural Resources, Municipality
Benefits:	Greater support for implementation of measures; commitment to improve watershed health
Priority:	Short and Medium Term

7.2 Implementation Considerations

A preliminary description of these measures was provided in Section 6.0 and is further described in Table 7.2. Implementation considerations for these measures are outlined in greater detail below.

M1 Roof Downspout Disconnection / Rainbarrel Program

As outlined previously, in the order of 25-50% of residences have roof downspouts directly connected to storm sewers. It is estimated that a 5% increase in baseflows and a 5% reduction in peak flows would result from implementing this management action. NOTL has been looking at a downspout disconnection program as part of addressing problems in some areas served by combined sewers, and a similar program could be initiated in One Mile Creek. An example of a similar program for the City of Toronto is shown in Figure 16 (See Appendix B). This management action would have an indirect water quality benefit by increasing base flows (through infiltration) and marginally reducing the transport of nutrients and sediments to the watercourse.

	Source Controls	**Downspout Disconnection; Soak-away Pits**	area served by storm sewers, so downspouts discharge onto grassed areas or into soak-away pits. The town would need to develop a program providing technical advice, free disconnect services or incentives to individual homeowners	program	Conservation Authority, Municipality	downspout ($600/home); $36,000
		Rainbarrel Program	this measure would involved homeowners installing rainbarrels on their downspouts to collect rainwater for lawnwatering, etc. The Town would develop a program to provide rainbarrels and advice on how to install	1)municipality to develop a brochure explaining how to disconnect downspouts; 2)develop technical assistance and incentive program; 3) examine funding arrangements with the CA and Region	Municipality	$60/barrel; $18,000
	Conveyance Controls	**Perforated Pipe / Infiltration Techniques**	As roads are re-constructed within the watershed, infiltration devices consisting of perforated storm sewer pipes (within ditches or under roads) would be installed at the same time	1) municipality to identify additional cost in capital works programs; 2) incorporate measures into proposed design templates (4 - 6)	Municipality	$110 per linear m of road; 8.5 km - $900,000
	End-Of-Pipe Controls	**Stormwater Management Pond / Wetland**	a stormwater management pond/wetland constructed at Peller Estates or the Commons would provide water quality/quantity control and low flow augmentation	1) meeting with Peller and Parks Canada to review feasibility and acceptability; 2) develop conceptual plans for each site and assess anticipated environmental benefits 3) select preferred location; 4) develop funding program; 5) undertake archeological assessment	Landowner, Conservation Authority, Municipality, Federal Government	$500,000
	Culvert Improvements	**Culvert Replacement / Upgrade (Nassau, Dorchester, Victoria, Gage)**	as roads are re-constructed or as culverts deteriorate, they would be replaced / twinned to provide convey larger events (eg up to the 5 - 10 yr) then currently. Culverts with the smallest conveyance capacity are highest priority.	1) municipality to identify additional cost in capital works programs; 2) CA to review funding alternatives for reducing flooding and recommend appropriate culvert size	Landowner, Conservation Authority, Municipality	$100,000/crossing x 4 culverts = $400,000
	Stream Restoration	**Stewardship (How To) Manual**	A landowner stewardship manual would be developed to assist CA staff and Landowners in making improvements to the watercourse as it crosses their property. Items addressed would include: 1) ways to improve conveyance in the channel; 2) ways to improve instream habitat - pools/riffles/instream cover; 2) plant materials and densities for streamside plantings; 3) measures to reduce water quality impairment (fertilizer use, mowing, etc) 4) measures to improve baseflow (downspout disconnection, rainbarrels, raingardens, etc)	1) prepare manual; 2) work with Friends of One Mile Creek, CA and MNR Stewardship Council on design, possible grant programs, etc	Landowner, Conservation Authority, Friends of One Mile Creek, MNR	$10,000 to develop Manual
		Technical Assistance Program	CA to focus existing programs on One Mile Creek working with Friends of One Mile and Landowners	1) CA to incorporate in existing programs	Landowner, Conservation Authority, Friends of One Mile Creek, MNR	existing program
		Stream Clean Up Program	Friends of One Mile Creek and CA to initiate a spring/fall stream cleanup program to remove litter and debris from creek to improve conveyance of flows	1) CA and Friends of One Mile Creek to organize on an annual basis; 2) municipality to consider assisting with debris removal	Landowner, Conservation Authority, Friends of One Mile Creek, MNR	existing funding
		Instream Habitat Enhancement	develop templates showing examples of how to improve existing stream reaches for fish and flow conveyance. These templates would be part of the How To Manual	1) develop series of templates showing possible improvements; 2) meet with Landowner Group / Friends of One Mile Creek to discuss needs; 3) incorporate into How to manual	Landowner, Conservation Authority, Friends of One Mile Creek, MNR	up to $200 / m of stream; Zone 2 - 50 properties - $500,000
		Streamside Habitat Enhancement	develop templates showing examples of how to improve existing stream riparian conditions to improve water quality andd shade the stream. These templates would be part of the How To Manual	1) develop series of templates showing possible improvements; 2) meet with Landowner Group / Friends of One Mile Creek to discuss needs; 3) incorporate into How to manual	Landowner, Conservation Authority, Friends of One Mile Creek, MNR	$300/ ha of plantings; zone 2 - 4 km - $40,000
	Erosion Remediation	**Erosion Remediation / Stream Restoration Behind William Street Pumping Station**	a conceptual erosion remediation plan will be developed to provide long term stabilization of an existing erosion problem impacting on a former landfill site. Several alternative solutions would be examined, including relocation of the stream in a former channel, as well as undertaking a cleanup of the stream bed to remove accumulated debris from the landfill. A meeting with MOE would be arranged to discuss long term requirements for the landfill.	1) develop alternative remedial measures; 2) identify preferred solution; 3) meet with MOE to discuss long term requirement for landfill site management; 4) prepare detailed design of preferred alternative and construct	Conservation Authority, MOE, MNR, Municipality	$35,000
	Landsdowne Pond	**Detailed Assessment of Pond**	a detailed assessment of possible remedial measures to improve water quality /flow conditions in Landsdowne Pond would be undertaken. The assessment would review historic sediment deposition patterns, determine land ownership and assess functionning of the pond in relation to Lake	1) reconstruct a history of sediment accumulation in pond by coring; 2) determine landownership 3)meet with regulatory agencies to discuss constraints; 3) determine effect of downstream controls (barrier beach, Lake Ontario water levels, Niagara Blvd) on sediment deposition patterns; 4) identify current sediment loads; 5) develop Landsdowne Pond	Landowner, Conservation Authority, provincial / federal agencies	$20,000

		Blvd	conveyance through the culvert.		Municipality	
		Habitat Works / Outlet Modification (downstream of Niagara Blvd)	a plan would be developed to improve instream habitat downstream of Niagara Blvd and to review ways to eliminate the existing barrier beach at the mouth to improve fish passage and lower the creek invert. The role of the existing shore protection works at the mouth in affecting barrier beach formation would be determined.	1) develop habitat enhancement plan and review impacts of historic shore protection works on barrier beach formation; 2) meet with regulatory agencies to discuss constraints to removing barrier beach to improve fish passage; 3) develop project plan proposal to provide a long term solution to barrier beach formation to seek funding support	Landowner, Conservation Authority, provincial / federal agencies	$15,000 to develop proposal
	Environmental Monitoring	**Comprehensive Environmental Monitoring Program**	an environmental monitoring program for One Mile Creek would be established to monitor stream flows and water quality in relation to implementation of the recommended plan. Other monitoring elements would include monitoring of sediment transport in the watercourse and accumulation in Landsdowne Pond. Monitoring of the impacts of culvert improvements (Niagara Blvd) and barrier beach removal on Landsdowne pond would also occur.	1) identify comprehensive program focusing on use of volunteer support to undertake monitoring; 2) identify existing resources / agencies that could assist 3) develop a recurring 5 year monitoring program for implementation	Conservation Authority, Municipality, MNR, Friends of One Mile Creek	existing funding
		Environmental Awareness Program	an environmental awareness program promoting the One Mile Creek Watershed Plan and advocating support for implementation of the recommended actions would be developed.	1) develop a series of brochures highlighting recommendations of watershed plan; 2) hold landowner workshops to show how to implement measures 3) encourage residents to participate in activities such as stream plantings, stream cleanup, etc.	Conservation Authority, Municipality, MNR, Friends of One Mile Creek	existing funding

Recommended Measures		
Short Term		$154,000
Medium Term		$1,020,000
Long Term		$1,400,000

Figure 16. City of Toronto downspout disconnection program

Downspout disconnection program

Be part of the water-pollution-solution

By making a phone call, you can help:

- Reduce your risk of basement flooding
- Reduce pollution to our creeks, rivers and Lake Ontario
- Make Toronto's beaches cleaner for swimming

Toronto Downspout Disconnection

How?
When you call the City's Downspout Disconnection Program at **416-392-1807**, we'll arrange to disconnect your downspouts free of charge. Disconnecting your downspout reduces the overflow in our sewer system, helping alleviate pollution to our rivers and lake. When it rains in Toronto, a lot of rain falls on the roof of your house where it flows to the eavestrough, then down the downspout and directly into the sewer system. During heavy rainfall, millions of litres of rainwater mixes with sewage in the sewer system - overloading it and causing the mixture to flow, untreated, into our rivers and Lake Ontario. The overloading of this system causes flooded basements, contaminated lake water and beaches unsafe for swimming.

See our ads!

The City has a plan - but we need your help!
The City has many projects to improve water quality in Toronto as outlined in Toronto's Water Pollution Solution, but we need residents' help. While we're building tanks, tunnels and stormwater management ponds, we need residents to disconnect downspouts wherever possible.

How do I know if I'm connected?
If you're connected, your home's downspouts (you could have one or more) will go straight into a pipe in the ground as pictured here.

We'll do it for you – Absolutely FREE!
We'll do all the work for you. All you have to do is complete our easy registration process.
Call us at: 416-392-1807.

What the City will do:

- Cut the downspouts where they enter the ground.
- Install a plug where it has been cut off.
- Add an extension and splash pad, or a rainbarrel (if necessary) to ensure water is not draining near your home's foundation.

Do-it-yourself! Confident with your fix-it skills and want to tackle the job yourself? Check out our easy to follow instructions.

NOTL recently completed a review of its sanitary sewer system that prioritized necessary remedial works focused on repairing infrastructure and reducing infiltration and introduction of stormwater into the system (Earth Tech Canada Inc. 2005). A key recommendation was the disconnection of roof downspouts from the sanitary system which could result in a 4% reduction in flows to the sanitary system. The Town is currently planning to proceed with a program similar to St.Catherines to address roof downspout disconnection in the areas served by combined sewers. Currently the Town has a policy in place that encourages roof downspouts to be connected to the storm sewer system. It is recommended that the Town change this policy to have downspouts disconnected from both storm and sanitary systems. It is important to note that there are instances where lot grading would prohibit disconnection.

M2 Perforated Pipe / Infiltration Techniques (as roads are upgraded)

There are over 8 km of roads with storm sewers within the watershed. NOTL has recently completed a review of different alternatives for road cross sections as part of a comprehensive assessment of road designs. Each of the preferred alternatives has the potential to incorporate perforated pipe systems that would allow storm runoff to infiltrate into the ground as it travels through the storm sewer network to the stream. The recommendations of the road design study has been completed including a new road policy endorsed by Council. The benefits of implementing this infiltration technique as roads are upgraded is as follows:

- up to 30% reduction in peak flow;
- up to 30% increase in baseflow; and
- up to 30% reduction in nutrients / sediment / bacteria.

If this measure is implemented as roads are upgraded, the incremental cost is relatively low ($110/ road metre). It is recommended that NOTL also ensure that infiltration techniques are included in any road upgrades within One Mile Creek. Perforated pipe systems can be incorporated into the approved road designs selected by the Town.

M4 Stormwater Management Pond
1. Municipal Lands adjacent to the Commons

The purpose of constructing a stormwater management pond on the municipally owned lands adjacent to the Commons (on the west side of the existing creek at the corner of John and King Streets) is as follows:

- provide some level of water quality control
- provide for base flow augmentation
- provide an aesthetic and wetland habitat benefit

The upstream drainage area at this point is approximately 120 ha, and based on the MOE Stormwater Planning and Design Manual (2004), an appropriate pond volume to provide water quality control is in the order of 110-140 m^3/ha for soils characteristic of the headwaters of One Mile Creek, representing about 13,000- 17,000 m^3 for the total pond

volume. Assuming that the pond is entirely located within the municipal property here, only about 0.5 ha is available, limiting pond volume to about 5,000-8,000 m^3. This volume would be sufficient to store events of 5-8 mm in size.

As shown in Figure 13, the pond would be designed as a wetland/pond system that could provide an aesthetic amenity and focal point for the local community. It could also be used to provide an interpretive focus to highlight recommended management actions for One Mile Creek.

While the pond volume would not provide full water quality benefits, it would significantly reduce loadings of nutrients, sediment and bacteria for small runoff events. For these events, it would reduce sediments and nutrients by about 80%. The pond would also be capable of augmenting baseflows. This would be limited to in the order of 5-10 l/s, depending on the reserve volume to be maintained in the pond for aesthetics. By establishing a wetland/pond feature, wildlife habitat, particularly for ducks and muskrat would be enhanced. The wetland feature would also attract other local birds.

If the pond is limited to the municipal lands, little if any flood control benefit would result, however some limited benefits could be achieved if the pond area was increased to accommodate flood storage up to the 2 year event. This would require expanding the pond area onto the Parks Canada lands. At this time, this would not appear to be feasible because of Parks Canada's concerns regarding any disturbance to the historic features of the site. However, further discussion with Parks Canada should occur to investigate this further.

2. Peller Estates / Epp Drain

Preliminary discussions with Peller Estates and also with the NOTL Drainage superintendent indicate that opportunities to enhance base flows in One Mile Creek, by diverting flows from the Epp Drain are limited. The drain is not part of the NOTL's irrigation system and currently the drain is intermittent, therefore there is no baseflow available to be diverted to One Mile Creek. There is an unopened road allowance (municipally owned) extending between the Peller Estates Property and the adjacent property to the west, where the Epp Drain crosses John Street. This would provide a limited opportunity to capture a small amount of runoff from the Epp Drain (in the order of 4,000 m^3) in an extended detention pond, that could be diverted to One Mile Creek and provide in the order of 5 l/s of baseflow. There would be no water quality, flooding, aesthetic or habitat benefits from this measure. At this time, the benefits of this action are limited and it is not recommended that this be pursued.

Another alternative would be to provide a low flow connection from the Epp Drain to One Mile Creek along John Street (by means of a small diameter pipe). While there currently is no source of base flow in the Epp Drain to provide low augmentation, this could be enhanced if a connection from the NOTL's drainage sytem to the Epp Drain was made. This connection could be achieved by means of a pipe or channel along East West Line between Two Mile Creek and the Epp Drain. This would create the opportunity to

utilize excess flows from the Town's agricultural irrigation system. It is recommended that the Irrigation Committee be asked to consider such a diversion.

M5 Culvert Replacements

The majority of the culverts under road crossing in One Mile Creek are undersized, with capacities limited to the 2 or 5 year flow. This, combined with the fact that the floodplain is very flat and historic development has occurred in the floodplain, results in nuisance flooding of lands and structures as flows are backwatered behind the culverts on a regular basis. A simplified stream hydraulic model showed that nuisance flooding could be reduced by increasing culvert capacity by twinning or replacing existing culverts at several locations with larger ones (Figure 13). Several culverts were identified as priorities for replacement (Table 7.2). Replacement of culverts will reduce nuisance flooding and improve flow conveyance within the creek and its flood plain, however, upgrading must be carefully planned in order to ensure that upgrading one culvert does not lead to increased flooding downstream (from backwater effects).

Undersized culverts can have other unexpected effects. The culvert at Nassau Road has a capacity of less than or equal to the 2 year flow, and unlike some other crossings, the flows up to and including the Regional Flood do not overtop the road. The impact of this culvert on the One Mile Creek channel immediately downstream of the culvert has been channel downcutting and entrenchment. This means that the channel is becoming less connected to its floodplain and the channel has become unstable. Downcutting of the channel has resulted in sediment loading to Landsdowne Pond and deposition of sediment in the lower part of the channel just upstream of the pond. Increasing the culvert capacity here may actually alleviate downstream erosion and sediment transport by allowing flows to migrate out into the floodplain again instead of being confined in the channel as they are now.

It is recommended that the Town and NPCA undertake a review of the current culverts to identify possible upgrades. These could then be implemented as funding becomes available.

M6 Stewardship Manual and Technical Assistance; M8 Instream Habitat Restoration; M9 Streamside Habitat Restoration

A key component of the manual is to provide guidance the nature of the changes that could be undertaken by landowners with advice from NPCA staff. The objective of the manual is to provide guidance on how to improve the conditions in the creek to reduce water stagnation, improve flow conveyance, and enhance fish and wildlife habitat. The manual should include the following:

- recommended riparian plantings, focusing on native shrubs and grasses
- guidelines on how to reduce impacts on the stream by maintaining a buffer along the stream, reducing fertilizer and pesticide use, removing obstructions from the stream
- examples of improvements that can be made to begin restoring the stream to a more natural state, by replacing hardened banks with vegetation and introducing riffle features into the stream

- templates for naturalizing the creek, provided recommended stream dimensions, material sizes for the stream bed and banks, recommended treatments/ plantings for the riparian (streamside) environment

It is recommended that the NPCA and Friends of One Mile Creek develop a Stream Restoration Manual covering the above areas. It is important to note that NPCA has a number of grant programs under its Water Quality Improvement Program and Restoration Program. While these programs generally focus on rural lands, there are some opportunities for urban lands. There are also several federal programs that could provide funding assistance such as the Green Municipal Enabling Fund and the Great Lakes Renewal Fund. Friends of One Mile Creek could play a lead role in applying for some of these funds.

The following discussion outlines some of the key technical components to be considered in developing templates for stream naturalization in the proposed manual that could be applied in different parts of the watershed.

One Mile Creek is a modified watercourse that flows through many residential properties within NOTL. These channel modifications, in conjunction with influences exerted by road crossings, maintenance activities, and the physical setting of the area (e.g., geology, slope) have altered natural functions of One Mile Creek. Indeed, some of these functions have become impaired. Various restoration and rehabilitation options are available that can be used to improve the form and function of One Mile Creek with respect to aquatic habitat and the conveyance of both water and sediment.

The primary functions of One Mile Creek that appear to have become adversely impacted within the NOTL include:

- excess sediment accumulations within the channel;
- interference with flow conveyance caused by undersized culverts under road crossings;
- constriction of channel that contributes to nuisance flooding;
- poorly defined channel to convey average flows (i.e., bankfull channel);
- poorly developed bed morphology;
- poorly formed planform configuration.

Stream stewardship initiatives provide an opportunity to enhance stream functioning and promote sediment transfer through the system. Addressing stream functions can include aquatic habitat improvement, hydraulic diversity enhancement, and sediment transport considerations. Actions that can be undertaken to enhance or improve natural channel functions of One Mile Creek include:

- replacement of undersized culverts,
- removal of in-stream barriers and debris,
- limit water taking

- development of bed morphology (pools, riffles) to provide variability in terms of water depth and flow velocity. Placement of coarse material in riffle sections (e.g. coarse gravel) will enhance aeration of water.
- adjustment of planform configuration
- naturalize channel boundaries
- ensure appropriate capacity to convey the more frequent flow events,
- enhance Floodplain capacity
- enhance Energy Grade
- concentration of flow in over-sized sections to enhance flow velocity and water depth (e.g., upstream of John Street),
- enable continuity of sediment movement through the channel,
- enhance channel capacity to convey larger than bankfull flows.

Removal of In-stream Barriers

Barriers or channel obstructions that cause upstream ponding of water (during low and/or high flow conditions) tend to induce sediment deposition and interfere with the continuity of water and sediment flow along the channel. Removal of these barriers will improve sediment conveyance and enhance the energy grade. Eliminating obstructions that interfere with continuity of flow along long stretches of the channel enables flows to 'work' with respect to moving sediment and maintaining natural channel features such as pools.

In addition to land owner placed barriers across the channel, natural barriers also exist which can include branches. In many situations, branches will redirect flow within the channel and may contribute to some sediment accumulation. Branches and similar organic debris do enable a continuity of flow (i.e., minimal upstream ponding) and, in general, should not be removed.

