City of Hamilton

PUBLIC WORKS COMMITTEE

Meeting #: 18-012
Date: September 17, 2018
Time: 9:30 a.m.
Location: Council Chambers, Hamilton City Hall
71 Main Street West

Lauri Leduc, Legislative Coordinator (905) 546-2424 ext. 4102

Pages

1. APPROVAL OF AGENDA

(Added Items, if applicable, will be noted with *)

2. DECLARATIONS OF INTEREST

3. APPROVAL OF MINUTES OF PREVIOUS MEETING

4. DELEGATION REQUESTS

5. CONSENT ITEMS

9. MOTIONS

9.1 Accessible Entrance Improvements to the Dundas Lawn Bowling Club 375

10. NOTICES OF MOTION

11. GENERAL INFORMATION / OTHER BUSINESS

11.1 Outstanding Business List:

11.1.a Items considered complete and needing to be removed:

Hamilton-Halton Homebuilders' Association (HHHBA) Delegation on Water Main Approval Issues and Recommendations for Master-water wastewater Servicing Studies
Item 8.5 on today's agenda
Item on OBL: T

Glen Carey Delegation (re: berm on his property)
Item 5.3 on today's agenda
Item on OBL: L

Mandatory Drive Thru Garbage Containers
Item 8.4 on today's agenda
Item on OBL: P

12. PRIVATE AND CONFIDENTIAL

12.1 Hamilton Public Bike Share System Contract Negotiations (PED18223) (City Wide)

Pursuant to Section 8.1, Sub-sections (e) and (f) of the City's Procedural By-law 14-300, and Section 239(2), Sub-sections (e) and (f) of the *Ontario Municipal Act*, 2001, as amended, as the subject matter pertains to litigation or potential litigation, including matters before administrative tribunals, affecting the municipality or local board; and advice that is subject to solicitor/client privileges, including communications necessary for that purpose.

13. ADJOURNMENT

PUBLIC WORKS COMMITTEE
MINUTES 18-011

9:30 a.m.
Thursday, August 16, 2018
Council Chambers
Hamilton City Hall
71 Main Street West

Present: Councillors L. Ferguson (Chair), T. Jackson (Vice Chair), C. Collins, S. Merulla, T. Whitehead, R. Pasuta, A. VanderBeek D. Conley

Also Present: Councillor J. Farr

THE FOLLOWING ITEMS WERE REFERRED TO COUNCIL FOR CONSIDERATION:

1. 2018 Mid-Term Report on Stadium Event Bookings at Tim Hortons Field (PW18075) (Ward 3) (Item 5.2)

(Collins/Merulla)
That Report PW18075, respecting the 2018 Mid-Term Report on Stadium Event Bookings at Tim Hortons Field, be received.

CARRIED

2. Proposed Permanent Closure and Sale of a Portion of Public Assumed Alley and a Portion of Public Unassumed Alley Abutting 286 Sanford Ave N and 276 Sanford Avenue North, Hamilton (PW18072) (Ward 3) (Item 6.1)

(Merulla/VanderBeek)
That the application of the owners of 286 Sanford Avenue North and 276 Sanford Avenue North, to permanently close and purchase a portion of the assumed and unassumed alleyway abutting the South side of 286 Sanford Avenue North and the North Side of 276 Sanford Avenue North, Hamilton (“Subject Lands”), as shown on Appendix "A", attached to Report PW18049, be approved, subject to the following conditions:

(a) That the applicant makes an application to the Ontario Superior Court of Justice, under Section 88 of the *Registry Act*, for an order to permanently close the Subject Lands, if required by the City, subject to:

(i) The General Manager of Public Works, or designate, signing the appropriate documentation to obtain any required court order;

(ii) The documentation regarding any required application to the Ontario Superior Court of Justice being prepared by the applicant, to the satisfaction of the City Solicitor;

(b) That the applicant be fully responsible for the deposit of a reference plan in the proper land registry office, and that said plan be prepared by an Ontario Land Surveyor, to the satisfaction of the Manager, Geomatics and Corridor Management Section, and that the applicant also deposit a reproducible copy of said plan with the Manager, Geomatics and Corridor Management Section;

(c) That, subject to any required application to the Ontario Superior Court of Justice to permanently close the Subject Lands being approved:

(i) The City Solicitor be authorized and directed to prepare all necessary by-laws to permanently close and sell the alleyway, for enactment by Council;

(ii) The Real Estate Section of the Planning and Economic Development Department be authorized and directed to sell the closed alleyway to the owners of 286 Sanford Avenue North and 276 Sanford Avenue North, Hamilton, as described in Report PW18072, in accordance with the City of Hamilton Sale of Land Policy By-law 14-204;

(iii) The City Solicitor be authorized to complete the transfer of the Subject Lands to the owners of 286 Sanford Avenue North and 276 Sanford Avenue North, Hamilton, pursuant to an Agreement of Purchase and Sale or Offer to Purchase, as negotiated by the Real Estate Section of the Planning and Economic Development Department;

(iv) The City Solicitor be authorized and directed to register a certified copy of the by-laws permanently closing and selling the alleyway in the proper land registry office; and,

(v) The Public Works Department provide any required notice of the City's intention to pass the by-laws and/or permanently sell the closed alleyway pursuant to City of Hamilton Sale of Land Policy By-law 14-204.

CARRIED

3. Proposed Permanent Closure and Sale of a Portion of Public Assumed Alley Abutting 542 Upper Sherman Avenue, Hamilton (PW18073) (Ward 7) (Item 6.2)

(Collins/Pasuta)
That the application of the owner of 542 Upper Sherman Avenue, Hamilton, to permanently close and purchase a portion of the assumed alleyway abutting the East side of 542 Upper Sherman Avenue, Hamilton, ("Subject Lands"), as shown on Appendix "A", attached to Report PW18073, be approved, subject to the following conditions:

(a) That the applicant makes an application to the Ontario Superior Court of Justice, under Section 88 of the *Registry Act*, for an order to permanently close the Subject Lands, if required by the City, subject to:

(i) The General Manager of Public Works, or designate, signing the appropriate documentation to obtain any required court order; and,

(ii) The documentation regarding any required application to the Ontario Superior Court of Justice being prepared by the applicant, to the satisfaction of the City Solicitor;

(b) That the applicant be fully responsible for the deposit of a reference plan in the proper land registry office, and that said plan be prepared by an Ontario Land Surveyor, to the satisfaction of the Manager, Geomatics and Corridor Management Section, and that the applicant also deposit a reproducible copy of said plan with the Manager, Geomatics and Corridor Management Section;

(c) That, subject to any required application to the Ontario Superior Court of Justice to permanently close the Subject Lands being approved:

(i) The City Solicitor be authorized and directed to prepare all necessary by-laws to permanently close and sell the alleyway, for enactment by Council;

(ii) The Real Estate Section of the Planning and Economic Development Department be authorized and directed to sell the closed alleyway to the owners of 542 Upper Sherman Avenue, Hamilton, as described in Report PW18073, in accordance with the City of Hamilton Sale of Land Policy By-law 14-204;

(iii) The City Solicitor be authorized to complete the transfer of the Subject Lands to the owners of 542 Upper Sherman Avenue, Hamilton~~,~~ pursuant to an Agreement of Purchase and Sale or Offer

to Purchase as negotiated by the Real Estate Section of the Planning and Economic Development Department;

(iv) The City Solicitor be authorized and directed to register a certified copy of the by-laws permanently closing and selling the alleyway in the proper land registry office;

(v) The Public Works Department provide any required notice of the City's intention to pass the by-laws and/or permanently sell the closed alleyway pursuant to City of Hamilton Sale of Land Policy By-law 14-204; and,

(d) That the applicant/owner of 542 Upper Sherman Avenue, Hamilton, enter into agreements with any Public Utility requiring easement protection.

CARRIED

4. Parkside Cemetery (PW18074) (Ward 13) (Item 8.1)

(VanderBeek/Conley)

(a) That the establishment of a new city-owned and operated cemetery on the entire property municipally known as 31 Parkside Avenue in Dundas, be approved;

(b) That staff be directed to send a copy of Council's decision to the Registrar appointed under the *Funeral, Burial and Cremation Services Act*, 2002, and to publish notice of Council's decision in a local newspaper;

(c) That staff be directed to seek the consent of the Registrar for the establishment of the cemetery on the entire property municipally known as 31 Parkside Avenue in Dundas, pursuant to *Funeral, Burial and Cremation Services Act* by submitting the prescribed application, together with the required supporting documentation;

(d) That the General Manager of Public Works be authorized and directed to execute any documentation required respecting the application for consent for a new city-owned and operated cemetery on the entire property municipally known as 31 Parkside Avenue in Dundas, in a form satisfactory to the City Solicitor;

(e) That staff be authorized and directed to execute the documents required with the Registrar of Cemeteries to designate the entire property municipally known as 31 Parkside Avenue (Dundas) as a cemetery; and,

(f) That staff be directed to proceed with applications to fulfil the *Planning Act* requirements for zoning approval, site plan approval and an Official Plan

amendment for a new city-owned and operated cemetery on the entire property municipally known as 31 Parkside Avenue in Dundas.

CARRIED

5. Feasibility of Green Burials as a Burial Option in Hamilton (PW18071) (City Wide) (Item 8.2)

(VanderBeek/Whitehead)
That Report PW18071, respecting the Feasibility of Green Burials as a Burial Option in Hamilton, be received.

CARRIED

6. Investment in Flamborough Parking Lots (Ward 14) (Item 9.1)

(Pasuta/Merulla)
WHEREAS, the majority of City of Hamilton owned facility and park assets in Ward 14 are operated and maintained by volunteer community groups and park sub- committees;

WHEREAS, many of the current parking lots at the volunteered operated facilities and parks in Ward 14 are in need of repair;

WHEREAS, the volunteer community groups and park sub-committees do not have sufficient funds to repair their parking lots; and,

WHEREAS, the parking lots at Sheffield Town Hall, Sheffield Baseball Diamond Park, Strabane Park, Greensville Baseball Diamond Park, Freelton Centennial Park and Freelton Baseball Diamond are all in need of repair;

THEREFORE, BE IT RESOLVED:

That staff be directed to complete the parking lot paving work at the current projects listed below ***to an upset limit of $300,000***, to be funded from Capital Account 4031611614 (Ward 14 Roads Minor Maintenance - $ 739,000 unspent):

(a) Sheffield Town Hall;
(b) Sheffield Baseball Diamond Park;
(c) Strabane Park;
(d) Greensville Baseball Diamond Park;
(e) Freelton Centennial Park;
(f) Freelton Baseball Diamond; and,
(g) Westover Park.

MOTION, *AS AMENDED*, CARRIED

7. Expediting Approvals and Permits for Odour Mitigation at the Central Composting Facility (Item 9.2)

(Merulla/Ferguson)
WHEREAS, City Council has maintained an adequate capital budget for necessary upgrades to the Central Composting Facility since its commissioning in 2006;

WHEREAS, on October 31, 2016, City Council directed staff to investigate opportunities to improve odour control at the facility;

WHEREAS, on December 4, 2017, City Council supported the pilot testing and implementation of a long-term odour mitigation solution in the form of carbon filters;

WHEREAS, the City of Hamilton's Central Composting Facility had a high number of odour complaints in May and June of 2018;

WHEREAS, the City of Hamilton voluntarily shut down the Central Composting Facility and stopped receiving organic waste until an odour control solution is found; and,

WHEREAS, City Council approved a capital budget of approximately $2,600,000 for a variety of measures including odour control management upgrades at the Central Composting Facility.

THEREFORE, BE IT RESOLVED:

(a) That City of Hamilton staff be directed to work with both the Hamilton District and the Environmental Approvals Branch of the Ministry of the Environment, Conservation and Parks, to expedite any issuance of permits or approvals that may be required to implement any short-term and/or long-term odour mitigation solutions, as identified by the City for the Central Composting Facility; and,

(b) That the Mayor correspond with the Honourable Rod Phillips, Minister of the Environment, Conservation and Parks, requesting that any permits and/or approvals for odour mitigation solutions at the Central Composting Facility, be expedited.

CARRIED

8. New Stop Controls – Market Street South at Mill Street (Dundas) (Ward 13) (Item 9.3)

(VanderBeek/Pasuta)
WHEREAS, the City of Hamilton is committed to creating safe neighbourhoods and vibrant communities; and,

WHEREAS, ensuring the safety of both pedestrians and motorists is a priority;

THEREFORE, BE IT RESOLVED:

(a) That staff be directed to take the required steps to add new stop controls on Market Street South at Mill Street (Dundas), as illustrated on Appendix "A" attached hereto; and,

(b) That the By-law, being a by-law to Amend By-law No. 01-215, being a By-law to Regulate Traffic, as it relates to new Stop Controls on Market Street South at Mill Street (Dundas) attached hereto as Appendix "B", be enacted.

CARRIED

9. Retaining Wall Repair/Replacement Loan Agreements Between the City of Hamilton and the Property Owners, at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton (Item 10.1)

(Whitehead/Merulla)
WHEREAS, the City of Hamilton's Property Standards by-law requires property owners to maintain their properties;

WHEREAS, the City of Hamilton has no obligation for the funding of repairs and / or replacement of retaining walls on private properties;

WHEREAS, retaining walls on private property on 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton are in need of repair and / or replacement;

WHEREAS, Hamilton City Council, at its meeting June 14, 2017 passed a motion stating that no action be taken to establish a non-repayable grant program for the funding of repairs and/or replacements of retaining walls located on private properties on Guildwood Drive (Report PW17038);

WHEREAS, the City would like to provide compassionate loans for residential property owners for the repair and / or replacement of retaining walls on their private property at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton for an amount not to exceed $10,000 per affected property;

WHEREAS, the City has External Loan Guidelines (Reports FCS06078 and FCS06078(a)) for loans to external, not-for-profit corporations for the repair and / or replacement of their capital assets;

WHEREAS, some of the conditions of these loan guidelines would need to be waived to provide loans to the affected property owners at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton to repair and / or replace their private retaining walls;

WHEREAS, these loan guidelines include interest rate terms for interest bearing loans at the City's cost of borrowing plus 0.25% administration fee;

THEREFORE, BE IT RESOLVED:

(a) That the City of Hamilton provide an interest-bearing loan to the affected property owners at at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton, as borrowers to fund the repair of retaining walls on their private property in an amount not to exceed $10,000 to be repaid in full over a period of five years from the date of the loan advance at an interest rate of 3.07% for an annual amount of $2,187.91;

(b) That the affected property owners at at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton, provide a charge/mortgage to be registered on title for the retaining wall loans as security;

(c) That the affected property owners at at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton, provide proof of payment for the repairs / replacement to the retaining walls by October 31, 2018 to the General Manager of Finance and Corporate Services, prior to the loan advance payment, in a form satisfactory to the General Manager of Finance and Corporate Services;

(d) That the affected property owners at at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton, enter into Retaining Wall Repair/Replacement Loan Agreements with the City of Hamilton, in a form satisfactory to the City Solicitor; and,

(e) That the Mayor and Clerk be authorized to execute these Retaining Wall Repair/Replacement Loan Agreements between the City of Hamilton and the affected property owners, at at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton, with content satisfactory to the General Manager of Finance and Corporate Services and in a form satisfactory to the City Solicitor.

CARRIED

FOR INFORMATION:

(a) CHANGES TO THE AGENDA (Item 1)

The Committee Clerk advised of the following changes to the agenda:

1. ADDED DELEGATION REQUESTS (Item 4)

4.1 Brian Zeman, MHBC Planning, on behalf of Lafarge Canada Inc., to speak in support of Lafarge's application requesting the closure of Moxley Road (for September 17, 2018 Public Works Committee)

2. PUBLIC HEARINGS / DELEGATIONS (Item 6)

6.2 Proposed Permanent Closure and Sale of a Portion of Public Assumed Alley Abutting 542 Upper Sherman Avenue, Hamilton (PW18073) (Ward 7) (Item 6.2)

Sub-section (c)(iii) in the recommendations (on page 2) has a typographical / copy and paste error that will be properly reflected in the Minutes:

The address reflected in that sub-section is "102 Francis Street, Hamilton" and should read "***542 Upper Sherman Avenue, Hamilton***".

3. NOTICES OF MOTION (Item 10)

10.1 Retaining Wall Repair/Replacement Loan Agreements Between the City of Hamilton and the Property Owners, at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton

(VanderBeek/Pasuta)
That the agenda for the August 16, 2018 Public Works Committee meeting be approved, as amended.

CARRIED

(b) DECLARATIONS OF INTEREST (Item 2)

There were no declarations of interest.

(c) APPROVAL OF MINUTES OF THE PREVIOUS MEETING (Item 3)

(i) July 12, 2018 (Item 3.1)

(VanderBeek/Pasuta)
That the Minutes of the July 12, 2018 meeting of the Public Works Committee be approved, as presented.

CARRIED

(d) DELEGATION REQUESTS (Item 4)

(i) Brian Zeman, MHBC Planning, on behalf of Lafarge Canada Inc., to speak in support of Lafarge's application requesting the closure of Moxley Road (for September 17, 2018 Public Works Committee) (Item 4.1)

(Pasuta/VanderBeek)
That the delegation request, submitted by Brian Zeman, MHBC Planning, on behalf of Lafarge Canada Inc., to speak in support of Lafarge's application requesting the closure of Moxley Road, be approved to appear before the Public Works Committee on September 17, 2018,

CARRIED

(e) CONSENT ITEMS (Item 5)

(i) Various Sub-Committee/Advisory Committee Minutes (Item 5.1)

(Collins/Merulla)
That the following Sub-Committee/Advisory Committee Minutes, be received:

(1) Keep Hamilton Clean and Green Advisory Committee, January 23, 2018 (Item 5.1(a))

(2) Keep Hamilton Clean and Green Advisory Committee, March 20, 2018 (Item 5.1(b))

(3) Keep Hamilton Clean and Green Advisory Committee, May 15, 2018 (Item 5.1(c))

(4) Accessible Transit Services Review Sub-Committee, April 27, 2018 (Item 5.1(d)

CARRIED

(f) MOTIONS (Item 9)

(i) Investment in Flamborough Parking Lots (Ward 14) (Item 9.1)

(Pasuta/Jackson)
That the Motion, respecting an Investment in Flamborough Parking Lots, be amended by deleting the words "at the estimated cost of $ 250,000" and replacing them with the words "***to an upset limit of $300,000***"; and, by adding the words "***Westover Park***" under a new sub-section (g), to read as follows:

That staff be directed to complete the parking lot paving work at the current projects listed below ~~at the estimated cost of $ 250,000~~ ***to an upset limit of $300,000***, to be funded from Capital Account 4031611614 (Ward 14 Roads Minor Maintenance - $ 739,000 unspent):

(a) Sheffield Town Hall;
(b) Sheffield Baseball Diamond Park;
(c) Strabane Park;
(d) Greensville Baseball Diamond Park;
(e) Freelton Centennial Park;
(f) Freelton Baseball Diamond; and,
(g) Westover Park.

***AMENDMENT* CARRIED**

For disposition of this matter, please refer to Item 6.

(g) NOTICES OF MOTION (Item 10)

Councillor Whitehead introduced a Notice of Motion respecting retaining wall repair/replacement loan agreements between the City of Hamilton and the property owners, at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton (Item 10.1)

(i) Retaining Wall Repair/Replacement Loan Agreements Between the City of Hamilton and the Property Owners, at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton (Item 10.1)

(Whitehead/Merulla)
That the Rules of Order be waived to allow for the introduction of a Motion respecting Retaining Wall Repair/Replacement Loan Agreements Between the City of Hamilton and the Property Owners, at 93 Greencedar Drive, Hamilton and 140 Golfwood Drive, Hamilton.

CARRIED

For disposition of this matter, please refer to Item 9.

(h) GENERAL INFORMATION / OTHER BUSINESS (Item 11)

(i) Amendments to the Outstanding Business List (Item 11.1)

(Merulla/Collins)
That the matter respecting the Photo Radar on the LINC and Red Hill Expressway remain on the Public Works Committee's Outstanding Business List with a due date of December 10, 2018.

***AMENDMENT* CARRIED**

(Merulla/Collins)
That the following amendments to the Public Works Committee's Outstanding Business List, be approved:

(a) Items to be removed:

(i) Feasibility of Green Burials as a Burial Option in Hamilton (Addressed as Item 8.2 on today's agenda – Report PW18071)

(b) Proposed New Due Dates:

(i) Watermain Approval Issues and Recommendations for the Master Water-Wastewater Servicing Studies
Current Due Date: August 16, 2018
Proposed New Due Date: September 17, 2018

(ii) Mandatory Drive-Thru Garbage Containers
Current Due Date: August 16, 2018
Proposed New Due Date: September 17, 2018

MOTION, *AS AMENDED*, CARRIED

(i) ADJOURNMENT (Item 13)

(Jackson/Conley)
That there being no further business, the Public Works Committee be adjourned at 10:15 a.m.

Respectfully submitted,

Councillor L. Ferguson
Chair, Public Works Committee

Stephanie Paparella
Legislative Coordinator
Office of the City Clerk

Form: **Request to Speak to Committee of Council**
Submitted on Wednesday, August 15, 2018 - 1:00 pm

==Committee Requested==
Committee: Public Works Committee

==Requestor Information==
Name of Individual: Kevin Gonci

Name of Organization: Golden Horseshoe Track & Field Council

Contact Number: +1 09053179381

Email Address: kgonci4@gmail.com

Mailing Address: 21 Elora Drive, Hamilton, ON L9C 6T4

Reason(s) for delegation request:
The Golden Horseshoe Track & Field Council advocates on behalf of the sport of Athletics throughout our region. Our recent collaborative partnership between various community stakeholder groups and the City of Hamilton has resulted in nearly a $1M investment towards the renewal of the Mohawk Sports Park outdoor track & field facility (Ray Lewis Track & Field Centre) the only public facility of its kind. We would like to request that our Phase 3 renewal proposal be accepted and included on the 2019 Capital Planning Projects list. This proposal includes the installation of two sections of fully accessible, spectator bleachers and an outdoor gazebo structure contingent on our ability to secure the necessary funds established within our proposal.
Secondary to this request, we would also like to request that the City of Hamilton obtain three written quotes for the proposed renewal of the current field house building structure located at this site so that we may prepare for a Phase 4 and final renewal of this facility by 2020.

Will you be requesting funds from the City? Yes

Will you be submitting a formal presentation? Yes

Ray Lewis Track & Field Center (Mohawk Sports Park)

Proposed Phase 3 Work Plan

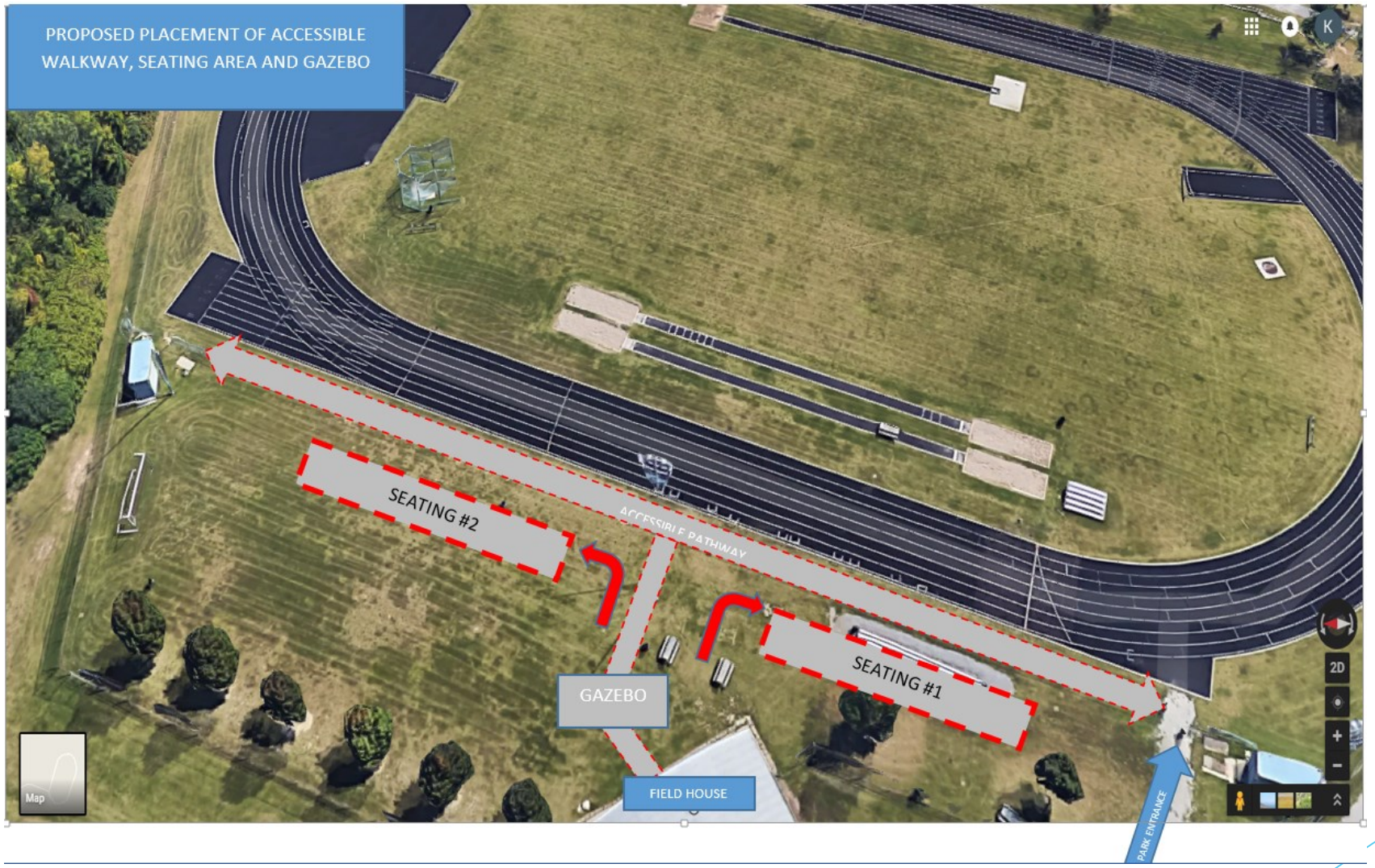
THE GOLDEN HORSESHOE GHTFC TRACK & FIELD COUNCIL

Current Facilities

Phase 3 Objectives

Accessible Spectator Seating

Accessible Gazebo


PROPOSED PLACEMENT OF ACCESSIBLE WALKWAY, SEATING AREA AND GAZEBO
SEATING #2
ACCESSIBLE PATHWAY
SEATING #1
GAZEBO
FIELD HOUSE
PARK ENTRANCE
Map
2D

Cost Assessment

Total Project Cost $439,000 - $450.000

Part 1	Part 2	Part 3
Accessible spectator bleachers (500 person capacity).	Accessible Gazebo Structure.	Accessible spectator bleachers (500 person capacity).
$187,000	$65,000	$187,000

Funding Model

Government of Canada Enabling Accessibility Grant

Application Date:

July 2018

Response:

November 2018

Amount: $100,000

Ontario Trillium Foundation Capital Grant

Application Date:

September 2018

Response:

April 2019

Amount: $150,000

Jumpstart Foundation

Enabling Accessibility Grant

Application Date:

February 2019

Response:

August 20129

Amount: $100,000

Hamilton Future Fund Grant

Application Date:

2019

Response:

Amount: $100,000

Phase 4 Proposal

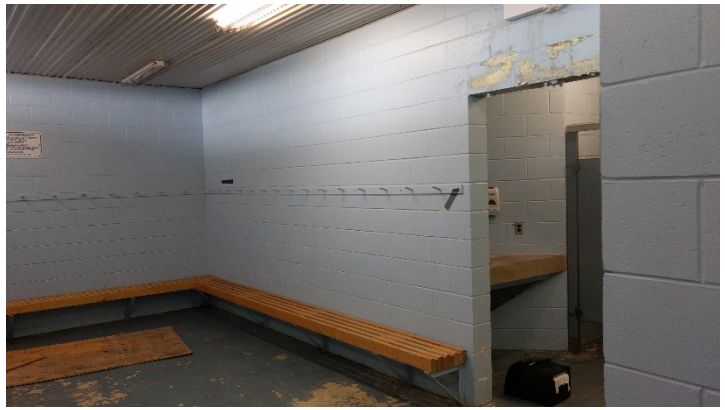
Field House Renewal

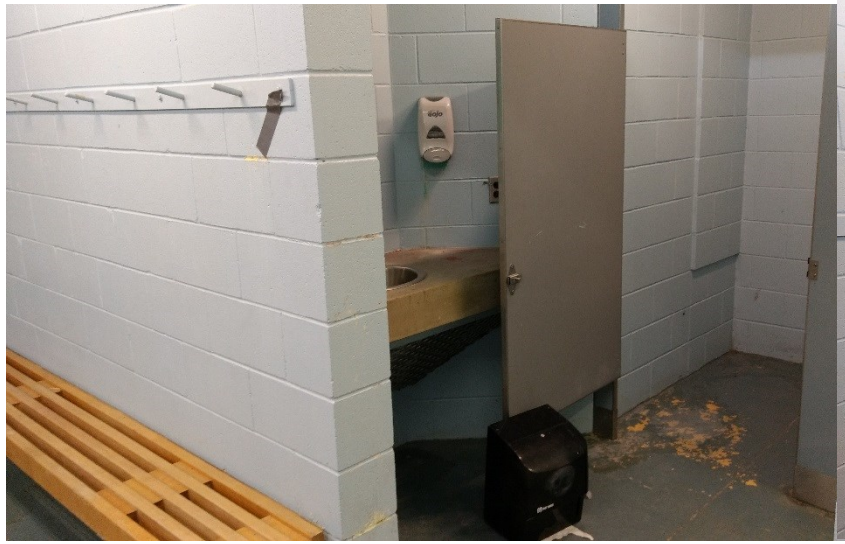
2020/21

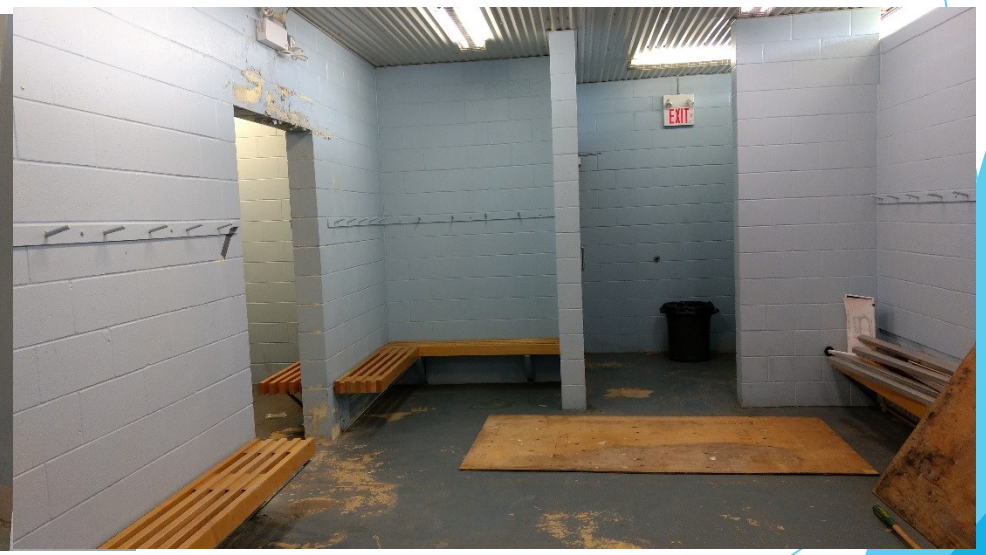
Summary

REQUEST

1. Include Phase 3 work plan (Bleachers & Gazebo) on 2019 Capital Planning List (contingent on funding). Recommended schedule April 2019 or August 2019.
2. Complete Feasibility Study of proposed Field House renewal to include Concept Design & Cost Estimate in consultation with community user groups. Community groups to contribute to funding model & feasibility study.