Provision of Channel Bed Diversity

Most natural watercourses demonstrate variability in water depth through variation in bed elevations. Deeper sections are referred to as pools and shallower sections are often termed flat, riffles, or runs. A sequence of riffles and pools are typical channel features that create a more diverse aquatic and hydraulic environment. Riffles tend to consist of coarser material and the deeper pools are characterized by finer bed material. The mixing of water that occurs over riffles is considered a significant process in water aeration, while pools provide slow moving aquatic habitat. As a guideline, bends in the channel are associated with pools, while riffles are more commonly located in straight sections of the channel. Nevertheless, pools can occur in relatively straight channel sections. Incorporation of pools and riffles is beneficial since it provides variability in water depth and flow velocity, enables pooling of water during periods of low/no flow, and therefore is beneficial to aquatic habitat.

In natural channels, the spacing of riffle features typically ranges from 5 to 7 channel widths. As a representative width for One Mile Creek is about 3 metres, a riffle spacing

of 15 to 20 m may be used as a guideline (Figure 15(A)). This riffle spacing is appropriate the creek, since there is very little change in channel dimensions. In order to promote hydraulic diversity, and aeration of flow, it is recommend that material such as coarse gravel be placed on the bed. The sizing of this material is appropriate for stability under bankfull flow conditions, but is not so large as to make redistribution impossible.

As riffle features represent a slight rise in the elevation of the bed (Figure 15(B)), construction of pool:riffle features will require either some excavation of the channel bed or some minor increase in bed elevation at each riffle. As pool depth only tends to increase the feature's capacity for water storage, deeper pools are not detrimental to channel function, however, are beneficial for aquatic habitat. For One Mile Creek, maximum depth of the channel bed in pools should be no more than 0.10 – 0.16 m below the crest of the subsequent/downstream riffle (Figure 15(C))**.** This depth was determined through consideration of flow hydraulics during bankfull flow conditions.

Concentration of Flow

When a channel is over-wide then water that is usually contained in a narrower channel is spread over a wider area, resulting in a decrease in water depth. Water velocity also decreases in a wider channel which often leads to sediment deposition. The broader area of water occupation and resulting moist conditions of soils often provides a suitable environment for cattail and other similar vegetation to become established. While some of this vegetation may be beneficial, it can also induce further sediment deposition. The implication of these changes, from a narrow, deep channel to a wide, shallow one is that aquatic habitat conditions for fish deteriorate and the sediment transport capacity of the stream is reduced.

Enhancement of natural channel functions in over-wide channels can be achieved by creating a defined channel within them. The dimensions of this defined 'bankfull' channel should be suitable to convey the frequent flow events. Spilling of larger flows into the remainder of the over-wide channel would occur during higher flows.

Ensure Appropriate Channel Capacity

The natural dimensions of a channel are a result of the interaction between the flow regime of the watercourse, bank and bed materials, riparian vegetation and other influences. The channel dimensions that typically result from this interaction are those that enable flow and sediment to be conveyed efficiently through the channel and hence it follows that, in general, channel width increases gradually from upstream to downstream along a watercourse. When a channel is under-sized (and there are no channel obstructions), flows will tend to spill onto adjacent land more often. Erosion of channel boundaries will also occur until the channel form has enlarged to one that is stable for the range of flows that are conveyed through the channel.

When a channel is undersized and banks are lined with stone or wood, then the channel will be unable to adjust its width. As a result, scour of the channel bed may occur or, where there is insufficient energy, more frequent flooding may be anticipated.

Enhancement of natural channel form and function can occur by removing the channel bank protection and providing for an appropriate channel capacity. This can be accomplished by ensuring that the width and/or depth of the channel is sufficient to convey the channel-forming flows.

In addition to increasing flow conveyance capacity, adjustment of the channel cross-sectional dimensions may also promote the transport of sediment downstream and alleviate concerns regarding sediment accumulation as a result of increased flow volume within the channel.

For the purpose of this Stewardship Manual, a field investigation was undertaken to examine the existing channel capacity. Through careful examination and analyses of the channel between King Street and Dorchester Street, it became apparent that One Mile Creek is, in general, undersized for the 2 year flow.

A preliminary determination of appropriate channel dimensions was made. The appropriate channel dimensions (i.e. width, depth, area) for selected reaches (Figure 16) of One Mile Creek are presented in Table 7.3. Based on field surveys, these dimensions generally recommend a 0.10 metre increase in the channel depth throughout the watercourse. This increase in channel depth promotes the transfer of sediment downstream during bankfull and near bankfull flow events by increasing the average and maximum velocities in the channel. The dimensions presented in Table 7.3 also recommend slight increases in channel width over some reaches to allow for some slight increases in channel capacity, while still maintaining adequate water depths and velocities within the channel. It is not the intent of this increase in channel capacity to fully address nuisance flooding, but, to use the flooding to flush fine sediment from the channel.

Table 7.3: General Channel Dimensions based on 2005 survey, by Channel Reach

CR #	Reach Boundaries	Channel Width (m)	Average Channel Depth (m)	Maximum Channel Depth (m)	Channel Cross-Section Area (m^2)	Increase in Cross-Sectional Area (m^2)
1	Dorchester Street to Mississauga Street	3.2	0.45	0.5	1.4	0.3
2	Mississauga Street to Johnson Street	3.0	0.30	0.4	0.9	0.3
3	Johnson Street to Victoria Street	3.0	0.30	0.4	0.9	0.3
4	Victoria Street to Regent Street	3.4	0.30	0.4	1.0	0.3
5	John Street to Charlotte Street	3.0	0.30	0.4	0.9	0.3

Enhance Flooding Capacity

The common occurrence of flooding suggests that the existing channel is typically undersized for regular flow events. This was confirmed through appropriate hydraulic analyses. One option to address this issue is the construction of a two stage channel and terracing into the floodplain. These proposed channel adjustments to contain the 2 year flow event are provided in Table 7.4 and shown graphically in Figures 17 and 18. Generally, terracing can be used to contain larger channel flows, while limiting the extent of floodplain inundation. In effect, this approach will result in a two stage channel, whereby low-flows are contained within the original small channel and high-flows are able to spill over the constructed terrace. As the cross-sectional floodplain topography varies throughout the watercourse, proposed channel and floodplain adjustments will require modification for each circumstance. For example, some floodplain areas will be appropriate for asymmetric terracing, while others may allow for terracing on both sides of the channel

It is important to note that because of the culvert restrictions, the benefit in terms of reducing nuisance flooding using this approach will be small. However there will also be a benefit in terms of providing an improved low flow channel that will provide better flow conveyance under low flow conditions.

Table 7.4: Suggested channel dimensions to contain the 2 year flow event, by Channel Reach.

CR #	Reach Boundaries	Terrace Width (m)	Total Width (m)	Terrace Height above Bed (m)	Maximum Channel Depth (m)	Total Cross-Section Area (m^2)	2 Year Flow (m^3/s)
1	Dorchester Street to Mississauga Street	6.0	9.6	0.3	0.7	4.5	5.8
2	Mississauga Street to Johnson Street	6.0	8.5	0.25	0.60	3.5	3.7
3	Johnson Street to Victoria Street	5.0	8.5	0.25	0.55	3.1	3.2
4	Victoria Street to Regent Street	8.0	11.4	0.2	0.4	2.8	2.3
5	John Street to Charlotte Street	3.0	6.0	0.2	0.4	1.7	1.5

Naturalize Channel Boundaries

Natural watercourses are in a constant state of adjustment in response to variations in the flow and sediment regimes that are conveyed through them. The adjustments generally involve alteration of channel dimensions (e.g., minor widening or deepening) and/or movement of material along the channel bed. Naturalized channel banks have the following benefits to the natural physical and aquatic habitat functions:

- enhance strength of boundary materials through depth and density of rooting materials,
- provide roughness to flow, thereby dissipating flow energy and reducing erosive potential downstream,
- binding soil particles to bank to reduce erodibility
- providing shade to the watercourse which helps to regulate flow temperatures,
- providing aquatic habitat functions

Naturalization of channel boundaries is encouraged along the entire watercourse. This can be accomplished through the following:

- remove any bank lining (e.g., concrete, wood, rock)
- establish dense and deep rooting vegetation along channel banks (e.g., grasses, willow shrubs, etc.)
- limit mowing of lawn and other maintenance to a distance of 1 – 3 m minimum from the edge of bank

Table 7.5 provides a summary of the estimated One Mile Creek flow velocities for the bankfull flow and the maximum permissible velocity that different plant materials can withstand. Note that there are a variety of plant materials that can be used to effectively stabilize streambanks, as opposed to hard materials such as rock and concrete.

Table 7.5. Maximum permissible velocities of different plant materials

Vegetation	Estimated One Mile Creek Velocities (m/s)	Maximum Permissible Velocity (m/s)*	Recommendation
Long Native Grass	0.7 – 1.2	1.23 – 1.83	Good
Short Native Grass	0.7 – 1.2	0.91 – 1.23	Satisfactory
Reed Plantings	0.7 – 1.2	N/A	Good
Hardwood Trees	0.7 – 1.2	N/A	Good
Wattles	0.7 – 1.2	0.91	Satisfactory
Reed fascine	0.7 – 1.2	1.52	Good
Coir Roll	0.7 – 1.2	2.44	Good
Vegetated Coir Mat	0.7 – 1.2	2.9	Good
Live Brush Mattress (initial)	0.7 – 1.2	1.2	Satisfactory
Live Brush Mattress (grown)	0.7 – 1.2	3.66	Good
Brush Layering	0.7 – 1.2	3.66	Good
Live fascine	0.7 – 1.2	1.83 – 2.44	Good
Live Willow Stakes	0.7 – 1.2	1.83 – 3.05	Good

*Source: Fischenich, C. 2001. Stability Thresholds for Stream Restoration Materials.

A variety of native and ornamental grasses, shrubs and trees can be used as bank treatments. Examples and sources are provided in Diemair *et. al*. (2003). While the preferred materials are native species (ideally Carolinian species, if possible), ornamentals are acceptable and preferable to hard-lining (armouring the banks with concrete or rock). An important consideration in the case of One Mile Creek is to select species that are well adapted to shade, given the large number of shade trees throughout the watershed. Preference should also be given to shrubs over grasses and trees, since shrubs provide better rooting and overhanging vegetation for the size of the channel. Shrubs are also less likely to block the channel and also may provide better trapping of sediment on the floodplain when out of channel flows occur.

Enhance Channel Grade

The grade of a channel, or slope, will influence the energy available to transport sediment downstream. In areas that are characterized by excessive sediment accumulation, and where the channel slope is low, an increase in sediment transport capacity may not be readily achieved by enhancing channel capacity. In these areas (e.g., downstream of Nassau Street, in proximity to Lansdowne Pond), enhancement of channel grade may be possible and desirable to improve channel functions and processes. Such work would need to occur over a substantial length of channel rather than along individual properties.

Enhancement of channel grade would be accomplished by building up the channel bed. This would be most feasible in areas where invert elevations can be modified without adversely affecting the upstream channel. **This approach would require a reach-level solution that should only be considered with NPCA consultation.**

Other Measures

A number of additional measures can be included in a Stewardship Manual, including:
- a How To Guide for roof downspout disconnection /rainbarrel use
- recommendations for reducing / eliminating pesticide use
- guidelines for eliminating mosquito breeding grounds for carriers of West Nile virus
- native species plant lists and suggestions for improving backyard habitat
- guidelines for identifying invasive plant species and control measures
- a summary of agency responsibilities and contact lists

M7 Stream Clean Up

A spring and fall clean up program was identified to help remove debris that may cause localized sediment accumulation and restrict flow conveyance. Many residents identified this as a problem and also identified the need for assistance in helping to clear debris. A clean up program could be spearheaded by FOMC, with support from NOTL and NPCA (provision of facilities to haul debris away, for example). This would involve the entire community. Since the watercourse lacks sufficient energy to move this material, this action would maintain flow conveyance by removing debris jams and improve sediment transport.

Because of the mature trees and vegetation in the watershed, this measure is needed since the stream cannot move the material on its own. As residents begin to make improvement to the stream itself with guidance from NPCA staff using the Stream Enhancement Manual (once it is created), the need to control debris may be reduced.

M10 Detailed Assessment of Landsdowne Pond

As noted within this report, at the downstream end of One Mile Creek (at the inlet to Landsdowne Pond), the watercourse is unstable and influenced by both Lake Ontario and Lansdowne Pond. Given site characteristics in this area, it appears that the channel is in a

state of adjustment towards a new configuration. Currently, the channel is poorly defined, the valley floor in which it is situated is saturated, and excess deposition of fine sediment was observed. Within the last several decades, the amount of lands in urban development has doubled, and it is expected that this growth resulted in an increased sediment load to the creek, similar to what has occurred in other urbanizing watersheds.

The outlet of One Mile Creek at Lake Ontario is blocked by a gravel bar that extends across the outlet. This bar has presumably formed as a result of wave action and associated coastal processes along the shore of Lake Ontario. This condition may have been exacerbated by the hardened shore protection of the tablelands at the One Mile Creek outlet.

Simply dredging the pond without examining its current functions and the role that the above modifications have played in its recent history, will only achieve a short term solution and may result in rapid infilling of the dredged areas again. This was observed when a reach of the creek just upstream of the pond was dredged.

Prior to identification of appropriate restoration plans for One Mile Creek at its outlet, it is recommended that further studies be undertaken. The objective of the studies should be to answer the following questions:

- What effect does the barrier at the One Mile Creek outlet (both at Niagara Street and the barrier beach across the mouth) exert on the channel?
- How far upstream do Lake Ontario water levels exert an influence on channel processes?
- Can a defined channel be restored for One Mile Creek through alteration of channel grade and removing backwater influences from the pond and lake?
- What is a sustainable setting for this area (e.g., wetland vs single thread or multiple thread channel vs pond)?
- What actions can be taken to improve efficiency of water conveyance through the channel? (e.g., span of crossing at Niagara Blvd).

In addition, documentation of the sedimentation history of Landsdowne Pond can be undertaken by collecting and dating sediment cores. Contaminant levels in the sediment can also be determined from these samples. Landowners at the creek mouth should be contacted to obtain the engineering design reports for the shoreline works adjacent the creek mouth and the land ownership and land use around Landsdowne Pond should be researched.

In addition to an assessment of the Pond, several measures should be undertaken that would begin to restore natural stream processes through the Pond, as follows:

- remove the rock in the Niagara Blvd. culvert
- clear fallen trees downstream and upstream of Niagara Blvd that may be obstructing the channel
- obtain approvals (NPCA, MNR, DFO) to temporarily remove the barrier beach at the creek mouth and monitor its condition

- experimentally remove some of the yellow iris monocultures to evaluate whether these plants are contributing to sediment buildup in the pond
- aggressively implement the recommended watershed plan measures that are aimed at reducing the sources of sediment loading to the pond

These measures could be completed with the participation of landowners, agencies and FOMC through a stewardship program such as the MNR's Community Fisheries Improvement Program, supported through the local Stewardship Council or through one of NPCA's programs. Ducks Unlimited also represents a potential funding source for improvements to the pond.

M11 Erosion Remediation

Existing Conditions – William Street Pumping Station Erosion Site

Downstream of the Nassau Street crossing, a 35 metre reach of One Mile Creek is situated adjacent to the east valley wall **(Photo 1)**. Erosion of this valley wall has exposed material from a former landfill site. MOE has requested that NOTL (the landowner) address this impact on the landfill site and also develop a long term management strategy for the landfill. As part of the watershed study, the erosion problem was investigated to recommend measures to eliminate further erosion of the landfill.

Flow downstream of Nassau Street originates from a culvert; 1.1 metres in diameter. Two stormwater outfalls are located on either side of the culvert with measured diameters of 0.45 and 0.60 metres. The erosion site downstream of Nassau Street was surveyed on July 21, 2005 to assess and quantify site conditions and channel characteristics. The survey enabled quantification of key parameters necessary for development of restoration alternatives.

The channel through the subject reach was on average 3.5 metres wide, and had a bankfull depth of approximately 0.45 metres. The average slope of the channel bed was determined to be 0.005 m/m based on survey points along the channel bed. There was some evidence of riffle and pool development along the channel bed and a depositional bar of sediment was noted along the channel, immediately downstream of the erosion site. This bar was considered a lateral side channel bar. The channel then exhibited two channel bends before continuing downstream of the study site.

Immediately downstream of Nassau Street, a small ephemeral tributary entered One Mile Creek from the west and was associated with a gully-like valley. The main valley then narrowed and the valley floor was measured to be 12 metres wide at the erosion site. The One Mile Creek channel was adjacent to the east valley wall which was about 3.0 metres in height, with a slope of 2H:1V. The west valley wall was more gently sloping at about 6H:1V. The valley was generally forested, with many mature trees (Willow, Elm, Maple) and herbaceous ground cover. Trees were commonly located on the banks of the One Mile Creek channel.

Recent temporary erosion control work was noted adjacent to the channel at the erosion site, and spanned 16 metres along the slope toe **(Photo 2)**. This work included a 1.5 metre wide erosion control blanket secured with stakes and angular rip-rap placed along the slope toe. The location of the stone protection along the slope generally correlated with the top of the bankfull channel, providing protection to both the bank and the slope toe.

Erosion of the channel has occurred over many years and can be generally characterized as follows:

- historic channel abandonment: As shown in Figure 19, there is evidence of a former channel in the valley. This former channel is at a slightly higher elevation than the former channel and appears to have been abandoned long ago. The reason for this is not clear, but may be the result of both natural and man-made causes, for example a debris jam (natural) or perhaps culvert replacement/maintenance (man-made).
- Downcutting of the existing channel: the bed of the current channel has downcut in the order of 30 – 40 cm, as evidenced by exposed tree roots. This downcutting appears to have been a gradual phenomena over many years, and may be the result of both natural man-made events. The primary cause would appear to be the undersized culvert at Nassau Street, which appears to be back-watered under the 2 year flow. The impact on the channel has been an increase in the duration of erosive flows on the channel, resulting in downcutting.
- Current bank erosion along landfill: As shown in Figure 19, the channel as been eroding its bank adjacent to the landfill. This may also be related to effects of the undersized culvert at Nassau Street (see above) and also possibly debris jams that have caused the channel to erode this bank.

Regardless of the cause of bank erosion, some remedial works are required in order to prevent further losses of landfill material. These remedial works as discussed below will address current and future erosion concerns. At this time, there is no evidence that channel erosion through the rest of this zone is a concern, since no structures are affected. Erosion through this zone may also contribute sediment to Landsdowne Pond.

Proposed Channel Restoration Alternatives

Aquafor Beech Limited has identified three alternatives to alleviate erosion concerns along One Mile Creek downstream of Nassau Street (Figure 19). The proposed restoration alternatives are intended to address erosion problems associated with the valley wall/former landfill site, and provide a range of options to allow for consideration of varied levels of work, disturbance, and cost. Conceptual diagrams are shown in Figure 19, illustrating the following alternatives for channel restoration:

- **Alternative 1:** No channel modification, remove some landfill materials and stabilize slope.
- **Alternative 2:** Minor relocation of the channel away from the slope and stabilize slope.

- **Alternative 3:** Relocate the channel to a historic location. Fill in former channel and stabilize the slope.

The schematic diagrams represent preliminary concepts which require further consultation to determine the benefits and limitations of each alternative . Once the preferred alternative has been identified, detailed design would need to be undertaken prior to implementation A summary of the advantages and disadvantages of each alternative are outlined in Table 7.6. Planning and design should consider existing conditions at the site, as well as future conditions resulting from watershed stewardship and culvert replacement.

Table 7.6: Advantages and disadvantages of the three restoration alternatives along One Mile Creek, downstream of Nassau Street.

Approach	Advantages	Disadvantages
Alternative 1	▪ No channel modification reduces required work and disturbance to watercourse, vegetation and valley form ▪ Opportunity to enhance vegetation community	▪ Channel still situated at base of slope ▪ Fluvial stress and erosion potential along bank not removed, but reduced.
Alternative 2	▪ Only minor channel realignment required ▪ Channel moved away from base of slope to reduce fluvial stress and erosion potential ▪ Opportunity to enhance vegetation community	▪ Channel relocation increases work and disturbance to watercourse, vegetation and valley form ▪ Some existing trees within the floodplain would need to be removed
Alternative 3	▪ Channel moved significantly away from landfill site to reduce fluvial stress and erosion potential ▪ Opportunity to enhance vegetation community ▪ Improve channel connection to floodplain and increase floodplain capacity	▪ Channel relocation requires significant work and disturbance to watercourse, vegetation, and valley form ▪ Some existing trees within floodplain would need to be removed

Implementing any of these alternatives would address the localized erosion occurring here. In addition, the accumulated landfill debris in the channel would also need to be removed. As noted above, this could be best accommodated by moving the channel or potentially raising the bed to its historic level, rather than removing bed material from the channel.

It is recommended that NOTL meet with MOE to present the proposed remediation works as a solution to address the landfill's impact on the creek.

M12 Environmental Monitoring Program

Environmental monitoring can include monitoring a variety of indicators over time to measure the health of the watershed. Monitoring can include many components, measured over different time periods, including:

- stream flow, including groundwater flow
- water quality
- stream channel characteristics, including sediment movement
- aquatic habitats and species
- terrestrial communities and species

Comprehensive monitoring programs can be expensive and require specialized technical expertise that is beyond the capability of local groups and organizations. In the case of One Mile Creek, Niagara College students have taken an active interest in the watershed and there is an opportunity to seek their assistance with some of the watershed monitoring initiatives. NOTL, MNR and NPCA also could provide some assistance. It is recommended that a number of monitoring activities by undertaken as follows:

- Water quality: NOTL should undertake a water quality sampling program to document levels of bacteria, nutrients (total phosphorus) and trace metals throughout the watershed (at 4 or 5 locations) during summer low flow conditions and during a summer storm event. This would provide a snapshot of current water quality conditions. This could be linked to monitoring of the William Street Pumping Station. The purpose of the sampling would be to identify any potential sources of poor water quality.
- Fish and benthic invertebrates: NPCA and MNR should establish a reference sampling site, in the vicinity of Nassau Street. These agencies should complete a late summer inventory of fish and benthic invertebrates as a benchmark. Future monitoring at this location could be undertaken by Niagara College students.
- Terrestrial communities and species: It is recommended that FOMC continue to document local plants and wildlife in the area and any observed changes in Landsdowne Pond.

FOMC should also be responsible, in collaboration with the NPCA for monitoring progress in implementing the recommended plan. As indicated above this can take the form of an annual progress report.

M13 Environmental Awareness Program

Through the course of the study, Friends of One Mile Creek have demonstrated their excellent capability of maintaining the profile of the study and getting the public and landowners involved through participation in Open Houses. While there are many ways of providing public awareness, the FOMC is already well organized in this regard. The following is a list of program components:

- continuing the FOMC as a community-based organization to provide a focus for implementation, a network of commited volunteers and a political voice for the protection and enhancement of the watershed resources
- annual/bi-annual stream cleanups
- promotion of success stories – examples of landowner initiatives to address implementation actions
- an annual newsletter addressing accomplishments that could be posted on NPCA's website

7.3 Plan Administration

In order to be effective, an implementation committee is needed to ensure that responsible agencies, groups and individuals are fulfilling their roles. For One Mile Creek, it is recommended that an Implementation Committee be formed to meet annually to assess progress. The committee consist of membership from FOMC, NPCA, NOTL, Parks Canada and MNR.

The committee should report annually on progress and identify actions that should be undertaken for the upcoming year. Key initial priorities are as follows:

- initiate studies for Landsdowne Pond
- complete the Stream Restoration Manual
- initiate discussions with Parks Canada for the Stormwater Pond
- develop a roof downspout disconnection program and change the NOTL bi-law on downspout connections to storm sewers
- plan a fall stream cleanup program

8.0 REFERENCES

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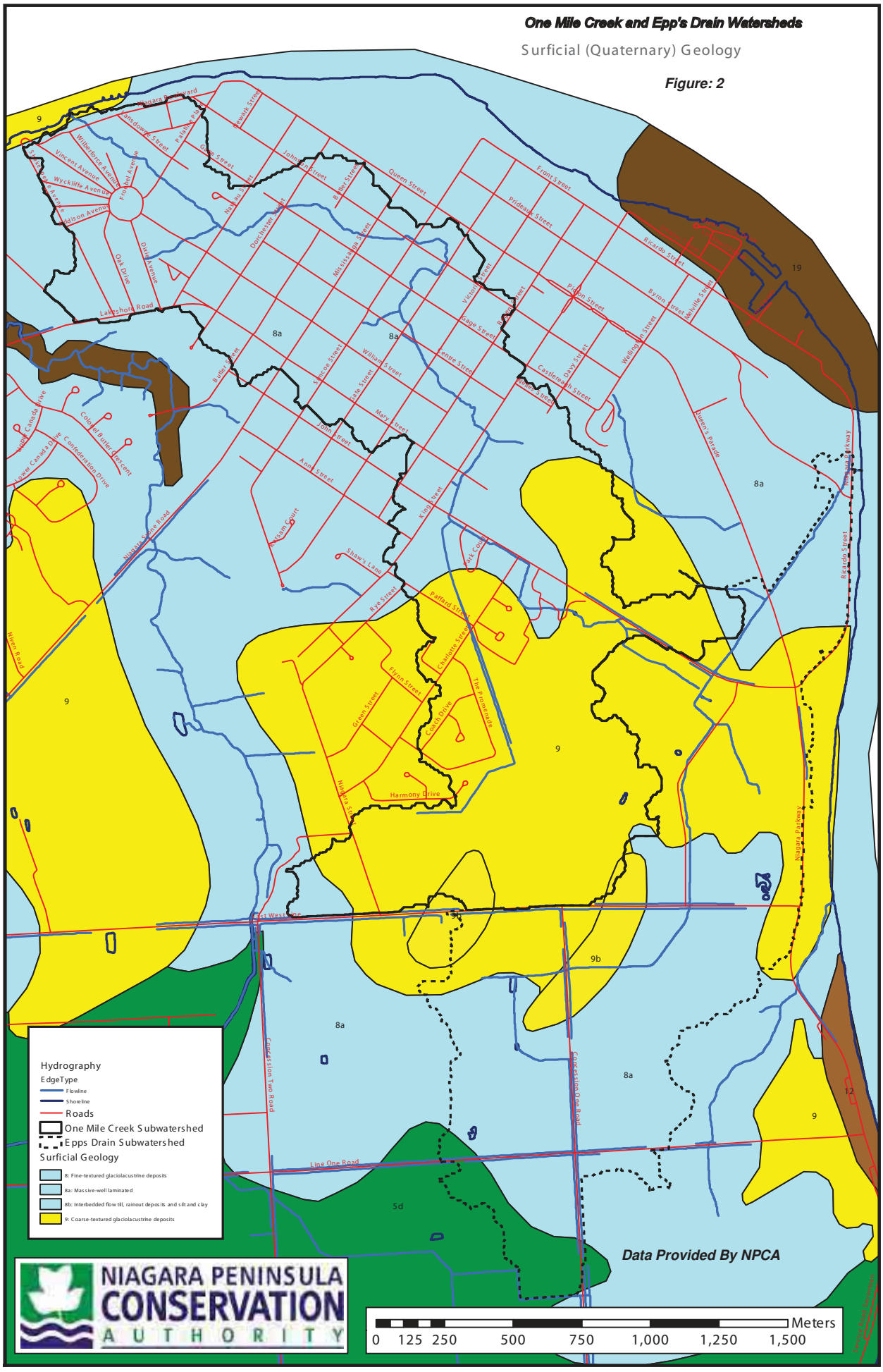
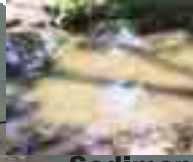
REPORT FIGURES


Lansdowne Ave
Palatine Pl.
Nassau St.
Dorchester St.
Butler St.
Mississauga St.
Simcoe St.
Gage St.
Johnson St.
Queen St.
William St.
Gate St.
Victoria St.
Mary St.
Regent St.
King St.
Queen's Parade
Park Ct.
John St. E
Paffard St.
Charlotte St.
Niagara St.
East & West Line
Epp's Drain
0 100 200 300 400 500
SCALE IN METRES

:12,500


One Mile Creek and Epp's Drain Watersheds
Surficial (Quaternary) Geology
Figure: 2
Hydrography
EdgeType
Flowline
Shoreline
Roads
One Mile Creek Subwatershed
Epps Drain Subwatershed
Surficial Geology
8: Fine-textured glaciolacustrine deposits
8a: Massive-well laminated
8b: Interbedded flow till, rainout deposits and silt and clay
9: Coarse-textured glaciolacustrine deposits
Data Provided By NPCA
NIAGARA PENINSULA CONSERVATION AUTHORITY
0 125 250 500 750 1,000 1,250 1,500
Meters

Minor Bank Erosion



Sedimen

Floodplain Er

Floodplain Er

Undersiz

Queen St.

Johnson St.

Nassau St.

Dorchester St.

Mississauga St.

Gage St.

William St.

Main St.

Regent St.

Gage St.

King St.

John St. E

2

2

1

Management

ased on an assessment
tream characteristics,
terrestrial
s, land use and land
patterns, One Mile
e divided into 3
t Zones:
ers zone: upstream of

one: between King
Butler Street
ne: between Butler
he mouth at Lake
cluding Landsdowne

y of One Mile Creek
ized by an ill-defined
a meandering creek
low banks and broad
ain. Flooding is
evated by numerous
s that are undersized
he size of flood flows
oachment of
t in the floodplain.
of dwellings and
buildings within the
re as follows:
ent Zone 1: 2
ent Zone 2: 6
ent Zone 3: 7

the Epps Drain was
ivert the majority of
lows away from One
to assist in alleviating
problems.

Erosion

Erosion in streams is a natural process, however this process can be accelerated as the watershed urbanizes. Stream bank erosion is generally not a concern until the stream enters the well defined valley system downstream of Butler Street. In general, only minor erosion concerns exist, however there are some sites that may represent sediment sources and some evidence suggests that the stream may be causing localized erosion of an existing landfill site. Natural stream reaches occur downstream of Butler Street, with the majority of reaches in the middle and upper part of the watershed dominated by highly altered streams separated by road culverts. Stream substrates throughout tend to be scoured, with clayey beds, occasionally overlain by silts, suggesting a lack of sediment sources upstream. Modification of stream beds is common with use of materials such as cobbles/boulders, concrete, and other hard structures. Sedimentation occurs in Management Zone 3.

Enhancement Opportunities

Opportunities to reduce flooding problems include culvert improvements and possibly retrofitting some areas with stormwater management facilities. Opportunities are limited because of lack of public lands.

East & West Line

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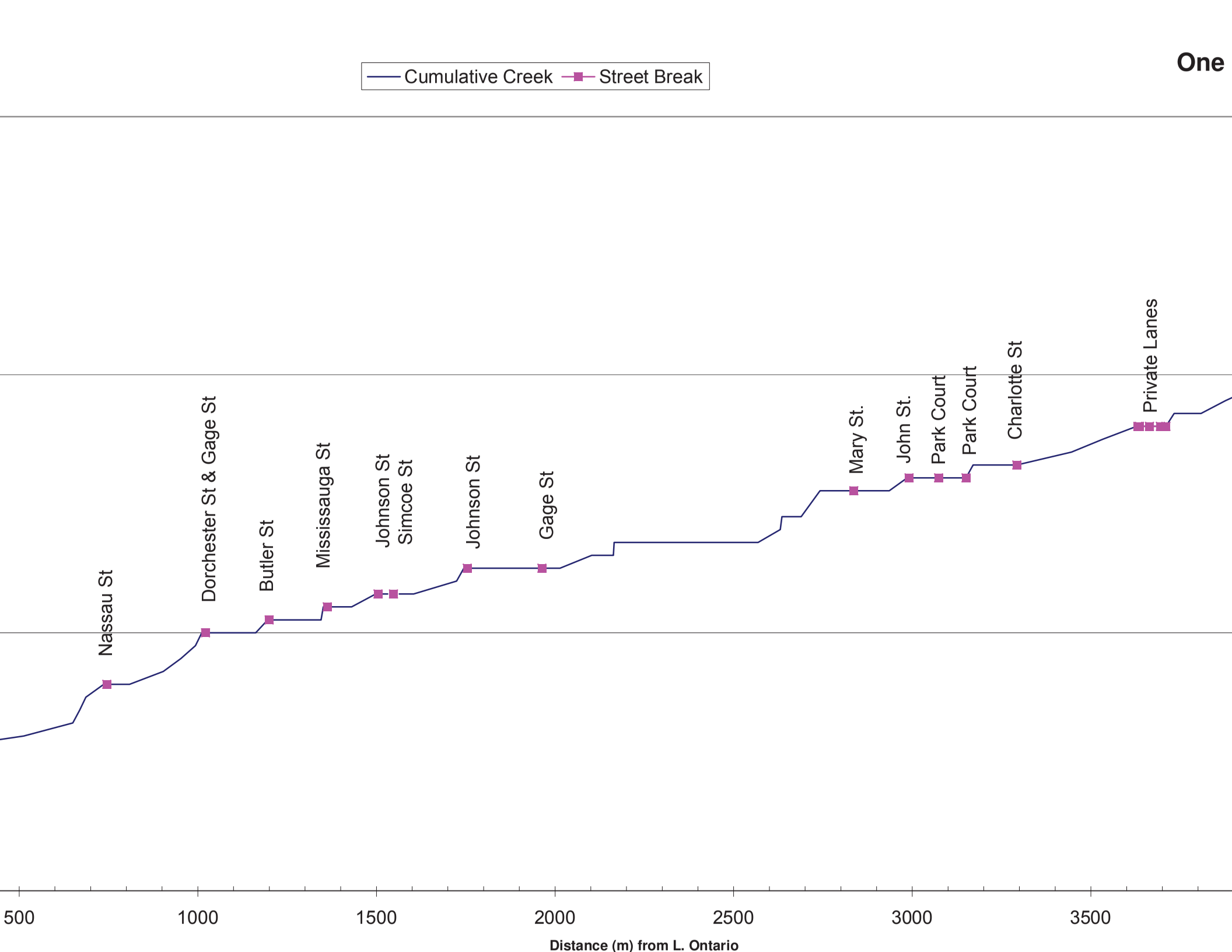

Cumulative Creek
Street Break
One
Nassau St
Dorchester St & Gage St
Butler St
Mississauga St
Johnson St
Simcoe St
Johnson St
Gage St
Mary St.
John St.
Park Court
Park Court
Charlotte St
Private Lanes
500
1000
1500
2000
2500
3000
3500
Distance (m) from L. Ontario

One Mile Creek Subwatershed Plan

Base Mapping provided by N P C A
Aerial photo dated year 2002

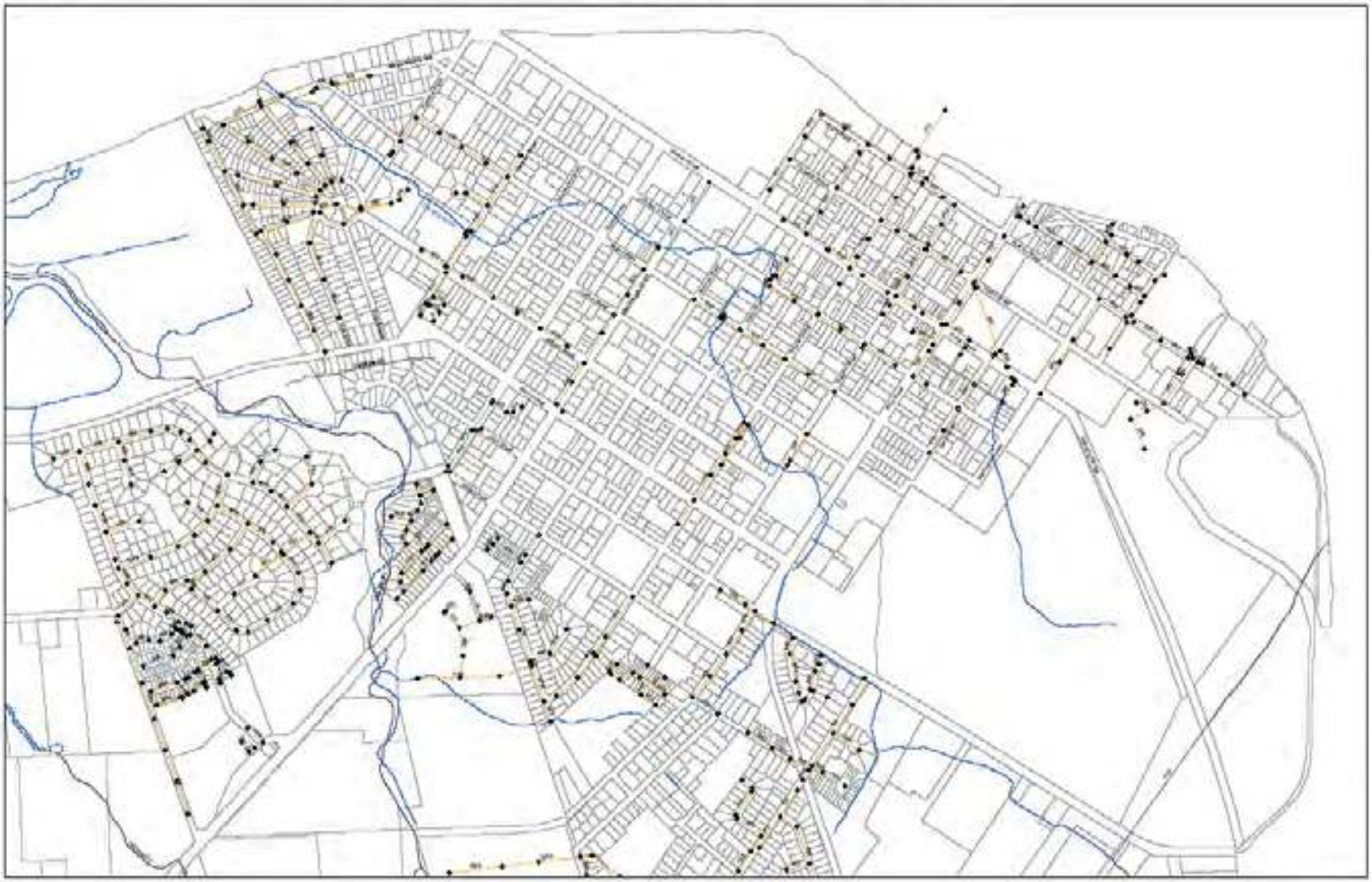
Lengend

- Creek
- Subwatershed
- Watershed
- 5 year Foodline Mapping
- 5 year Floodline Mapping with Culvert Improvment