EXIT

Form: Request to Speak to Committee of Council
Submitted on Friday, August 17, 2018 - 2:57 pm

==Committee Requested==
Committee: Public Works

==Requestor Information==
Name of Individual: Jonathan Jones

Name of Organization:

Contact Number:

Email Address:

Mailing Address:

Reason(s) for delegation request: Safety issues with new DARTS vehicles and DARTS scheduling concerns.

Will you be requesting funds from the City? No

Will you be submitting a formal presentation? No

4.3

Form: Request to Speak to Committee of Council
Submitted
Submitted on Thursday, August 23, 2018 - 10:25 am

==Committee Requested==
Committee: Public Works

==Requestor Information==
Name of Individual: Giovanni Puzzo

Name of Organization:

Contact Number:

Email Address:

Mailing Address:

Reason(s) for delegation request:
I was never notified, nor were my neighbors that they would be taking away our on street parking and installing bike lanes. We were never given a chance to have a say or provide any input. I have been told there was a letter sent out to the residents.

However, no one can tell us how this letter was distributed and to whom it was distributed.

I am asking the city to reconsider their decision to take away the on street parking on the west side of Bay Street north between Barton Street and Stuart. They removed the on street parking to put 2 sets of bike lanes and said the street is not wide enough to have the bike lanes and parking work together.

They removed all the parking without providing any designated parking. All the other street blocks along Bay Street have at least one lane of parking. My street is the only one that does not.

I was told that some of the residents will be getting their parking ramp put in for free and going to the committee of adjustments waived. Back in the 1990's I paid for these services to have one parking spot installed on the front of my property.

There are several Issues with maintenance work being done at my property. Also, I am not being able to stop out front and pick up or drop off passengers or deliveries.

Will you be requesting funds from the City? No

Will you be submitting a formal presentation? No

INFORMATION REPORT

TO:	Chair and Members General Issues Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Asset Management and Regulations Update (PW18085) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Gord McGuire (905) 546-2424, Extension 2382
SUBMITTED BY: **SIGNATURE:**	Gord McGuire Director, Engineering Services Public Works

Council Direction:

Not Applicable.

Information:

In June 2015, Bill 6, Infrastructure for Jobs and Prosperity Act ("Act"), was enacted by the Provincial Government. One of the objectives of this legislation is to have municipalities complete a long-term infrastructure plan and ensure that this plan is updated on a regular basis. The approval of Bill 6 was the result of significant effort by many individuals and groups in the province of Ontario on infrastructure asset management over many years.

The Provincial Government's Building Together: Guide for Municipal Asset Management Plans, released in June 2011, established a framework to guide future infrastructure investments to meet the Province's Municipal Infrastructure Investment Initiative. Expanding on work completed for the State of the Infrastructure Reports and asset management principles, staff presented and Council approved the Public Works Asset Management Plan (Report PW14035) for roads, bridges, water, wastewater and stormwater assets in April 2014.

Working together representatives from the provincial government, municipalities, related associations and industry experts developed the Act and related proposed infrastructure asset management regulations. City staff were part of the working group and provided input to the documents. At the General Issues Committee meeting on October 20, 2017, staff provided committee members with an update on Bill 6 and the proposed regulations.

The Provincial Government released their long-term infrastructure plan in November 2017. Building Better Lives: Ontario's Long-Term Infrastructure Plan ("LTIP") 2017

details the plan for investment in infrastructure and the requirements for asset management plans for Provincial assets to meet the requirements of the Act. This LTIP included reference to the proposed regulations for municipal assets.

On December 27, 2017, the Ministry of Infrastructure filed Ontario Regulation 588/17 - Asset Management Planning for Municipal Infrastructure under the Act. Regulation 588/17 went into force on January 1, 2018 and applies to all infrastructure assets directly owned by a municipality or consolidated on the municipality's financial statements. The Regulation is attached as Appendix "A" to Report PW18xxx.

Under the regulation, all Ontario municipalities are required to meet staged requirements around the management of their infrastructure assets. The following is a summary of the stages, timelines and requirements;

A. Strategic Asset Management Policy (by July 1, 2019)
   - Requires municipalities to outline commitments to best practices and continuous improvement

B. Asset Management Plan: Phase 1 (by July 1, 2021)
   - For core assets:
     - Inventory of assets
     - Current levels of service measured by standard metrics
     - Costs to maintain levels of service

C. Asset Management Plan: Phase 2 (by July 1, 2023)
   - Would build out the Phase 1 plan to include all municipal assets

D. Asset Management Plan: Phase 3 (by July 1, 2024)
   - Proposed levels of service
   - Lifecycle management strategy
   - Financial strategy

❖ Strategic Asset Management Policy

By July 1, 2019 all municipalities in Ontario will be required to develop and adopt a corporate wide Strategic Asset Management Policy. This Policy will need to establish executive and council's involvement as well as link to the City's financial and other strategic plans. The policy will need to be approved by Council and will apply to all city assets.

The policy will articulate the principles by which the organization intends to apply asset management to achieve its organizational objectives. Its intent is to set out the organization's commitments and expectations for decisions, activities and behaviour concerning asset management. Authorized by top management the policy will demonstrate commitment to asset management.

The Policy must address twelve components:

(1) The municipality's goals, policies, and plans that are supported by the asset management plan;

(2) The process by which the asset management plan is to be considered in the development of the budget or long-range financial plan;

(3) The municipality's approach to continuous improvement and adoption of appropriate practices regarding asset management planning.

(4) The principles to be followed in the municipality's asset management planning process. These principles must uphold the points outlined in section 3 of the Infrastructure for Jobs and Prosperity Act;

(5) The municipality's commitment to consider, as part of its asset management planning,

i. the actions that may be required to address the vulnerabilities that may be caused by climate change to the municipality's infrastructure assets, in respect of such matters as,

a. operations, such as increased maintenance schedules,

b. levels of service, and

c. lifecycle management,

ii. the anticipated costs that could arise from the vulnerabilities described in subparagraph i,

iii. adaptation opportunities that may be undertaken to manage the vulnerabilities described in subparagraph i,

iv. mitigation approaches to climate change, such as greenhouse gas emission reduction goals and targets, and

v. disaster planning and contingency funding.

(6) Alignment of the asset management plan with financial plans related to the municipality's water and wastewater assets;

(7) Alignment of the asset management plan with the Province's land-use planning framework, including the County's and municipality's official plans;

(8) Explanation of the capitalization thresholds used to determine which assets are to be included in the asset management plan and how the thresholds compare to those in the municipality's tangible capital asset policy;

(9) The municipality's commitment to coordinating planning on asset management for infrastructure that is jointly-owned (or inter-related) with other municipalities (e.g., County or neighbouring municipalities);

(10) Identification of the persons involved with the asset management planning process at the municipality, including the executive lead;

(11) Explanation of Council's involvement in asset management planning; and

(12) The municipality's commitment to provide opportunities for residents and other interested parties to provide input into the asset management planning process

❖ Phased Compliance Requirements

Phase 1 of compliance requires that by July 1, 2021 each municipality must prepare an asset management plan for all core Infrastructure consisting of roads, bridges, culverts and any assets used in the collection, conveyance, distribution, treatment or disposal of wastewater, water and storm water.

Phase 2 of compliance will require the asset management plan be completed for the remaining municipal infrastructure by July 1, 2023.

Elements of the plan must contain the following;

a. Plain language explanation of the current levels of service (LOS) provided by each category of infrastructure asset.

b. State of the Infrastructure Inventory.

c. Estimated annual lifecycle cost to sustain current Levels of Service - capital expenditures as well as any significant operating and energy costs, for the ten years following the year that the current levels of service are established.

The final phase 3 of compliance must be completed by July 1, 2024;

a. A plain language explanation of the future levels of service (LOS) being provided by each category of infrastructure asset.

b. Lifecycle management strategy to maintain the proposed levels of service and manage risk.

c. Lifecycle activities would be based on options examined by the municipality to reduce the overall lifecycle costs, including through green infrastructure and non-infrastructure solutions such as demand management and conservation measures.

d. Financial strategy - An Asset Management Plan (AMP) would include a financial strategy that contains items relating to expenditures, revenues and reserves for each year for the ten year period aligned with the proposed levels of service section of the asset management plan.

❖ Regulatory Overview

The Province has articulated that asset management planning is incredibly important to government and that smart infrastructure investment requires sound evidence based analysis and financial planning that ensures investment decisions.

The Province also recognizes that Ontario municipalities have made excellent progress in developing asset management plans to support long-term, stable infrastructure funding. Therefore, it is the intent of the Province, through this regulation to instil a culture of asset management through multi-disciplinary collaboration.

The new asset management regulation will require that municipalities dedicate significantly more time and resources to asset management. The regulation's multi-disciplinary requirements touch upon all departments and boards with explicit connections to assets managed by public works (roads, bridges, culverts, water, wastewater, stormwater, transit, fleet, facilities, waste management, parks, cemeteries, etc.), museums, housing, homes for the aged, child care, fire, paramedics, police, library, information technology and finance. Asset management planning for many of the City's assets is well on its way. However, it is the intent of staff to continue this work so as to comply with the various phases of this regulation. In this regard an Asset Management Working Group has been established with representation from the various Departments of the City. This Group will report to the City's Senior Leadership Team and will be tasked with compliance with this regulation.

The first outcome from this Working Group will be the development of the City's Strategic Asset Management Policy. It's anticipated that staff will seek Council endorsement of this policy in the first quarter of 2019 in order to comply with the regulatory prescribed timelines.

Appendices and Schedules Attached

Appendix A: Ontario Regulation 588/17

ONTARIO REGULATION 588/17

made under the

INFRASTRUCTURE FOR JOBS AND PROSPERITY ACT, 2015

Made: December 13, 2017

Filed: December 27, 2017

Published on e-Laws: December 27, 2017

Printed in *The Ontario Gazette*: January 13, 2018

ASSET MANAGEMENT PLANNING FOR MUNICIPAL INFRASTRUCTURE

CONTENTS

COMMENCEMENT

11. Commencement

INTERPRETATION AND APPLICATION

Definitions

1. (1) In this Regulation,

"asset category" means a category of municipal infrastructure assets that is,

(a) an aggregate of assets described in each of clauses (a) to (e) of the definition of core municipal infrastructure asset, or

(b) composed of any other aggregate of municipal infrastructure assets that provide the same type of service; ("catégorie de biens")

"core municipal infrastructure asset" means any municipal infrastructure asset that is a,

(a) water asset that relates to the collection, production, treatment, storage, supply or distribution of water,

(b) wastewater asset that relates to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater,

(c) stormwater management asset that relates to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater,

(d) road, or

(e) bridge or culvert; ("bien d'infrastructure municipale essentiel")

"ecological functions" has the same meaning as in Ontario Regulation 140/02 (Oak Ridges Moraine Conservation Plan) made under the *Oak Ridges Moraine Conservation Act, 2001*; ("fonctions écologiques")

"green infrastructure asset" means an infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs; ("bien d'infrastructure verte")

"hydrological functions" has the same meaning as in Ontario Regulation 140/02; ("fonctions hydrologiques")

"joint municipal water board" means a joint board established in accordance with a transfer order made under the *Municipal Water and Sewage Transfer Act, 1997*; ("conseil mixte de gestion municipale des eaux")

"lifecycle activities" means activities undertaken with respect to a municipal infrastructure asset over its service life, including constructing, maintaining, renewing, operating and decommissioning, and all engineering and design work associated with those activities; ("activités relatives au cycle de vie")

"municipal infrastructure asset" means an infrastructure asset, including a green infrastructure asset, directly owned by a municipality or included on the consolidated financial statements of a municipality, but does not include an infrastructure asset that is managed by a joint municipal water board; ("bien d'infrastructure municipale")

"municipality" has the same meaning as in the *Municipal Act, 2001*; ("municipalité")

"operating costs" means the aggregate of costs, including energy costs, of operating a municipal infrastructure asset over its service life; ("frais d'exploitation")

"service life" means the total period during which a municipal infrastructure asset is in use or is available to be used; ("durée de vie")

"significant operating costs" means, where the operating costs with respect to all municipal infrastructure assets within an asset category are in excess of a threshold amount set by the municipality, the total amount of those operating costs. ("frais d'exploitation importants")

(2) In Tables 1 and 2,

"connection-days" means the number of properties connected to a municipal system that are affected by a service issue, multiplied by the number of days on which those properties are affected by the service issue. ("jours-branchements")

(3) In Table 4,

"arterial roads" means Class 1 and Class 2 highways as determined under the Table to section 1 of Ontario Regulation 239/02 (Minimum Maintenance Standards for Municipal Highways) made under the *Municipal Act, 2001*; ("artères")

"collector roads" means Class 3 and Class 4 highways as determined under the Table to section 1 of Ontario Regulation 239/02; ("routes collectrices")

"lane-kilometre" means a kilometre-long segment of roadway that is a single lane in width; ("kilomètre de voie")

"local roads" means Class 5 and Class 6 highways as determined under the Table to section 1 of Ontario Regulation 239/02. ("routes locales")

(4) In Table 5,

"Ontario Structure Inspection Manual" means the Ontario Structure Inspection Manual (OSIM), published by the Ministry of Transportation and dated October 2000 (revised November 2003 and April 2008) and available on a Government of Ontario website; ("manuel d'inspection des structures de l'Ontario")

"structural culvert" has the meaning set out for "culvert (structural)" in the Ontario Structure Inspection Manual. ("ponceau structurel")

Application

2. For the purposes of section 6 of the Act, every municipality is prescribed as a broader public sector entity to which that section applies.

STRATEGIC ASSET MANAGEMENT POLICIES

Strategic asset management policy

3. (1) Every municipality shall prepare a strategic asset management policy that includes the following:

1. Any of the municipality's goals, policies or plans that are supported by its asset management plan.
2. The process by which the asset management plan is to be considered in the development of the municipality's budget or of any long-term financial plans of the municipality that take into account municipal infrastructure assets.
3. The municipality's approach to continuous improvement and adoption of appropriate practices regarding asset management planning.
4. The principles to be followed by the municipality in its asset management planning, which must include the principles set out in section 3 of the Act.
5. The municipality's commitment to consider, as part of its asset management planning,

i. the actions that may be required to address the vulnerabilities that may be caused by climate change to the municipality's infrastructure assets, in respect of such matters as,

   A. operations, such as increased maintenance schedules,

   B. levels of service, and

   C. lifecycle management,

ii. the anticipated costs that could arise from the vulnerabilities described in subparagraph i,

iii. adaptation opportunities that may be undertaken to manage the vulnerabilities described in subparagraph i,

iv. mitigation approaches to climate change, such as greenhouse gas emission reduction goals and targets, and

v. disaster planning and contingency funding.

6. A process to ensure that the municipality's asset management planning is aligned with any of the following financial plans:

   i. Financial plans related to the municipality's water assets including any financial plans prepared under the *Safe Drinking Water Act, 2002*.

   ii. Financial plans related to the municipality's wastewater assets.

7. A process to ensure that the municipality's asset management planning is aligned with Ontario's land-use planning framework, including any relevant policy statements issued under subsection 3 (1) of the *Planning Act*, any provincial plans as defined in the *Planning Act* and the municipality's official plan.

8. An explanation of the capitalization thresholds used to determine which assets are to be included in the municipality's asset management plan and how the thresholds compare to those in the municipality's tangible capital asset policy, if it has one.

9. The municipality's commitment to coordinate planning for asset management, where municipal infrastructure assets connect or are interrelated with those of its upper-tier municipality, neighbouring municipalities or jointly-owned municipal bodies.

10. The persons responsible for the municipality's asset management planning, including the executive lead.

11. An explanation of the municipal council's involvement in the municipality's asset management planning.

12. The municipality's commitment to provide opportunities for municipal residents and other interested parties to provide input into the municipality's asset management planning.

(2) For the purposes of this section,

"capitalization threshold" is the value of a municipal infrastructure asset at or above which a municipality will capitalize the value of it and below which it will expense the value of it. ("seuil de capitalisation")

Update of asset management policy

4. Every municipality shall prepare its first strategic asset management policy by July 1, 2019 and shall review and, if necessary, update it at least every five years.

ASSET MANAGEMENT PLANS

Asset management plans, current levels of service

5. (1) Every municipality shall prepare an asset management plan in respect of its core municipal infrastructure assets by July 1, 2021, and in respect of all of its other municipal infrastructure assets by July 1, 2023.

(2) A municipality's asset management plan must include the following:

1. For each asset category, the current levels of service being provided, determined in accordance with the following qualitative descriptions and technical metrics and based on data from at most the two calendar years prior to the year in which all information required under this section is included in the asset management plan:

    i. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 1, 2, 3, 4 or 5, as the case may be.

ii. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.

2. The current performance of each asset category, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency, and based on data from at most two calendar years prior to the year in which all information required under this section is included in the asset management plan.

3. For each asset category,

   i. a summary of the assets in the category,

   ii. the replacement cost of the assets in the category,

   iii. the average age of the assets in the category, determined by assessing the average age of the components of the assets,

   iv. the information available on the condition of the assets in the category, and

   v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.

4. For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service as described in paragraph 1 for each of the 10 years following the year for which the current levels of service under paragraph 1 are determined and the costs of providing those activities based on an assessment of the following:

   i. The full lifecycle of the assets.

   ii. The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service.

   iii. The risks associated with the options referred to in subparagraph ii.

   iv. The lifecycle activities referred to in subparagraph ii that can be undertaken for the lowest cost to maintain the current levels of service.

5. For municipalities with a population of less than 25,000, as reported by Statistics Canada in the most recent official census, the following:

    i. A description of assumptions regarding future changes in population or economic activity.

    ii. How the assumptions referred to in subparagraph i relate to the information required by paragraph 4.

6. For municipalities with a population of 25,000 or more, as reported by Statistics Canada in the most recent official census, the following:

    i. With respect to municipalities in the Greater Golden Horseshoe growth plan area, if the population and employment forecasts for the municipality are set out in Schedule 3 or 7 to the 2017 Growth Plan, those forecasts.

    ii. With respect to lower-tier municipalities in the Greater Golden Horseshoe growth plan area, if the population and employment forecasts for the municipality are not set out in Schedule 7 to the 2017 Growth Plan, the portion of the forecasts allocated to the lower-tier municipality in the official plan of the upper-tier municipality of which it is a part.

    iii. With respect to upper-tier municipalities or single-tier municipalities outside of the Greater Golden Horseshoe growth plan area, the population and employment forecasts for the municipality that are set out in its official plan.

    iv. With respect to lower-tier municipalities outside of the Greater Golden Horseshoe growth plan area, the population and employment forecasts for the lower-tier municipality that are set out in the official plan of the upper-tier municipality of which it is a part.

    v. If, with respect to any municipality referred to in subparagraph iii or iv, the population and employment forecasts for the municipality cannot be determined as set out in those subparagraphs, a description of assumptions regarding future changes in population or economic activity.

    vi. For each of the 10 years following the year for which the current levels of service under paragraph 1 are determined, the estimated capital expenditures

and significant operating costs related to the lifecycle activities required to maintain the current levels of service in order to accommodate projected increases in demand caused by growth, including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets.

(3) Every asset management plan must indicate how all background information and reports upon which the information required by paragraph 3 of subsection (2) is based will be made available to the public.

(4) In this section,

"2017 Growth Plan" means the Growth Plan for the Greater Golden Horseshoe, 2017 that was approved under subsection 7 (6) of the *Places to Grow Act, 2005* on May 16, 2017 and came into effect on July 1, 2017; ("Plan de croissance de 2017")

"Greater Golden Horseshoe growth plan area" means the area designated by section 2 of Ontario Regulation 416/05 (Growth Plan Areas) made under the *Places to Grow Act, 2005*. ("zone de croissance planifiée de la région élargie du Golden Horseshoe")

Asset management plans, proposed levels of service

6. (1) Subject to subsection (2), by July 1, 2024, every asset management plan prepared under section 5 must include the following additional information:

1. For each asset category, the levels of service that the municipality proposes to provide for each of the 10 years following the year in which all information required under section 5 and this section is included in the asset management plan, determined in accordance with the following qualitative descriptions and technical metrics:

    i. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 1, 2, 3, 4 or 5, as the case may be.

    ii. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.

2. An explanation of why the proposed levels of service under paragraph 1 are appropriate for the municipality, based on an assessment of the following:

    i. The options for the proposed levels of service and the risks associated with those options to the long term sustainability of the municipality.

    ii. How the proposed levels of service differ from the current levels of service set out under paragraph 1 of subsection 5 (2).

    iii. Whether the proposed levels of service are achievable.

    iv. The municipality's ability to afford the proposed levels of service.

3. The proposed performance of each asset category for each year of the 10-year period referred to in paragraph 1, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency.

4. A lifecycle management and financial strategy that sets out the following information with respect to the assets in each asset category for the 10-year period referred to in paragraph 1:

    i. An identification of the lifecycle activities that would need to be undertaken to provide the proposed levels of service described in paragraph 1, based on an assessment of the following:

        A. The full lifecycle of the assets.

        B. The options for which lifecycle activities could potentially be undertaken to achieve the proposed levels of service.

        C. The risks associated with the options referred to in sub-subparagraph B.

        D. The lifecycle activities referred to in sub-subparagraph B that can be undertaken for the lowest cost to achieve the proposed levels of service.

    ii. An estimate of the annual costs for each of the 10 years of undertaking the lifecycle activities identified in subparagraph i, separated into capital expenditures and significant operating costs.

iii. An identification of the annual funding projected to be available to undertake lifecycle activities and an explanation of the options examined by the municipality to maximize the funding projected to be available.

iv. If, based on the funding projected to be available, the municipality identifies a funding shortfall for the lifecycle activities identified in subparagraph i,

A. an identification of the lifecycle activities, whether set out in subparagraph i or otherwise, that the municipality will undertake, and

B. if applicable, an explanation of how the municipality will manage the risks associated with not undertaking any of the lifecycle activities identified in subparagraph i.

5. For municipalities with a population of less than 25,000, as reported by Statistics Canada in the most recent official census, a discussion of how the assumptions regarding future changes in population and economic activity, set out in subparagraph 5 i of subsection 5 (2), informed the preparation of the lifecycle management and financial strategy referred to in paragraph 4 of this subsection.

6. For municipalities with a population of 25,000 or more, as reported by Statistics Canada in the most recent official census,

i. the estimated capital expenditures and significant operating costs to achieve the proposed levels of service as described in paragraph 1 in order to accommodate projected increases in demand caused by population and employment growth, as set out in the forecasts or assumptions referred to in paragraph 6 of subsection 5 (2), including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets,

ii. the funding projected to be available, by source, as a result of increased population and economic activity, and

iii. an overview of the risks associated with implementation of the asset management plan and any actions that would be proposed in response to those risks.

7. An explanation of any other key assumptions underlying the plan that have not previously been explained.

(2) With respect to an asset management plan prepared under section 5 on or before July 1, 2021, if the additional information required under this section is not included before July 1, 2023, the municipality shall, before including the additional information, update the current levels of service set out under paragraph 1 of subsection 5 (2) and the current performance measures set out under paragraph 2 of subsection 5 (2) based on data from the two most recent calendar years.

Update of asset management plans

7. (1) Every municipality shall review and update its asset management plan at least five years after the year in which the plan is completed under section 6 and at least every five years thereafter.

(2) The updated asset management plan must comply with the requirements set out under paragraphs 1, 2 and 3 and subparagraphs 5 i and 6 i, ii, iii, iv and v of subsection 5 (2), subsection 5 (3) and paragraphs 1 to 7 of subsection 6 (1).

Endorsement and approval required

8. Every asset management plan prepared under section 5 or 6, or updated under section 7, must be,

(a) endorsed by the executive lead of the municipality; and

(b) approved by a resolution passed by the municipal council.

Annual review of asset management planning progress

9. (1) Every municipal council shall conduct an annual review of its asset management progress on or before July 1 in each year, starting the year after the municipality's asset management plan is completed under section 6.

(2) The annual review must address,

(a) the municipality's progress in implementing its asset management plan;

(b) any factors impeding the municipality's ability to implement its asset management plan; and

(c) a strategy to address the factors described in clause (b).

Public availability

10. Every municipality shall post its current strategic asset management policy and asset management plan on a website that is available to the public, and shall provide a copy of the policy and plan to any person who requests it.

TABLE 1

WATER ASSETS

Column 1 Service attribute	Column 2 Community levels of service (qualitative descriptions)	Column 3 Technical levels of service (technical metrics)
Scope	1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system. 2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	1. Percentage of properties connected to the municipal water system. 2. Percentage of properties where fire flow is available.
Reliability	Description of boil water advisories and service interruptions.	1. The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system. 2. The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.

TABLE 2

WASTEWATER ASSETS

Column 1 Service attribute	Column 2 Community levels of service (qualitative descriptions)	Column 3 Technical levels of service (technical metrics)
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system.	Percentage of properties connected to the municipal wastewater system.
Reliability	1. Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes. 2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches. 3. Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes. 4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3. 5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.	1. The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system. 2. The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system. 3. The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.

TABLE 3

STORMWATER MANAGEMENT ASSETS

Column 1 Service attribute	Column 2 Community levels of service (qualitative descriptions)	Column 3 Technical levels of service (technical metrics)
Scope	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system.	1. Percentage of properties in municipality resilient to a 100-year storm. 2. Percentage of the municipal stormwater management system resilient to a 5-year storm.

TABLE 4

ROADS

Column 1 Service attribute	Column 2 Community levels of service (qualitative descriptions)	Column 3 Technical levels of service (technical metrics)
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.
Quality	Description or images that illustrate the different levels of road class pavement condition.	1. For paved roads in the municipality, the average pavement condition index value. 2. For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).