Figure 5

Impact on Flood Elevations for the 5 year Storm of selected culvert replacements

Town of Niagara-on-the-Lake
NUSA Storm Sewers

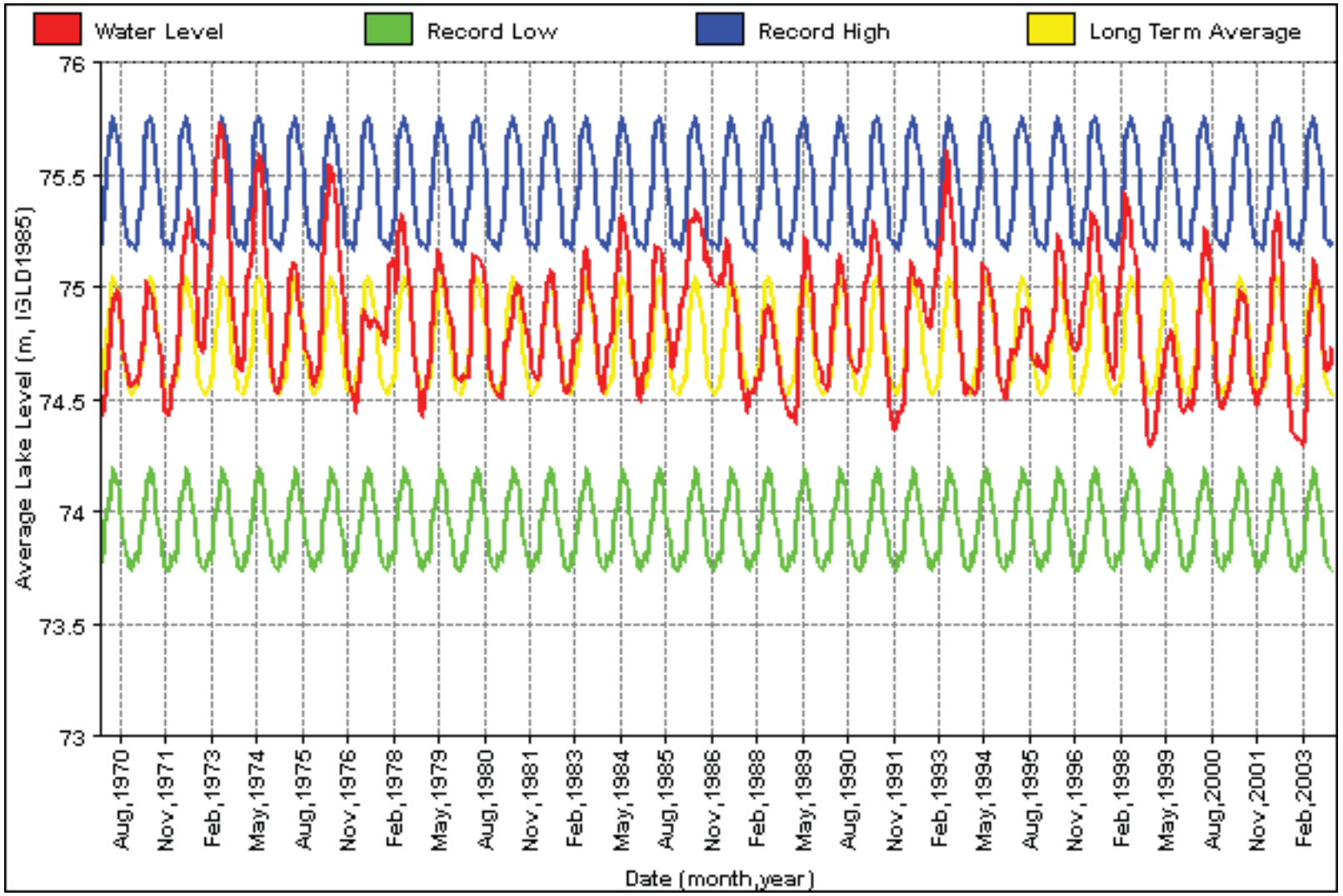


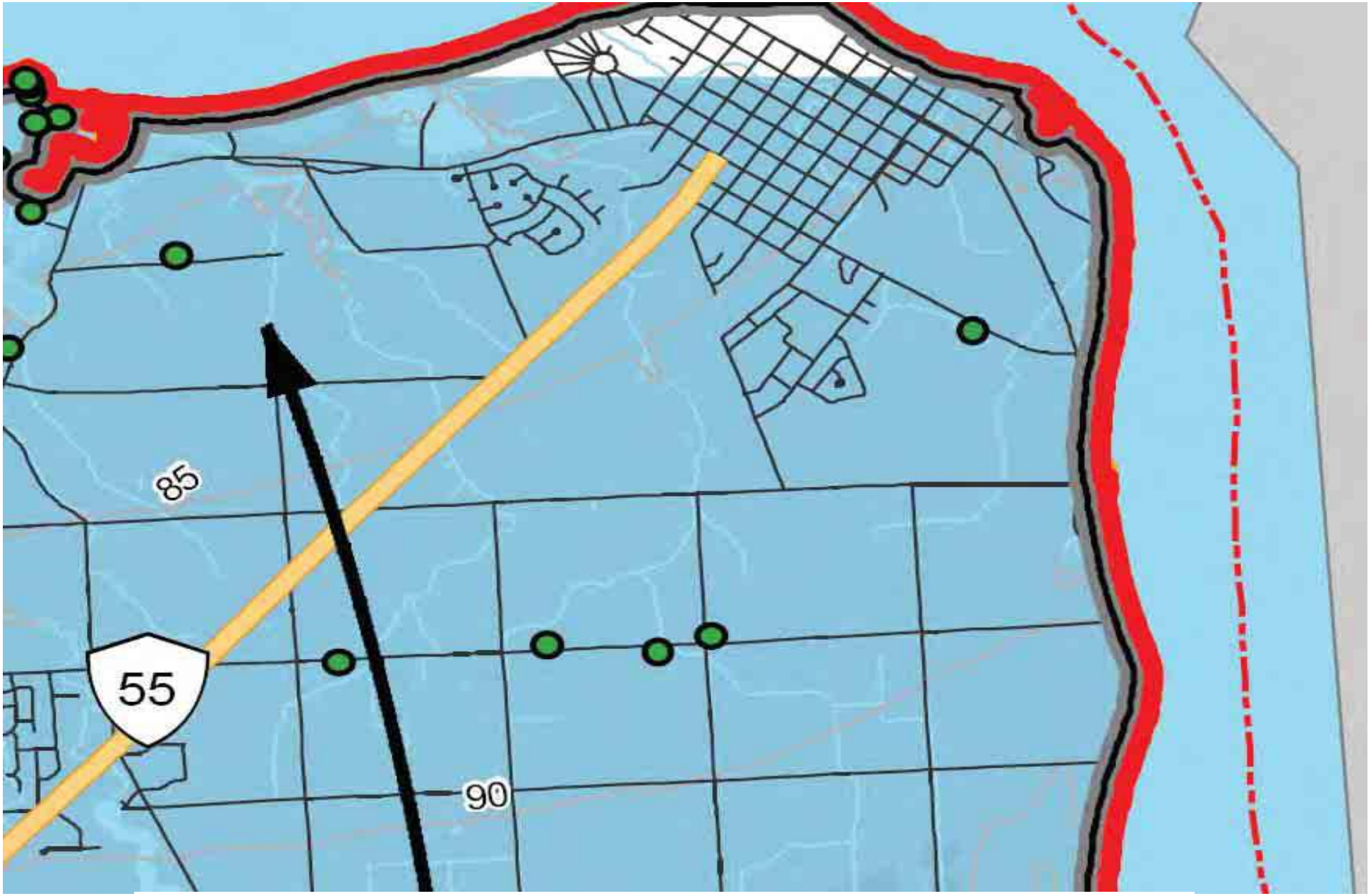
Mapping Provided by NTOL

Figure: 6
Existing Storm Sewer Network

Figure: 7 - Great Lakes Water Levels for Lake Ontario Graphed for Consecutive Years

Lake Ontario: 1970-2003





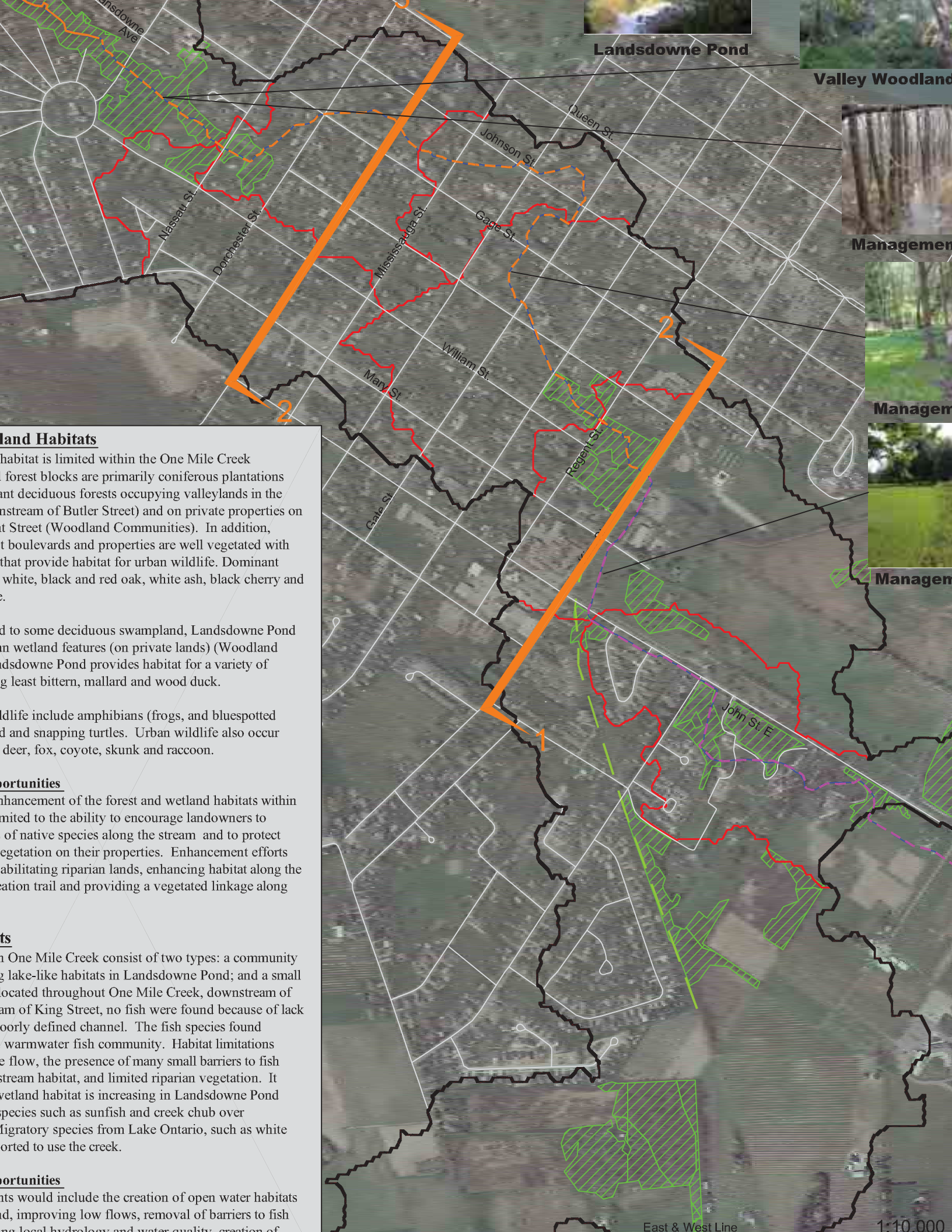
Legend

- Data Interpretation Boundary
- Study Area Boundary
- Municipal Boundaries
- International Boundary
- Major Highways
- Highways
- Roads
- Rivers, Streams, Creeks
- Ponds, Reservoirs, Lakes
- Wells Used in Analysis
- Contour Interval - 5m
- Interpreted Direction of Groundwater Flow

Water Table (masl)

70 155 245

□igure: 8
Ground □ ater Table Elevations
□□rom □ HI et al. 200□□



land Habitats

habitat is limited within the One Mile Creek
forest blocks are primarily coniferous plantations
ant deciduous forests occupying valleylands in the
nstream of Butler Street) and on private properties on
t Street (Woodland Communities). In addition,
t boulevards and properties are well vegetated with
that provide habitat for urban wildlife. Dominant
white, black and red oak, white ash, black cherry and
e.

d to some deciduous swampland, Landsdowne Pond
n wetland features (on private lands) (Woodland
dsdowne Pond provides habitat for a variety of
g least bittern, mallard and wood duck.

ldlife include amphibians (frogs, and bluespotted
d and snapping turtles. Urban wildlife also occur
deer, fox, coyote, skunk and raccoon.

portunities

nhancement of the forest and wetland habitats within
mited to the ability to encourage landowners to
of native species along the stream and to protect
egetation on their properties. Enhancement efforts
abilitating riparian lands, enhancing habitat along the
eation trail and providing a vegetated linkage along

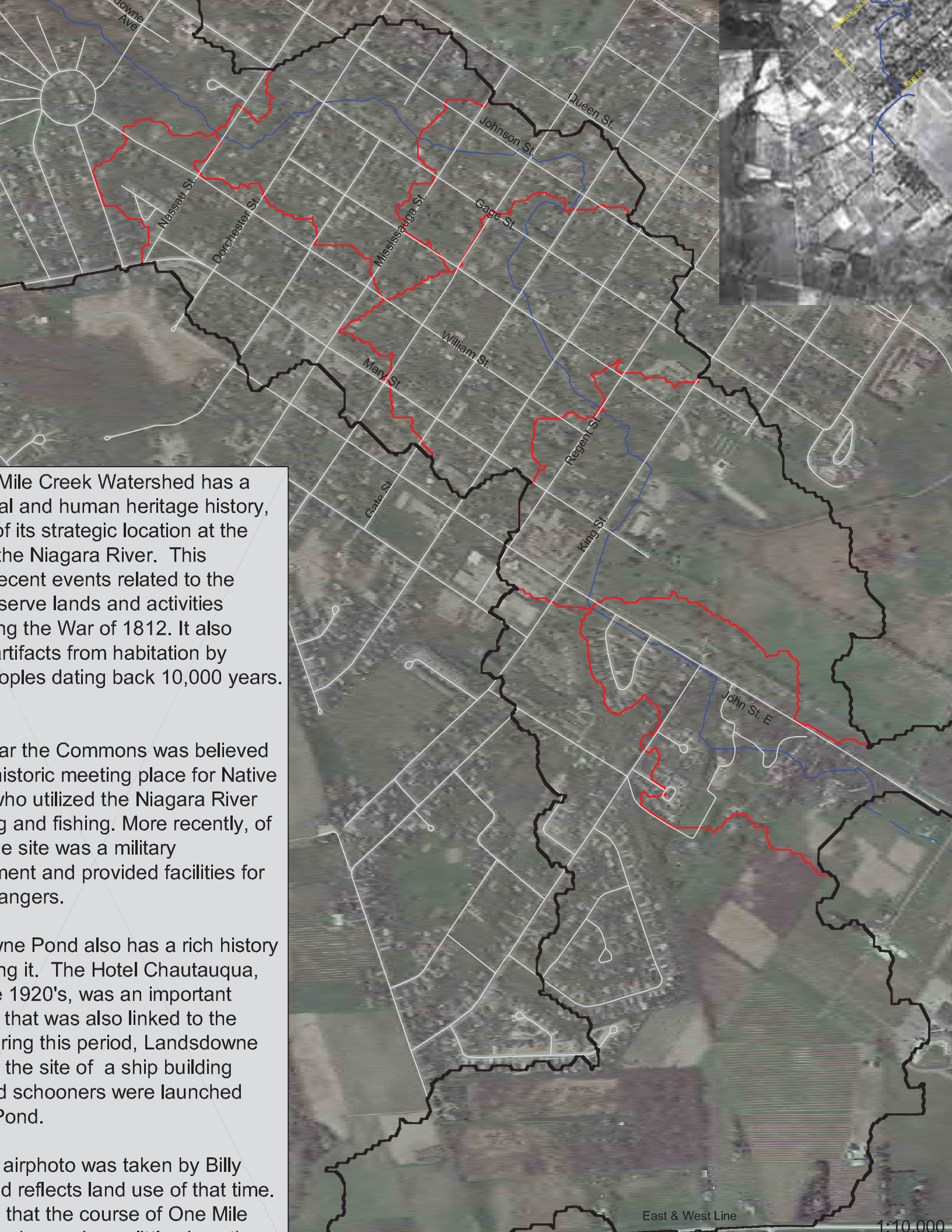
ts

n One Mile Creek consist of two types: a community
g lake-like habitats in Landsdowne Pond; and a small
located throughout One Mile Creek, downstream of
am of King Street, no fish were found because of lack
oorly defined channel. The fish species found
warmwater fish community. Habitat limitations
e flow, the presence of many small barriers to fish
stream habitat, and limited riparian vegetation. It
wetland habitat is increasing in Landsdowne Pond
species such as sunfish and creek chub over
Migratory species from Lake Ontario, such as white
orted to use the creek.

portunities

nts would include the creation of open water habitats
d, improving low flows, removal of barriers to fish
ng local hydrology and water quality, creation of

Figure: 10
Region of Niagara Draft Natural Heritage System

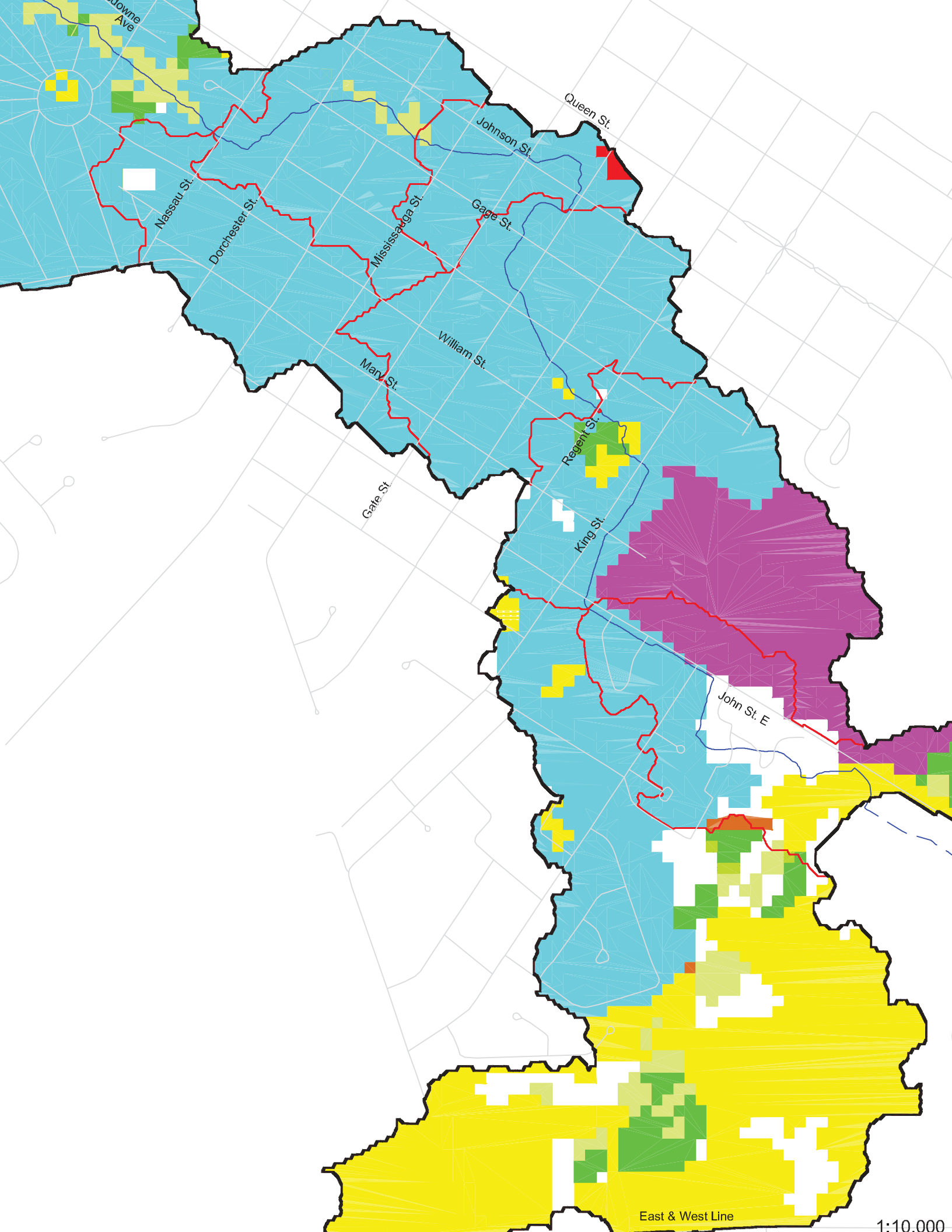


Mile Creek Watershed has a
al and human heritage history,
of its strategic location at the
the Niagara River. This
ecent events related to the
serve lands and activities
ng the War of 1812. It also
rtifacts from habitation by
oples dating back 10,000 years.

ar the Commons was believed
istoric meeting place for Native
who utilized the Niagara River
g and fishing. More recently, of
e site was a military
ment and provided facilities for
angers.

yne Pond also has a rich history
ng it. The Hotel Chautauqua,
e 1920's, was an important
that was also linked to the
ring this period, Landsdowne
the site of a ship building
d schooners were launched
Pond.

airphoto was taken by Billy
d reflects land use of that time.
that the course of One Mile


Queen St.
Johnson St.
Gage St.
Mississauga St.
Dorchester St.
Nassau St.
William St.
Mary St.
Gate St.
Regent St.
King St.
John St. E
East & West Line
1:10,000

M3

CUL

- **Actio**
- **Imple**
- **Benef**

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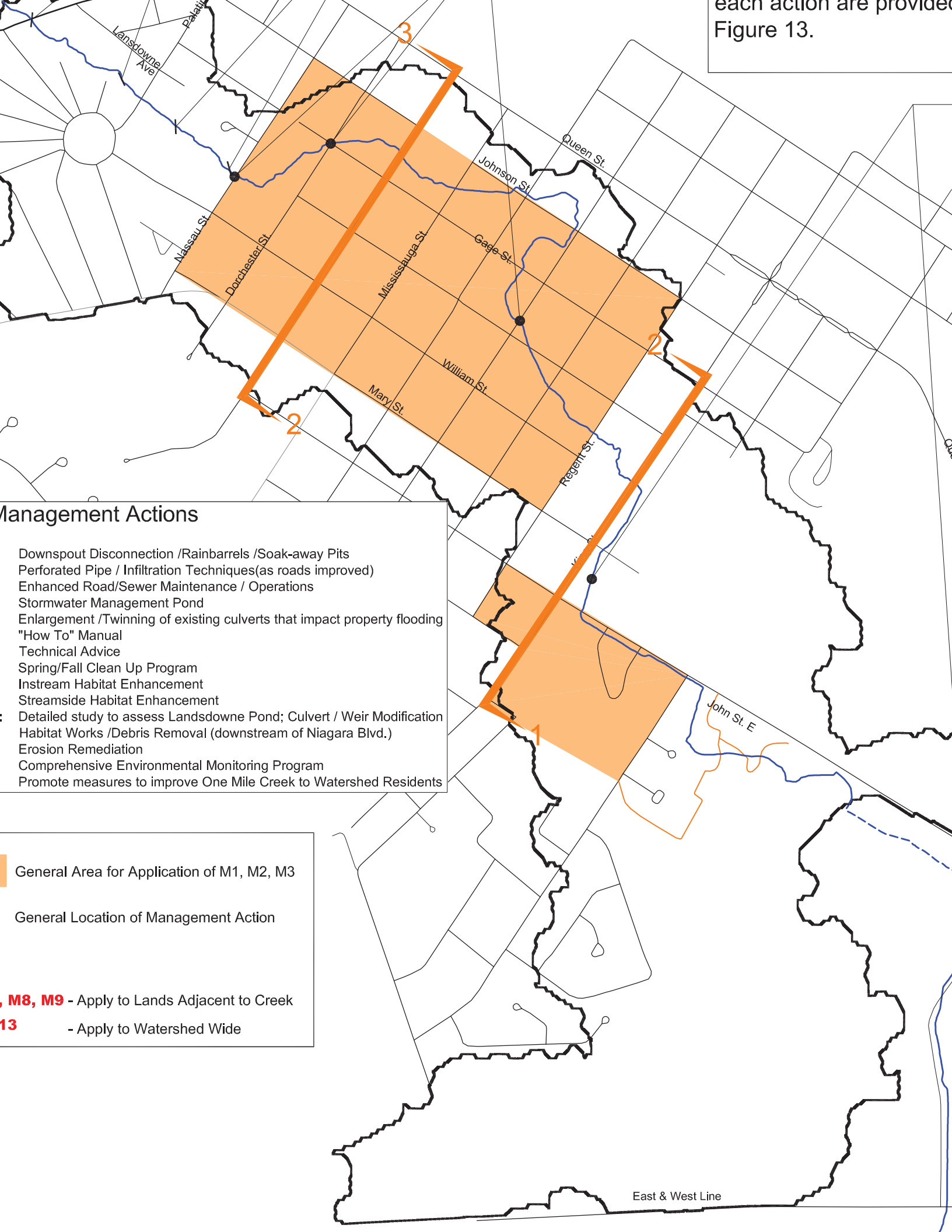
ementation: Conservation
rity, Landowner, Municipality,
unity Group

M7

each action are provided
Figure 13.



Management Actions

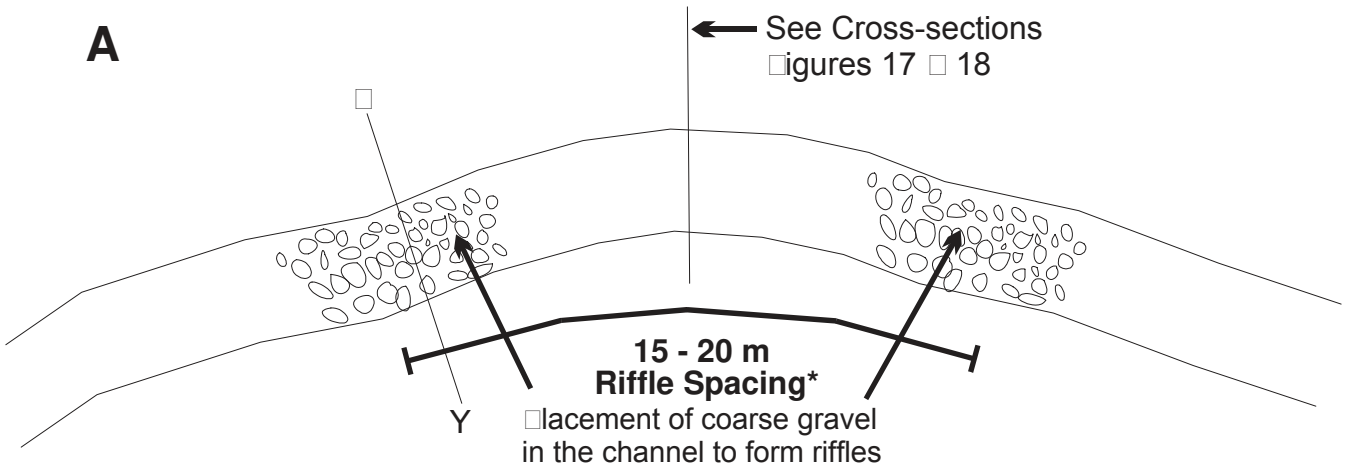
Downspout Disconnection /Rainbarrels /Soak-away Pits
Perforated Pipe / Infiltration Techniques(as roads improved)
Enhanced Road/Sewer Maintenance / Operations
Stormwater Management Pond
Enlargement /Twinning of existing culverts that impact property flooding
"How To" Manual
Technical Advice
Spring/Fall Clean Up Program
Instream Habitat Enhancement
Streamside Habitat Enhancement
Detailed study to assess Landsdowne Pond; Culvert / Weir Modification
Habitat Works /Debris Removal (downstream of Niagara Blvd.)
Erosion Remediation
Comprehensive Environmental Monitoring Program
Promote measures to improve One Mile Creek to Watershed Residents

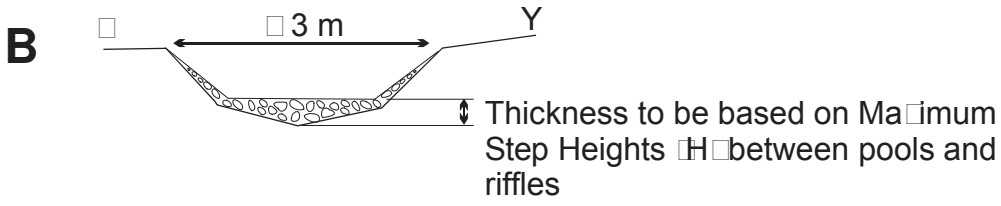
General Area for Application of M1, M2, M3

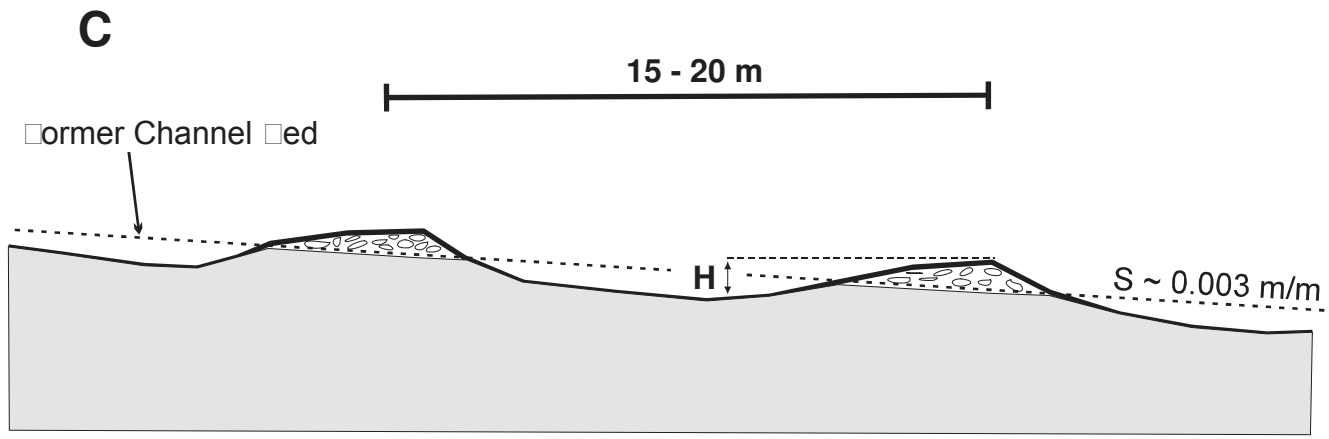
General Location of Management Action

, M8, M9 - Apply to Lands Adjacent to Creek

13 - Apply to Watershed Wide





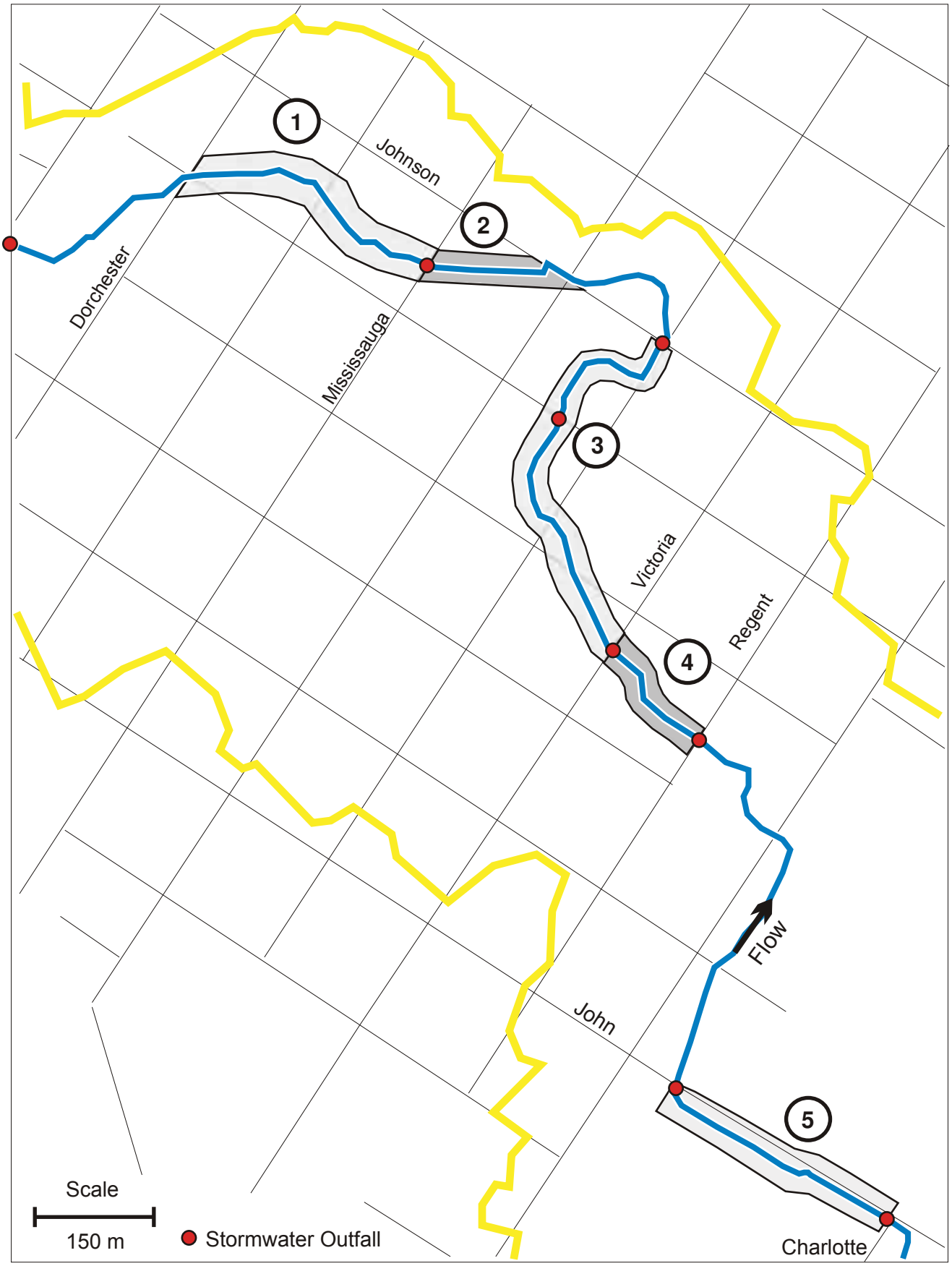


H: Ma imum Step-Height

each 1	0.11 m
each 2	0.14 m
each 3	0.14 m
each 4	0.16 m
each	0.16 m

iffle spacing is based on a length of to 7 channel widths.
Note: Channel width variation is not significant between reaches relative to variations within each reach.

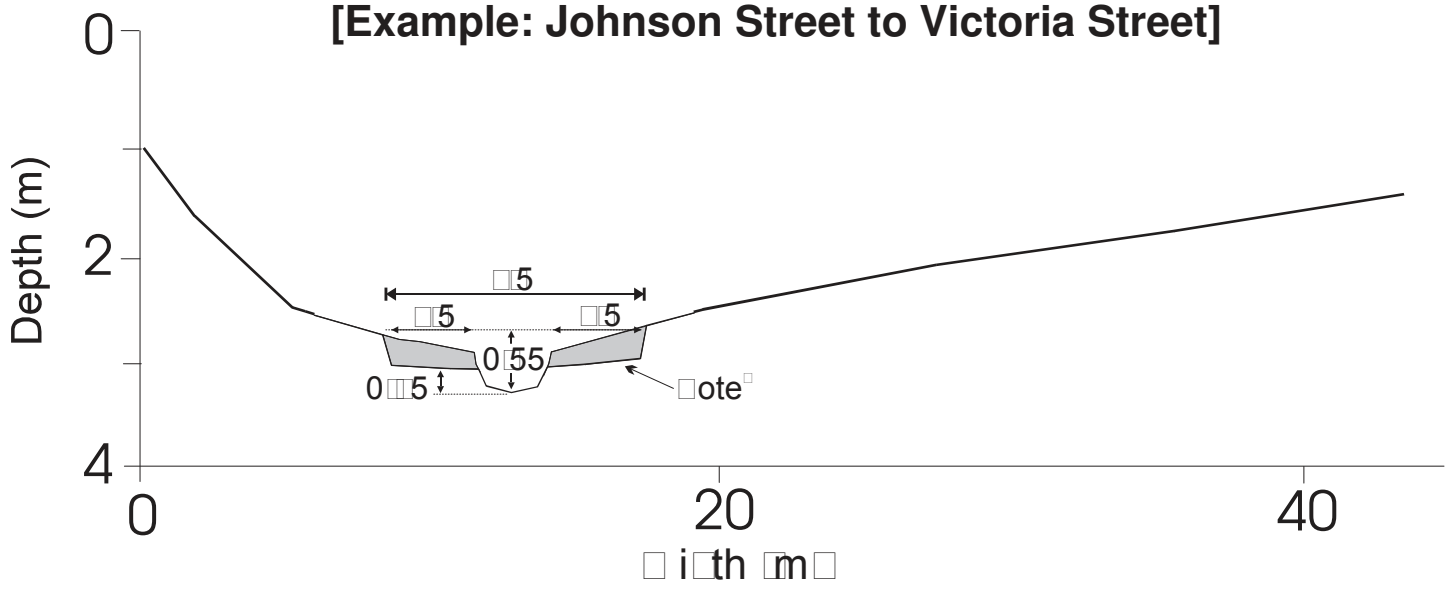
Figure:1
Channel planform **A**, cross-section **B** and profile **C** showing conceptual diagrams of riffles and pools for One Mile Creek



□igure: 16
One Mile Creek showing reaches based on
Channel Geometry Survey

Figure: 17
Conceptual Diagram of Terracing in Channel Reach 1
[Example: Dorchester Street to Mississauga Street]

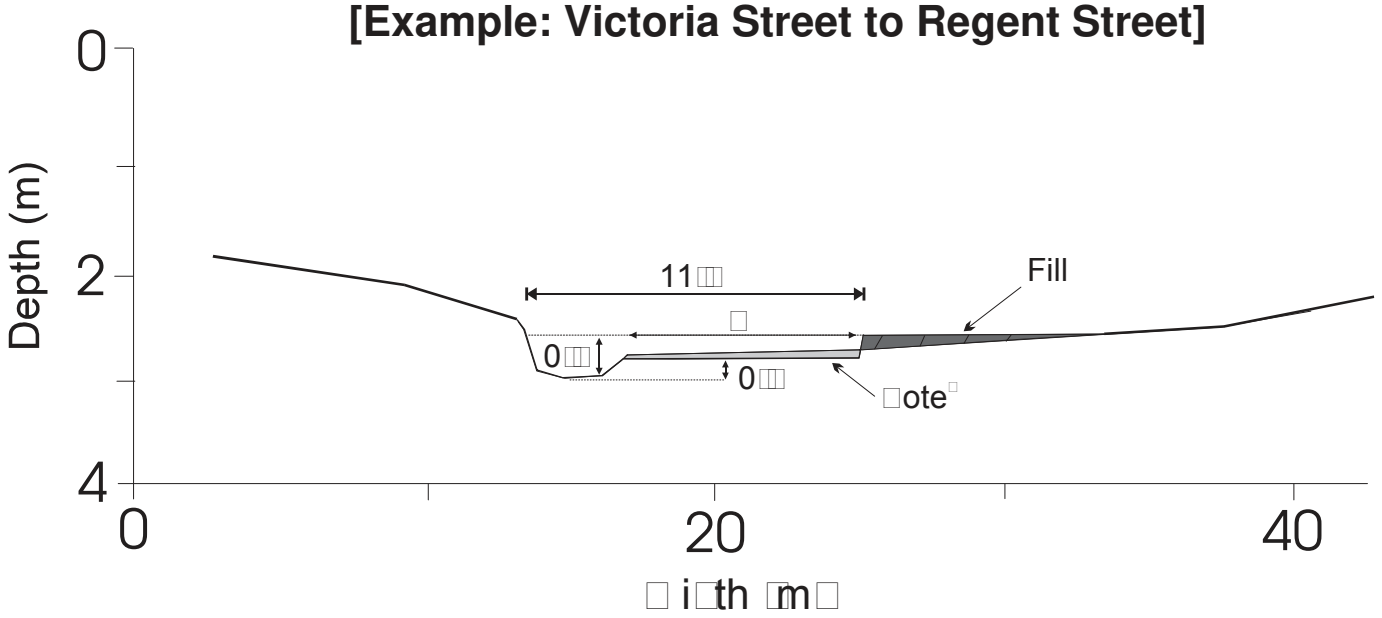
Conceptual Diagram of Terracing in Channel Reach 3
[Example: Johnson Street to Victoria Street]



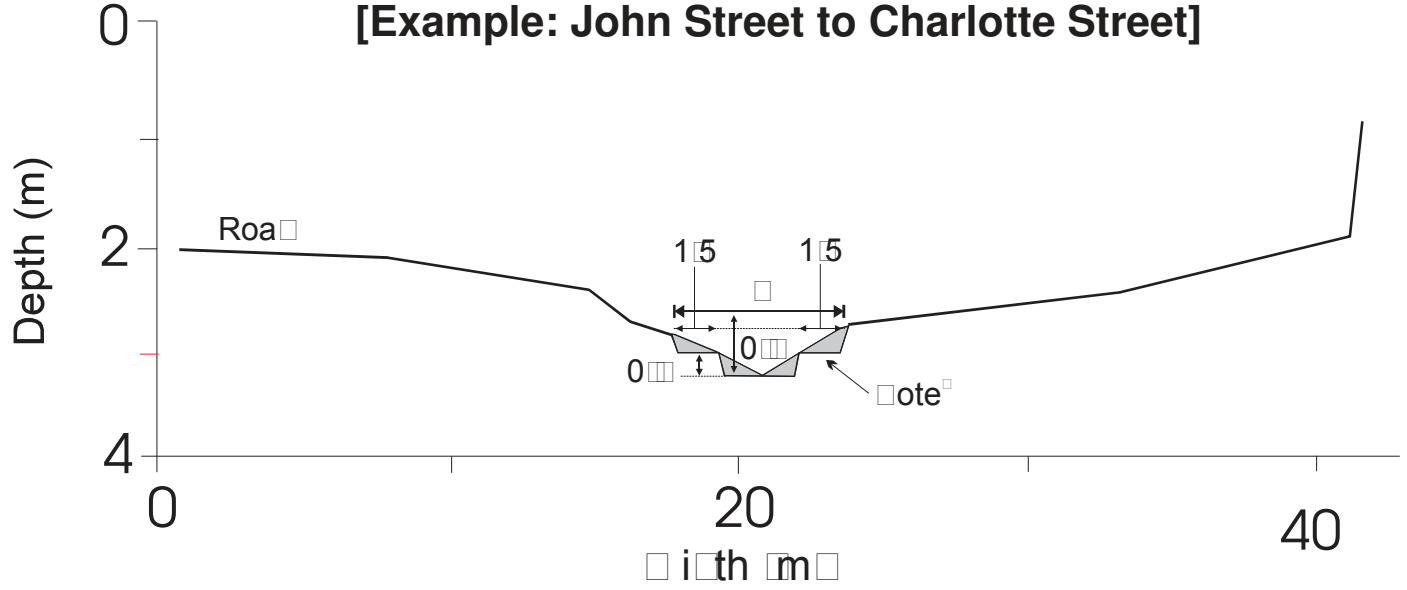
otes
1 For terraces in e cess of 50 cm height si e slo e shoul e hor 1 ert
erraces shoul e re egetate using nati e grasses an shru s

ca ation

Figure: 18
Conceptual Diagram of Terracing in Channel Reach 4
[Example: Victoria Street to Regent Street]