TABLE 5

BRIDGES AND CULVERTS

Column 1 Service attribute	Column 2 Community levels of service (qualitative descriptions)	Column 3 Technical levels of service (technical metrics)
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Percentage of bridges in the municipality with loading or dimensional restrictions.
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges. 2. Description or images of the condition of culverts and how this would affect use of the culverts.	1. For bridges in the municipality, the average bridge condition index value. 2. For structural culverts in the municipality, the average bridge condition index value.

COMMENCEMENT

Commencement

11. This Regulation comes into force on the later of January 1, 2018 and the day it is filed.

Martin White, Extension 4345
PW18001e

INTERSECTION CONTROL LIST
Public Works Committee – September 17, 2018

PUBLIC WORKS DEPARTMENT
Roads and Traffic
Traffic Operations & Engineering Section

RECOMMENDATION

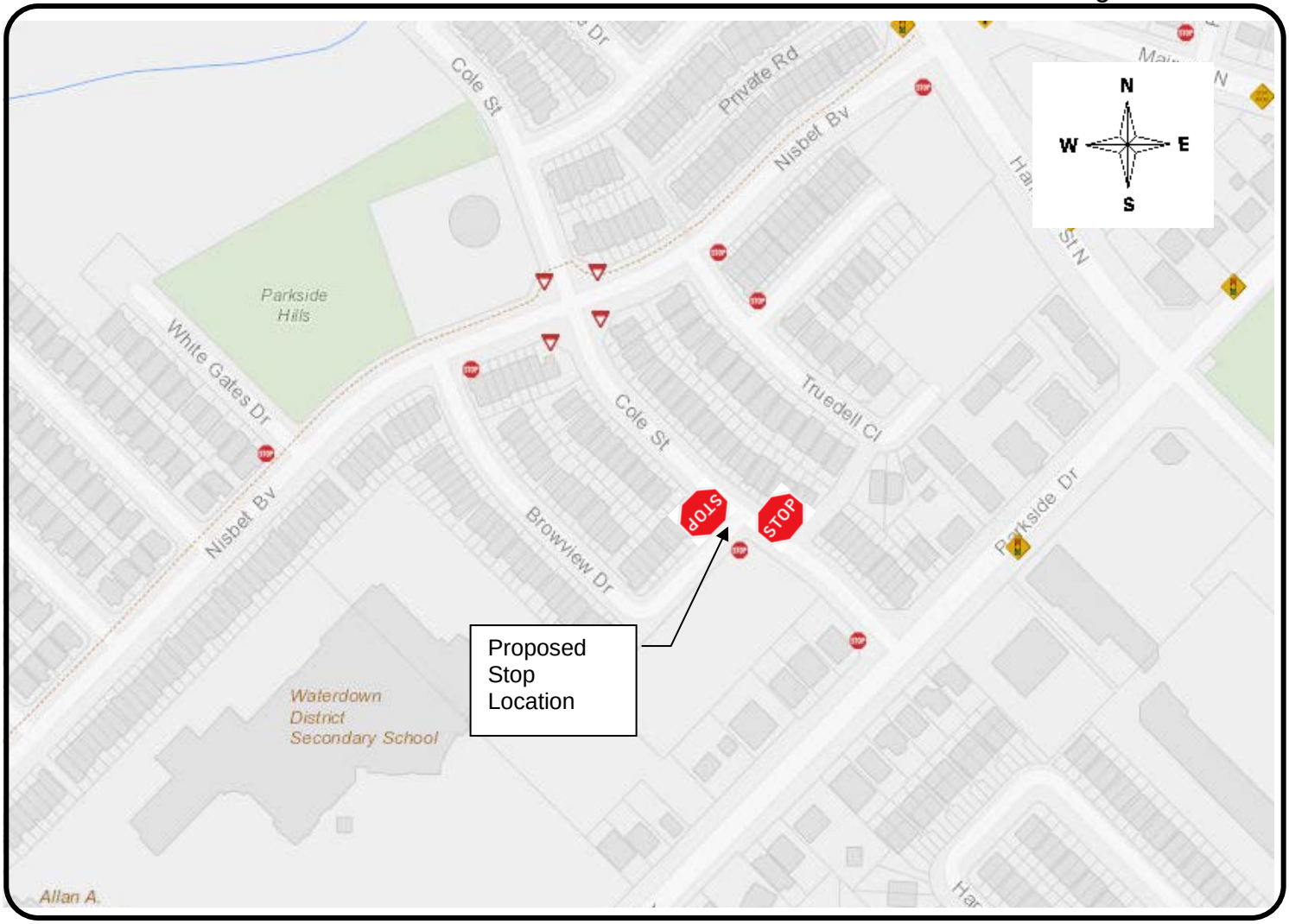
That the appropriate By-law be presented to Council to provide traffic control as follows:

	Intersection		Stop Control Direction		Class	Comments / Petition	Ward
	Street 1	Street 2	Existing	Requested			
Section "C" Flamborough							
(a)	Cole Street	Browview Drive	EB	All	A	Converting to allway stop – Clr Approved	15
(b)	Chudleigh Street	Culotta Drive (West Leg)	NB	All	A	Converting to allway stop – Clr Approved	15
(c)	Chudleigh Street	Culotta Drive (East Leg)	All	All	A	Housekeeping – Adding to By-law	15
(d)	Riley Street	Chudleigh Street	WB	All	B	Converting to allway stop – Clr Approved	15
(e)	4th Concession West (Westerly Intersection)	Sheffield Road	EB	All	D	Converting to allway stop – Clr Approved	14
(f)	4th Concession West (Easterly Intersection)	Sheffield Road	WB	All	D	Converting to allway stop – Clr Approved	14
Section "E" Hamilton							
(g)	West 4th Street	Richwill Road	NB/SB Yield	NB/SB	A	Housekeeping – Converting yield sign to stop sign	8
(h)	Golfwood Drive	Atkins Drive	EB	All	A	Converting to allway stop – Clr Approved	8
(i)	Roxborough Avenue	Frederick Avenue	SB	All	A	Converting to allway stop – Clr Approved	4
(j)	Hunter Street	East Avenue	NB/SB	All	A	Converting to allway stop – Clr Approved	2

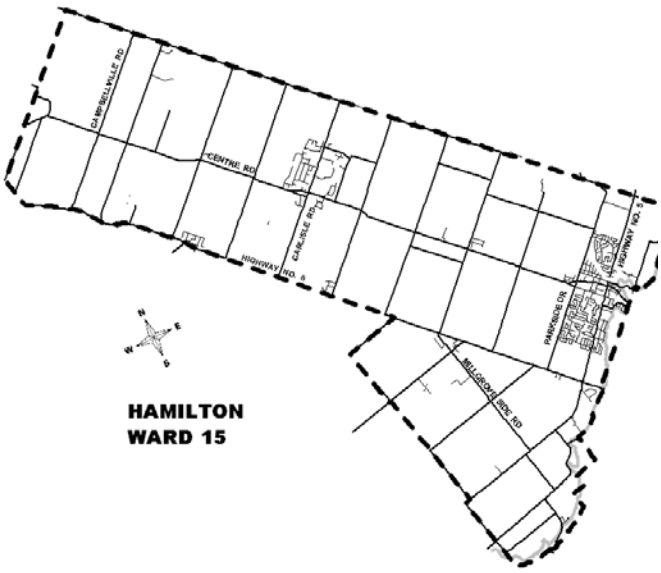
Martin White, Extension 4345
PW18001e

Intersection			Stop Control Direction		Class	Comments / Petition	Ward
	Street 1	Street 2	Existing	Requested			
(k)	Strachan Street	Catharine Street	SB	All	A	Converting to allway stop – Clr Approved	2
(l)	McElroy Road	Howard Avenue	EB/WB	ALL	A	Converting to allway stop – Clr Approved	7
(m)	McElroy Road	Clarendon Avenue	EB/WB	ALL	A	Converting to allway stop – Clr Approved	7
(n)	Dragoon Drive	Fusilier Drive	EB/WB	ALL	A	Converting to allway stop – Clr Approved	7
(o)	Osgoode Court	Presidio Drive	None	SB	A	Housekeeping – no control Clr Approved	7
Section "F" Stoney Creek							
(p)	Hewitson Road	Dupont Street	None	ALL	A	Converting to allway stop – Clr Approved	10
(q)	Margaret Avenue	Guernsey Drive	EB/WB	ALL	A	Converting to allway stop – Clr Approved	10

Legend
No Control Existing (New Subdivision) - **NC**
Intersection Class: **A** - Local/Local **B** - Local/Collector **C** - Collector/Collector **D** – Arterial/Collector



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Cole Street at Browview Drive

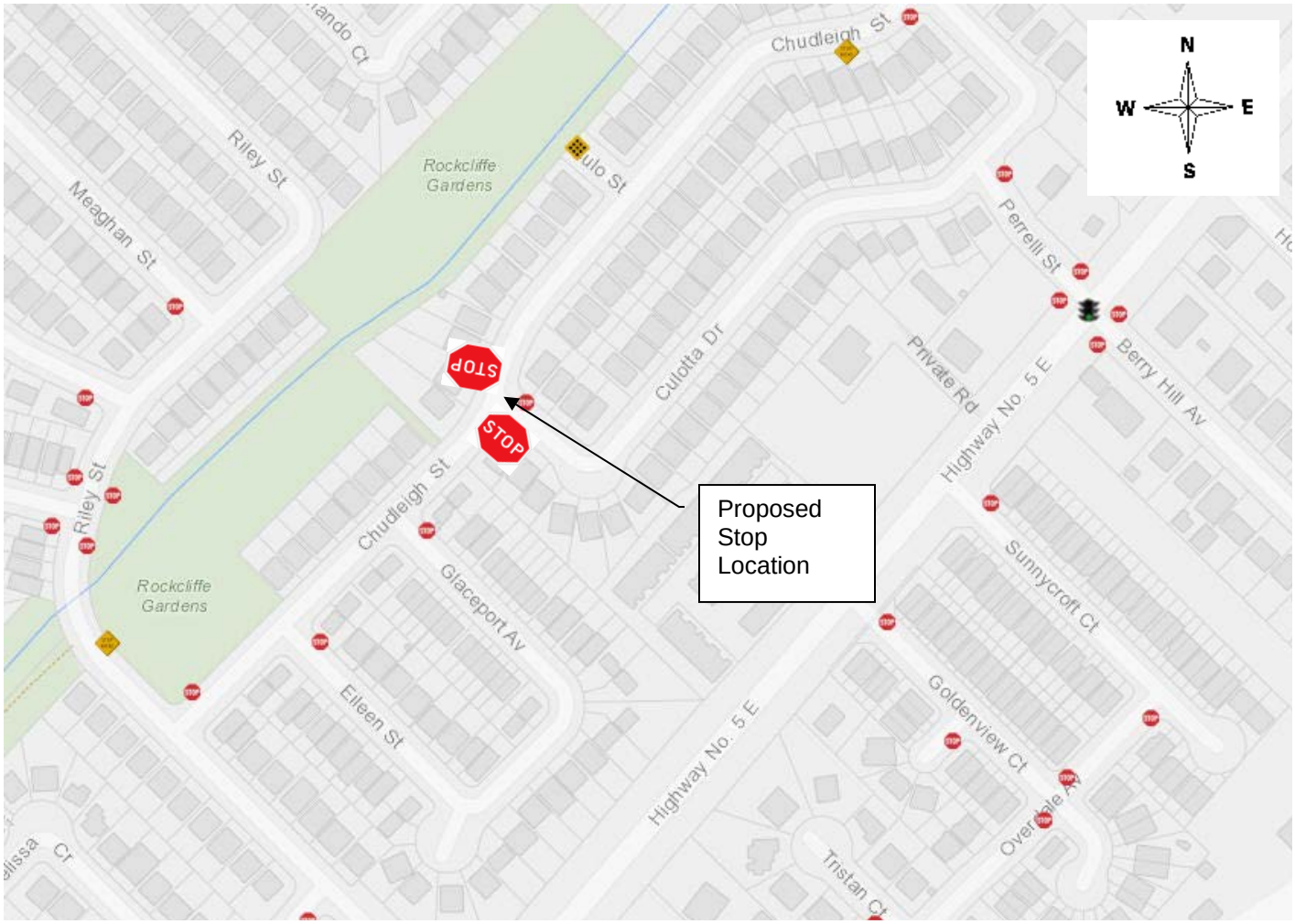
Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

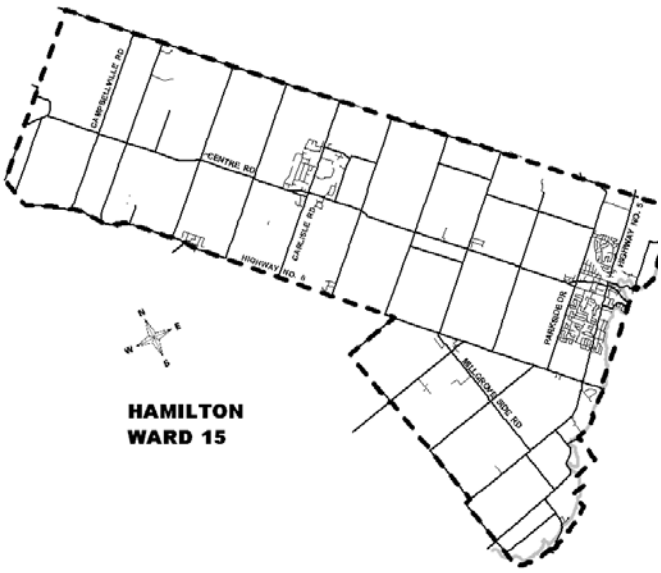
EXISTING STOP

PROPOSED STOP

SCALE	DATE
NOT TO SCALE	**September 17, 2018**



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Chudleigh Street at Culotta Drive (West Leg)

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

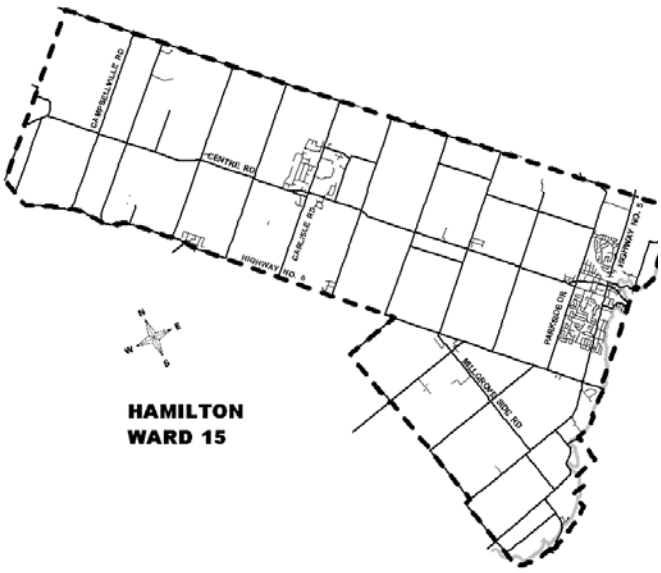
EXISTING STOP

PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Riley Street at Chudleigh Street

Roads and Traffic
PUBLIC WORKS DEPARTMENT

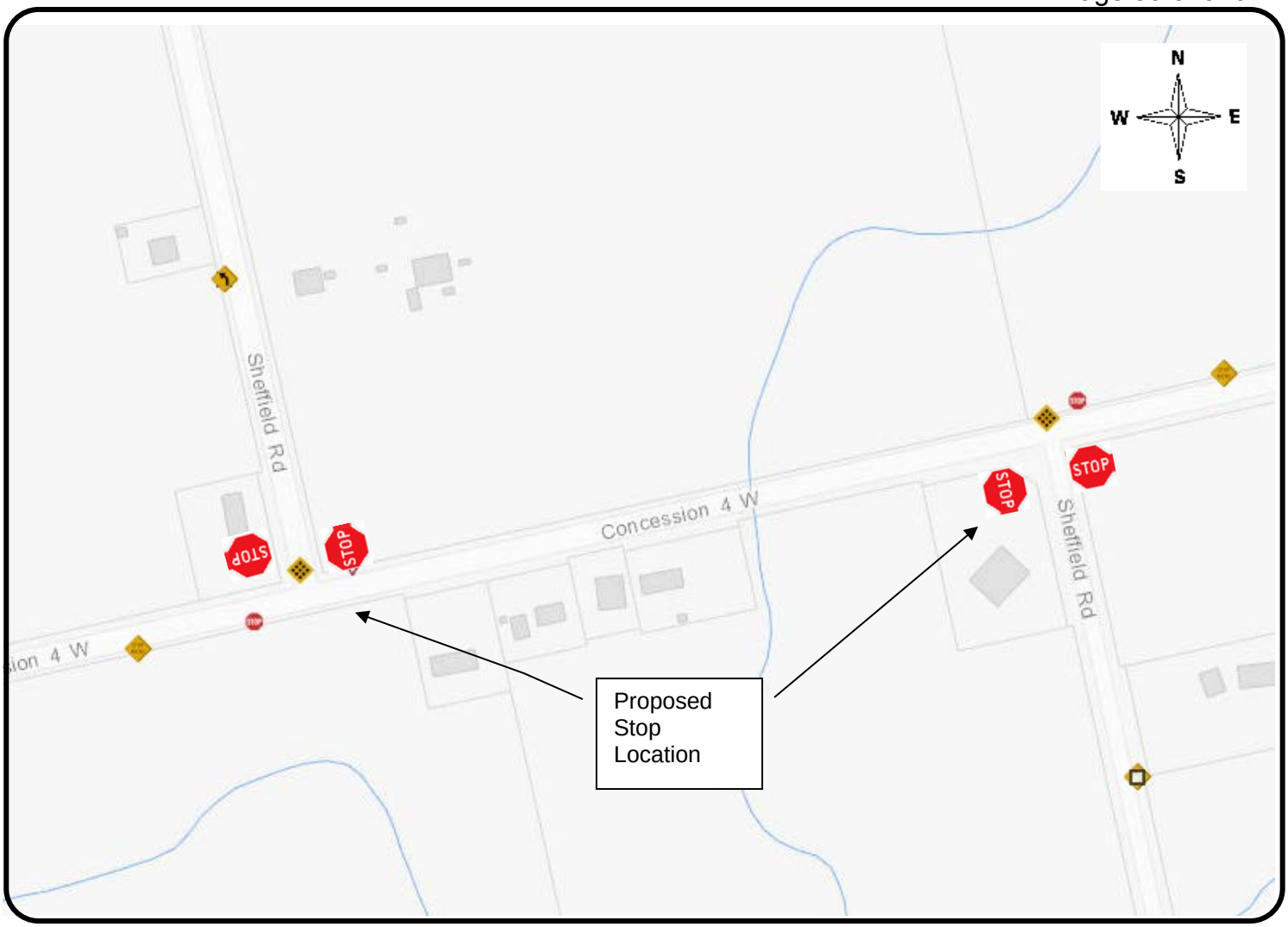
LEGEND

EXISTING STOP

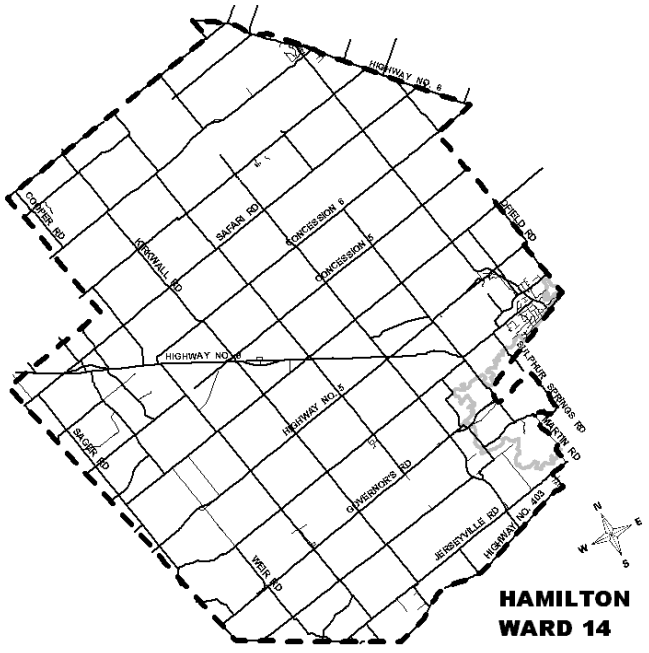
PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

4th Concession West at Sheffield Road (Westerly Intersection)
4th Concession West at Sheffield Road (Easterly Intersection)

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

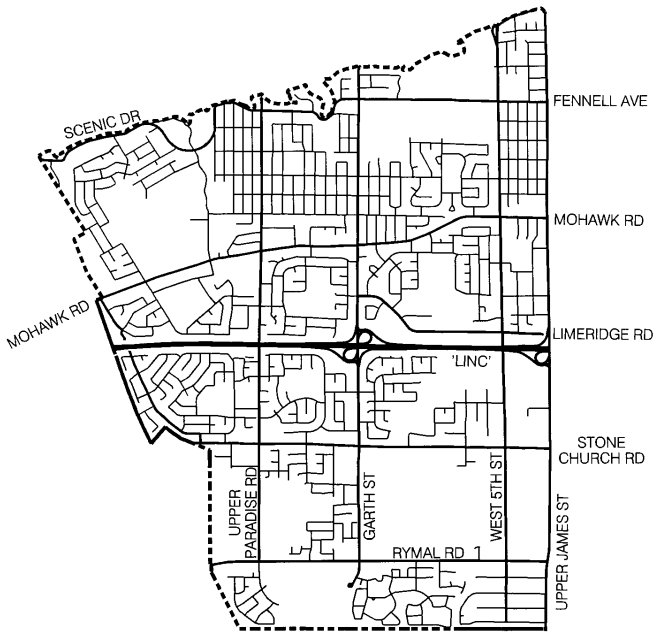
EXISTING STOP

STOP PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17th, 2018

KEY MAP



HAMILTON
WARD 8

LOCATION PLAN

PROPOSED STOP CONTROL:

West 4th Street at Richwill Road

Roads and Traffic
PUBLIC WORKS DEPARTMENT

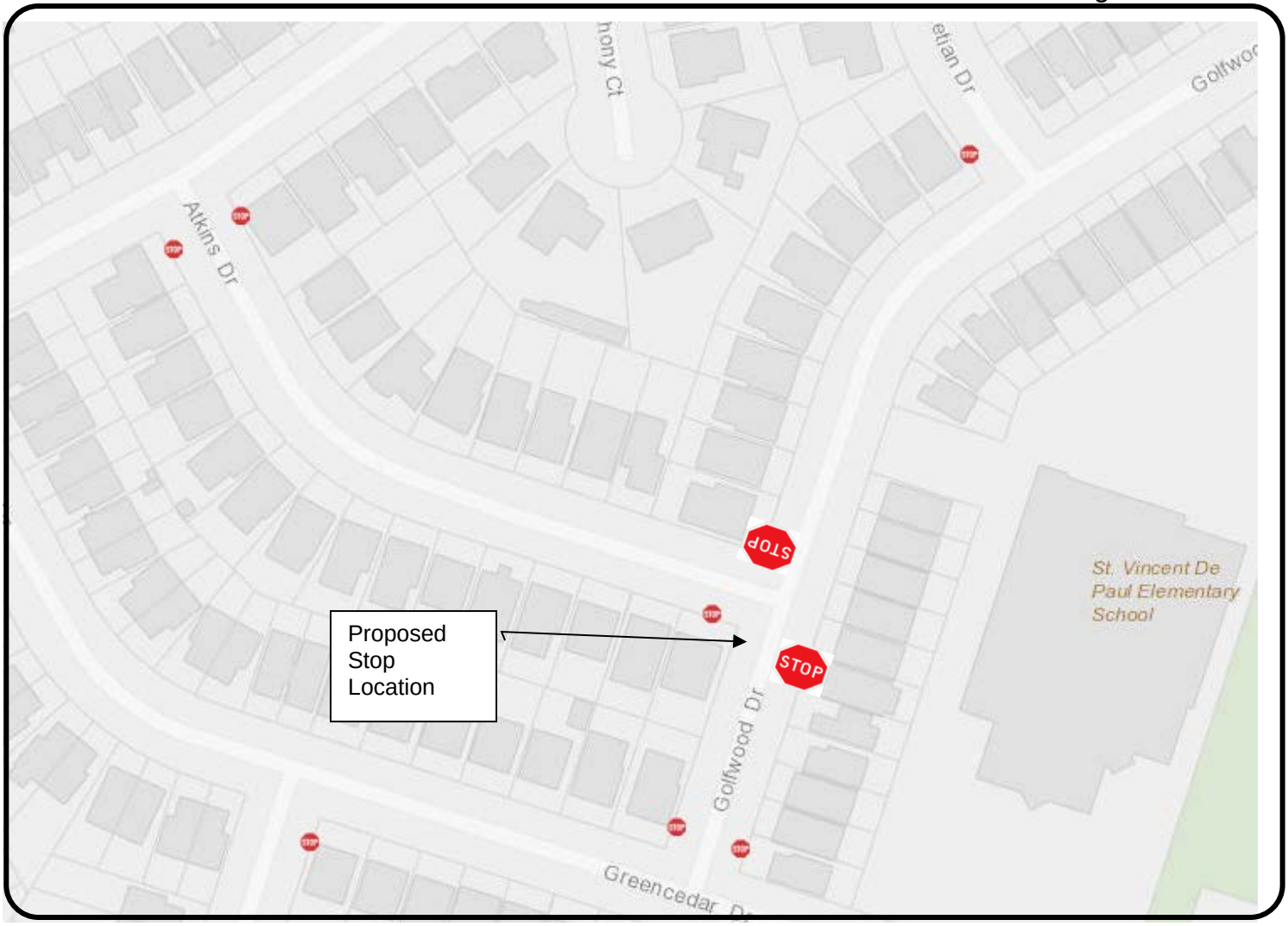
LEGEND

EXISTING STOP

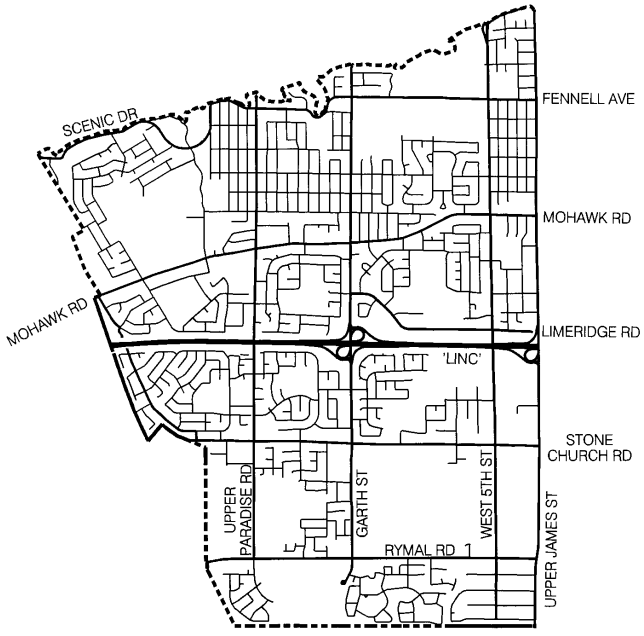
STOP PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Golfwood Dr and Atkins Dr

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

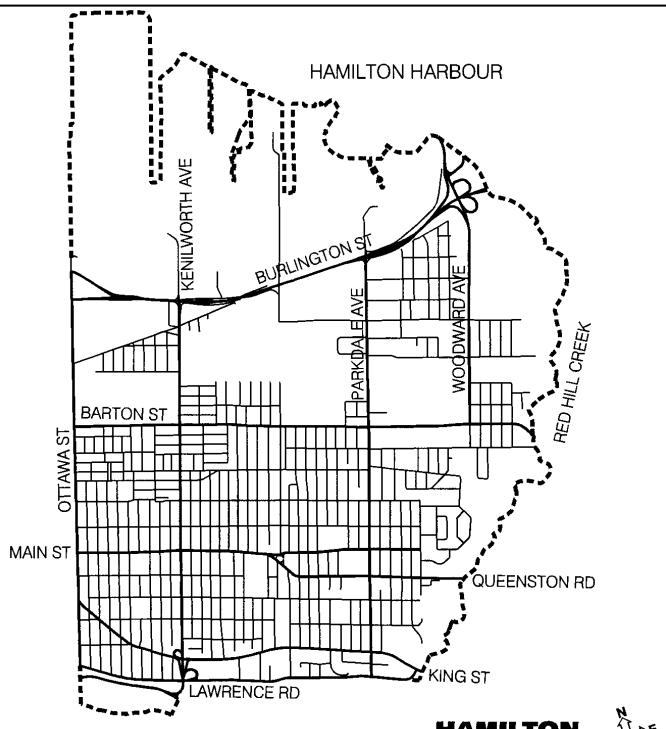
EXISTING STOP

STOP PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Frederick Avenue at Roxborough Avenue