Conceptual Diagram of Terracing in Channel Reach 5
[Example: John Street to Charlotte Street]

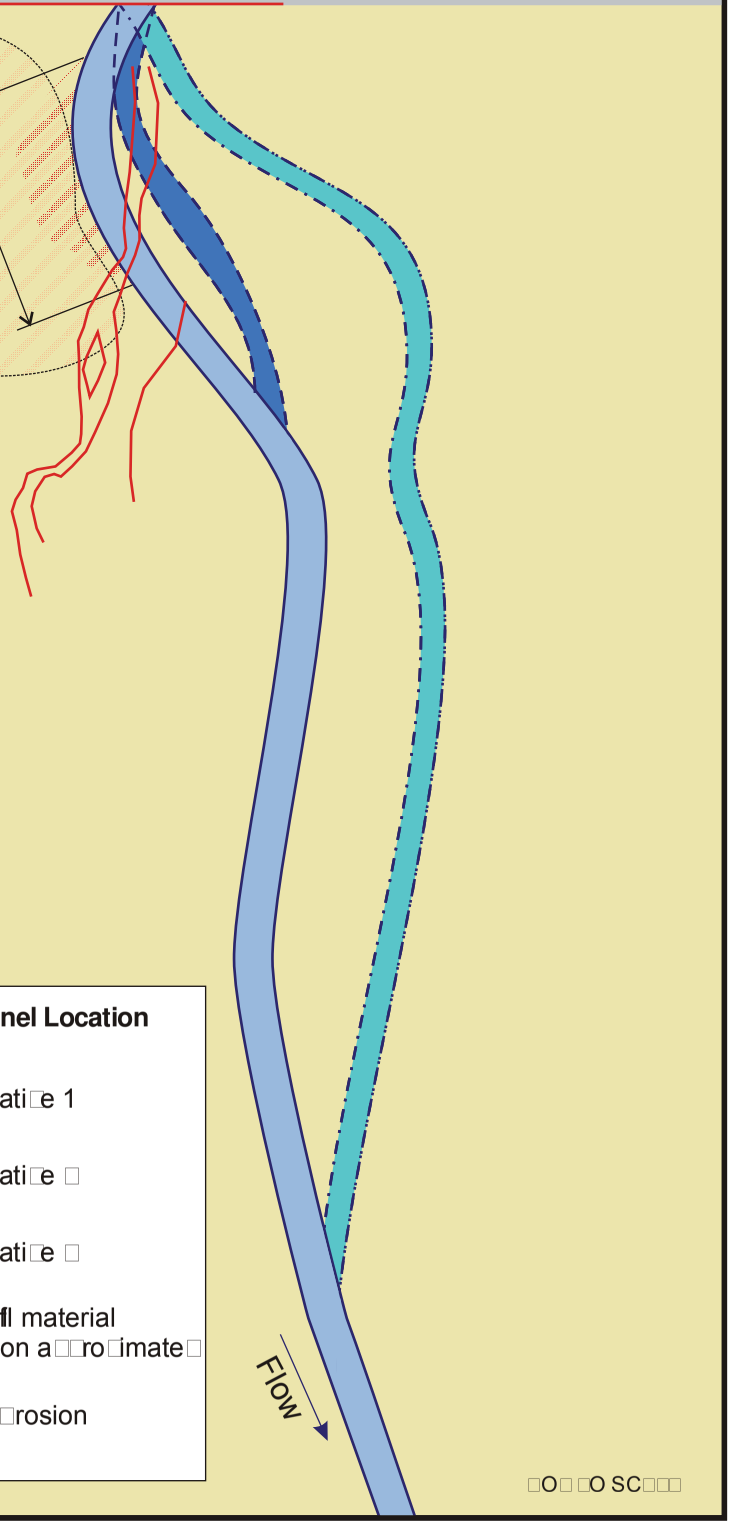


otes
1 For terraces in e cess of 50 cm height si e slo e shoul e hor 1 ert
erraces shoul e re egetate using nati e grasses an shru s

ca ation

NIAGARA PENINSULA CONSERVATION AUTHORITY

Aquafor Beech



channel remo e ortion of lan fill

ALTERNATIVE 2

Minor Relocation of Channel

Mo e channel awa from slo e sta ili e sl
remo al of lan fill material clean u e ris
channel

Former Channel

ALTERNATIVE 3

Relocation Channel to istoric ocation

Mo e channel to former location sta ili e s
fill in former channel minor clean u of e

Former Channel

APPENDIX A
OPEN HOUSE SUMMARIES

One Mile Creek Watershed Plan

Public Workshop #1

October 19, 2004

Participant Workbook

NIAGARA PENINSULA CONSERVATION AUTHORITY

One Mile Creek Watershed Plan Public Workshop #1

October 19, 2004
6:30 p.m. - 9:00 p.m.
Niagara-on-the-Lake Community Centre
29 Platoff Street, Niagara-on-the-Lake, Ontario

AGENDA

Meeting Purpose:

- *Introduce the One Mile Creek Watershed Study and the planning team*
- *Share ideas on issues, goals and objectives for the future of the One Mile Creek Watershed*

6:30 pm **Open House**

7:00 pm **Welcome to Participants**
Niagara Peninsula Conservation Authority (NPCA)

7:05 pm **Introductions and Agenda Review**

7:10 pm **Presentation**
David Maunder, Aquafor Beech

7:40 pm **Discussion**

8:55 pm **Closing Remarks**

9:00 pm **Adjourn**

One Mile Creek Watershed Plan:
PRELIMINARY LIST OF ISSUES*

- Lack of baseflow
- Diversion of flows
- Sanitary Sewer Pumping Station overflow
- Erosion
- Private property flooding
- High Flows and Pollutants from urban storm sewers
- Lack of riparian vegetation
- Alteration of stream
- Landsdowne Pond (Odour and Water Quality)
- Siltation within Creek
- Debris
- Lack of access
- Health Issues with deposits in Creek
- Loss of natural stream functions
- Impacts on Agricultural Lands

** Drawn from Aquafor Beech & Friends of One Mile Creek*

Additions/Changes:

One Mile Creek Watershed Plan: DISCUSSION QUESTIONS

Question 1: As you look at the identified issues (opposite) and think about the One Mile Creek Watershed, are there any additions or changes that you suggest (fill in your advice in the table on the opposite page)? What do you think are the 3-5 **MOST IMPORTANT ISSUES**? Why?

ISSUE 1.

ISSUE 2.

ISSUE 3.

ISSUE 4.

ISSUE 5.

One Mile Creek Watershed Plan:
GOALS & OBJECTIVES IDENTIFIED TO DATE*

Study Goal

To produce a Watershed Management Plan developed in consultation with appropriate government agencies, landowners, and interest groups that assists with the management of water, land/water interactions, aquatic life and aquatic resources to protect and improve the health of the ecosystem.

Study Objectives

Communication & Education

- Demonstrate and promote awareness of the linkages between healthy water, healthy lifestyle and economic viability of rural and urban land use
- Promote the use of surface and ground waters having regard to both humans, agricultural, and ecological needs
- Promote the need for environmental stewardship and better understanding of the importance of ecological functions
- Promote the need for environmental stewardship and better understanding of the importance of ecological functions of the One Mile Creek Watershed

Water Quantity

- Manage flooding risks to human life and property to within acceptable limits
- Maintain, enhance or restore stream processes to support human uses, agricultural needs and natural habitats
- Manage stream flow to reduce erosion impacts on habitats and property

Water Quality

- Maintain or improve water quality conditions within the Creek in order to support ecological and human use functions
- Reduce or eliminate objectionable deposits, nuisance algae growth, turbidity and odour to improve aesthetics of the area surface waters

Aquatic Communities and Habitats

- Protect, enhance or restore populations of native aquatic species and their habitats

Terrestrial Communities

- Protect, enhance or restore the stability, diversity and linkages between habitats that support terrestrial species and communities

Social/Economic

- Identify and promote the social and economic benefits of a healthy watershed system

** Drawn from Aquafor Beech & Friends of One Mile Creek*

Question 2: As you look at the identified goals and objectives identified to date (opposite) for the One Mile Creek Watershed, are there any **ADDITIONS OR CHANGES** that you suggest? Are some more important than others? Why?

Addition/Change

Addition/Change

Addition/Change

Addition/Change

Question 3: Do you have any **LOCAL INFORMATION OR DATA** that you believe would be useful for the One Mile Creek Planning Process (it may help if you refer to the categories outlined on page four)?

Additional Comments:

PLEASE RETURN completed workbooks by **November 9th 2004** to:

Suzanne McInnes
Niagara Peninsula Conservation Authority
250 Thorold Rd West 3rd Floor, Welland, Ontario L3C 3W2
Phone: (905) 788-3135 Ext. 235
Fax: (905) 788-1121
Email: smcinnes@conservation-niagara.on.ca

One Mile Creek Watershed Plan

Public Workshop # 2

March 9, 2005

Draft Meeting Record

NIAGARA PENINSULA CONSERVATION AUTHORITY

March 9 2005, 7:00-9:00 p.m.
Niagara-on-the-Lake Community Centre, 29 Platoff Street

This draft meeting record was prepared by Lura Consulting. It integrates the key discussion points and outcomes from the second public workshop held on March 9, 2005. The contents of this record are subject to review by meeting participants. Please forward any comments to: Liz Nield, Lura Consulting at (905) 527-0754, by fax at (905) 528-4179, or by email at lnield@lura.ca

Meeting Purpose

This workshop was held to identify alternative strategies and approaches for the One Mile Creek Watershed Plan; and to identify evaluation criteria for defining the alternatives.

Open House

Participants were invited to review a series of displays that focused on the Niagara Peninsula Conservation Authority's recent floodplain mapping program, maps indicating areas that could be flooded during a heavy storm, and that indicated historic and current land use activities.

Participants

A total of 30 representatives from 5 organizations participated in the workshop. *A complete list of participants is included in Appendix B.*

Welcome, Agenda Review and Introductions

Suzanne McInnes, Planner from the Niagara Peninsula Conservation Authority welcomed participants to the workshop and thanked them for coming, including the Friends of One Mile Creek, a local community group.

Suzanne introduced the consultants, Aquafor Beech Limited who are responsible for conducting the study.

Presentation

David Maunder, Project Manager from Aquafor Beech Limited provided an update on the study, and presented the recent study findings. He explained that the impacts that have affected One Mile Creek to date have been primarily due to land use development in and around the watershed. Some of the issues affecting the watershed, fish and wildlife include flooding, erosion, sedimentation, poor water quality and alteration of natural streams.

He presented the management alternatives that will be considered in the planning process. These alternatives will address the issues within the watershed, and will be implemented on both public and private lands.

Questions of clarification

Q: Concern that because we are amateurs how will our suggestions and judgements be helpful in this process?

A: We recognize that not everyone is an expert in this field, however input from the general public and local residents is a very valuable asset to this project. The Study team will also work through the alternative measures.

Q: Concerns about the threat of West Nile Virus, and where will this fit into the Study?
A:

Q: What will happen to the fish?
A: Fish could swim down stream, or in a small pool.

Q: Where does the study begin, at EPPs drain?
A: The Study begins at Peller Estate, at EPPs drain.

Q: What is the source for One Mile Creek?
A: The water source for One Mile Creek is surface waster and ground water.

C: The priority should be to "keep the flow in One Mile Creek".
A: This study will be looking at ways to keep the flow consistent in One Mile Creek, we will be using alternative measures to decide on the preferred measures.

C: Participants expressed concerns about the possibility of sewage overflow from the pumping station.
A: Town of Niagara on the Lake and the Region of Niagara are conducting studies on this issue.

Q: Is Lansdowne Pond a natural pond/wetland? Why is the sediment issue so prominent in this area?
A: Yes, Lansdowne Pond is a natural pond/wetland; however the sedimentation rate has accelerated due to land use development. One measure that could be implemented in this case would be to manage the sediment that is coming into the pond by installing a middle channel, this will help slow the sedimentation process, and would increase the flow back into and within the pond.

Q: Sedimentation has been so high for the past 20 years, how can you change this?
A: Sedimentation has occurred at a rate of five times higher than normal because One Mile Creek is within an urban area; during this study the team will be looking at various measures that will help solve this issue.

Q: What is a sediment trap?
A: A sediment trap is a containment area that allows sediment to be collected. Sediment traps are formed by constructing an earthen embankment across a waterway or low drainage area.

Q: What does CSO mean?
A: CSO is the acronym for Combined Sewer Overflow. Combined sewer overflow is the discharge of a storm water and domestic waste as a result of the sewer capacity being exceeded during heavy storms. The resulting volume of rainwater and sanitary wastewater exceeds the system's capacity and sewage is forced to overflow into area streams and rivers through CSO outfalls.

Additional Comments on the overall plan and process:

- Provide residents with how-to information and background info; tell people how the process works and will come together.
- Some participants suggested that it would be helpful to residents if the Town of Niagara on the Lake provided them with additional materials (blue boxes, composters etc) and information.
- Participants indicated that they found the presentation very helpful and informative.
- Participants feel that this process and study is very important.

- A suggestion was made that it might be helpful if one of the members of the consultation team could be available to call and visit citizens who live close to the creek to help with suggestions as to rain barrels and rain gardens?

Evaluation of Alternatives

Following the presentation, Brian Hindley of Aquafor Beech explained the workbook to the participants; and invited participants to discuss and work through the following focus questions:

1. Identify the importance of each management measure on public lands;
2. Rank the importance of each of the barriers in implementing the following management measures on private lands; and
3. Look at the draft evaluation criteria and indicate the level of importance.

This section presents a summary of the feedback received from participants at the workshop. Each table represents a summary of the results received. The result in each column represents the number of participants who indicated their preference (i.e. level of importance) on each category. It is important to note that some participants requested to complete the workbook on their own time, and will send the workbook once complete to the Niagara Peninsula Conservation Authority; this summary does not include those workbooks.

1. Identify the importance of each management measure on public lands.

Management Measure	Very Important	Somewhat important	Not important
Stormwater Management Measures (water quality and quantity benefits)			
Conveyance Controls	12	8	0
End-of-Pipe Controls	12	9	0
Baseflow Augmentation Measures			
Headwater wetland creation (King and John area)	17	3	1
Flood Control (2 – 5 year events)			
Culvert improvements	16	6	1
Conveyance controls	11	9	0
Dry ponds	11	8	2
Fish habitat enhancements			
Barrier removal	11	9	1
Landsdowne Pond			
Dredging and sediment removal	11	5	4
Re-contouring and onsite sediment disposal	8	10	1
Sediment trap	11	8	2
Outlet modification	14	3	2
Water Quality			
Review CSO performance	17	6	1
Eliminate Storm sewer cross connections	19	4	1

In Summary, most people felt that all of the measures were equally important.

Additional comments that were received included:

Very Important

- Stop the overflow of sewage from the pumping station. This currently occurs at least 3 times per year.
- Storm sewer management.
- Educate the general public about the Watershed including the study.
- Engage local residents in activities that will take place on private land.
- Explain to landowners why each measure is important.
- Some of the properties are rental therefore are problems for tenants whom are elderly and lack financial measures.
- Consider that archaeological studies may need to be conducted if any dredging/digging to be done
- Providing assistance and help to property owners for the slow-down of water runoff (different plots have different solutions).
- Even the flow of water in the creek, slowing the storm run-off and augment the flow in dry periods
- Measures to ameliorate the rapid ingress of water.
- Culvert improvements– many culverts are higher than the level of the creek so water can't flow through, Dorchester and Gage Street.
- Replacement of culverts, should be replaced where they are undersized.
- Be cost conscious. Fix the less costly things first, see what the improvement would be and then address the issues in a logical manner.
- People are more likely to follow through on more sensible alternatives that they can do themselves. Encourage this idea to affected homeowners.
- A wetland (headwater creation) would probably give a more positive impact in the long run and encourage more people to do their personal improvements.
- Landsdowne Pond: I have property which borders the pond and I have lived there since 1980 – until about 1985 or 86 the pond was a small inland lake which supported a wide variety of wildlife and plant life – carp would spawn every year. The sediment build-up has been unnaturally rapid in the past 20 years. It is the most profound example I can think of and the best evidence for the need to revitalize the One Mile Creek using all means available. There are no priorities. All measures need to be considered with a minimum of procrastination.
- I am concerned that some areas along the creek have man-made barriers causing water to spill over the edge of the creek into other sections and this causes flooding.
- I think that there should be consistent blocks or stones or bricks all along the route of the creek or consistent plantings.
- I think that Lansdowne should either be dredged or modify the size of the pond so the water is not stagnant.

Somewhat Important

- Find the most effective measure to slow down the flow of rainwater into the creek (perhaps the perforated pipe or perhaps the disconnection of downpipes). "Both together even better."
- Provide for secondary measures to eliminate restrictions and barriers to prevent abnormal backup in periods of high runoff.

Not Important

- Dredging and sediment removal of Lansdowne pond should not be considered

2. Rank the importance of each of the barriers in implementing the following management measures on <u>private</u> lands.

Management Measure	Lack of time	Lack of space	Lack of information	Lack of help	Negative effects	Money	Other
Stormwater Management Measures (water quality and quantity benefits)							
Source Controls	1	0	14	6	1	4	0
Conveyance Controls	0	1	10	4	0	5	0
Baseflow Augmentation Measures							
Stormwater infiltration (roof downspouts, conveyance controls)	0	0	13	7	1	4	0
Flood Control (2 – 5 year events)							
Conveyance controls	1	0	6	0	0	3 (taxes)	0
Roof downspout disconnection	1	0	12	4	0	1	0
Dry ponds	0	2	13	5	2	4	0
Fish habitat enhancements							
Barrier removal	0	0	9	7	1	3	1
Instream measures (pool/riffle creation, gravel placement, instream cover)	1	0	8	3	0	4	1 Lack of interest
Streamside measures (riparian plantings, "softening" of banks)	0	1	9	6	2	4	2 No interest
Erosion Protection							
Selective protective works (lower zone)	2	0	9	5	0	6	0
Protection of landfill	2	0	6	2	0	5 Taxes	0
Landsdowne Pond							
Dredging and sediment removal	?		5	1		7 (taxes)	2
Re-contouring and onsite sediment disposal	0	1	4	1	0	6 incl. Taxes	0
Sediment trap	1	2	5	4	0	5 incl. Taxes	0
outlet modification		0	3	1	0	4 incl. Taxes	2
Water Quality							
Improve CSO performance	1	0	5	0	0	6	Na
Identify and correct storm sewers with cross connections	2	0	6	0	0	7	NA

In Summary, most people felt that lack of information; help; and money were the barriers for implementation.

Additional comments that were received included:

- Major concerns were expressed regarding the storm and sanitary sewer management, the potential CSO sewage overfull, suggestions that the Town of Niagara on the Lake should be responsible for stopping the overflow.
- Strong support for the improvement of water quality
- Some participants felt that separating the CSO on private lands was impractical.
- Storm water management issue needs to be considered
- Rental properties need to be considered in this process
- Consider the demographic when doing this study (elderly people have difficulty doing some work)
- Support for Public Engagement and education
- Priorities (in order of importance)
    - Settling ponds
- Information needs to be easily accessible and available (pamphlets, education)
- Fisheries and environmental regulations, alteration of fish habitat
- Dredging of Landsdowne Pond may be complicated by the lack of knowledge of who actually owns it

Participants questioned who or which agency is officially in control. Some participants suggested that the Municipality/region should be responsible

3. Look at the draft evaluation criteria and indicate the level of importance

Evaluation Criteria	Very important	Somewhat important	No opinion	Somewhat not important	Not important
Ability to meet study objectives and targets	6	7	2	0	0
Environmental benefits and impacts	15	2	0	0	0
Social impacts	4	6	4	2	0
Implementation considerations, including phasing	6	9	0	1	0
Cost	6	3	3	1	2
Stakeholder acceptance	10	6	0	0	0
Agency acceptance	7	7	2	0	0
Recreational and cultural impact	5	10	2	0	0

In summary, providing benefits and mitigating impacts on the environments, stakeholder acceptance and agency acceptance were seen as very important criteria.

Other Comments

- It was suggested that the study team consider the Ontario Water Resources Act to help get a base understanding of what is required and allowed and not allowed with regard to: water quality impairment, pollution prevention and prohibiting and regulating sewage discharge.

Next Steps & Closing Remarks

Next Steps in the Planning Process

- Third Workshop – April 2005: Chance to review and comment on the preferred approaches that will be developed using the evaluation criteria.
- Fourth Workshop – June 2005: Review and provide feedback on the Draft Watershed Plan. At this meeting opportunities for ongoing community involvement will be discussed.

Brian Hindley closed the meeting by thanking everyone for attending the meeting and participating in the process.