Roads and Traffic
PUBLIC WORKS DEPARTMENT

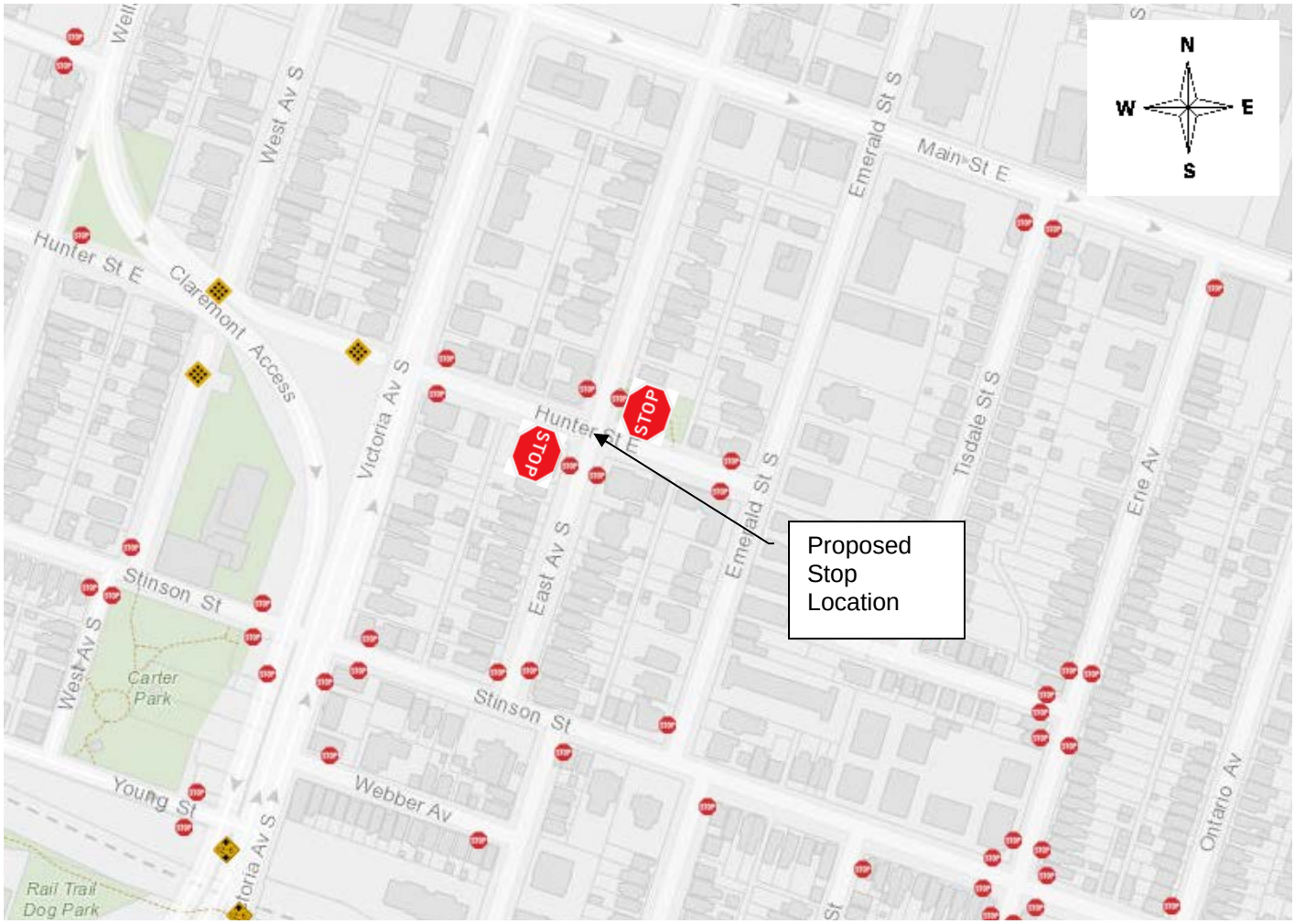
LEGEND

EXISTING STOP

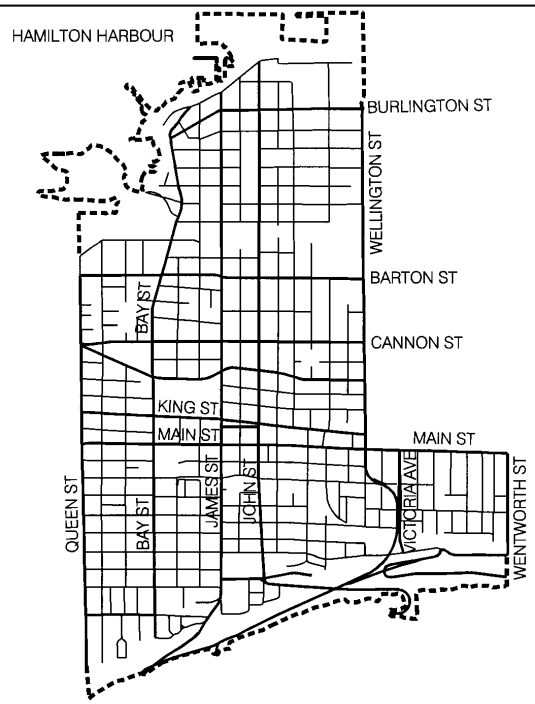
STOP PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Hunter Street at East Avenue

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

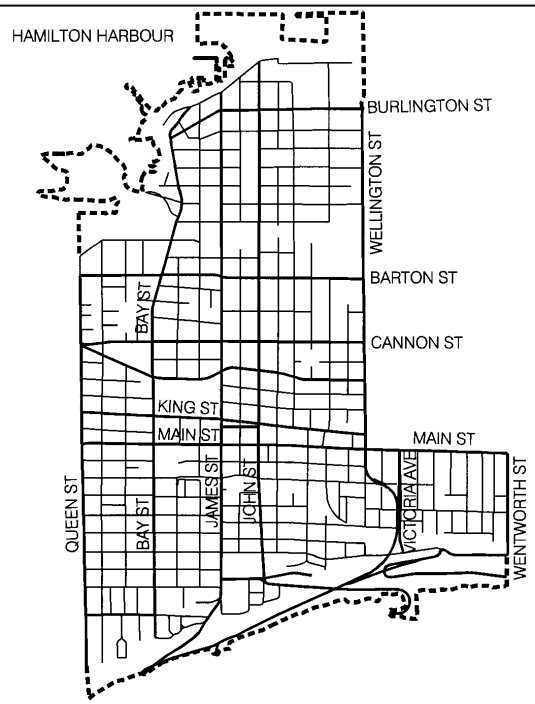
EXISTING STOP

STOP PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Strachan Street at Catharine Street

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

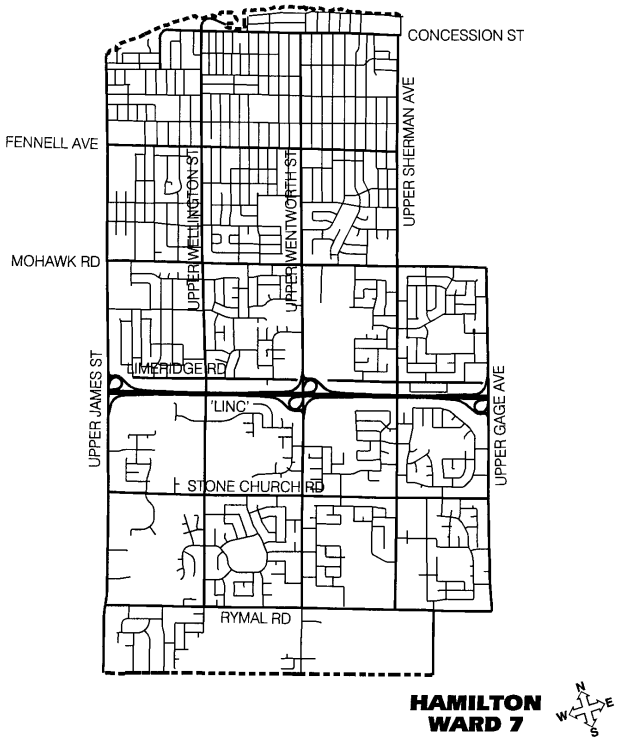
EXISTING STOP

STOP PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

McElroy Road at Howard Avenue
McElroy Road at Clarendon Avenue

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

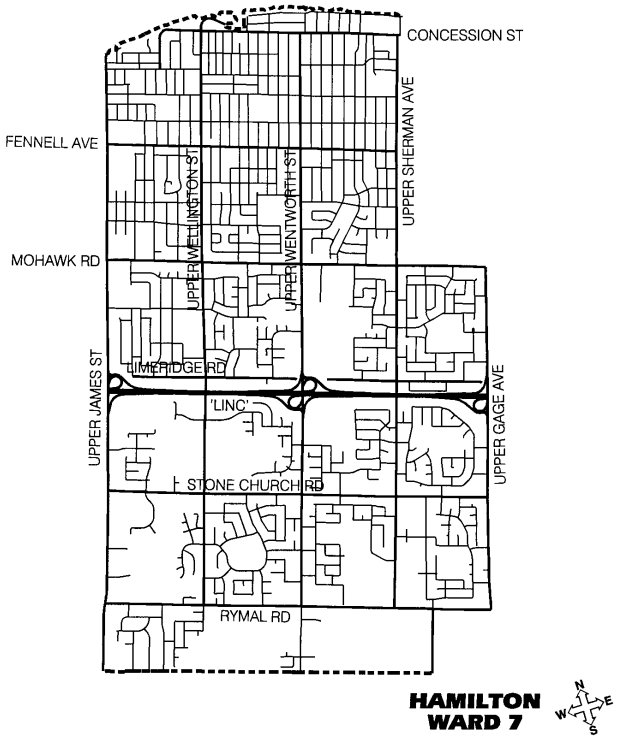
EXISTING STOP

PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Dragoon Drive at Fusilier Drive

Roads and Traffic
PUBLIC WORKS DEPARTMENT

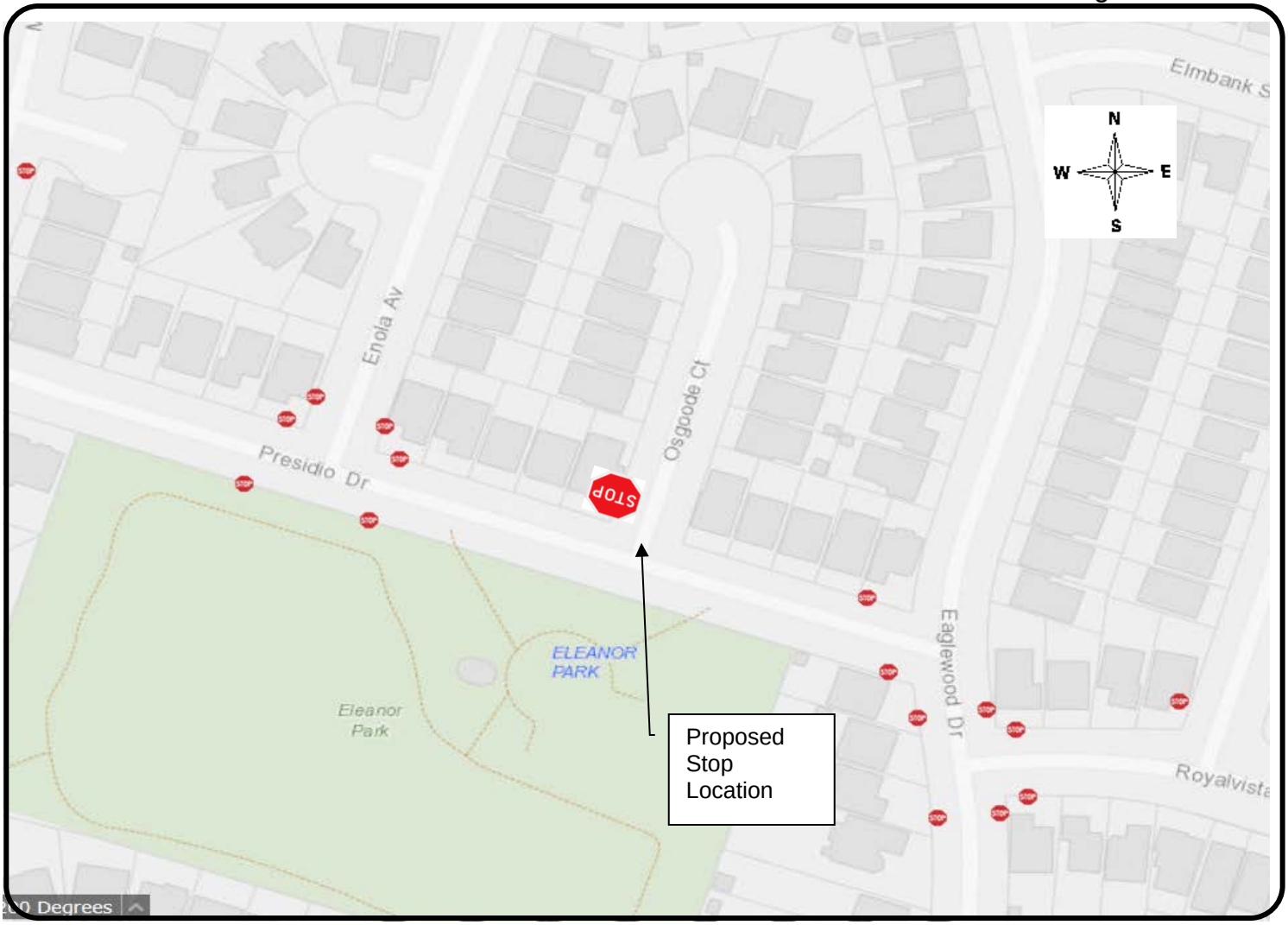
LEGEND

EXISTING STOP

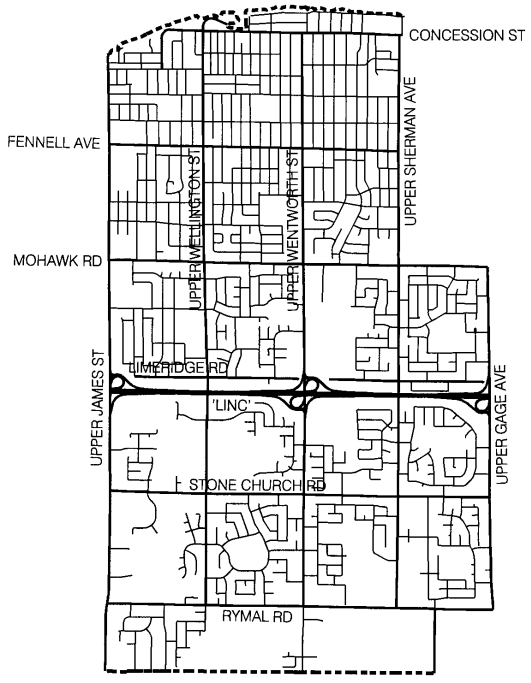
PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Osgoode Court at Presidio Drive

Roads and Traffic
PUBLIC WORKS DEPARTMENT

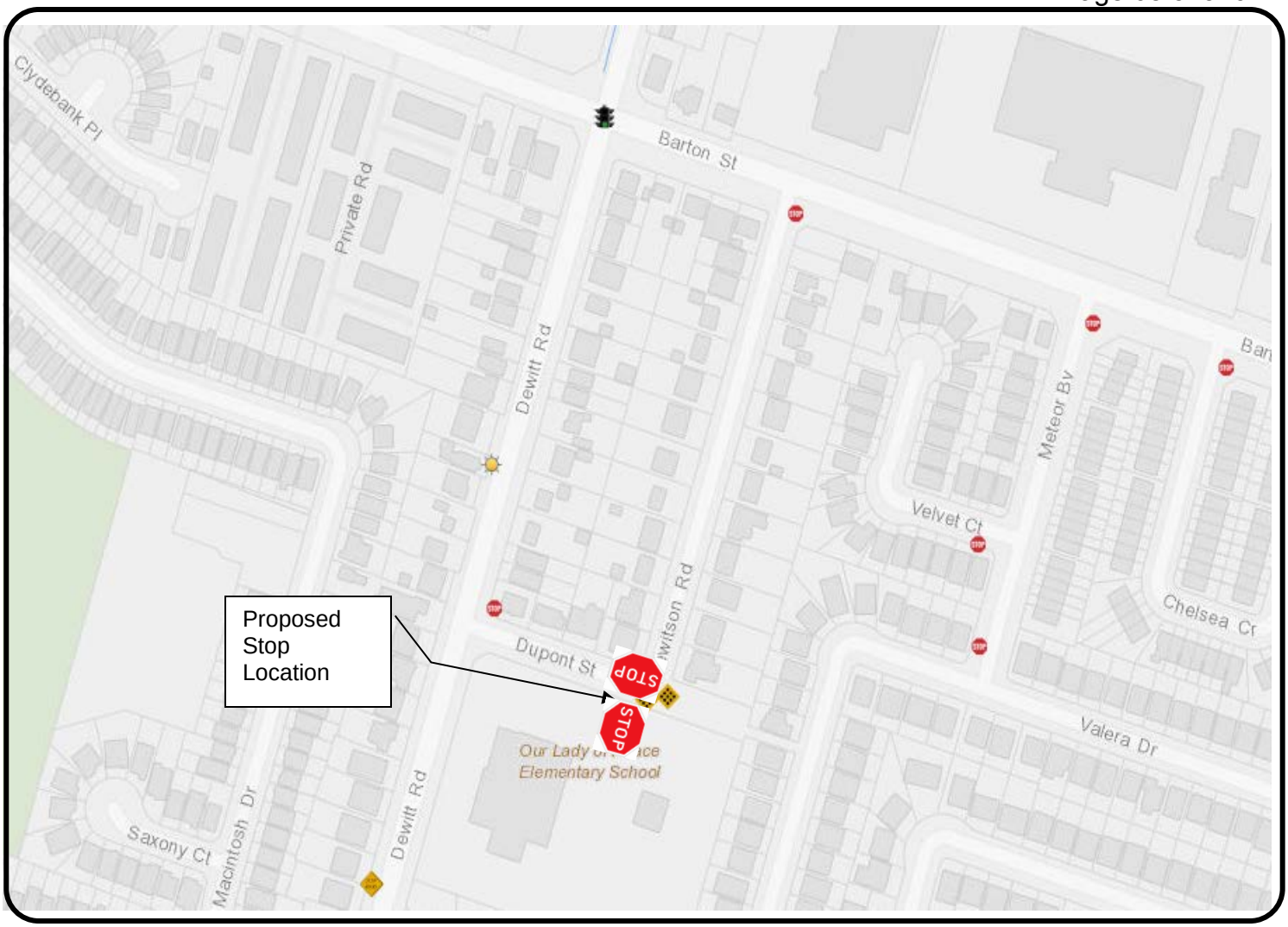
LEGEND

EXISTING STOP

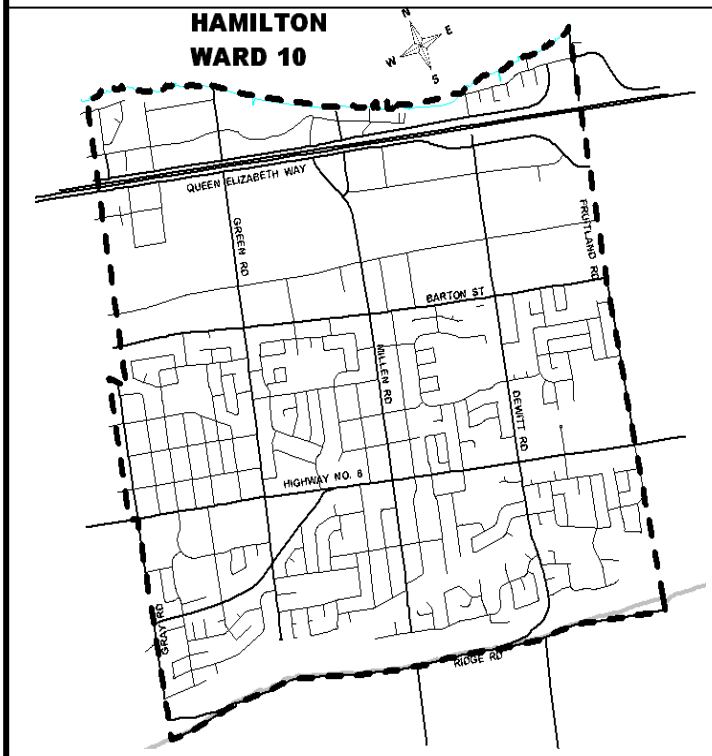
PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018



KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Hewitson Road at Dupont Street

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

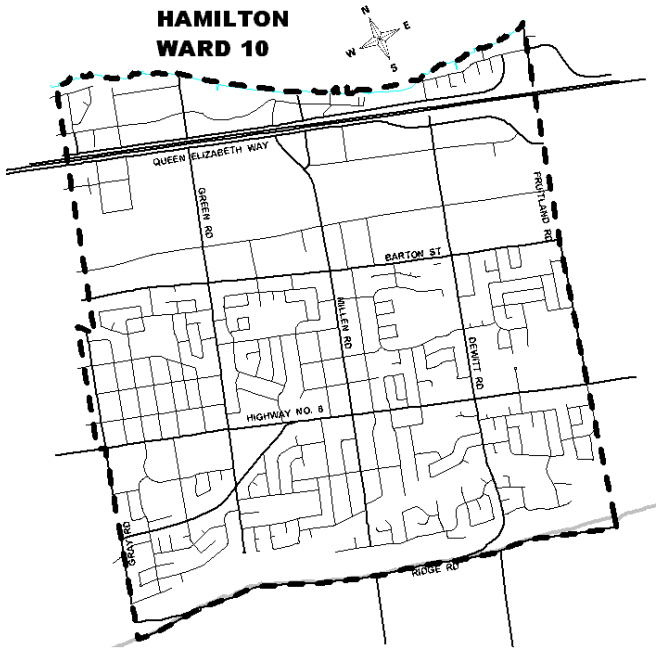
EXISTING STOP

PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

KEY MAP



LOCATION PLAN

PROPOSED STOP CONTROL:

Margaret Avenue at Guernsey Drive

Roads and Traffic
PUBLIC WORKS DEPARTMENT

LEGEND

EXISTING STOP

PROPOSED STOP

SCALE
NOT TO SCALE

DATE
September 17, 2018

Authority: Name of Committee
Report:
Date:
Wards: 2, 4, 7, 8, 10, 14, 15

Bill No.

CITY OF HAMILTON

BY-LAW NO. 18-

To Amend By-law No. 01-215
Being a By-law To Regulate Traffic

WHEREAS sections 8, 9 and 10 of the Municipal Act, 2001, S.O. 2001, c. 25, authorize the City of Hamilton to pass by-laws as necessary or desirable for the public and municipal purposes, and in particular paragraphs 4 through 8 of subsection 10(2) authorize by-laws respecting: assets of the municipality, the economic, social and environmental well-being of the municipality; health, safety and well-being of persons; the provision of any service or thing that it considers necessary or desirable for the public; and the protection of persons and property;

AND WHEREAS on the 18th day of September, 2001, the Council of the City of Hamilton enacted By-law No. 01-215 to regulate traffic;

AND WHEREAS it is necessary to amend By-law No. 01-215.

NOW THEREFORE the Council of the City of Hamilton enacts as follows:

1. Schedule 5 (Stop Control) of By-law No. 01-215, as amended, is hereby further amended by removing from Section “C” (Flamborough) thereof the following items, namely;

Chudleigh St.	Eastbound	Culotta Dr. E
Chudleigh St.	Westbound	Culotta Dr. E

And by adding to Section “C” (Flamborough) thereof the following items, namely;

Cole Street	Northbound & Southbound	Browview Drive
Chudleigh Street	Eastbound & Westbound	Culotta Drive (West Leg)

Chudleigh Street	Eastbound & Westbound	Culotta Drive (East Leg)
Culotta Drive (West Leg)	Northbound	Chudleigh Street
Culotta Drive (East Leg)	Northbound	Chudleigh Street
Riley Street	Northbound & Southbound	Chudleigh Street
4th Concession West	Eastbound & Westbound	Sheffield Road (Westerly Intersection)
4th Concession West	Eastbound & Westbound	Sheffield Road (Easterly Intersection)

2.Schedule 4 (Yield Control) of By-law No. 01-215, as amended, is hereby further amended by removing from Section “E” (Hamilton) thereof the following item, namely;

West 4th Street(North Leg)	Southbound & Northbound	Richwill Road

And by adding to Section “E” (Hamilton) thereof the following items, namely;

West 4th Street	Northbound & Southbound	Richwill Road
Golfwood Drive	Northbound & Southbound	Atkins Drive
Roxborough Avenue	Eastbound & Westbound	Frederick Avenue
Hunter Street	Eastbound & Westbound	East Avenue
Strachan Street	Eastbound & Westbound	Catharine Street
McElroy Road	Northbound & Southbound	Howard Avenue
McElroy Road	Northbound & Southbound	Clarendon Avenue
Dragoon Drive	Northbound & Southbound	Fusilier Drive
Osgoode Court	Southbound	Presidio Drive

And by adding to Section “F” (Stoney Creek) thereof the following items, namely;

Hewitson Road	Southbound	Dupont Street
Dupont Street	Eastbound	Hewitson Road
Margaret Avenue	Northbound & Southbound	Guernsey Drive

2. Subject to the amendments made in this By-law, in all other respects, By-law No. 01-215, including all Schedules thereto, as amended, is hereby confirmed unchanged.

3. This By-law shall come into force and take effect on the date of its passing and enactment.

PASSED and ENACTED this 26th day of September, 2018.

F. Eisenberger
Mayor

Janet Pilon, CMMIII, DPA, CMO
Acting City Clerk

INFORMATION REPORT

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Glen Carey (270 Tenth Road East) Respecting Truck Traffic and Construction of a Berm on Property (PW18083) (Ward 11) (Outstanding Business List Item)
WARD(S) AFFECTED:	Ward 11
PREPARED BY:	Bob Paul 905-546-2424, Extension 7641
SUBMITTED BY: **SIGNATURE:**	Edward Soldo, P.Eng. Director, Roads and Traffic Public Works Department

Council Direction

Further to the September 18, 2017 Public Works Committee meeting, Roads & Traffic were requested to provide a report containing a chronology of the actions taken on the property to date, identify any additional measures that can be taken to address the remaining concerns and provide an overview of the City's service standard related to the construction of berms.

Information

The property owner, Mr. Carey resides at 270 Tenth Road East; the property is located on the northeast corner of the Tenth Road East and Mud Street in Ward 11. The property has a partially installed berm along the east side to the rear of the home and a berm along the south side parallel to Mud Street within the City's road allowance. The intention of the berms was to create a visual and noise barrier between the property and Mud Street to the south, due to traffic and noise volumes along Mud Street. Mud Street is a designated Truck Route with an Annual Average Daily Traffic (AADT) of 2816 based on a 2017 traffic count. The speed limit is set at 70 km/h. The traffic volumes along Mud Street have increased over the last number of years as a 2011 traffic count on Mud Street between Tenth Road East and the Eleventh Road East recorded an AADT of 1916 vehicles/day, an increase of over 900 vehicles per day.

Chronology of Actions

The following is a chronology of the actions on the property:

- A review of Google images indicates that the construction of the berms occurred between July 2015 and April 2016;
- The District East Roads and Maintenance Superintendent recalls speaking with the property owner in the spring of 2015 about the City supplying a few loads of fill material with the intent of the material being placed within the property limits. The Superintendent recalls agreeing to provide some fill when it became available with the stipulation that the fill was to remain on the property of 270 Tenth Road East, and that the fill was not to be placed within the right of way (ROW);
- The property owner indicated that they would be shaping the fill material to create a berm within the property line with a piece of equipment they had access to;
- After this conversation, approximately three loads of material were supplied by the District, which the resident placed along the rear lot within the property, as previously agreed to;
- The delivery of fill from District East was stopped after the first few loads as the access to the site became difficult to maneuver. The property owner then requested that the material be placed within the ROW. This request was denied by the Superintendent;
- According to the property owner, the remainder of the material deposited on site, along the front of the property and within the ROW, came from the City's contracted ditching program in the summer/fall of 2015;
- A stipulation in the City's rural ditching contract (C-13-26-15) required the contractor to supply, prior to commencement of the work, an executed Schedule D waiver for permitted fill dumping from the City's Site Alteration By-law 03-126. Documentation from the contractor in 2015 to the City's Roads & Maintenance Project Manager includes copies of all executed wavier forms. The list did not include a permit (Schedule "D") issued to the property at 270 Tenth Road East;
- A search of the District East in-house ditching records for this time period indicates no record of any additional in-house material being placed at this location nor any waiver for placement of fill (Schedule "D" to By-law 03-126) being issued for the property;
- Based on a review of the City's records available, the City appears not to be the source of the additional fill deposited on site.

The fill was deposited on the property between July 2015 and April 2016. The outstanding concern is that the material has been placed within the municipal road allowance and may impede operations along the ROW.

The placement of the berm in its present location along the Mud Street side of the property creates many issues:

- The City does not permit the construction/placement of any private berms or private infrastructure within the City's road allowance without an encroachment agreement, and in the past, has directed the removal of such infrastructure;
- In consultation with Corridor Management, given the berm's location within the ROW and the material planted around the berm, this type of an installation is not supported nor would the City enter into an encroachment agreement due to a number of reasons, including the potential safety risk to the public, and potential liability should a vehicle collide into it. In entering into an encroachment agreement, the City would assume responsibility for the long term care and maintenance of the berm, as well as taking on the liability risk associated with it in its present location;
- The berm partially blocks a vertical geodetic control bench mark. This bench mark is part of a vertical geodetic vertical control network that is available through the Ministry of Natural Resources (MNR) and Forestry Control Survey Information Exchange (COSINE). The database is available on the MNR website for all private companies and public agencies to use;
- There are concerns with potential sightline issues with southbound motorists at the intersection of Tenth Road East and Mud Street due to the berms location. While there is no existing sight line issue with the current location, future growth of trees and shrubs may restrict sightline issues.

While construction of a berm may be permitted within the property at 270 Tenth Road East, subject to approvals, the berm may not extend onto City property along the ROW.

City Standards

In consultation with Development Engineering, the City will typically deal with berms through the Site Alteration By-law or through plans of subdivision or site plans where the berms are used in combination with a barrier for noise attenuation (where the height of the barrier will exceed 3 m).

The Site Alteration By-law states:

> *Section 16; (c.1) despite the City of Hamilton Storm Drainage Policy and the City of Hamilton Development Engineering Guidelines, both as amended or replaced from time to time, ensure that fill placed or dumped within 6 meters of a property line shall:*
>
> *(i) Not exceed a maximum height of 2 meters; and*
> *(ii) Meet existing elevations at property lines with slopes no greater than 33% grade (3H to 1V), unless exempted in writing by the Director after completion of a site plan approval process, modified as necessary by the Director, including payment of the fee for a minor site plan approval.*

Through a site plan, the City is able to ask for justification for the berm height through any noise studies and further review to planning policies.

In summary, the City will not provide any additional fill material to the berm in question until such time as the berm has been removed from the ROW and placed within the property at 270 Tenth Road East and the appropriate applications and permits have been requested and approved.

INFORMATION REPORT

TO:	Mayor and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Clean and Green Hamilton Strategy 2017 Year-End Update (PW11052l) (City Wide) (Outstanding Business List Item)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Diedre Rozema 905-546-2424, Extension 5089
SUBMITTED BY & SIGNATURES:	Edward Soldo, P.Eng. Director, Roads and Traffic Public Works Department Craig Murdoch, B.Sc. Director, Environmental Services Public Works Department

Council Direction:

Report PW11052/PED11127 concerning "Illegal Dumping, Litter and Escaped Waste" was approved by Council on July 7, 2011, as part of General Issues Committee Report 11-024, and included the following recommendation:

That the General Manager of Public Works be directed to:

(ii) Provide a semi-annual Clean City Strategy progress report to the General Issues Committee.

Report PW11052k was approved by Council on April 12, 2017, as part of General Issues Committee Report 17-008, and included the following recommendation:

That progress updates on the Clean and Green Strategy be revised to annual from semi-annual reporting to General Issues Committee for their information.

Report PW17078/PED17198 was approved by Council on November 22, 2017, as part of Public Works Committee Report 17-013, and included the following recommendation:

That staff provide updates on the progress of the Graffiti Management Strategy and its various components as part of the Clean and Green Strategy annual reporting;

This report aims to fulfil Council's direction identified in the recommendations above and presents the 2017 Clean and Green Strategy year-end progress report, and 2018 Graffiti Management Strategy progress report.

Information:

This report reflects progress in each of the 5 pillars of the Clean and Green Hamilton Strategy (litter, illegal dumping, graffiti, beautification and environmental stewardship). It also highlights initiatives undertaken by local citizens, organizations and community groups whose work supports the goals of the Clean and Green Hamilton Strategy.

Pillar #1 – Litter

Citizen Engagement Litter Remediation Programs

Citizen engagement litter remediation activities included in this report are a combination of City-coordinated and significant community-led initiatives. The results of all volunteer programs and initiatives is shown in Table 1.

Team Up to Clean Up and Adopt-A-Park, the City of Hamilton's two volunteer-driven programs, each have individual focus areas, but are linked by the goal of litter remediation.

In previous reports, the metrics of community-led groups of all sizes were combined with the City of Hamilton's program results. Beginning in 2017, the results of three notable community-led groups is reported separate from City of Hamilton program results to highlight and celebrate their substantial efforts. The three groups are: Beautiful Alleys; The Escarpment Project; and, the Stewards of Cootes Watershed and Stewards of Red Hill Watershed. Each group has used unique approaches to make significant contributions towards litter reduction in Hamilton and has prepared their own appendix to this report to describe their 2017 activities.

The result of 2016 litter remediation efforts is also shown in Table 1. In 2017, staff implemented process changes to increase data accuracy by encouraging volunteers to self-report their clean-up results. This initiative resulted in an increase in reports submitted by volunteers from 23% to 78%. The 2017 results reflect the actual volunteer contributions but are not comparable to historic program results which relied on estimates. Increased data accuracy will allow staff to determine appropriate key performance indicators for Citizen Engagement Litter Remediation Programs going forward.

The work completed by volunteers in 2017 from all City-coordinated and community-led initiatives have a value of more than **$1,506,940**, enhancing the litter remediation and beautification services provided by City of Hamilton staff.

Table 1 – Citizen Engagement Litter Remediation Programs 2017 Results

Program	Volunteers	Garbage (bags)	Recycling (bags)	Volunteer hours	Value of volunteer hours ($)[1]
Team Up to Clean Up	20,695	2,846	1,468	53,824	$1,302,002
Adopt-A-Park	445	125	45	3,500	$84,665
Beautiful Alleys	325	373	159	650	$15,723
The Escarpment Project	400	566[2]	0	800	$19,352
Stewards of Cootes Watershed	949	3,377[5]	1,249[6]	2,643	$63,934
Stewards of Red Hill Watershed	295	1,835[7]	3,977[8]	879	$21,263
2017 TOTAL	**23,109**	**8,556**	**6,898**	**62,296**	**$1,506,940**
2016 TOTAL	*33,578*	*6,645*	*2,791*	*45,164*	*$1,008,060[3]*

Great Canadian Shoreline Clean-Up

On July 14, 2017, Council approved a motion to enter into a national partnership with the Great Canadian Shoreline initiative. Locally, this initiative involved more than 570 volunteers in 13 litter clean-up events along Hamilton area shorelines during 2017. Volunteers cleaned more than 40 km of Hamilton shorelines and removed

[1] Value based on hourly staff rate for a 'Labourer (Waste)' position ($24.19/hour)
[2-8] The Escarpment Project and Stewards of Cootes Watershed and Stewards of Red Hill Watershed track overall weight of litter collected annually rather than number of bags. Both groups predominately collect heavier, bulk items that cannot be placed in bags. The total weight of litter collected by the group has been converted into an estimated number of bags based on a rate of 1 bag = 5kg of litter.
[3] Value based on 2016 average hourly staff rate for a 'Labourer (Parks)' position ($22.32/hour)

approximately 923 kilograms of litter in 2017. Reported data indicated that cigarette butts and food wrappers were the most prevalent litter items along Hamilton shorelines.

Clean Canada Together

In 2017, Canada celebrated the 150th anniversary of Confederation. To recognize this milestone year, 10 communities — Brockville, Edmonton, Hamilton, Mississauga, Oakville, Toronto, Vancouver, Vaughan, Winnipeg and the Province of Nova Scotia — participated in a nation-wide clean-up challenge dubbed Clean Canada Together. Close to 285,000 people across Canada, including Hamilton's Team Up to Clean Up participants, volunteered their time at Clean Canada Together events held in the spring. Litter remediation statistics were posted weekly to show the impact of these events.

Participation in the program will continue in 2018 with the goal of increasing the number of communities participating from 10 to 25.

Pillar #2 – Illegal Dumping

Following restructuring in the Municipal Law Enforcement (MLE) Division in 2017, Municipal Law Enforcement Officers ceased to have specific job titles and positions for Property Standards and Environmental. The Illegal Dumping Team included three Officers assigned to investigate dumping on private and city property throughout 2017 as part of the Trash Talk program.

Officers worked closely with staff in Parks and Waste Management to investigate and pursue violations under the Parks By-law 01-219, Solid Waste Management By-law 09-067 and the Yard Maintenance By-law 10-118. The team continued to work with property owners and property managers to locate repeat offenders. This included regular site visits, action strategies (marking bags, reviewing property security footage, and surveillance) and communication. In 2017, MLE staff investigated 2,800+ calls directly related to the above By-laws, issued 16 Provincial Offences Notices (charges) and issued over 100 Notices to Comply (Orders).

The Illegal Dumping team continued to assist the King Street Alleyway project through investigation, education and regular monitoring throughout 2017. This program ended in April 2018.

Coordination continued with Canadian National (CN) and Canadian Pacific (CP) Rail Police in 2017. Officers connected at regular intervals with CN and CP staff and remediated areas of concern. Staff did not participate in organized clean-ups on CN affected properties in 2017.

Following the approval of Report PW18033/PED18092 - Staffing Changes to Address Solid Waste Management By-law Enforcement and Illegal Dumping, in September 2018 the three Officers supporting the Trash Talk program are anticipated to transition into the Public Works Department. Following that transition, Public Works will assume illegal dumping investigations on City property, and enforcement of the Parks and Solid Waste Management By-law for waste related violations. MLE staff will continue to enforce violations on private property through a revised version of the Illegal Dumping Team.

Pillar #3 – Graffiti

Due to the complexity of the strategy, depth of research, and consultation with a number of stakeholders, staff have provided a separate update, noted as Appendices D and E to Report PW11052l.

Pillar #4 – Beautification

Adopt-A-Park

Adopt-a-Park groups contributed to year-round maintenance and care for trees, flowerbeds and shrubbery in 67 municipal parks across Hamilton. In addition to remediating litter in adopted parks, Adopt-a-Park volunteers reported removing 5 bulk items and 32 graffiti tags in 2017, while filling 81 leaf and yard waste bags, weeding 46 shrub beds and laying woodchips at 27 trees. This program continues to engage park users and community groups in creating and preserving clean and safe parks for their neighbourhood, while taking pride and ownership of their community.

Extreme Park Makeover

The Extreme Park Makeover program promotes community involvement, attracts private donations, leverages municipal funds and empowers neighbourhoods to take ownership of their local parks. The Environmental Services Division coordinated an Extreme Park Makeover at North Central Park. Community members, the Adopt-A-Park group, members of the Rotary Club of Hamilton, and local youth helped to beautify North Central Park over three days in July 2017. Funds for a new play structure were donated by the Elly4Kids Foundation through the support of Ryan Ellis of the Nashville Predators.

Hamilton in Bloom

The Hamilton in Bloom traffic island sponsorship program continued to be a popular corporate sponsorship program in 2017. This year, 45 traffic islands were sponsored through the program. Total revenues from the program were approximately $46,000 which aided in offsetting costs.

Trillium Awards

Instituted in 1956, the Hamilton Trillium Awards Program is one of the oldest and largest beautification programs in North America. The Trillium Awards recognizes those residents who, by landscaping and property maintenance, contribute to a more attractive neighbourhood and community. The program is operated by a volunteer committee and supported by City staff and over 100 volunteers, who spend long days each June to visit hundreds of properties city-wide to select the Trillium winners.

Each fall, the Public Works Department hosts a celebration event to showcase and recognize the beautification efforts of residents and the accomplishments of the Horticulture section. The celebration event highlights the annual Hamilton Fall Garden & Mum Show, Hamilton in Bloom sponsors and the Trillium Award recipients.

The 97th Annual Hamilton Fall Garden & Mum Show was held October 20-29, 2017 with the theme, Under the Big Top. Over 13,400 residents and visitors attended the Mum Show in 2017 to view floral displays, attend gardening demonstrations and participate in workshops hosted by the City's Horticulture experts.

Pillar #5 – Environmental Stewardship

Forestry Outreach and Education

Environmental Services, Forestry section staff delivered 15 presentations to Grade 3 students on the benefits and care of trees. Approximately 400 students participated in this outreach program in 2017. This program also contributes to increasing Hamilton's urban forest as each school that participated also received a tree planted in their schoolyard.

Forestry staff participated in St. Marguerite D'Youville Catholic Elementary School's annual Eco Fair and shared information about the value of trees with approximately 500 people who attended the event. Forestry staff also hosted tree planting events at Johnson Tew Park and Windemere Park. Approximately 120 volunteers participated in Forestry's tree planting events and planted 650 trees in total at both parks.

Waste Outreach and Education

Environmental Services, Business Programs section staff delivered seven waste presentations to community groups and 28 presentations at school events. Staff led 28 tours of the Central Composting Facility. A total of 2,326 students and community members participated in these outreach programs.

Festival Waste Management

Public Works staff continued Put Waste in the Right Place festival waste management in 2017 in coordination with the City's Special Events Advisory Team (SEAT). Seven events participated in the program with 5 events participating in the City's full diversion program collecting recyclables, organics and waste. Two events collected recyclables and garbage. Two additional events offered waste diversion programs managed through a private contractor. The Festival Waste Management program resulted in 3,740kg of cardboard, 6,150kg of recyclable containers and 8,310kg of organics diverted from the landfill in 2017.

Clean & Green Neighbourhood Grants

The Keep Hamilton Clean and Green Committee supports community-led initiatives by awarding small grants to individuals or community groups which have developed a project plan to keep their neighbourhood clean and green. $3,880 in grant funding was distributed by the committee in 2017 to 6 community groups to support environmental stewardship initiatives and special projects.

Appendices and Schedules Attached

Appendix A – Beautiful Alleys
Appendix B – The Escarpment Project
Appendix C – Stewards of Cootes Watershed and Stewards of Red Hill Watershed
Appendix D – Graffiti Management Strategy Update
Appendix E – Graffiti Management Strategy Progress Report

www.beautifulalleys.com
hamiltonalleys@gmail.com

Beautiful Alleys 2017 Clean Ups and Beautification

Introduction

Alleys have served as transportation networks for communities across the globe for decades including vehicular and foot transportation. The maintenance and beatification of back alleys are crucial to urban renewal strategy in communities where alleys are collectively used by its residents. Back alleys could also be a great source of green space contributing to the overall look of the community. Alleys also offer the potential for citizen engagement and neighborhood planning resulting in healthy communities.

In Hamilton, the community members took upon themselves the responsibility of alleys maintenance and beautification with support from Keep Hamilton Clean and Green Committee, City of Hamilton Public Works Department, Hamilton Community Foundation and Neighbourhood Action Strategy. Donations from several local businesses and individual residents allow us to continue our work.

Beautiful Alleys is a volunteer organized and volunteer led team of people dedicated to maintaining and beautifying their public spaces. The mission is to create safe, enjoyable spaces for people of all ages and abilities regardless of status, gender, race, religion or ethnicity.
This community group of volunteers work together to create safe and beautiful green spaces in neighbourhood alleys and laneways. Two cleanup days are organized each year in the Spring and Fall and regular maintenance and monitoring is encouraged throughout the year. The goal is to educate and empower people to take ownership of these public spaces.

History of Beautiful Alleys

A small group of concerned residents from the GALA Planning Team took it upon themselves to work independently to maintain and beautify their alleys under an Action Team called Alley and Laneway Enhancement. This group came together in the fall of 2015 and that was the birth of the Beautiful Alleys project. They decided to bring residents together and hold twice annual alleys cleanups under the banner of Beautiful Alleys. The first cleanup was promoted through social media and community outreach and generated positive results that translated into over 300 volunteers and over one hundred alleys in the spring of 2016. This initiative expanded across the city and included residents from eight of the eleven identified Neighbourhood Action Team (NAS) neighbourhoods.

Since that first clean up in April 2016, Beautiful Alleys has redirected thousands of bags of yard waste and recyclables from our landfills through the twice yearly cleanups. In addition, engaged volunteers continue to keep hundreds of alleys clean on a regular basis.

www.beautifulalleys.com
hamiltonalleys@gmail.com

Residents take pride in accomplishments and an encouraging trend is that each clean- up results in less garbage in their alleys because of the ongoing efforts of the residents and the community. Beautiful Alleys is hoping to work with the City to initiate an "Alley Adoption" program that will recognize these members of our community and their efforts.

Community Engagement and Partnerships

The annual cleanups bring several hundred community members together at each event to share a common goal; Beautiful Alleys. Friendships are formed and many communities start initiatives in their immediate neighbourhoods for regular maintenance. Many of the volunteers look forward to these events to meet and bond with neighbours and peers. Many use the events as an opportunity to build community by holding neighbourhood celebrations. The clean ups average between one hundred and two hundred volunteers at each event with many of them adding additional alleys to their original area so that the area of alleys reached is expanded. The average number of new alleys across the city is about one hundred in addition to the alleys that are regularly maintained. We see a decrease in the amount of waste collected at each event due to the on-going maintenance and our efforts to educate people about waste management and by-law.

The results of that cleanup in the Spring of 2016 were well received and people wanted to expand their goals. Beautiful Alleys initiated the Urban Art Project. Funded by a grant from the Hamilton Community Foundation, six art applications were initiated in different neighbourhoods. These included artwork on fences and garage doors and showcased the work of local artists.

Beautiful Alleys

www.beautifulalleys.com
hamiltonalleys@gmail.com

In 2016, Green Venture received funding through the Hamilton Future Fund to undertake the Hamilton Alleyway Project. In partnership with Beautiful Alleys, Green Venture brought forward the first Alley Makeover to enhance the alley between Westinghouse and Milton, now known as Westmill Alley, with artwork, signage, lighting and plantings.

The beautification efforts continued in 2017 with an Alley Makeover in the alley between Sanford and Westinghouse. Named after a long time resident who cared for the alley over the years it is now known as Lois Lane. The artwork depicts the history of the Italian Restaurant that has been in her family for three generations. An art installation that speaks to the theme of Super Heroes in our alleys depicts Superman and adds a note of interest. Garden beds, a rain barrel and plantings beautify the space as well.

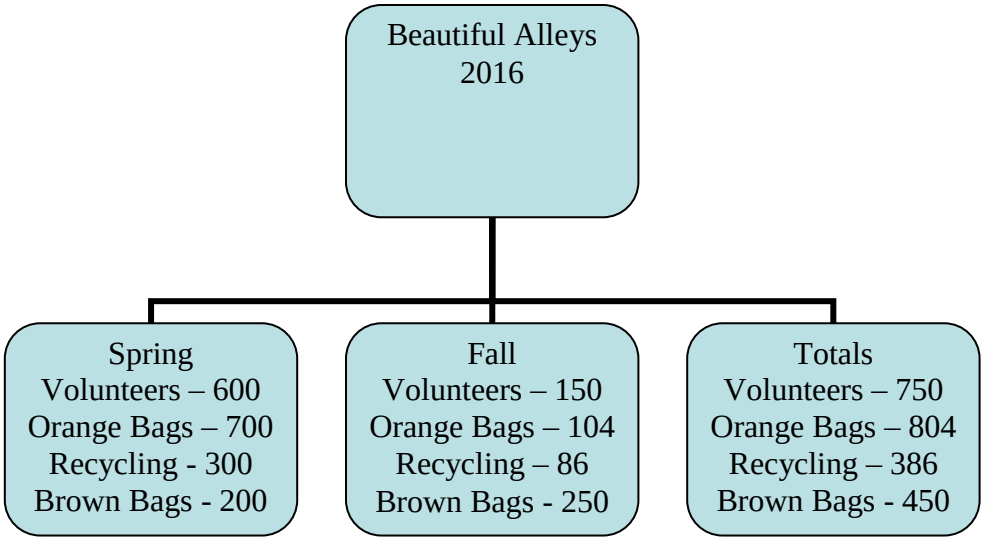
www.beautifulalleys.com
hamiltonalleys@gmail.com

Since then, Beautiful Alleys has partnered with Friendly Streets, Hamilton Health Sciences and Environment Hamilton to create alternative pathways that offer pedestrians and cyclists a safe, clean route that bypasses the busy commercial corridors and heavily trafficked streets.

During 2017, Beautiful Alleys established a partnership with Canadian National Rail (CN) and held the first organized clean up in April 2018 that generated over six tons of waste. CN has committed to carry on this initiative with a partnership between their employees and the community. They have established and committed to regular maintenance on the sections we clean throughout the year. We look forward to reporting back with the results of this partnership next year.

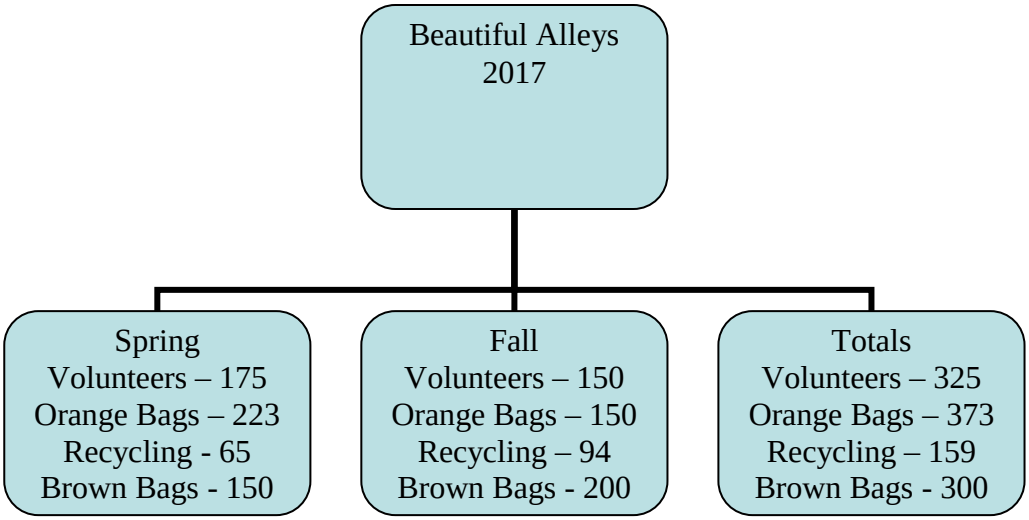
These twice yearly cleanups are supported by various partnerships with the City of Hamilton. Staff in the Public Works Department have worked with Beautiful Alleys volunteers to make regular maintenance more efficient and helped educate the community.
The on-going efforts and results are mainly supported by the Keep Hamilton Clean and Green Committee, which has supplied thousands of yard waste bags, gloves and garbage bags over the past years. Funding through the Committee's Clean and Green Neighbourhood Grants has enabled us to reward our volunteers with a celebratory gathering following each cleanup. The efforts of Beautiful Alleys and the results would not be possible without their support.

Reporting Statistics



www.beautifulalleys.com
hamiltonalleys@gmail.com

The Spring event in 2016 was the first event that spanned several neighbourhoods across the city where volunteers thoroughly cleaned and removed large items that were dumped in the alley. At the Fall event, the organizers noted many residents that live abutting the alleys had continued cleaning through the Summer months. The upkeep of the alley's cleanliness had a direct correlation to the decrease in garbage collected at the second event. With the continued use and maintenance of the alleyways, the hope is these will become beautiful and useful public spaces again where safety and cleanliness are not a concern.



It is important to note that these numbers only apply to the twice yearly clean ups. On-going maintenance by residents increases the numbers and eliminates waste and illegal dumping on a regular basis. As the project matures and more residents take ownership of these spaces, we hope to see the numbers continue to decrease.

During 2017, Beautiful Alleys focused on building partnerships within the community to build on the beautification projects and making more opportunities available to the residents for their public spaces because each alley is unique to the area it is in. We also looked to funding opportunities that would enable us to become sustainable.

- Friendly Streets
- Hamilton Health Sciences
- Environment Hamilton
- Canadian National Rail
- Urban Art
- The Aids Network

www.beautifulalleys.com
hamiltonalleys@gmail.com

- City of Hamilton Public Works Department
- Hamilton Community Foundation
- McMaster University

The Keep Hamilton Clean and Green Committee provide us with supplies for each clean-up. In 2017, we had access to over 1000 orange bags, 500 – 600 recycle clear bags, 1000 brown yard waste bags plus gloves and tools provided with the Community Clean Trailer. With the support of the Keep Hamilton Clean and Green Committee, we provide supplies throughout the year to residents that maintain their alleys on a regular basis. During 2017, we gave out an additional 250 orange bags, approximately 200 clear recycling bags, over 350 brown yard waste bags. It is difficult to monitor if these clean ups are reported but we can assume that the availability of supplies increases the numbers.

The Keep Hamilton Clean and Green Committee has also supported our efforts through their Clean and Green Neighbourhood grant program and that enables us to provide a community celebration for our volunteers after each clean-up event.

The Escarpment Project
1 – 1355 Upper Gage Avenue
Hamilton, Ontario

Dear Members of Council,

The Escarpment Project is a not-for-profit organization that provides remediation and stewardship of the Niagara Escarpment. The organization was founded in 2011 and its Annual Spring Clean-up is the largest single day volunteer environmental clean-up of its kind in Canada. People of all ages gather at various locations along the escarpment in the Greater Hamilton Area to revitalize the Niagara Escarpment and help return it to its natural splendour by removing litter & debris that has been dumped and left there, in some cases for years and even decades.

The Escarpment Project's 2017 Annual Spring Clean-up was held on Sunday April 30. Hundreds of volunteers braved cold, wet, and windy weather conditions to clean thirteen sites along the Escarpment:

- The Bruce Trail in Dundas
- Chedoke Falls, Stairs and Radial Trail
- James Street Stairs
- Wentworth Stairs and side trails to Sam Lawrence Park
- Kenilworth Rail Trail from Mohawk Road to Wentworth Street South
- Kenilworth Stairs
- Armes Park
- Albion and Buttermilk Falls
- Red Hill Valley Trail from Greenhill to Queenston Road
- Glendale Falls area from the Escarpment to the Glendale Golf & Country Club
- Felkers Falls and Davis Creek area
- Glovers Falls
- Billy Green Falls
- Devil's Punchbowl

Overall, volunteers removed over 500 hundred bags of litter from the Niagara Escarpment, plus furniture, car parts, bikes, shopping carts, computers, TVs and more.

After the clean-up, volunteers gathered for a BBQ at the Devil's Punchbowl Market & Bakery to celebrate a great clean-up effort which made the event even more fun and rewarding.

Highlights from the clean-up include:

- 2,830 kg (approximately 566 bags) of litter was removed from the Niagara Escarpment by volunteers
- The Escarpment Project's online profile increased. Twitter followers increased to 990 as of April 30, 2017, Facebook ads reached over 43,000 people and the website was viewed 37,067 times.

- Despite the challenge posed by wet and rainy weather conditions, approximately 400 volunteers participated in the annual clean-up.
- Proceeds from rain barrel sales and increased corporate sponsorship in 2017 have contributed to the organization's financial sustainability.
- Due to the success of the Annual Spring Clean-up in April, The Escarpment Project hosted three smaller scale clean-up events throughout the summer and fall.

Photos from the 2017 Escarpment Project annual spring clean-up are included on pages 3 and 4 of this report and a video summary of the event is available online: https://youtu.be/X0_gwp5Fc4Q

I would like to extend thanks to the many supporters who have helped make The Escarpment Project an ongoing success. Hardworking volunteers spent countless hours coordinating all the details behind the scenes to make sure the clean-up go ahead each year. Essential financial support from many corporate partners, City Councillors and grant funding provided through the City Enrichment Fund have made the clean-up and volunteer appreciation BBQ possible each year. Your contributions each year help keep Hamilton's Escarpment clean and healthy so that it can be enjoyed and appreciated for many years to come.

Best regards,

Greg Lenko
Founder/Executive Director
The Escarpment Project

the escarpment PROJECT

the escarpment PROJECT




Stewards of Cootes Watershed
Stewards of Red Hill Watershed
BRINGING BACK PRISTINE STREAMS

August 13th, 2018

Dear Councillors,

My thanks to City staff for providing this opportunity to include our own submission describing our contribution towards keeping Hamilton clean and green.

We have two separate initiatives each of considerable scope and impact – one in the Cootes Watershed, the other in the Red Hill Watershed. Each program is fervently support by its local neighbourhoods and we feel that they deserve to be recognized separately.