One Mile Creek Watershed Plan

Public Workshop #1

October 19, 2004

Participant Workbook

NIAGARA PENINSULA CONSERVATION AUTHORITY

APPENDIX A: AGENDA

One Mile Creek Watershed Plan Public Workshop # 2
Wednesday March 9, 2005
7:00 p.m. - 9:00 p.m.
Niagara-on-the-Lake Community Centre
29 Platoff Street, Niagara-on-the-Lake, Ontario

AGENDA

Meeting Purpose:

- *To identify alternative strategies and approaches for the One Mile Creek Watershed Plan*
- *To identify evaluation criteria for defining the alternatives*

7:00 pm **Welcome to Participants**
Niagara Peninsula Conservation Authority (NPCA)

7:05 pm **Introductions and Agenda Review**

7:10 pm **Presentation**
David Maunder, Aquafor Beech

7:40 pm **Discussion**

8:55 pm Closing Remarks

9:00 pm Adjourn

APPENDIX B: WORKSHOP PARTICIPANTS

One Mile Creek Watershed Plan Public Workshop #2

The following is a list of participants who signed in at the registration table at the meeting.

Bonnie Dawe	Friends of One Mile Creek
Evelyn Eaton	Friends of One Mile Creek
Gerry Beneteak	Friends of One Mile Creek
Harry Flood	Friends of One Mile Creek
Helen Moelil	Friends of One Mile Creek
Hermann Moehl	Friends of One Mile Creek
Ivan Eaton	Friends of One Mile Creek
Katleya Young-Chin	Friends of One Mile Creek
Kaye Toye	Friends of One Mile Creek
Klara Young-Chin	Friends of One Mile Creek
Marek Laulrly	Friends of One Mile Creek
RuthBelfie	Friends of One Mile Creek
Mike Belfie	Friends of One Mile Creek
Terry Judd	Friends of One Mile Creek
Marek Laubitz	Friends of One Mile Creek
Emily Hyde	Interested Citizen
Johan Somerwil	Interested Citizen
Luba Fraser	Interested Citizen
Wray Koepke	Interested Citizen
Adrien Berube	
Anneliese Belau	
Christoper Allen	
D. Will	
Diana Laubitz	
Mr & Mrs Geuaro Cisneros	
Robert Witherell	
Ted Warner	
Suzanne McInnes	Niagara Peninsula Conservation Authority
Rob Diermair	Niagara Peninsula Conservation Authority
Dave Maunder	Aquafor Beech Ltd.
Brian Hindley	Aquafor Beech Ltd.
Liz Nield	Lura Consulting

One Mile Creek Watershed Plan

Public Workshop # 3

May 18, 2005

Draft Meeting Record

NIAGARA PENINSULA CONSERVATION AUTHORITY

March 18 2005, 7:00-9:00 p.m.
Niagara-on-the-Lake Community Centre, 29 Platoff Street

This draft meeting record was prepared by Lura Consulting. It integrates the key discussion points and outcomes from the second public workshop held on May 18, 2005. The contents of this record are subject to review by meeting participants. Please forward any comments to: Liz Nield, Lura Consulting at (905) 527-0754, by fax at (905) 528-4179, or by email at lnield@lura.ca.

Meeting Purpose

This workshop was held to seek community feedback on the Recommended Management Strategy for One Mile Creek, and to discuss the priorities for implementation.

Open House

Participants were invited to review a series of displays that focused on the One Mile Creek Watershed; specifically they were invited to review the Recommended Management Actions.

Participants

A total of 27 representatives from 5 organizations participated in the workshop. *A complete list of participants is included in Appendix B.*

Welcome, Agenda Review and Introductions

Suzanne McInnes, Planner from the Niagara Peninsula Conservation Authority welcomed participants to the workshop and thanked them for coming, including the Friends of One Mile Creek, a local community group.

Suzanne introduced the consultants, Aquafor Beech Limited who is responsible for conducting the study.

Presentation

David Maunder, Project Manager from Aquafor Beech Limited provided an update on the study, and provided an overview of the progress since the last Workshop which was held in March.

David reviewed the feedback from the last Workshop, and indicated that the Study Team has identified: 1) Residents have not received enough information about One Mile Creek; 2) there is a lack of understanding about the Management Actions; and 3) there needs to be further opportunities for education about this project.

Based on the overall study including the feedback heard from the last Workshop, the study team developed a recommended Management Strategy. David indicated that since an extensive proportion of the Creek is on private lands, the recommended Management Actions are a series of "best bets", which include a strategy for implementation.

Dave presented the recommended Management Actions that have been developed. The following table provides an overview.

RECOMMENDED MANAGEMENT ACTIONS

SOURCE CONTROLS		
M1	**Action:**	Downspout Disconnection /Rainbarrels /Soak-away Pits
	Implementation:	Landowner, Conservation Authority, Municipality
	Benefits:	Reduced nuisance flooding, baseflow augmentation, reduced storm sewer flows
CONVEYENCE CONTROLS		
M2	**Action:**	Perforated Pipe / Infiltration Techniques(as roads improved)
	Implementation:	Municipality
	Benefits:	Reduced nuisance flooding, baseflow augmentation, reduced storm sewer flows
M3	**Action:**	Enhanced Road/Sewer Maintenance / Operations
	Implementation:	Municipality
	Benefits:	Reduced sediment loading to stream; improved water quality
END OF PIPE CONTROLS		
M4	**Action:**	Stormwater Management Pond
	Implementation:	Municipality, Conservation Authority, Landowner, Federal Government
	Options:	Possible locations include the Commons, Peller Estates
	Benefits:	Baseflow augmentation, reduced flooding, water quality enhancement, community amenity
CULVERT IMPROVEMENTS		
M5	**Action:**	Enlargement /Twinning of existing culverts that impact property flooding
	Implementation:	Municipality, Conservation Authority, Landowner
	Benefits:	Reduced flooding
STREAM RESTORATION/ HABITAT ENHANCEMENT		
M6 a)	**Action:**	"How To" Manual
	Implementation:	Conservation Authority, Landowner
	Benefits:	Assist landowners by providing information on how to improve instream habitats, improve streamside habitats, and improve instream flows
M6 b)	**Action:**	Technical Advice
	Implementation:	Conservation Authority
	Benefits:	Assist landowners by providing technical advice, concept designs for improving instream habitats, streamside habitats, and instream flow conditions

RECOMMENDED MANAGEMENT ACTIONS

STREAM RESTORATION/ HABITAT ENHANCEMENT *Continued*

M7	**Action:**	Spring/Fall Clean Up Program
	Implementation:	Conservation Authority, Landowner, Municipality, Community Group
	Benefits:	Provide assistance to landowners to remove leaf litter and debris from streams
M8	**Action:**	Instream Habitat Enhancement
	Implementation:	Conservation Authority, Landowner, Community Group
	Options:	Remove Barriers / Channel Constrictions; Naturalized Stream Rehabilitation, MNR
	Benefits:	Improved instream habitats, improved flow conveyance
M9	**Action:**	Streamside Habitat Enhancement
	Implementation:	Conservation Authority, Landowner, Community Group, MNR
	Options:	Tree/Shrub Plantings; reduced lawn maintenance along stream
	Benefits:	Improved habitat, stream shading, water quality enhancement

LANDSDOWNE POND

M10 a)	**Action:**	Detailed study to assess Landsdowne Pond; Culvert / Weir Modification (Niagara Blvd)
	Implementation:	Conservation Authority, Municipality, Landowner, provincial/federal agencies
	Benefits:	Improve fish passage; Modify gradient in lower stream to reduce sedimentation, enhance water quality, and improve flood conveyance
M10 b)	**Action:**	Habitat Works /Debris Removal (downstream of Niagara Blvd.)
	Implementation:	Conservation Authority, Municipality, Landowner, Community Group
	Benefits:	Improve channel characteristics, enhance aquatic habitat

EROSION REMEDIATION

M11	**Action:**	Erosion Remediation
	Implementation:	Conservation Authority, Municipality, MNR
	Benefits:	Reduce sedimentation, minimize erosion of adjacent lands, water quality enhancement

ENVIRONMENTAL MONITORING

M12	**Action:**	Comprehensive Environmental Monitoring Program
	Implementation:	Conservation Authority, municipality, Landowner, Community Group, provincial agencies
	Benefits:	Monitor long term benefits of recommended plan actions; Monitor conditions in Landsdowne Pond

ENVIRONMENTAL MONITORING *Continued*		
M13	**Action:**	Promote measures to improve One Mile Creek to Watershed Residents
	Implementation:	Increase awareness of solutions to improve creek
	Benefits:	Greater support for implementation of measures; commitment to improve watershed health

Immediately following the presentation, and prior to commencing the small table discussions, participants were asked if they had any or comments directly related to the presentation. The following identifies the participants' questions (identified with 'Q') or comments (identified with 'C'), are listed below with responses (identified with 'A') from the project team in *italics*.

Q: Does One Mile Creek fall under the drainage act? If it does, suggest that we look into getting funding under the drainage act.

A: *It was not confirmed that One Mile Creek falls under the draining act. Suzanne McInnes offered to look into the question and provide feedback to the participant. However, Dave Maunder indicated that this is something that will be looked at in the implementation phase of the project.*

Q: In regards to the action for downspout disconnection – can the Town of Niagara on the Lake ask developers to do this for future developments? Clarification was requested about how this would be achieved (Owner responsibility, training, etc).

A: *Downspout disconnection is generally something that the Town would take the lead on, in other Municipalities and Towns they have sponsored training days, or specific times when the information would be made available.*

Q: Has the Study Team identified the septic systems that are close to One Mile Creek – concern about where Leachate could be coming from.

A: *Although the Study Team does not have a precise map, most of the Creek is on a sanitary sewer system. The Study Team agreed to look into this issue further.*

C: John Street is in a floodplain, the larger culverts have already been installed because it is in the floodplain.

Feedback on the Recommended Management Actions

Following the presentation, Brian Hindley of Aquafor Beech explained the workbook to the participants; and invited participants to discuss and work through the following focus questions:

1. Do you agree with the recommended measures presented? Are there any others that you would like to see?
2. From the list of Recommended Management Actions, identify what you consider to be the top three measures for implementation.
3. How important do you consider funding support to be to get measures implemented on private lands? What other tools are needed to encourage implementation on private lands?

Brian also noted that Landowners will need to play a significant role in the implementation of many of the recommended actions.

This section presents a summary of the feedback received from participants at the workshop. *A detailed list of the comments is provided as Appendix 'C'.*

1. DO YOU AGREE WITH THE RECOMMENDED MEASURES PRESENTED? ARE THERE ANY OTHERS THAT YOU WOULD LIKE TO SEE?

Most participants indicated that they agreed with the recommended measures, and felt that they were all worth implementing.

Additional comments on the suggested measures/ actions included:

- Culvert Improvements is very important; we need to twin culverts and improve road systems.
- Please put new Culverts on Gage Street (at cover of Gate)
- Landsdowne Pond needs to be cleaned and debris removed.
- Concerns about the Stormwater Management Action. Suggestion that the creek (and residents of Jake St.) would benefit more if the end of pipe controls were placed closer to the source (i.e. Peller Estates).
- Pond development near Nassau St. (near pumping station) is important
- Stormwater management is important
- Need verification that proposed Actions will work in Niagara on the Lake with specific soil conditions.
- Concern that financial resources will limit the major impact of recommendations.
- Don't know what others might be appropriate. Would be good to get these taken care of and then see what impact they have on the problem.
- As for the archaeological dig at the commons, suggest that archaeology students could do it. This could cut down costs as well as involve the students in the community more.
- Perhaps greater emphasis on education, persuasion and, as last resort, legal action, to assure implementation of these recommendations.
- Downspout disconnection – clarification and further details were requested about this Action.
- Concern that the downspout disconnection action has many implications. As a new homeowner the municipality required procedures regarding rain/water runoff. Participant indicated that drainage plans were regularly/changed as new homes were built.

Additional suggestions to consider included:

- Headwater wetland creation is very important
- Dry ponds
- Dredging and sediment removal (entire creek)
- Outlet modifications
- Allow natural stream flow. Prevent landowners from artificial reconstruction of stream flow.
- Strong action by the NPCA against landowners who have changed/interfered with/blocked the creek and/or floodplain.
- Suggest that the Town of Niagara on the Lake direct flow through storm sewers into creek.

- Suggest that the study team consider stopping the erosion from old landfill site downstream and flooding of debris into creek
- Suggest that laws to regulate what can and can't be done to the creek whether it goes through private property or not are implemented i.e. changing direction, flow, etc.

2. FROM THE LIST OF RECOMMENDED MANAGEMENT ACTIONS, IDENTIFY WHAT YOU CONSIDER TO BE THE TOP THREE MEASURES FOR IMPLEMENTATION.

1

Participants indicated that the following actions are their first priority:

- Stormwater Management
- Source Controls
- Culvert Improvements and flood control
- Education and Follow-up
- Dredging creek from Nassau downstream/cleanup
- Reduce/eliminate storm sewer inflow into One Mile Creek overall

2

Participants indicated that the following actions are their second priority:

- Culvert Improvements
- Information and education to landowners
- Stream restoration and habitat enhancement
- Reduce/eliminate storm sewer inflow into One Mile Creek
- Perforated Pipe/Infiltration Techniques
- Stormwater Management Ponds
- End of Pipe Controls
- Source Controls
- Landsdowne Pond: Study to assess the Pond and Habitat Works/Debris removal
- Convince the town to recognized alternatives i.e. work with the Conservation Authority

3

Participants indicated that the following actions are their third priority:

- Reduce/eliminate storm sewer inflow into One Mile Creek
- Culvert improvements
- Conveyance Controls
- Spring/Fall Clean-up Program
- Erosion Remediation
- Streamside Habitat Enhancement
- Instream Habitat Enhancement
- End of Pipe Controls
- Outlet modifications
- Cleanup of creek
- Road drainage storm sewer management

3. HOW IMPORTANT DO YOU CONSIDER FUNDING SUPPORT TO BE TO GET MEASURES IMPLEMENTED ON PRIVATE LANDS? WHAT OTHER TOOLS ARE NEEDED TO ENCOURAGE IMPLEMENTATION ON PRIVATE LANDS?

Most participants indicated that funding is essential and very important in order for the measures/actions to be implemented on private lands, although some participants indicated that it was of secondary importance. The following suggestions were made surrounding the importance of funding, and how to encourage implementation on private lands:

- Cooperation from property owners is essential.
- Many individuals won't or can't spend the money to take remedial action.
- Illustrate the positive benefits to the landowner.
- Niagara Peninsula Conservation Authority needs to be involved.
- Authority and responsibility of all the parties needs to be decided.
- Concern that residents would be less interested if the initiative was too expensive.
- I don't think it's a big priority for most people as small do it yourself projects can help in many ways. For those others with large properties and fewer resources i.e. 'the wild', it might be advantageous.
- Road work is needed to enhance the speed of water.
- Planting along the stream is important.
- Removal of the debris in the creek is important.
- Funding of secondary importance.
- Town should provide equipment and help to cleanup/remove heavy debris. Negotiate with private landowners.
- Review of all associated acts and regulations to be investigated to add to funding.
- Some sharing of costs might encourage private interest but further education re: the benefit to the total community should provide the incentive.
- Other tools could be to inform private landowners of what we are trying to accomplish which increases public awareness and possibly increases the support group size.
- Everyone on private lands should be notified regarding what can and has been done regarding the One Mile Creek Watershed.
- Friends of One Mile Creek can help here! That means leg work door-to-door… delivering concise and easily understood leaflets.
- A good education/help program is also essential.
- Information and education for the public needs to be easily accessible.

Next Steps

Next Steps in the Planning Process

- Fourth Workshop – June 14 2005: Review and provide feedback on the Draft Watershed Plan. At this meeting opportunities for ongoing community involvement will be discussed.

APPENDIX A: AGENDA

One Mile Creek Watershed Plan Public Workshop # 23
Wednesday May 18, 2005
7:00 p.m. - 9:00 p.m.
Niagara-on-the-Lake Community Centre
29 Platoff Street, Niagara-on-the-Lake, Ontario

AGENDA

Workshop Purpose:

To seek community feedback on the Recommended Management Strategy for One Mile Creek, and the priorities for implementation

7:00 Welcome to Participants

7:10 Meeting Purpose and Agenda Review

7:15 Presentation

1) Overview of Progress to Date, Summary of Findings from 2nd Workshop
2) Recommended Management Strategy

Questions of Clarification

7:50 Roundtable Discussions

- Recommended Strategy
- Implementation Considerations
- Priorities

8:55 Closing Remarks and Next Steps

9:00 Adjourn

APPENDIX B: WORKSHOP PARTICIPANTS

One Mile Creek Watershed Plan Public Workshop # 3

The following is a list of participants who signed in at the registration table at the meeting.

B.M Trow	
Bonnie Dawe	Friends of One Mile Creek
Diana Laubitz	Friends of One Mile Creek
Emily Hyde	
Evelyn Eaton	Friends of One Mile Creek
Gerry Beneteau	
Gloria Grieve	Friends of One Mile Creek
Helmi Moehl	Friends of One Mile Creek
Hermann Moehl	Friends of One Mile Creek
Ivan Eaton	Friends of One Mile Creek
J. Johnson	Friends of One Mile Creek
Jacquie MacInnes	
John MacInnes	
KatleyaYoung-Chin	Friends of One Mile Creek
Kaye Toye	Friends of One Mile Creek
Ken Goodwin	Friends of One Mile Creek
Klara Young-Chin	Friends of One Mile Creek
Marek Laubitz	Friends of One Mile Creek
Mike DAntini	
Robert Withereu	
Ted Turner	Chautauqua Residents Association
Suzanne McInnes	Niagara Peninsula Conservation Authority
Rob Diermair	Niagara Peninsula Conservation Authority
Dave Maunder	Aquafor Beech Ltd.
Brian Hindley	Aquafor Beech Ltd.
Liz Nield	Lura Consulting

APPENDIX C: DETAILED WORKBOOK COMMENTS

Question 1: Do you agree with the recommended measures presented? Are there any others that you would like to see?

- Downspout disconnection – the surface drainage has been changed on Park Court. How could you have surface drainage?
- Yes.
- I agree with the recommended actions. We need to get some teeth in laws that regulate what can and can't be done to the creek whether it goes through private property or not – i.e. changing direction, flow, etc. of creek – i.e. Butler and Gage area. Stars to drainage ponds and storm sewer changes!
- Yes – you're the experts.
- Re: M1 – downspout – As a new homeowner the municipality required procedures regarding rain/water runoff. The suggestions would suggest problems with flooding! Drainage plans were regularly/changed as new homes were built. Disconnecting downspouts has lots of implications!!
- Yes.
- Allow natural stream flow. Prevent landowners from artificial reconstruction of stream flow.
- yes
- headwater wetland creation
- culvert improvements
- dry ponds
- dredging and sediment removal
- outlet modifications
- Yes.
- Strong action by the NPCA against landowners who have changed/interfered with/blocked the creek and/or floodplain.
- Halt by NOTL town of direct flow through storm sewers into creek.
- M5 is very important; we need to twin culverts and improve road systems.
- Please put new ones on Gage Street (at cover of Gate)
- M10 Landsdowne needs to be cleaned and debris removed.
- M1,2,3,4 – 13 all could make improvements
- In general, yes, I agree with the recommendations. I have some concerns about M4. I believe that the creek (and residents of Jake St.) would benefit more if the end of pipe controls were placed closer to the source (i.e. Peller Estates). King and Jake site would not address the problem that we are currently facing. Our 'creek' at this moment, is a mud bed.
- pond development near Nassau St. (near pumping station)
- would stop erosion from old landfill site downstream and flooding of debris into creek
- storm water management
- need verification that proposed notion will work in NOL with specific soil conditions
- Generally yes. Financial resources will limit the major impact of recommendations. Don't know what others might be appropriate. It would be helpful to try and get these taken care of and then see what impact they have on the problem.

- Yes, I agree with all the recommendations. As for the archaeological dig at the commons, why not use archaeology students to do it. It may cut down costs as well as involve the students in the community more.
- Yes.
- Yes.
- Perhaps greater emphasis on education, persuasion and, as last resort, legal action, to assure implementation of these recommendations.
- Yes. They are all worthwhile.

Question 2: **From the list above, identify what you consider to be the top three measures for implementation.**

1.

- M4 – Stormwater pond
- Storm management pond
- Downspout disconnection
- M6 – education and follow up
- M4 – storm water management pond
- flood control – however and soon
- M1
- culvert improvements
- Stormwater management (This links the town plans about urban roads – i.e. curbs and gutters vs. swales)
- M5
- End of pipe controls
- dredging creek from Nassau downstream/cleanup
- reduce/eliminate storm sewer inflow into One Mile Creek
- M1
- M4
- M4
- M4
- Storm water management pond (M4)

2.