2017 represented our 5th year in the Cootes Watershed and with great excitement – our inaugural year in the Red Hill Watershed.

We report with great satisfaction that Hamiltonians regardless of where they live in our city, care deeply about the health and biodiversity of their neighbourhood watershed and that our reception in Red Hill has exceeded our expectations. Even more satisfying is that cleanups in both watersheds attract volunteers from across the city and at times from neighbouring municipalities.

Our efforts are guided by a single question: What would it take to get an entire watershed clean and to keep it clean. In tackling Hamilton's two watersheds that are complete from headwaters to Hamilton Harbour we believe that we will be the first city in Canada with this proud distinction and will gladly offer it up to the rest of the country as a more accurate indication of the true nature of our community than perhaps they presently hold.

We conduct 40 cleanups in each watershed each year for a total of 80 Group Cleanups

To date we have held 55 separate cleanup events in Red Hill Watershed and 251 events Cootes Watershed.

Through the hard work of our volunteers we have removed a total of 389,000 lbs of litter and debris from Cootes Watershed and 74,000 lbs from Red Hill Watershed

By March of 2019 we will have 150 Monthly Stewards across the two watersheds who are committed to keeping those areas pristine that the Group Cleanups have made pristine.

This summer we are completing the resolution of 40 different systemic stressors that are compromising the health of our watershed. Collapsed debris fences, pool water being purged directly into creeks, rainwater being released at the top of a slope causing irreversible erosion and increasing turbidity in our waterways, are a few examples of the type of stressors that we have been working with stake holders to resolve.

info@stewardsofcootes.ca info@stewardsofredhill.ca 289-239-7649

Stewards of Cootes Watershed
Stewards of Red Hill Watershed
BRINGING BACK PRISTINE STREAMS

What makes Stewards of Cootes Watershed and Stewards of Red Hill Watershed Unique

- Brought over $530,000 of Provincial and Federal funding into this community
- Cleanups conducted in-water from July to November, creating special demands on equipment, planning and safety protocols
- We own $80,000 of equipment used in the field including the finest collection of waders in the city
- We have developed an array of custom equipment to give our volunteers the ability to work smarter and safer
- We perform extensive reconnaissance in planning our cleanups to ensure safety, to make sure we respect the gift of time given by our volunteers and to minimize the environmental impact of our off trail work.
- We have developed and extensive GIS capability to respect the rights of private property owners and to give our volunteers the best tools possible.
- We empower a group of our finest volunteers to be Crew Leaders and give them extensive training including first aid training every Spring
- We participate in at least 10 days of festivals per year and make at least 20 presentations within the community to share the importance of the local watershed and the role we each can take to ensure its health and biodiversity.
- We co-ordinate our activities extensively with the city, Hamilton Conservation Authority, Conservation Halton, the Royal Botanical Gardens, Ontario MNRF, Ontario MOE, Mohawk College, McMaster University, the Joint Stewardship Board of Red Hill Valley, Local 5167 – City of Hamilton Outside Workers Bargaining Unit,
- Our experience organizing cleanups results in a high level of productivity – 1.3 bags of garbage collected per hour of volunteer time. Which compares very favourably to similar programs

Graffiti Management Strategy Update

Background

On November 22, 2017, Council approved Graffiti Management Strategy (PW17078/ PED17198). Staff brought forward six recommendations; two additional recommendations were added by committee. Recommendation (b), directed staff to report back on the progress of the Graffiti Management Strategy through the Clean and Green Strategy annual report. Below is an update on the work that has been completed to date as well as an identification of projects that will be further discussed, including recommendations and comprehensive costing, in a follow up report to Council in Q1 2019.

Information

A cross-departmental staff working group met earlier this year to review the report recommendations and develop an action plan to address Council's requests for: 1) a victim assistance program; 2) a proactive approach to graffiti management; 3) additional CCTV cameras; 4) a counter social media campaign encouraging citizens to participate in assisting police in catching graffiti vandals; and, 5) the cost of a one-time City-wide graffiti clean-up.

1. Victim Assistance Program

Graffiti is defined as any mark or scratch applied on the surface of a building, structure, or street without consent. Property that has been graffitied without consent is illegal and victimizes property owners. In addition, municipal by-laws can further victimize property owners by requiring them to bear the costs to remove graffiti or risk facing penalties.

(a) Paint removal/ graffiti block vouchers

A municipal scan revealed that many cities have programs in place to assist property owners with graffiti removal. Whether it is by providing financial or material assistance, graffiti removal kits, graffiti vouchers, or free graffiti removal services, proactive municipalities are supporting residents and businesses in removing graffiti.

Staff are in the process of working with Procurement on a discounted voucher program and the City's Revenue Generation section on related sponsorship opportunities. More information about these initiatives will be included in the Q1 2019 Council report. In the interim, staff secured funding from the *Keep Hamilton Clean & Green Committee* to purchase hardware store gift cards to support victims of graffiti. Municipal Law Enforcement's co-op students are distributing these gift cards to private property owners who have been victimized by graffiti on multiple occasions and/or who self-identify as income-eligible (i.e. meet low income criteria). More information about the gift card initiative can be found in Appendix "E".

Graffiti Management Strategy Update

(b) Youth engagement

Evidence suggests that most graffiti is applied by youth between the ages of 12 and 25. In addition to focusing on a punitive approach in dealing with youth and graffiti vandalism, many municipalities are taking the approach of working with youth to legitimize graffiti as an art form by offering opportunities for youth to express themselves and redirect their creativity (i.e. transitioning 'graffiti vandals' into 'street artists').

Staff are investigating opportunities to engage youth through the City's Youth Strategy. In particular, staff are investigating legal walls, street art and mural programs (more below) as well as youth outreach and education on graffiti vandalism. Staff will report back to Council in Q1 2019 on how the City can better engage youth in deterring graffiti vandalism and preventing the victimization of property owners.

(c) Street art

Staff are investigating several options for a pilot that may include (i) legal walls, (ii) murals and (iii) anti-graffiti wraps. These options will be presented alongside other methods of deterring graffiti vandalism, such as CCTV cameras, in Q1 2019.

i) Legal walls

Research suggests that graffiti vandalism can be reduced and controlled by offering opportunities and space for vandals to express themselves. Legal walls, also known as "sanctioned walls" or "free walls," are spaces that municipalities designate as legal graffiti zones. Walls are typically painted over a couple times a year, creating a blank canvas for new graffiti. Staff are in the process of investigating suitable City-owned locations and anticipated impacts to operating and capital budgets to establish a legal wall program in Hamilton.

ii) Murals

Like legal walls, murals can minimize unwanted graffiti and beautify cities. They can also contribute to the local economy by employing artists. Artists are typically hired to paint murals on the exterior walls of private residences and businesses. Staff are investigating a variety of options for how the City can support property owners who are interested in murals for their buildings. A scan revealed that other municipalities provide full or partial funding through granting programs, while others have created mural permitting processes.

Currently, the City of Hamilton provides funding for murals through Urban Renewal's Commercial Property Improvement Grant Program (C.P.I.G.) and the B.I.A. Commercial Property Improvement Grant Program (B.I.A.C.P.I.G.). Funding for murals is typically only approved for the front of a building or on the

Graffiti Management Strategy Update

'flankage,' street facing side of the building, if it is a corner property. Therefore, staff are in the process of investigating other dedicated sources of funding for mural projects.

iii) Anti-graffiti wraps

Traffic signal boxes (as well as other municipal infrastructure and street furniture) are often targets of graffiti. Art on these boxes can help to deter graffiti by removing the availability of a 'blank canvas' for graffiti vandals. A pilot project to create public art for traffic signal boxes in the Downtown Hamilton Community Improvement Project Area is planned for 2019. It will be led by the Tourism & Culture Division and funded from the Downtown Public Art Reserve as approved by Council in report PED18061.

(d) CPTED (Crime Prevention Through Environmental Design)

CPTED is a proactive design philosophy built on the belief that the proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime as well an improvement in the quality of life.

Hamilton Police Service's Crime Prevention Branch provides information, tips and techniques to property owners about how they can eliminate crime in, on and around their properties by identifying problem areas and making changes.

Staff have been working closely with Hamilton Police Service on developing opportunities to leverage this existing program as it relates to graffiti prevention and supporting victims of crime. Staff are targeting the end of Q4 2018 to implement additional audits for graffiti hotspots and workshops and webinars made available online for easy consumption.

(e) Centralized resources

Raising awareness about graffiti prevention and removal is key to the success of a city with reduced graffiti vandalism and victimization of property owners. Research overwhelmingly suggests that rapid removal is the most effective tool in mitigating graffiti vandalism.

Staff has begun the process to provide a 'one-stop-shop' for property owners looking for information on graffiti removal, reporting and prevention. This online resource will also include information about victim assistance initiatives and granting programs. Staff are targeting Q1 2019 to launch a revised webpage on the City's website that will act as a centralized location for graffiti-related resources.

Graffiti Management Strategy Update

2. Proactive graffiti management

Two co-op students from McMaster University were hired by Municipal Law Enforcement (MLE) in January as part of the two-year pilot that Council approved at its meeting on November 22, 2017 (recommendations (c), (d) and (e)). The students are dedicated exclusively to undertaking a proactive graffiti enforcement strategy, including victim assurance, victim education, and community engagement.

As part of their work, the students are:

- Providing information to residents and businesses about the importance of graffiti removal and how to prevent future graffiti vandalism
- Inventorying graffiti and comparing data to the 2013 graffiti audit
- Collecting information about barriers to graffiti removal for the development of a Victim Assistance Program
- Distributing gift cards for the purchase of paint, graffiti removal and graffiti prevention products, to those victimized by graffiti multiple times or self-identify as income-eligible
- Enforcing Yard Maintenance By-law (No. 10-118) as it relates to graffiti (as directed)

The soft enforcement approach by the students is having a positive response from the public to increase community confidence and voluntary compliance with the identified complaints. Details and results of inspections from January 2018 to July 2018 can be found in Licensing & By-law Services' August 3, 2018 report, noted in Appendix "E" attached to Report PW110521. Staff will continue to analyze and evaluate the data generated by the students to determine if the actions and initiatives met the goals and objectives of the pilot project.

3. Security cameras (e.g. CCTV, FlashCam)

Recommendation (g) directed staff to investigate the pursuit of additional CCTV cameras with associated costing. Staff are developing a matrix for security camera options and costing to expand the existing pilot at Fay Park in Ward 6 at other locations in the City. At present, options being investigated are city-owned hard-wired and solar cameras, and third-part turnkey services.

Staff are examining each option including associated costing. Energy, Feet & Facilities Management Division staff are also in the process of developing a corporate policy for City-wide use of security cameras in addition to issuing a Request For Information (RFI) to obtain information about the capabilities of suppliers. Staff will bring a report back to Council in Q1 2019 with options and costing for the expansion of the existing CCTV pilot program.

Graffiti Management Strategy Update

4. Crime Stoppers campaign

Recommendation (h) directed staff to report back on the cost of a counter social media campaign that encourages citizens to participate in assisting police in catching graffiti vandals. The City led a similar Crime Stoppers campaign in 2009-2010 encouraging the public to report graffiti and known taggers. Hamilton Police Service confirmed that there was a spike in reported graffiti "tips" and attributed the increase to this campaign.

Staff are determining the costs to expand the 2009-2010 campaign to include updated posters, bus wrapping and social media platforms. Staff will report back with advertising options and associated costing, targeting a campaign launch date in Q1 2019.

5. One-time clean-up

Staff were directed through recommendation (h) to report back to Council on the estimated cost of a one-time City-wide graffiti clean-up.

Staff have estimated the cost of a one-time City-wide graffiti clean-up to be approximately $2.5 M. The estimate is based on the current corporate contract rate per incidence for graffiti removal, and the number of graffiti hotspots identified in the 2013 graffiti audit.

One-time removal is not a strategy employed by other municipalities, likely because it is costly and will not eliminate graffiti vandalism. A multi-pronged approach that includes programs aimed at reducing graffiti vandalism through education, victim assistance, proactive graffiti management and graffiti deterrence strategies like legal walls and murals, has proven to be the most effective way to manage graffiti vandalism.

CITY OF HAMILTON PARKING AND BY-LAW SERVICES DIVISION

City of Hamilton Graffiti Management Strategy Progress Report

August 3, 2018

Submitted to:
Cindy Heuck
Ken Leendertse
Robert Ustrzycki

Submitted By:
Sukhmandeep Sidhu
Julia Wakulewicz

INDEX

CONTENT **PAGE**

Council Direction:

PUBLIC WORKS COMMITTEE REPORT 17-013

(Merulla/Farr)
That Item 6 of the Public Works Committee Report 17-013 respecting the Graffiti Management Strategy (PW17078/PED17198) be amended by adding sub-sections (g) and (h) to read as follows:

6. Graffiti Management Strategy (PW17078/PED17198) (City Wide) (Item 8.3)

(a) That the Graffiti Management Strategy and associated timelines outlined in this report be approved;

(b) That staff provide updates on the progress of the Graffiti Management Strategy and its various components as part of the Clean and Green Strategy annual reporting;

(c) That Municipal Law Enforcement (MLE) be approved to hire two (2) Municipal Law Enforcement Officers (Co-op students) for a 2 year pilot project;

(d) That annual costs associated with hiring of two (2) Municipal Law Enforcement Officers (Co-op students) and operating costs of one (1) vehicle, approximately $114,100, be funded through the Tax Stabilization Reserve #110046;

(e) That the one-time capital cost associated with the purchase of one (1) vehicle to support the new Municipal Law Enforcement Officers (Co-op students), approximately $26,400, be funded through Tax Stabilization Reserve #110046;

(f) That the internal Graffiti Working Group, led by Policy & Programs staff, develop and undertake a graffiti enforcement strategy with victim assistance program;

(g) That the pursuit of additional Closed-Circuit Television Cameras (CCTV) be included as part of the Graffiti Management Strategy with a report back, accompanied by a presentation, to the Public Works Committee outlining the costs of expanding the camera program; and,

(h) That the appropriate staff also report back on the cost of a counter social media campaign that encourages citizens to participate in assisting police in catching vandals and receiving a cash reward as well as the cost of a one-time City-wide graffiti clean-up.

Main Motion as Amended CARRIED

Response to Council Direction

The hiring of 2 new co-op students under the Municipal Law Enforcement Division for proactive enforcement, victim assurance, victim education, and community engagement.

The purpose of this project is to educate and communicate with the citizens of Hamilton, in order to reduce or minimize the amount of graffiti/tagging in the city and create a dialogue with the victims of these incidents. The goal of this project will be to increase the compliance of graffiti removal on properties by 10% from month 4 to month 8 of the program and to also decrease the amount of complaints by 10% from month 1 to month 8. Education will occur through verbal communication with victims and the distribution of graffiti education materials while encouraging citizens to tackle graffiti in the community together with the help of programs such as “Team Up to Clean Up”. Educational pamphlets include graffiti removal tips, prevention methods, the city number for reporting, Hamilton Police Auxiliary Branch number, general information of graffiti and the graffiti By-Law No. 10-118. Verbal warnings entail making the property owner/tenant aware that the officers will be visiting again to ensure the property abides the By-Law. An order to comply may be issued as a written warning to abide the By-Law and includes an expiry date upon which the officers will be conducting a re-inspection. When an order to comply has not been followed and adequate attempts have been made at education, then the property will be sent to contractors and those fees will be recuperated from the property owners tax roll.

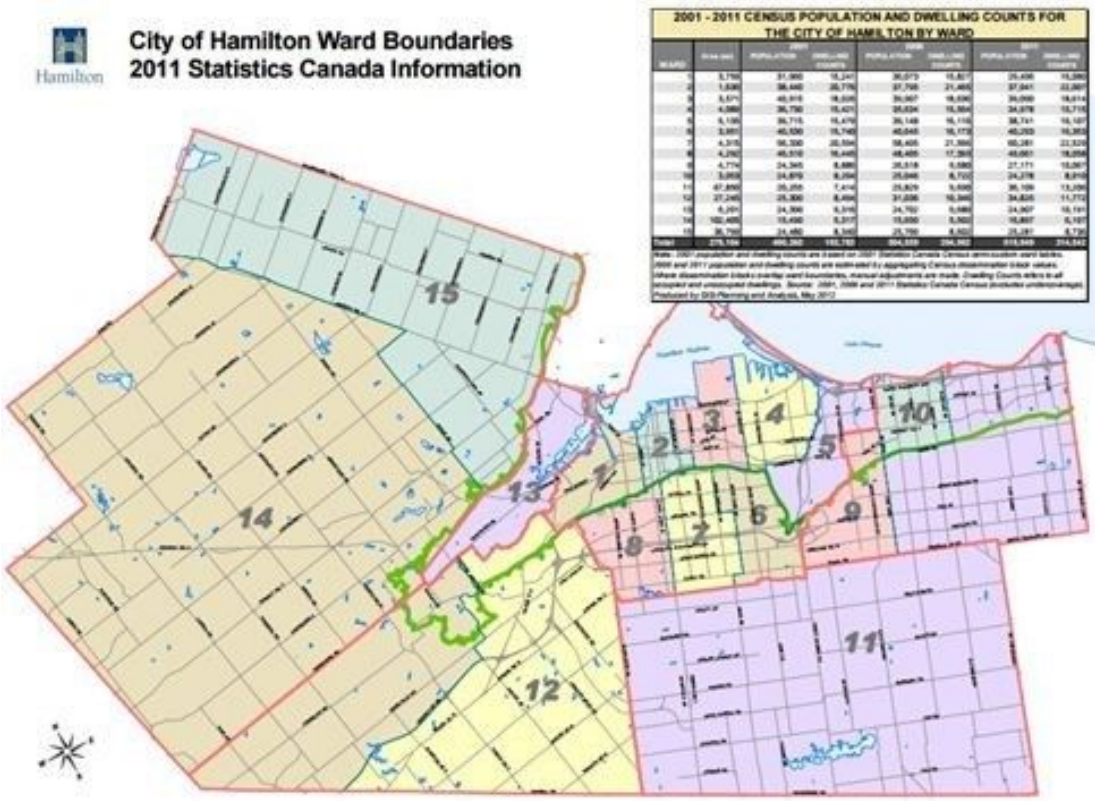
Summary of City of Hamilton Graffiti Vandalism Audit - 2013

This summary serves as baseline data to compare newly collected data over the course of this project. The audit was completed and submitted on December 16, 2013 by MGM Management, an external consulting firm. At this time, City of Hamilton's population was 505, 000. The most recent Hamilton census reported by Statistics Canada in 2016 brings the population up to 536, 917.

The audit recognized Wards 1-8 as 'target wards' since they appeared to have the highest incidence of graffiti complainants. Within these wards, 30 areas were labelled as 'hot spots' and were compared to 'random areas' as a control. Both the 'hot spots' and 'random areas' were measured as 4 city blocks by 4 city blocks with an approximate area of 25 hectares.

Within the 8 Wards, a total of 2, 256 graffiti tags were observed and 493 taggers were identified. An average yield of 6.3 graffiti tags per site was documented in the City of Hamilton Graffiti Vandalism Audit - 2013. The top 20 taggers contributed to 36% of all graffiti in the city. 74 percent of graffiti within the 8 Wards was concentrated in Ward 3 (43%), Ward 2 (18%), and Ward 4 (13%).

For more comprehensive, quantitative comparisons of graffiti intensity, the audit associated an 'Graffiti Index' with each sample area. The Graffiti Index was measured as the number of tags per area (in hectares).



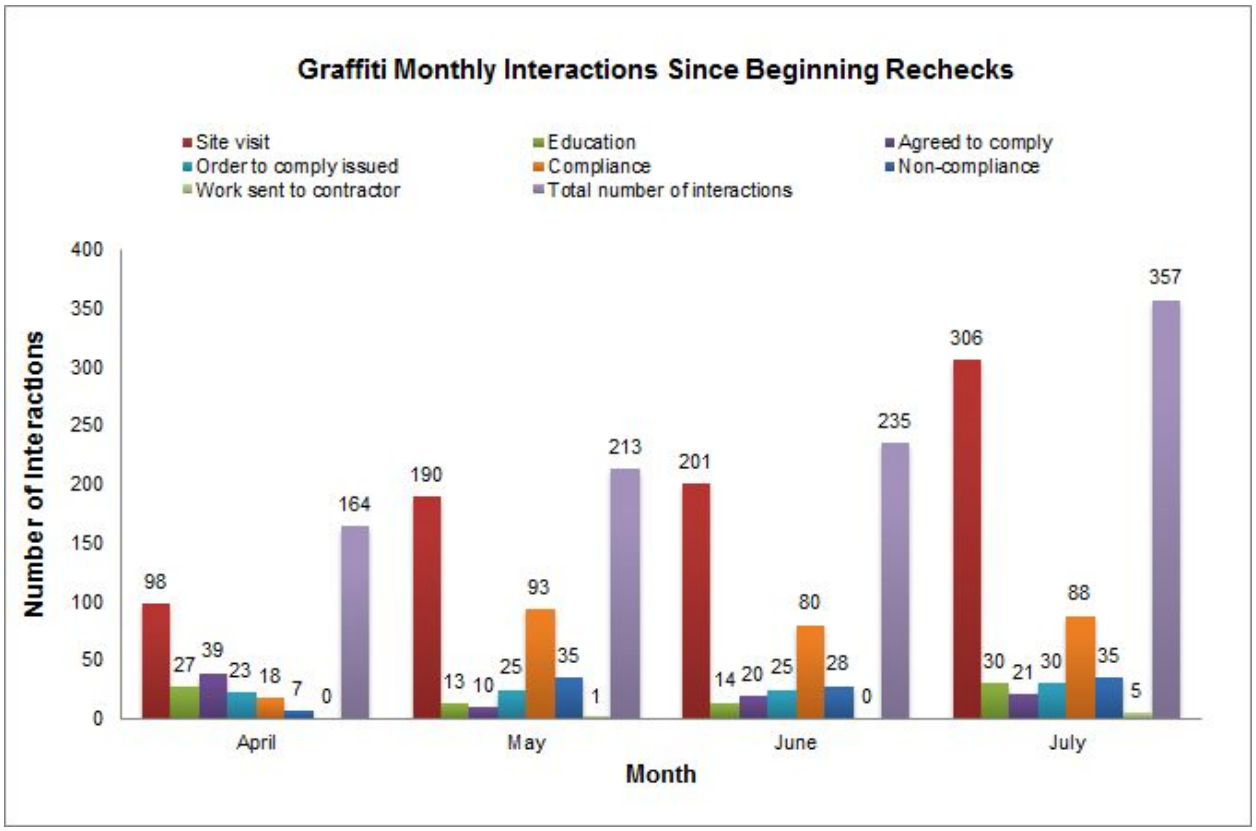
Statistical Information

Graffiti Enforcement Statistics - January 15 to July 31, 2018

	January	February	March	April	May	June	July	Totals
Complaints (phone/online)	26	29	53	11	11	18	13	169
Proactive	0	70	122	56	34	21	69	411
Total Investigations	26	99	175	90	173	155	205	988
Open Investigations	22	90	152	48	72	71	100	600
Closed Investigations	4	9	23	42	101	84	105	388
Duplicate	2	6	18	10	5	0	0	48
Cancelled	0	0	1	1	0	1	0	4
Referred to another dept	1	0	0	12	0	2	0	25
No Violation	1	1	0	1	3	1	17	25
Complied	0	2	4	18	93	80	88	286

Type of interaction	January	February	March	April	May	June	July	Totals
Site visit	23	93	157	98	190	201	306	1116
Education	14	70	52	27	13	14	30	239
Agreed to comply	14	68	77	39	10	20	21	279
Order to comply issued	9	14	18	23	25	25	30	149
Compliance	0	2	4	18	93	80	88	286
Non-compliance	0	0	0	7	35	28	35	105
Compliance rate	0%	100%	100%	72%	73%	74%	72%	74%
Non-compliance rate	0%	0%	0%	28%	27%	26%	28%	14%
Work sent to contractor	0	0	0	0	1	0	5	6
Total contracting fees	$ -	$ -	$ -	$ -	$180	$ -	$ -	180
Total interactions	51	231	286	164	213	235	357	1634

Progress Since Beginning Rechecks



Rechecks began in mid-April and since then, we have been tracking compliance and non-compliance stats. From April to May, we saw an increase of 1% compliance likely due to bettering weather conditions and spring cleaning. From May to June, the compliance increased 1%, due to the implementation of the gift card initiative. A total of 18 gift cards were handed out in June to 12 property owners, 6 of which were expected to be completed in June. There were 6 compliances in June for gift cards and this likely pushed the compliance rate closer to our goal of 82%.

In July, 18 properties were given gift cards. 26 of 34 properties that were given gift cards were complied (a compliance rate of 76%). The non-compliances were due to individuals leaving for vacation and being busy (not being able to cover).

The graph above shows the progress of monthly interactions since rechecks have begun. Site visits (98 to 306), education(27 to 30), OTCs (24 to 30), and work for contractors (0 to 5) have all increased since April. The compliance rate has been stable since April (72%).

Goals for Term 1 - Status and Thoughts

OVERARCHING GOALS:

- Educate and communicate with the citizens of Hamilton, in order to reduce or minimize the amount of graffiti/tagging in the city and create a dialogue with the victims of these incidents
- Gathering data and opinions of property owners to be used in the development of a City wide Victim Assistance program and Graffiti Management Strategy

STATISTICAL GOALS:

- Increase the compliance of graffiti removal on properties by 10% from month 4 to month 8
    - We have set the baseline rate for this goal at 72% (the rate for April) and we will be striving to increase this by the end of August to at least 82%.

- Decrease the amount of complaints by 10% from month 1 to month 8
    - The number of complaints has increased from January to February to March (26 to 29 to 53) and then dropped to 11 in April. The reason for this trend has not yet been determined, perhaps more tagging has already been logged and enforced, perhaps individuals are not reporting the tagging they see, perhaps the tagging is being covered before it has a chance to be reported. It could be any or a mixture of these three, further data from the next months will show a more firm trend of data.

QUALITATIVE GOALS:

- Conduct an academic review of all graffiti related research and educational materials
- Establish a cost retention program that helps individuals with the cost of paint or other graffiti removal procedures
- Create new educational materials (revamped) that can be used to educate and inform the public about graffiti and what they can do about it
- Gather information about all graffiti programs and which groups they help (and how much)
- Assess the effectiveness of deterrents and management strategies such as rapid removal, lighting, and presence of video surveillance.
- Analyze hotspots in each ward and measure most problematic wards.
    - Based on number of calls - both proactive and reactive. Our newly determined hotspots will be compared to the previous hotspots identified in the 2013 City of Hamilton Graffiti Vandalism Audit.

The educational materials mentioned above are attached in the appendix at the end of this report.