- Perforated pipe
- Storm water management pond
- M4 – flood control
- M2 – convince the town to recognized alternatives!! Put teeth /work with conservation, e.g. when streets are dug up make some changes
- M5
- dredging and sediment removal
- Information and education to landowners
- M10
- Stream restoration enhancement
- removal of landfill material (between Nassau and Newark/near pumping station)
- reduce/eliminate storm sewer inflow into One Mile Creek

- M2
- M1
- M1
- M8
- Road drainage improvement (action implementation benefits, M2)

3. Culvert improvements

- Road drainage storm sewer management
- M2 – M3
- M5
- cleanup of creek
- M7
- outlet modifications
- Stream restoration
- M11
- M9
- Erosion remediation (Landsdowne and John Street)
- reduce/eliminate storm sewer inflow into One Mile Creek
- M4
- M2
- M2
- Stream restoration/habitat enhancement M6 – M9
- M5

Question 3: How important do you consider funding support to be to get measures implemented on private lands? What other tools are needed to encourage implementation on private lands?

- Very.
- Very important. Cooperation from property owners.
- I don't think it's a big priority for most people as small do it yourself projects can help in many ways. For those others with large properties and fewer resources i.e. 'the wild', it might be advantageous.
- Very important. Many individuals won't or can't spend the money to take remedial action.
- Very.
- Very.
- Very important. Illustrate the positive benefits to the landowner.
- Funding is essential.
- Information and education for the public.
- funding is important; town of NOTL needs to be involved
- road work is needed to enhance the speed of water
- planting along the stream is important
- removal of the debris in the creek is important
- Essential. I'm afraid many of us would drag our collective feet if the improvements raided wallets.
- Funding of secondary importance.

- Town should provide equipment and help to cleanup/remove heavy debris. Negotiate with private landowners.
- review of all associated acts and regulations to be investigated to add to funding
- Some sharing of costs might encourage private interest but further education re: the benefit to the total community should provide the incentive.
- I believe that funding support is very important. Other tools could be to inform private landowners of what we are trying to accomplish which increases public awareness and possibly increases the support group size.
- Funding is very important. Everyone on private lands should be notified regarding what can and has been done regarding the One Mile Creek Watershed. FOMC can help here! That means leg work door-to-door… delivering concise and easily understood leaflets.
- Funding is very important, but a good education/help program is also essential.
- Very. A clean description of the authority and responsibility of all the parties.

One Mile Creek Watershed Plan

Public Workshop # 4

June 14, 2005

Draft Meeting Record

NIAGARA PENINSULA CONSERVATION AUTHORITY

June 14 2005, 7:00-9:00 p.m.
Niagara-on-the-Lake Community Centre, 29 Platoff Street

This draft meeting record was prepared by Lura Consulting. It integrates the key discussion points and outcomes from the second public workshop held on June 14, 2005. The contents of this record are subject to review by meeting participants. Please forward any comments to: Liz Nield, Lura Consulting at (905) 527-0754, by fax at (905) 528-4179, or by email at lnield@lura.ca.

Meeting Purpose

To review the draft watershed plan; provide feedback on the plan and implementation strategy; and explore opportunities for ongoing community involvement.

Open House

Participants were invited to review a series of displays that focused on the One Mile Creek Watershed. Specifically, they were invited to review the draft watershed implementation plan; provide feedback on the plan and implementation strategy; and, explore opportunities for ongoing community involvement after the plan is complete.

Participants

A total of 17 representatives from 5 organizations participated in the workshop. *A complete list of participants is included in Appendix B.*

Welcome, Agenda Review and Introductions

Suzanne McInnes, Planner from the Niagara Peninsula Conservation Authority welcomed participants to the workshop and thanked them for coming, including the Friends of One Mile Creek, a local community group.

Suzanne introduced the consultants, Aquafor Beech Limited who is responsible for conducting the study.

Presentation

David Maunder, Project Manager from Aquafor Beech Limited provided an update on the study, and provided an overview of the progress since the last Workshop which was held in May.

David reviewed the feedback from the last Workshop, and indicated that the Study Team identified that overall cost (of implementation) to the private landowner is a key component in regards to success in implementation.

Based on the overall study including the feedback heard from residents, Friends of One mile Creek, and the study team, a draft Implementation Plan has been developed for One Mile Creek. The draft plan includes short, medium, and long term measures that can be implemented over time. Dave presented the recommended Management Actions and Implementation plan. The following table provides an overview of what was presented.

RECOMMENDED MANAGEMENT ACTIONS

SOURCE CONTROLS

M1a	**Action:**	**Downspout Disconnection / Soak-away Pits**
	Implementation:	Landowner, Conservation Authority, Municipality
	Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
	Priority:	Short and Medium Term
M1b	**Action:**	**Rainbarrel Program**
	Implementation:	Municipality
	Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
	Priority:	Medium and Long Term

CONVEYENCE CONTROLS

M2	**Action:**	**Perforated Pipe / Infiltration Techniques(as roads improved)**
	Implementation:	Municipality
	Benefits:	1) Increased baseflow; 2) reduced water stagnation (water quality impairment)
M3	**Action:**	**Enhanced Road/ Sewer Maintenance / Operations**
	Implementation:	Municipality
	Benefits:	Reduced sediment loading to stream; improved water quality
	Priority:	NOT RECOMMENDED

END OF PIPE CONTROLS

M4	**Action:**	**Stormwater Management Pond**
	Implementation:	Landowner, Municipality, Conservation Authority, Landowner, Federal Government
	Options:	Possible locations include the Commons, Peller Estates
	Benefits:	Baseflow augmentation, reduced flooding, water quality enhancement, community amenity
	Priority:	Medium Term

CULVERT IMPROVEMENTS

M5	**Action:**	**Culvert Replacement/ Upgrade (Nassau, Dorchester, Victoria, Gage)**
	Implementation:	Municipality, Conservation Authority, Landowner
	Benefits:	Reduced flooding
	Priority:	Medium and Long Term

RECOMMENDED MANAGEMENT ACTIONS

STREAM RESTORATION/ HABITAT ENHANCEMENT

M6 a)	**Action:**	**Stewardship (How To) Manual**
	Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
	Benefits:	Assist landowners by providing information on how to improve instream habitats, improve streamside habitats, and improve instream flows
	Priority:	Short Term
M6 b)	**Action:**	**Technical Assistance Program**
	Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
	Benefits:	Assist landowners by providing technical advice, concept designs for improving instream habitats, streamside habitats, and instream flow conditions
	Priority:	Short Term
M7	**Action:**	**Stream Clean Up Program**
	Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
	Benefits:	Provide assistance to landowners to remove leaf litter and debris from streams
	Priority:	Short Term
M8	**Action:**	**Instream Habitat Enhancement**
	Implementation:	Conservation Authority, Landowner, Friends of One Mile Creek, Ministry of Natural Resources
	Options:	Remove Barriers / Channel Constrictions; Naturalized Stream Rehabilitation, MNR
	Benefits:	Improved instream habitats, improved flow conveyance
	Priority:	Short and Medium Term
M9	**Action:**	**Streamside Habitat Enhancement**
	Implementation:	Conservation Authority, Landowner, Community Group, MNR
	Options:	Tree/Shrub Plantings; reduced lawn maintenance along stream
	Benefits:	Improved habitat, stream shading, water quality enhancement
	Priority:	Short and Medium Term

LANDSDOWNE POND

	M10 a) Action:	**Detailed Assessment of Pond**
	Implementation:	Conservation Authority, Municipality, Landowner, Provincial/Federal agencies
	Benefits:	Develop long term plan to improve water quality and reduce stagnation
	Priority:	Short Term

	M10 b) Action:	**Weir Modifications – Niagara Blvd.**
	Implementation:	Conservation Authority, Municipality, Provincial/Federal agencies
	Benefits:	1) Improved flow conveyance; 2) improved fish passage
	Priority:	Short Term
M10 c) Action:		**Habitat Works / Outlet Modification (downstream of Niagara Blvd.)**
	Implementation:	Conservation Authority, Municipality, Landowner, Community Group
	Benefits:	Improve channel characteristics, enhance aquatic habitat
	Priority:	Short Term

EROSION REMEDIATION

M11	**Action:**	**Erosion Remediation**
	Implementation:	Landowner, Conservation Authority, Municipality, Ministry of Natural Resources, Ministry of the Environment
	Benefits:	Eliminate erosion of landfill
	Priority:	Short Term

ENVIRONMENTAL MONITORING

M12	**Action:**	**Comprehensive Environmental Monitoring Program**
	Implementation:	Conservation Authority, Friends of One Mile Creek, Ministry of Natural Resources, Municipality
	Benefits:	Documents in progress in implementing the plan and restoring environmental health of watershed
	Priority:	Short and Medium Term
M13	**Action:**	**Environmental Awareness Programs**
	Implementation:	Conservation Authority, Friends of One Mile Creek, Ministry of Natural Resources, Municipality
	Benefits:	Greater support for implementation of measures; commitment to improve watershed health
	Priority:	Short and Medium Term

Immediately following the presentation, and prior to commencing the small table discussions, participants were asked if they had any or comments directly related to the presentation. The following identifies the participants' questions (identified with 'Q') or comments (identified with 'C'), are listed below with responses (identified with 'A') from the project team in *italics*.

Q: Does the estimated cost for the Stormwater Management Pond ($500,000) include archaeological work?

A: *No, an archaeological assessment needs to be done – this estimate does not cover those costs.*

Q: In regards to management action M10a – who will pay for the detailed assessment of Landsdowne Pond ($20,000 – $30,000)?

A: *It has not yet been decided; however the NPCA is happy to look at different funding options, identify agencies, suggest a 'how to approach' and they are aware of some Federal/ Provincial programs.*

Q: Why does an assessment need to be done on Landsdowne Pond? What is the difference between the study on One Mile Creek and the recommended study on Landsdowne Pond?

A: *Landsdowne Pond is separate entity from One Mile Creek, several details needs to be confirmed i.e. ownership will need to be determined and there are a number of Wetland areas that need to be looked at (among many ecological issues). Ultimately Landsdowne Pond is a bigger piece of the puzzle in rehabilitating One Mile Creek. Conducting a detailed study on Landsdowne pond could provide more long term solutions and rehabilitation options for One Mile Creek.*

Q: Would Landsdowne Pond benefit from aeration (especially for the stench)?

A: *Although there has been little work done on Landsdowne Pond to date, the Study Team indicated that it would benefit very little from aeration, unless the volume of the pond is increased; aeration can be one measure to use, along with dredging.*

C: The original objective from the summer of 2001 was to get rid of the clutter in One Mile Creek. Participants expressed concern that the original issues are not being addressed.

Q: Concern that the issue does not originate in Landsdowne Pond. If we do not control the silt now -- we will have to rehabilitate and fix the creek again in 50 years!

A: *There are a number of different outfalls that affect the Creek. A Terms of Reference will be provided, and a plan needs to be in place in order to understand the big picture.*

Q: In regards to the Stewardship Manual – is the community responsible for finding financial support? Who is going to pay to develop this plan?

A: *Aquafor Beech will provide the technical input as part of the final report for this study. Once the plan is in place there will be a lot of recommended measures – the Conservation Authority will be looking at next steps after the plan is in place.*

Q: Will the manual contain an easy to use and short list of dos and don'ts?

A: *Yes, the manual will cover that – including recommended good, better and best approach that can be implemented.*

Q: Will the manual explain the reasoning behind every recommendation?

A: *Yes, the manual will highlight the benefits that can resolve from every recommended measure.*

Q: What has been recommended in regards to the culverts?

A: *We have recommended upgrading 4 culverts.*

Q: There has been flooding at the subdivision at John St. and Simcoe because of construction -- has this area been included in the study?

A: *Yes, this area and the issue of flooding have been identified in the study.*

Q: What is the timeline for the plan?

A: *10 years is the timeframe that we are looking at.*

Q: Has the Town of Niagara on the Lake agreed to implement this plan?

A: *No, at this point the plan and our advice have only been recommended to the Town.*

C: Dave Maunder suggested to participants that it might be worthwhile thinking about putting pressure on the Town for them to accept the plan – also Friends of One Mile Creek should continue to recruit members.

C: Suggest that the Study Team recommended that the Culvert at John and Corbett is restored.
A: *Brian Hindley suggested that participants indicated on the worksheet which Culverts they would like to see restored.*

Q: Does the study recommend that the Town implement an irrigation program i.e. take water from the Niagara River and bring it to EPPs drain?
A: *No, that was not related to this study – however, we believe that this option is not feasible for One Mile Creek. Brian Hindley offered to look into it; in particular he will review the Stantec study.*

Q: How will the Town be involved, is the Study Team currently working with the Town?
A: *This Study has been presented informally to the Town; the Study Team will be presenting the recommendations formally in the future.*

Q: New subdivisions need to have the same features – concern that this could offset the plan and rehabilitation of One Mile Creek.
A: *The Province provides options and support for new developments.*

Q: Was the Ontario Water resource act considered during the study?
A: *This study promotes voluntary actions; the context of the study was not to review the Town's policy.*

C: In regards to flood control measures, a suggestion was made that it might be worth considering building a culvert at the mouth of the Creek to help the flow into the Lake.

Q: In regards to the timing of the final report: how and where will the final report be available?
A: *The Final Report will be available to anyone who is interested.*

Feedback from Participants

Participants were invited to fill out worksheets on their own time to respond to the following focus questions:

1. Do you agree with the recommended measures presented?
2. How would you like to stay involved?
3. Additional Comments

This section presents a summary of the feedback received from participants at the workshop. *A detailed list of the comments is provided as Appendix 'C'.*

1. DO YOU AGREE WITH THE RECOMMENDED MEASURES PRESENTED?

- Most participants indicated that they agreed with the recommended measures (10).
- Some participants urged that liaison with the Town Planning department is required (1).
- Request to keep the <u>educational level</u> of the final report at the maximum possible, including technical aspects such as the quantities of silt going into the creek, and its effects. Include the 'worst' storms (1 yr., 5yr., 10 yr., etc.).
- Don't oversimplify the feedback received
- The Pond is critical if it is 30 % of the solution. It can be dealt with rapidly and at one stroke. Getting the residents and streets to participate will take longer.

- Participants indicated that they felt that these recommendations are very useful and will benefit the town
- Do not have enough have enough background info to make comment
- Some things definitely need to be done to improve the health of the streams in N.O.T.L.
- Checks need to be put in place to make sure that the local wineries and farms are not polluting the creeks and damaging the aquatic life.
- Time and energy need to be put into the foundations of N.O.T.L, not just the tourist area. There are many nature trails and streams which could be protected and enhanced to benefit N.O.T.L on the whole."

2. HOW WOULD YOU LIKE TO STAY INVOLVED?

- Suggest that the levels of consultation about related matters/issues with the town and other authorities are increased.
- Through Friends of One Mile Creek.
- Participants requested to receive information via email, telephone and mail; and provided their contact information.
- Request to be informed of new developments.
- Could exert 'political' pressure to implement recommendations; through Friends of One Mile Creek
- Very interested in positive recommendations regarding Landsdowne pond
- Attending meetings
- Reading/studying the forthcoming report

3. ADDITIONAL COMMENTS

- Participants indicated that they learned a great deal from the public workshops; and appreciate them.
- Good work-the devil is in the political will!
- Culvert under John St. should be reviewed; it is much smaller than upstream culverts in Park Court. Suggest that this could alleviate flooding on John St. itself.
- Implementation is very important.
- Fundamentally, well done!
- Let's hope our ideas can be initiated.
- People would like to be kept informed about his project.
- The Chautauqua Residents Association produce a quarterly newsletter which keeps our residents updated re: local issues-regular info, re: this study/project would be appreciated.

Next Steps

Next Steps in the Planning Process

- The Watershed Restoration Plan/Strategy which will include all of the implementation measures and suggestions will be finalized by the end of summer/early fall of 2005.

APPENDIX A: AGENDA

One Mile Creek Watershed Plan Public Workshop # 4
June 14 2005
7:00 p.m. - 9:00 p.m.
Niagara-on-the-Lake Community Centre
29 Platoff Street, Niagara-on-the-Lake, Ontario

AGENDA

Workshop Purpose:

- To review the draft watershed plan;
- Provide feedback on the plan and implementation strategy; and
- Explore opportunities for ongoing community involvement.

7:00 Welcome to Participants

7:10 Meeting Purpose and Agenda Review

7:15 Presentation

Questions of Clarification

9:00 Adjourn

APPENDIX B: WORKSHOP PARTICIPANTS

One Mile Creek Watershed Plan Public Workshop # 4

The following is a list of participants who signed in at the registration table at the meeting.

A. Michael Belfie	Friends of One Mile Creek
B.M Trow	
Barrie Wilding	Resident of Chautauqua
Buddy Andres	
Diana Laubitz	Friends of One Mile Creek
Emily Hyde	
Gerry Beneteau	
Geuaro Cisneros	
Helmi Moehl	Friends of One Mile Creek
Hermann Moehl	Friends of One Mile Creek
John Gartner	Friends of One Mile Creek
Ken Goodwin	Friends of One Mile Creek
Klara Young-Chin	Friends of One Mile Creek
Marek Laubitz	Friends of One Mile Creek
Martha Cisneros	
Ross Robinson	
Robert Withereu	
Suzanne McInnes	Niagara Peninsula Conservation Authority
Dave Maunder	Aquafor Beech Ltd.
Brian Hindley	Aquafor Beech Ltd.
Liz Nield	Lura Consulting

APPENDIX C: DETAILED WORKSHEET COMMENTS

Question 1: Do you agree with the recommendations presented?

- Yes, but more liaisons with town planning required. Please keep the educational level of the final report at the maximum possible, including technical aspects such as the quantities of silt going into the creek, and its effects. Include the 'worst' storms (1 yr., 5yr., 10 yr., etc.). I've learned a great deal from these meetings and appreciate them-thanks. Don't oversimplify, please.
- Yes. The Pond is critical if it is 30 % of the solution. It can be dealt with rapidly and at one stroke. Getting the residents and streets will take longer.
- In general yes.
- Yes
- Yes
- Yes
- Yes, I feel that these recommendations are very useful and will benefit the town.
- Do not have enough have enough background info to make comment.
- Some things definitely need to be done to improve the health of the streams in N.O.T.L. Checks need to be put in place to make sure that the local wineries and farms are not polluting the creeks and damaging the aquatic life. Time and energy need to be put into the foundations of N.O.T.L, not just the tourist area. There are many nature trails and streams which could be protected and enhanced to benefit N.O.T.L on the whole.
- Yes
- Yes

Question 2: How would you like to stay involved?

- Through the Friends of One Mile Creek.
- E-mail
- Yes-co-member of Friends of One Mile Creek
- E-mail -- Please inform of new developments
- Through Friends of One Mile Creek, exert 'political' pressure to implement recommendations
- I will continue to attend any seminars or public meetings.
- Receive info by e-mail
- Please let us know how we can be of assistance
- Through regular updates, re: developments to the organization I represent- 'Chautauqua Residents Assoc.'
- Very interested in positive recommendations re: Landsdowne pond
- By attending to meetings and reading-studying-the forthcoming report

Question 3: Additional Comments…

- Good work-the devil is in the political will!
- Culvert under John St. should be reviewed; t is much smaller than upstream culverts in Park Court. Could alleviate flooding on John St. itself.

- Recommendations are fine, but implementation is very important.
- Fundamentally, well done!
- Let's hope our ideas can be initiated.
- As a board member of Chautauqua Residents Association, I would like to be kept informed of all aspects of how this study impacts the community and Landsdowne pond.
- The Chautauqua Residents Association produce a quarterly newsletter which keeps our residents updated re: local issues-regular info, re: this study/project would be appreciated.
- It would be useful to increase the levels of consultation about related matters/issues with the town and other authorities.

APPENDIX B
PHOTOS

Epp Drain at Peller Estates

Zone 1 – along John Street

Zone 1 – The Commons (King and John)

Zone 1 – Along John Street

Zone 1 – The Commons (King and John)

Zone 2 – flood susceptible structure

Zone 2

Zone 2 – manicured banks

Zone 2 – Undersized Culvert

Zone 2 – Hardened banks

Zone 2 – Steam Restoration

Zone 2 – modified stream

Zone 3 - sedimentation

Zone 2 – street with curb and gutter

Zone 3 – entrenchment and sedimentation

Zone 2 – Street with swale

Zone 3

Zone 2/3

Zone 3 – Landsdowne Pond

Zone 3 – undersized culvert

Zone 3 – Landsdowne Pond

Zone 3 – Landsdowne Pond

Zone 3 – downstream of Nassau Street