Evaluation of Goals

OVERARCHING GOALS:

Listening to opinions of affected property owners:

- Created graffiti survey to collect data on tags and owner's prevention preference
- Establishing open conversations with victims when advising removal

Attended events to connect with citizens and external city departments:

- International Village BIA Walk-About
- Meeting with Westmount Students
- Keep Hamilton Clean and Green Committee Meeting
- East Hamilton 68th Town Hall Meeting (Councilor Merulla - Ward 4)
- Graffiti Briefing with Hamilton Police Services - Hate Crime / Extremism Unit

STATISTICAL GOALS:

- Increasing number of interactions each month. July leads with 357 as compare to 235 in June.
- Compliance rate has also increased from last month. We improved from 80 compliances in June to 88 in July
- Current compliance rate for the month of July is 72%
- Only 12 complaints were received this month, whereas June saw 18 total public complaints

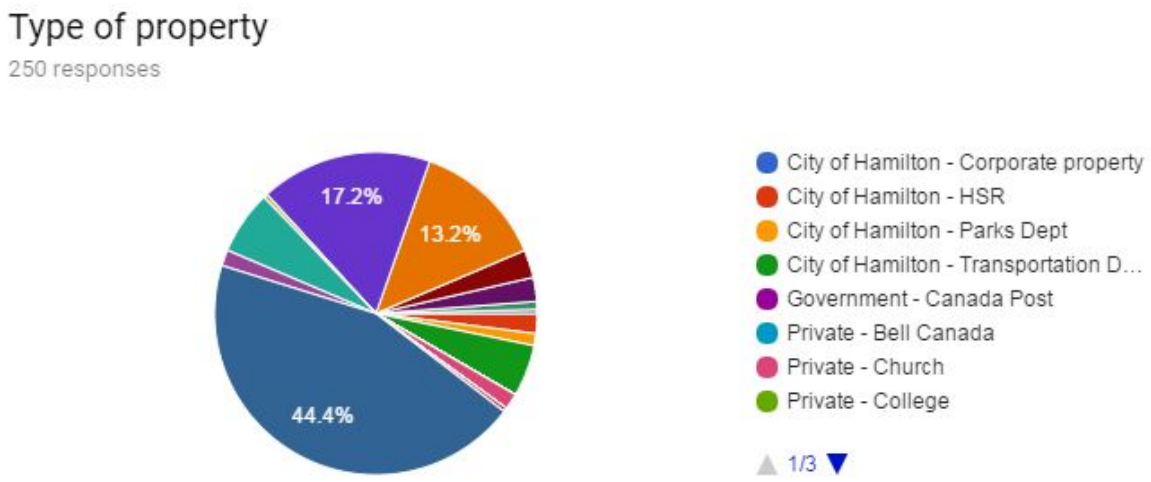
QUALITATIVE GOALS:

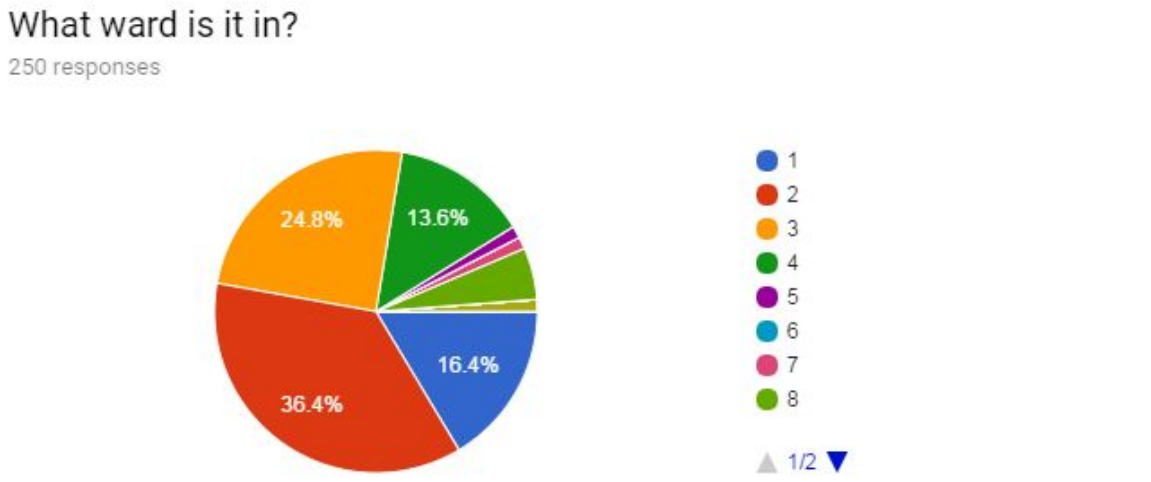
- Studied the articles and correspondence in the 2009 Graffiti Prevention Strategy binder as well as conducting external research on programs from other municipalities.
- Surveying costs, barriers, and opinions of property owners in regards to their experience in graffiti removal.
- Compiled information provided through previous audits to create pamphlets that target specific properties - commercial vs. residential. Created a tip sheet for business owners to use when they are dealing with graffiti.
- Researched other municipal programs in place to manage graffiti, including Saskatoon, New Zealand, and Australia. We have further broken these policies down and identified the areas most relevant to business owners and residents.
- Ongoing process to collect data on various factors that may influence tagging. These factors are tracked in Google Forms for each property.

Graffiti Reporting Survey

In addition to regular data collection, an extended survey was created on February 25, 2018 and began effective February 26, 2018. The purpose of the survey is to collect key information related to graffiti incidents that was not typically captured in Hansen or Amanda case files. This includes size, method of removal, cost, type of property, surface, etc. A copy of the survey questions and the survey URL can be seen and accessed in Appendix E.

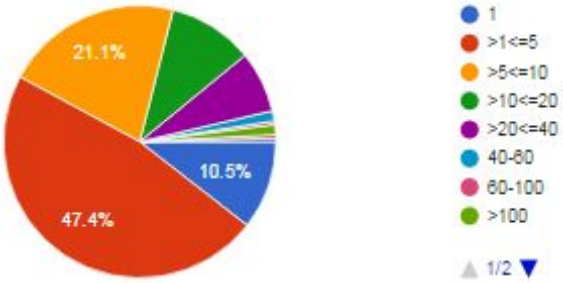
Data collection began on February 26, 2018 and were completed by Graffiti Enforcement Officers either when in the office or on the road during investigations. The survey range for this report is February 23 to July 31, 2018. The survey found the following:





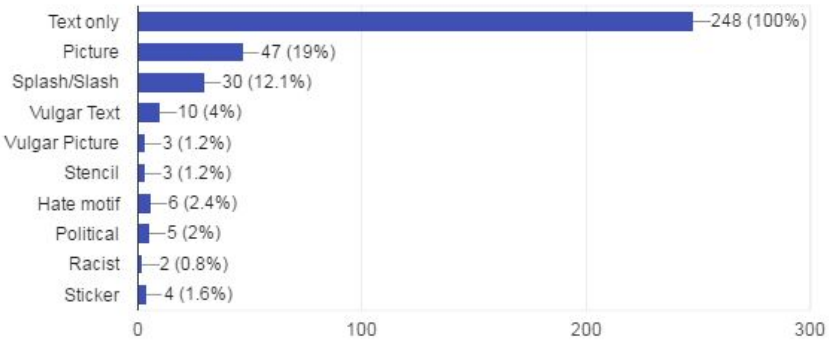
Number of tags?

247 responses



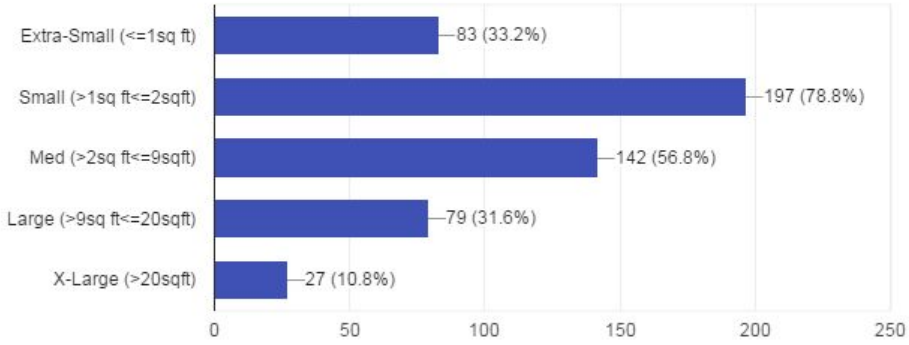
Descriptor of Graffiti

248 responses



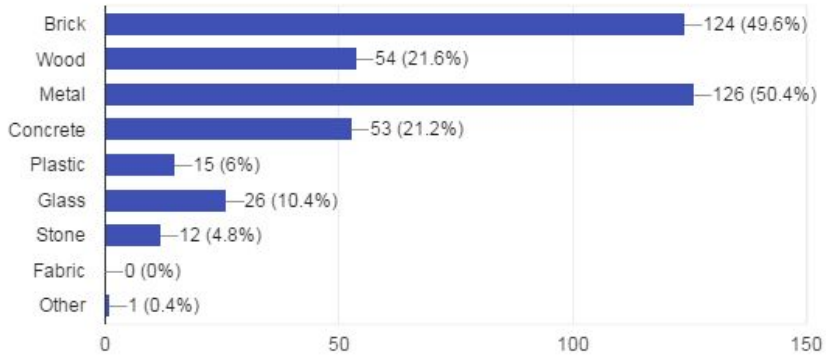
What is the size of the tag?

250 responses



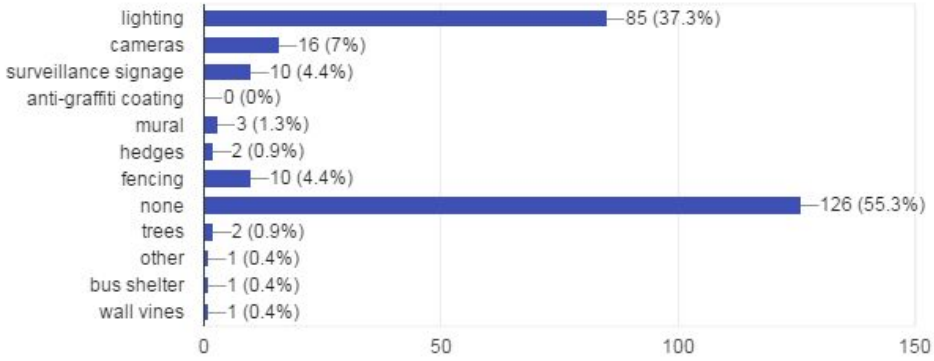
What surface is the tagging on?

250 responses



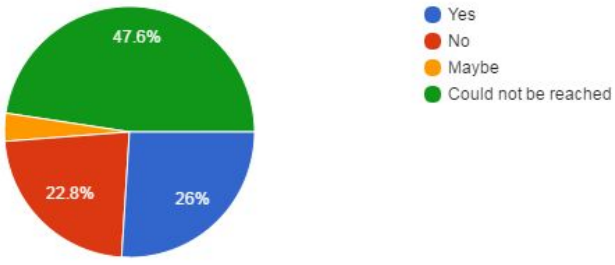
Any deterrents present?

228 responses

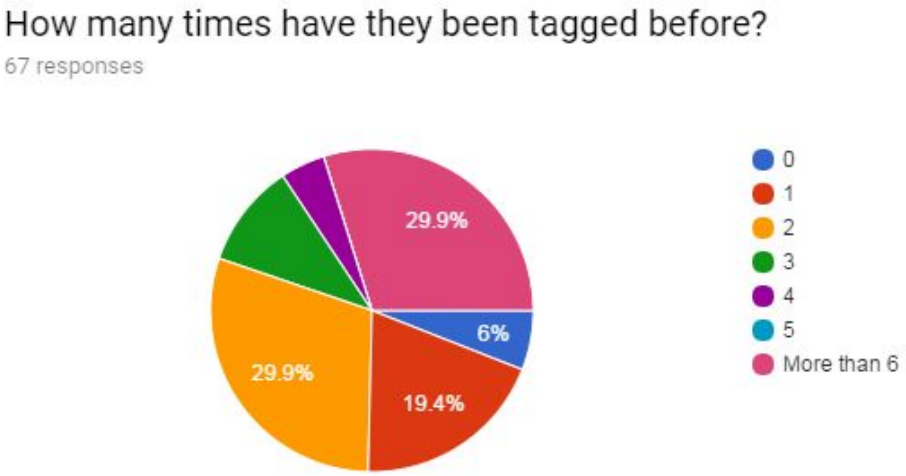


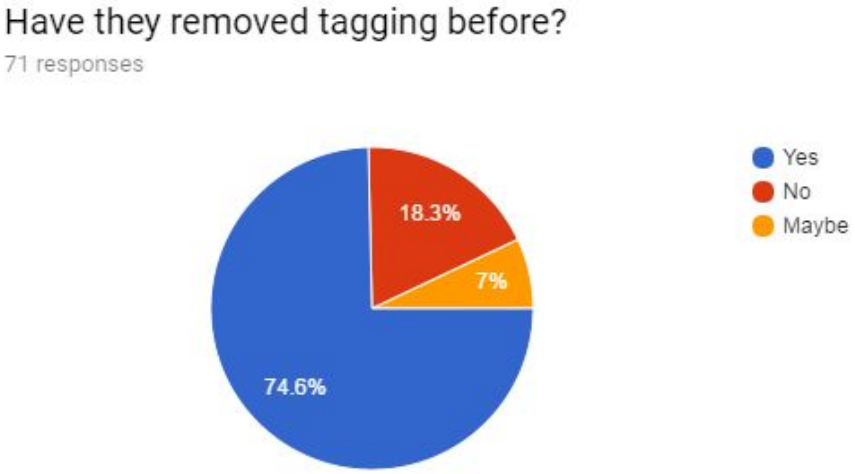
Have they been tagged before?

250 responses



If the property owner answered yes to the previous question, they were questioned these additional questions:

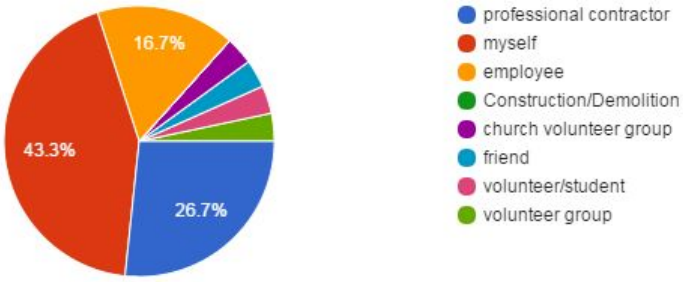




If yes, the following 7 remaining questions were asked:

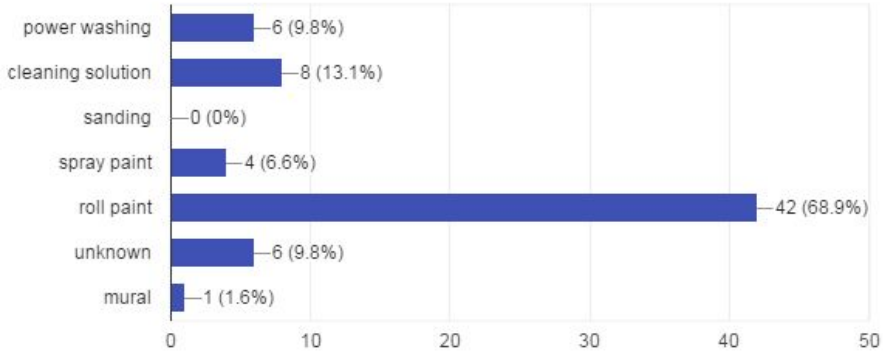
Did you have it professionally removed by a contractor or complete the work yourself?

30 responses



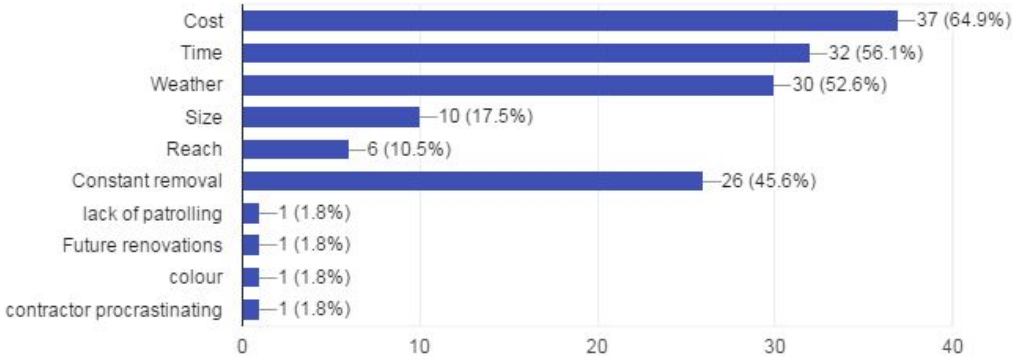
What method of removal did they use?

61 responses



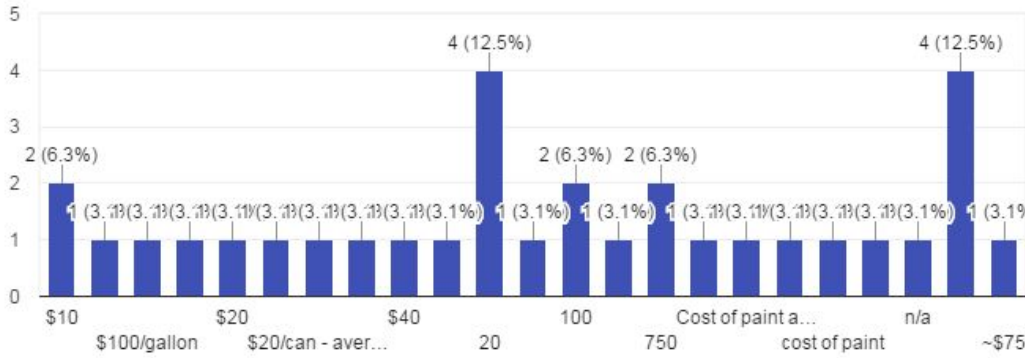
What are their barriers to removal?

57 responses



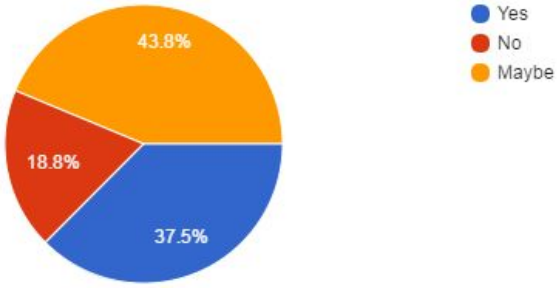
How much did it cost them? (number)

32 responses



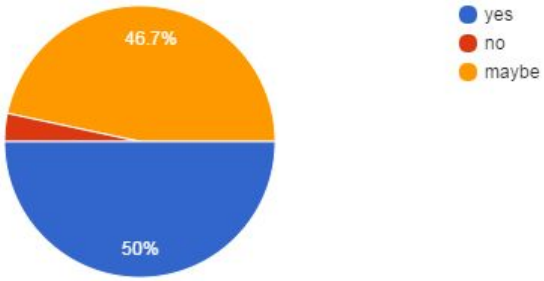
Would they be interested in a commissioned art mural to cover the wall(s) at no personal cost?

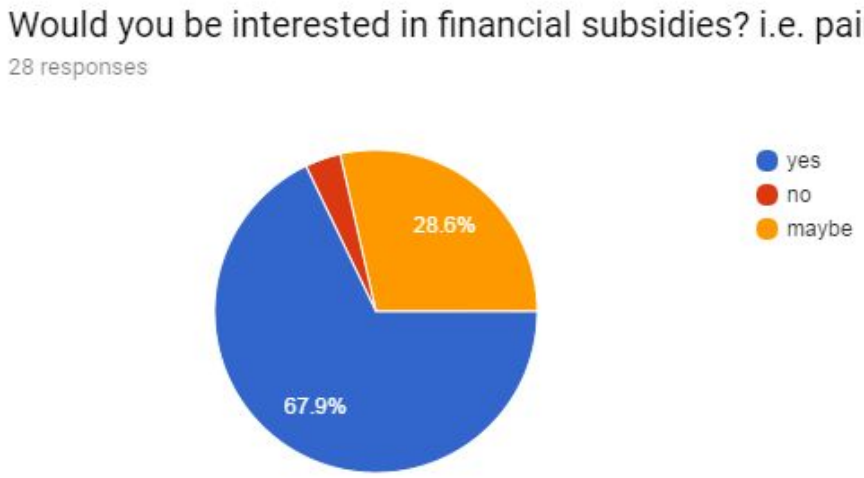
64 responses



Would you be interested in participating in a community clean-up or paint-out in your neighbourhood?

30 responses





Analysis/Summary of Data

- 250 responses, accurate as of July 31, 2018

- Private property - retail (17.2%) and commercial (44.4%) are tagged most
- Wards 1, 2, 3, 4 make up 91.2% of all tagged properties
- 47.4% of tagged properties have 1-5 tags inclusive
- Text tags are present at 100% of the properties, picture at 19%, and splash/slash at 12.1%
- 78.8% of properties have small tags (>1sqft <= 2sqft), 56.8% have medium
- 49.6% of properties were tagged on brick, 21.6% tagged on wood, 50.4% on metal
- Lighting was the most common deterrent present (37.3%) and 55.3% have no deterrents
- 47.6% of properties had been tagged before

Of properties that had been tagged:

- 29.9% were tagged more than 6 times before, 29.9% twice before
- 74.6% had removed the tagging before
- 26.7% have had previous tagging removed by a professional contractor and 43.3% removed it themselves
- Roll paint was the most common removal method (68.9%) followed by cleaning solution at 13.1%, and power washing at 9.8%
- The four biggest barriers to removal were cost, time, weather, and constant removal
- 47.5% would be interested in a commissioned art mural, 43.8% may be interested
- 50% would be interested in a community clean-up or paint-out while 67.9% support the idea of financial subsidies(i.e. Paint vouchers)

Gift Card Cost Subsidy Initiative

Following a meeting in Mid-May with the Keep Hamilton Clean and Green Committee, $2000 were secured for a preliminary testing of the gift card initiative. This money was split into $20 increments, which would be used by the students to subsidize the costs of removing tagging from properties that were 1) the victim of multiple taggings - they have been tagged and have cleaned their property multiple times or 2) a low income household - these individuals can not afford to cover the tagging as the removal may be an unnecessary cost to them. These demographics were chosen as they were the most affected and could benefit the most from this program.

Data tracking for the past month is as follows:

Gift Card #	Address issued to	ARM Number	Date Issued	Expiry	Date of Compliance	Repeat victim Y/N	If yes, tagged already this year? Y/N	If no, self-identified as low income?
1	[redacted]Upper James St	2018 119428	06-Jun-18	20-Jun-18	22-Jun-18	y	y	-
2								
3	[redacted]Upper James St	2018 119438	06-Jun-18	20-Jun-18	19-Jun-18	y	y	-
4	[redacted]Delaware Ave	2018 119919	08-Jun-18	22-Jun-18		y	y	-
5	[redacted]Upper James St	2018 110345	11-Jun-18	25-Jun-18	25-Jul-18	y	y	-
6	[redacted]King St. E.	2018 120810	11-Jun-18	25-Jun-18		y	y	-
7	[redacted] Queenston Rd.	2018 110168	14-Jun-18	28-Jun-18	26-Jun-18	y	y	-
8								
9	[redacted]Sanford Ave S	2018 112550	18-Jun-18	02-Jul-18	26-Jun-18	-	y	y
10								
11	[redacted]King St E	2018 113013	20-Jun-18	04-Jul-18	29-Jun-18	n	n	y

12	[redacted]Cannon St E	2018 121785	21-Jun-18	05-Jul-18	05-Jul-18	y	y	-
13	[redacted]King St E	2018 106370	22-Jun-18	06-Jul-18	29-Jun-18	y	n	-
14								
15	[redacted]Main St W	2018 125308	27-Jun-18	11-Jul-18	02-Aug-18	y	-	-
16								
17	[redacted] Regional Rd 56	2018 123224	27-Jun-18	11-Jul-18	17-Jul-18	y	-	-
18								
19	[redacted] Hughson St. N.	2018 124109	05-Jul-18	19-Jul-18	23-Jul-18	y	n	n
20								
21	[redacted]King St W Dundas	2018 110416	03-Jul-18	17-Jul-18		n	n	y
22	[redacted]Smith Ave.	2018 124136	04-Jul-18	18-Jul-18	11-Jul-18	n	n	y
23	[redacted]Smith Ave.	2018 124139	04-Jul-18	18-Jul-18		n	n	y
24	[redacted]Smith Ave.	2018 124143	04-Jul-18	18-Jul-18		n	n	y
25	[redacted]Main St. W.	2018 111852	06-Jul-18	20-Jul-18	12-Jul-18	y	y	-
26	[redacted]Barton St. E.	2018 124758	11-Jul-18	25-Jul-18		y	n	-
27	[redacted]Oak Ave.	2018 126808	23-Jul-18	06-Aug-18	27-Jul-18	y	n	n
28	[redacted]Smith Ave.	2018 126812	23-Jul-18	06-Aug-18		y	n	n
29	[redacted]Smith Ave.	2018 126813	23-Jul-18	06-Aug-18		y	n	n
30								
31	[redacted]Parkdale Ave. N.	2018 112164	25-Jul-18	08-Aug-18		y	y	y

32	[redacted]Parkdale Ave. N.	2018 127443	25-Jul-18	08-Aug-18	26-Jul-18	y	y	-
33	[redacted]Parkdale Ave. N.	2018 127389	25-Jul-18	08-Aug-18	26-Jul-18	y	y	-
34								
35	[redacted]Barton St. E.	2018 125196	12-Jul-18	26-Jul-18	16-Jul-18	y	y	-
36	[redacted]Barton St. E.	2018 125230	12-Jul-18	26-Jul-18	24-Jul-18	y	y	-
37								
38	[redacted]Main St. W.	2018 126066	18-Jul-18	01-Aug-18		y	y	-
39	[redacted]Main St. W.	2018 126049	18-Jul-18	01-Aug-18	25-Jul-18	y	y	-
40								
41	[redacted]Ottawa St. N.	2018 126493	20-Jul-18	03-Aug-18		y	y	-

We have given out a total of 41 gift cards to 30 property owners. Of these, a total of 27 have complied - with many of these being completed before the official expiry date. The 6 that were not complied, the owners had either 1) forgotten that they had a deadline and forgot to paint it on time or 2) been busy and had not had a chance yet to paint it. Regardless, a solution to this would be to call each recipient 3 to 4 days prior to the recheck to check in and let them know to get the property cleaned up prior to us attending.

Assessment of Management Strategies

Rapid Removal

One main suggestion from the 2013 Audit by MGM Management expressed the need for rapid removal based on the progress seen in Edmonton. This stems from the idea that vandals seek exposure, thus fast action limits this time and builds a non-tolerant reputation of the building that deters vandalism.

Before photos taken on February 6th 2018 at commercial property on Queenston Road.

Photo taken at same location on February 22nd 2018 with 2 additional tags on top of previous. The added colours and coverage leads to a larger clean-up and a higher cost.

Climbing Plants

The above photos were taken in an alleyway (tendency for high graffiti traffic) in a commercial zone on King St. W., Dundas. The tagging virtually ends where the climbing vines begin. The rationale behind this is that the plant provides an unfavourable texture and decreases surface area coverage for tags. Since taggers usually seek exposure, limiting the visibility of tagging proves to be an effective deterrent.

Murals & Wall Art

In an alley littered with graffiti, tagging is absent from this decorated garage door - only the wall left blank is vandalized. It has been suggested that vandals seek a 'blank canvas' to showcase their tag and others have suggested they won't tag art out of respect - either way, murals may provide a creative prevention strategy.

During our Barton St. E. and Fullerton St. walk around, we noticed multiple organic examples of graffiti preventing mural in alleyways and garages. Although city assets and industrial buildings in the area were tagger, the innovative residential properties remained graffiti free.

Legal Wall Spread

The idea of establishing legal walls for street artists to express themselves has been suggested in various media outlets and expressed by thousands of artists. Street art can showcase the local artistic talent and add personality to a community. But, there has been some debate regarding the effectiveness of utilizing legal walls as a graffiti deterrent as mentioned earlier in this report.

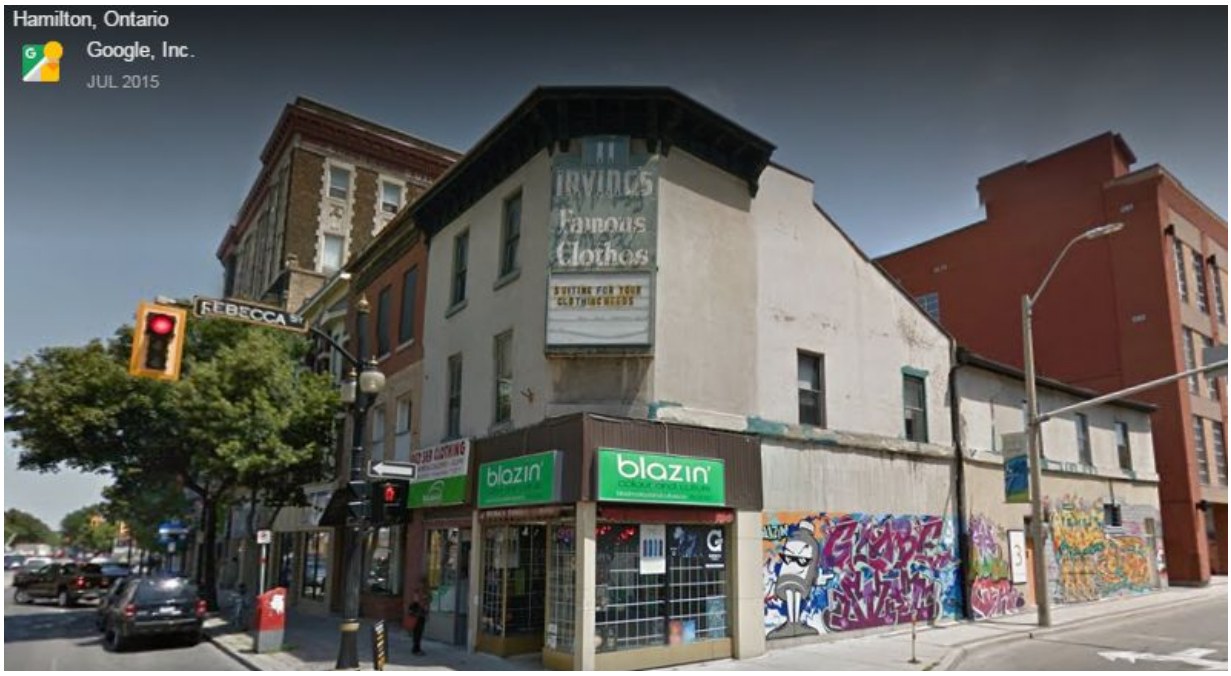


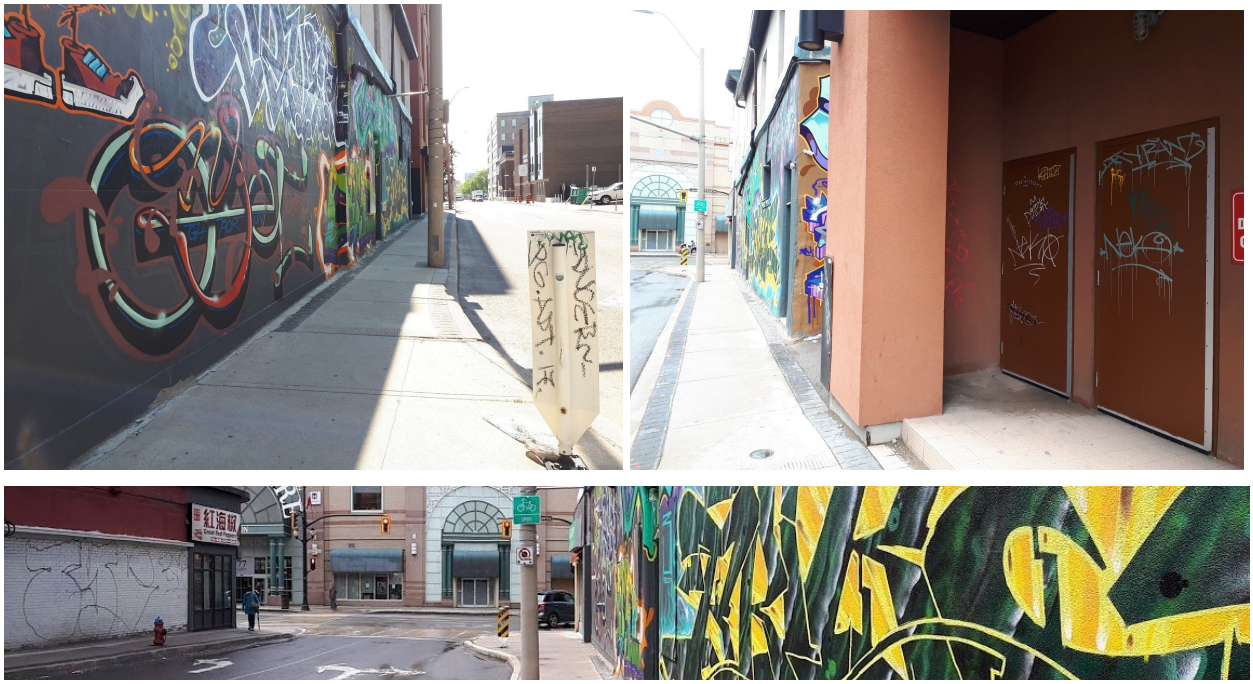
Photo taken from Google Maps Street View of 62 James St. N. where "Blazin' Colour and Culture" is located.

This month, we noticed how the walls of "Blazin' Colour and Culture" on the corner of James St. N. and Rebecca St. were covered in graffiti art. The store sells graffiti products and encourages customers to use their walls for art. The alleyway is filled and constantly evolving.

Murals in the alleyway of 62 James St. North.

The transforming art is an interesting aspect of our city but, unfortunately, the graffiti has spread throughout the alleyway and onto other properties that did not give their consent. Eventually the graffiti art dilutes into tags and even reaches adjacent commercial buildings.

Panorama of alleyway behind 62 James Street North exhibiting how the consented art has spread to nearby buildings and dilutes into senseless tags.



Top Left: tagging spreading to traffic post. Top Right: mixed commercial building East of alley has also been tagged. Bottom: panorama of legal wall and large tag on restaurant across street.

There are numerous parameters that need to be considered when planning a legal wall. One main reason why this specific location proved to be problematic is due to its proximity to other non consenting establishments. Located in a congested area of downtown, the alleyway is shared by multiple buildings and is adjacent to numerous commercial properties. A crowded, busy area like this is not ideal for a legal wall. Since the graffiti art tends to spread and transform into senseless tagging, it would be better to establish a legal wall that is more isolated.

Events and Presentations

BIA Walkaround

This month, we conducted a meeting and walkaround with the International Village BIA Executive Director, [redacted] highlighted the different problems in the BIA (dumping, graffiti, garbage and debris and property standards) and we took note of city assets and private assets that required intervention. The BIA walkaround is a great way of developing a positive working relationship with the BIA directors and learning more about the communities we are serving and the problems they face on a day to day basis.

As majority of graffiti violation we have logged appear to be in commercial areas, it is extremely beneficial to strengthen our links with Hamilton's BIAs. They may be important influencers of our developing Graffiti Management Strategy.

International VILLAGE

Community Outreach - Meeting with Westmount Students

On June 1st, we were invited to meet with highschool students at Westmount Secondary School with Sarah Linfoot-Fusina and Steve Woods. The grade 9 students had learned about the Graffiti Management Strategy and council project in their Civics class after their teacher spoke to Councillor Merulla regarding the subject. Our team shared our efforts thus far and our goals for the project. The students took notes and asked how youth can be involved. They seemed keen on engaging high school students in combating graffiti. We encouraged them to share what they know among their peers to educate them on the consequences of graffiti. Sarah also referred them to [redacted] Project Manager for Hamilton's Youth Strategy, for more engagement opportunities. Gaining the students input helps bridge the gap between the city and the public. Reaching out to youth is a vital component of the GMS. We hope to further engage with youth and participate in more opportunities to educate the public.

Keep Hamilton Clean and Green Committee Meeting

Thanks to the generous $2000 donation from the Keep Hamilton Clean and Green Committee(KHCGC), we were able to distribute Canadian Tire gift cards as a part of the Victim Assistance Program. These cards have been extremely beneficial in encouraging compliance and building rapport with property owners. This week also marks the first 2 cases where we attained compliance with a property owner whom received a gift card.

On Tuesday, June 19th, the KHCGC invited us to join their meeting in City Hall to provide an update on their contribution. Out presentation outlined our role in the Graffiti Management Strategy(GMS) and how the gift cards are being distributed. From our discussions with the committee members, we now have included a label on each gift card to give credit to the KHCGC for their donation.

Our next steps are to also include the committee signature on our thank you cards. The KHCGC is an important stakeholder in the GMS and Victim Assistance Program. We greatly appreciate their efforts and look forward to future collaborations.

Town Hall Presentation

Councillor Sam Merulla's Quarterly Ward 4, East Hamilton Town Hall Meeting was held on Thursday, June 28th 2018. Preceding our presentation, an Officer representing Hamilton Police Services spoke to graffiti enforcement and the HPS protocol. Our presentation then outlined MLE's role in graffiti enforcement and the development of a Victim Assistance program. The concise transition from HPS to MLE showed how graffiti is a community issue that must be tackled from numerous angles. We plan to have more regular discourse with the Hamilton Police. This includes advising the HPS City-Wide Graffiti Reporting Protocol pamphlet and meeting with an Officer in the coming weeks.

Planning and Economic Development - Municipal By-law Enforcement Graffiti Management Strategy presentation at Councillor Sam Merulla's Ward 4, East Hamilton Town Hall Meeting

HPS Briefing

We met with Hamilton Police Services' Hate Crime / Extremism Unit, to discuss graffiti and reporting of any hate bias, political, or gang related tagging. Our goal is to increase communication with the HPS and keep them informed on these types of tags. This will greatly improve the accuracy of HPS statistics as well as for Statistics Canada. As Municipal Law Enforcement Officers, we patrol areas for graffiti and can inform the HPS of unreported hate or gang tags.

Area Sweeps

City Gateways

To improve the perception of our city to visitors, we began and completed proactive patrols near Hamilton's entrances. We visited the 403 highway ramps on York Blvd. and Main St. W. as well as the ramps on Queenston Road near Red Hill Valley Parkway, Centennial Parkway and Nikola Tesla Boulevard. Photos were taken of these gateways and any violating city assets, and then reported to the city hotline for cleanup.

We have yet to attend: Concession Street, Main Street, King Street, Ottawa Street, Parkdale Avenue, and Beasley. We have attended the Locke Street, Kenilworth Avenue, and Upper James Street area already. Attending all of these areas will set a positive message with property owners and also make the City appear more beautiful to visitors and traffic.

Ward 4 Blitz

Following our presentation at the Ward 4 Town Hall meeting, Councillor Merulla suggested to revisit Ottawa St. for the new cases of graffiti. In response, we swept Kenilworth Avenue North, Ottawa Street North, and Parkdale Avenue North once again. Majority of properties on these streets are commercial and

are often tagged. We have swept these areas earlier in the year and noticed an evident decrease in graffiti cases during this second sweep.

During our revisit, only 2 orders were issued on Ottawa St. N. and 3 on Kenilworth Ave.; whereas, our initial visit totalled 13 violations on Ottawa and 9 violations on kenilworth.10 violations were found - all of which were already tagged earlier this year. Only one Order was given to a property since they were in violation since our first visit. Four gift cards were handed out and 2 of these properties complied the next day.

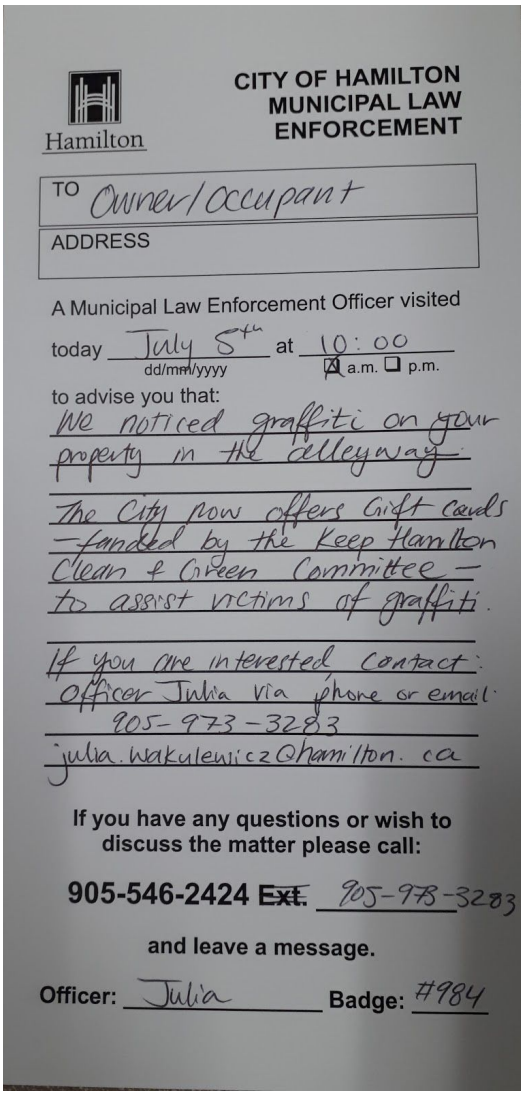
Large scale mural in commercial area of Ottawa Street North.

Barton Alleyway Sweep

In response to a complaint about the yard maintenance issues in an alley perpendicular to Barton St. E. between Smith Ave. and Oak Ave., a full sweep was conducted. Especially since this is a residential area, our soft-approach consisted of speaking to owners/occupants and leaving door knockers. On this sweep:

11 properties were affected, 8 were left with door knockers and educational pamphlets, and 3 were spoken to and given gift cards.

On our recheck on July 23rd 2018: 2 property complied, 2 owners were reminded, 1 order was mailed, and 4 more gift cards were handed out.



Hamilton

CITY OF HAMILTON
MUNICIPAL LAW
ENFORCEMENT

TO Owner/Occupant

ADDRESS

A Municipal Law Enforcement Officer visited today July 5th (dd/mm/yyyy) at 10:00 ☒ a.m. ☐ p.m.

to advise you that:

We noticed graffiti on your property in the alleyway.

The City now offers Gift Cards - funded by the Keep Hamilton Clean & Green Committee - to assist victims of graffiti.

If you are interested Contact: Officer Julia via phone or email
905-973-3283
julia.wakulewicz@hamilton.ca

If you have any questions or wish to discuss the matter please call:

905-546-2424 ~~Ext.~~ 905-973-3283

and leave a message.

Officer: Julia Badge: #984

Door Knocker example.

Alley garage - before and after

Management Strategy Initiatives

Gift Card Cost Subsidy

Following a meeting in Mid-May with the Keep Hamilton Clean and Green Committee, $2000 were secured for a preliminary testing of the gift card initiative. This money was split into $20 increments, which would be used by the students to subsidize the costs of removing tagging from properties that were 1) the victim of multiple taggings - they have been tagged and have cleaned their property multiple times or 2) a low income household - these individuals can not afford to cover the tagging as the removal may be an unnecessary cost to them. These demographics were chosen as they were the most affected and could benefit the most from this program.

Thank You Cards

We have also developed 'thank you' cards to give to property owners as appreciation for their compliance. This small action will exemplify our dedication to sensational service and hopefully strengthen the connection between the City and its citizens. One of our main goals is to bolster the faith property owners have in regards to the City. By showing our gratitude for compliance with the By-Law, citizens will better recognize the vital role they play in our community.

Dear Hamilton Property Owner,

Thank you for your great contribution to keeping our neighbourhoods clean and graffiti-free. Combating graffiti is a community effort and your actions play an impactful role. By working together, we will improve the quality of life for everyone in our community.

If you would like to report graffiti, please use our call centre at 905-546-CITY (2489) or our graffiti reporting site: www.hamilton.ca/graffitiform and feel free to contact us directly if you have any questions or concerns regarding graffiti.

Graffiti Enforcement and Victim Assistance By-Law Officers

Program Analysis

- The program has **two McMaster University co-op students** and will continue until September 2018.
- The purpose of this program is to help the **city** by promoting the maintenance of properties, education of occupants, and keeping the community a clean and safe environment.
- The students are working hard to **enforce and educate** property owners and occupants within the City of Hamilton about graffiti by-laws and will continue to strive to exceed on a daily basis.

Appendix

Appendix A - Hamilton Income Statistics

	Average Household Total Income ($) 2011	2016 Population
Ward 1	67, 302	29, 765
Ward 2	44, 515	37, 155
Ward 3	48, 340	37, 735
Ward 4	58, 248	35, 00
Ward 5	60, 501	37, 160
Ward 6	69, 263	40, 290
Ward 7	73, 409	60, 770
Ward 8	81, 870	52, 220
Ward 9	81, 878	30, 015
Ward 10	86, 807	24, 140
Ward 11	98, 464	45, 180
Ward 12	136, 773	38, 745
Ward 13	99, 141	24, 285
Ward 14	106, 724	15, 995
Ward 15	118, 084	28, 475

Appendix B - Hamilton Ward Property Uses

	Primary Land Use Areas 2013 (ac)								
	Residential	Commercial	Institutional	Industrial	Transport/Utility	Agricultural	Open Space	Vacant Land	Total Land
Ward 1	910	102	384	127	360	10	1, 030	104	3, 027
Ward 2	477	200	131	59	68	0	122	120	1, 177
Ward 3	731	146	122	1, 369	369	0	112	137	2, 986
Ward 4	1, 006	203	110	1, 407	277	0	134	338	3, 475
Ward 5	1, 201	282	141	458	184	7	1, 059	623	3, 955
Ward 6	1, 511	153	171	285	155	29	407	311	3, 022
Ward 7	2, 111	311	254	24	105	27	226	246	3, 304
Ward 8	2, 129	136	530	1	29	60	234	205	3, 324
Ward 9	1, 153	276	173	57	217	962	745	513	4,096
Ward 10	1, 249	96	140	519	80	6	153	144	2, 387
Ward 11	4, 124	644	288	1, 052	2, 883	50, 283	3, 908	1, 626	64, 808
Ward 12	3, 079	434	610	238	1, 459	14, 114	4,240	895	25, 069
Ward 13	1, 501	75	155	54	251	455	2, 538	288	5, 317
Ward 14	4, 189	243	580	2, 284	1, 638	77, 281	12, 474	810	99, 499
Ward 15	3, 707	422	330	405	280	24, 887	4, 554	796	35, 381

Above data retrived from City of Hamilton website - Ward Profiles (https://www.hamilton.ca/city-initiatives/strategies-actions/ward-profiles)
Population data retrieved from Statistics Canada 2016 Census.

Appendix C - Sample Hotspot and Random Areas from 2013 Audit

Ward	Type	Neighbourhood Name	Area
			(Hectares)
1	Hot Spot 1	Westdale South	31.8
1	Random 1	Kirkendall North	27.1
1	Hot Spot 2	Kirkendall North	20.3
1	Random 2	Strathcona	21.0
2	Hot Spot 1	Beasley	25.0
2	Random 1	Central	24.7
2	Random 2	Central	23.7
2	Hot Spot 2	Corktown	24.3
3	Hot Spot 1	Stipeley	33.5
3	Random 1	Blakeley	21.9
3	Hot Spot 2	St. Clair	28.2
3	Random 2	Landsdale	24.5
4	Hot Spot 1	Normanhurst-McQueen West	23.6
4	Hot Spot 2	Crown Point East	24.3
4	Random 2	Bartonville	22.7
4	Random 1	Parkview West	23.1
5	Hot Spot 1	Corman-Red Hill	25.5
5	Random 1	Riverdale West	28.6
6	Hot Spot 1	Lisgar	25.6
6	Random 1	Sherwood	27.7
6	Hot Spot 2	Berrisfield	27.5
6	Random 2	Macassa	27.2
7	Hot Spot 2	Greeningdon	27.8
7	Hot Spot 1	Eastmount	27.2
7	Random 1	Hill Park	23.0
7	Random 2	Centremount	28.6
8	Random 1	Fessenden	24.4
8	Hot Spot 1	Gourley	28.2
8	Hot Spot 2	Buchanan	23.0
8	Random 2	Westcliffe East	24.1
			AVERAGE
			25.6

Appendix D - Sample Areas & Street Boundaries

Ward	Type	Northern Street Boundary	East Street Boundary	South Street Boundary	West Street Boundary
1	Hot Spot 1	Cline Ave N	Bond St	Main St W	Cline Ave S
1	Random 1	Duke St, Pine St, Melbourne St	Queen St S	Aberdeen Ave	Locke St S, Fanning St
1	Hot Spot 2	Chatham St	Locke St S	Aberdeen Ave	Dundurn St
1	Random 2	Peter St	Queen St N	Main St W	Locke St S, Locke St N
2	Hot Spot 1	Wilson St, Kelly St	Ferguson Ave N, Ferguson Ave S	Main St E	Houghson St S
2	Random 1	Stuart St, Bay St N, Railway	James St N	Mulberry St	Bay St N, Barton St W, Caroline St N
2	Random 2	Cannon St W	James St N, James St S	Main St, Macnab St, King St, Summers Ln, Main St	Bay St S, Bay St N
2	Hot Spot 2	Main St E	Walnut St S	Young St	James St S
3	Hot Spot 1	Railway	Leinster Ave N, Chapple St	Beechwood Ave	Sherman Ave N
3	Random 1	Main St E	Gage Ave S	Cumberland Ave	Lorne Ave, Maplewood Ave, Albert St
3	Hot Spot 2	Main St E	St Clair Blvd	Cumberland Ave, Sanford Ave S, Rutherford Ave	Myrtle Ave
3	Random 2	Barton St E	Wentworth St N	Cannon St E	Victoria Ave N
4	Hot Spot 1	Melvin Ave	Bernard St, Britannia Ave, Bernard St	Roxborough Ave	Adeline Ave
4	Hot Spot 2	Roxborough Ave	Kenilworth Ave N	Main St E	Park Row N
4	Random 2	Monterey Ave	Bell Ave	King St E	Kenilworth Ave S
4	Random 1	Brampton St, Knox Ave, Glow Ave	Woodward Ave	Rennie St, Tate Ave, Morley St	Brighton Ave
5	Hot Spot 1	Lawrence Rd, King St E, Ward Boundary	Pottruff Rd S, King St E	Hixon Rd	Mt Albion Rd
5	Random 1	Delawana Dr, Grandville Ave, Violet Dr	Lake Ave N	Glenburn Ct, Gainsborough Rd, Vineyard Rd	Centennial Pkwy N
6	Hot Spot 1	Gatineau Dr, Summer Pl, Summerlea Dr	Carson Dr	Carson Dr	Upper Ottawa St, Larch St, Moxely Dr
6	Random 1	Edgewood Ave, High St, Woodside Dr	Oakcrest Dr, Donlea Dr, Princeton Dr	Fennell Ave E	Upper Ottawa St, Brucedale Ave E, Sherwood Rise
6	Hot Spot 2	Mohawk Rd E, Palmer Rd, Reno Ave	Currie St, Larch St, Billington Cr	Behan St, Palmer Rd, Thorley Dr	Upper Gage Ave
6	Random 2	Macassa Ave	E 36th St	Mohawk Rd E	Upper Sherman Ave
7	Hot Spot 2	Hester St	Upper Wellington St	Limeridge Rd E	Manning Av, Washington S, Purdy Cr, Greeningdon Dr
7	Hot Spot 1	Crockett St, E 27th St, Russell St	Upper Sherman Ave, Queensdale Ave, E 26th St	Brucedale Ave E	E 22nd St
7	Random 1	Vickers Rd	Upper Wentworth St	Mohawk Rd E	E 16th St
7	Random 2	Queensdale Ave E	E 8th St	Fennel Ave E	Upper James St
8	Random 1	Wendover Dr	Appleford Rd, Forestgate Dr, Daisy St	Magnolia Dr	Magnolia Dr
8	Hot Spot 1	Duncairn Cr, Brigadoon Dr	Appleblossom Dr, Brigadoon Dr, Matthew St	Stone Church Rd W	Garth St, Galt St, Brigadoon Dr
8	Hot Spot 2	Delmar Dr	W 5th St, S Bend Rd W, Laurier Ave	Laurier Ave, Stacey St	Columbia Dr
8	Random 2	Sanatorium Rd	Garth St	Mohawk Rd W	Upper Paradise Rd

Appendix E - Graffiti Reporting Survey

https://goo.gl/forms/d2Mb1PcFQ5ZZHKo93

Works Cited

(Ninnes, Ted. "Diversion and graffiti abatement programmes-a new direction." *Social Policy Journal of New Zealand* (1998): 203-212.)

http://www.cbc.ca/news/canada/hamilton/news/graffiti-mar-1-1.3470408

https://hamiltonpolice.on.ca/community/news/2018/03/arrest-made-ottawa-street-graffiti-mischief

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Engineering Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Proposed Permanent Closure and Sale of a Portion of Binkley Road and a Portion of Original Road Allowance Between the Townships of Beverly and West Flamborough, Dundas, ON (PW18081) (Ward 13 & Ward 14)
WARD(S) AFFECTED:	Ward 13 & Ward 14
PREPARED BY:	Gary Kirchknopf, Senior Project Manager Corridor Management (905) 546-2424, Extension 7217 Cetina Farruggia, Road Programming Technician Corridor Management (905) 546-2424, Extension 5803
SUBMITTED BY: **SIGNATURE:**	Gord McGuire Director, Engineering Services Public Works

RECOMMENDATION

That the applications of the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON, to permanently close and purchase a portion of Binkley Road (Forced Road) and a Portion of Original Road Allowance between the Townships of Beverly and West Flamborough, Dundas, ON ("Subject Lands"), as shown on Appendix "A", attached to Report PW18081, be approved, subject to the following conditions:

(a) That the City Solicitor be authorized and directed to prepare all necessary by-laws to permanently close and sell the highway, for enactment by Council;

(b) That the Real Estate Section of the Planning and Economic Development Department be authorized and directed to sell the closed highway to the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON, in accordance with the City of Hamilton Sale of Land Policy By-law 14-204;

(c) The City Solicitor be authorized to complete the transfer of the Subject Lands to the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON pursuant to Agreements of Purchase and Sale or Offer to Purchases

as negotiated by the Real Estate Section of the Planning and Economic Development Department;

(d) That the City Solicitor be authorized and directed to register a certified copy of the by-laws permanently closing and selling the highway in the proper land registry office;

(e) That the Public Works Department publish any required notice of the City's intention to pass the by-laws and/or permanently sell the closed highway pursuant to the City of Hamilton Sale of Land Policy By-law 14-204;

(f) That the applicants be fully responsible for the deposit of a reference plan in the proper land registry office, and that said plan be prepared by an Ontario Land Surveyor to the satisfaction of the Manager, Geomatics and Corridor Management Section, and that the applicant also deposit a reproducible copy of said plan with the Manager, Geomatics and Corridor Management Section.

EXECUTIVE SUMMARY

The owners of 29 Middletown Road, Dundas, ON has made an application to permanently close and purchase a portion of Binkley Road, Dundas ON in order to provide his property access to Governor's Road, as the City had opted to close the Binkley Road hill due to its need for extensive and costly maintenance. The owners of 107 Middletown Road, and 67 Middletown Road, Dundas, ON, have each made application to close and purchase a Portion of Original Road Allowance between the Townships of Beverly and West Flamborough, Dundas, ON in order to add to their existing property limits. There were no objections from any City Departments, divisions, or public utilities. Staff reviewed 4 objections from abutting land owners. 2 objections did not provide reason for objection. One owner objected as they want to maintain a walking trail along the existing road allowance known as Binkley Road. One owner expressed concerns regarding road traffic, access to the rear of their property for future development, and trail enjoyment. Upon review of these comments, this road was open for half the year with public traffic and now has been closed by the City with no intention of reopening due to the extended costs of maintaining and restructuring the road. As a private road would not create the same level of traffic residents were accustomed to while the road was open, and as there is no City plan for this road to be used as a trail in the future, staff support the applications.

Alternatives for Consideration – See Page 4

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The applicant has paid the Council approved user fee of $4,454.00. The Subject Lands will be sold to the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON, as determined by the Real Estate Section of the Planning and Economic Development

Department, in accordance with the City of Hamilton Sale of Land Policy By-law 14-204.

Staffing: An agreement to purchase the Subject Lands will be negotiated by the Real Estate Section of the Planning and Economic Development Department.

Legal: The City Solicitor will prepare all necessary by-laws to permanently close and sell the Subject Lands and will register such by-laws in the Land Registry Office once Council has approved the by-law. The by-law does not take effect until the certified copy of the by-law is registered in the proper land registry office. The City Solicitor will complete the transfer of the Subject Lands to the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON, pursuant to agreements negotiated by the Real Estate Section of the Planning and Economic Development Department.

HISTORICAL BACKGROUND

The portion of the Subject Lands known as Binkley Road operated as a seasonal access between Middletown Road and Binkley Road, Dundas ON. In 2015, the City's Road Operations division decided to permanently close this road access due to the extensive costs to repair and maintain this access. A geotechnical consultant reviewed the embankment issues noted by staff and a decision was made to close the road following this investigation as there was no funding available to repair the seasonal road. In early 2018, Corridor Management staff met with Road Operations staff to discuss the proposed closure of Binkley Road. On March 24, 2018 staff received an application from the owner of 29 Middletown Road to close and purchase a portion of the Subject Lands (A) for the purpose of creating a private access road from their property to lower Middletown Road which further creates access to Governors Road. On March 24, 2018 staff also received an application from the owner of 67 Middletown Road to close and purchase a portion of the Subject Lands (B) for the purpose of extending existing property limits. On April 16, 2018 staff received a third application from the owner of 107 Middletown Road to close and purchase a portion of the Subject Lands (C) also for the purpose of extending existing property limits. These portions of the Subject Lands being a portion of the Original Road Allowance between the township of Beverly and West Flamborough are currently untraveled.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

A by-law must be passed to permanently close the lands in accordance with the *Municipal Act, 2001.*

RELEVANT CONSULTATION

The following City Departments and Divisions and Public Utilities were provided with a copy of this application and invited to provide comments:

- Planning and Economic Development Department: Development Engineering, Building, Economic Development, Real Estate, and Planning
- Public Works Department: Engineering Services, Hamilton Water, Operations, Environmental Services, and Transportation
- Hamilton Emergency Services
- Corporate Services Department: Budgets and Finance
- Mayor and Ward Councillor
- Bell, Horizon Utilities/Alectra Utilities, Hydro One, and Union Gas

There were no objections received from any public utilities, City departments and divisions.

Road Operations provided the following comments:

"Binkley Road from approx. 200 metres north of Old Governors Rd to where it meets Middletown Rd on the other side of the valley was a seasonal road normally closed between October and April over the winter period. No maintenance was carried out during these months. During 2015 embankment problems were noted by one of our Road Supervisors. This was investigated by our Section. We retained a geotechnical consultant to review the embankment and provide recommendations. The stability of the embankment is a concern and is therefore a safety concern for motorists on this road. The road was closed following the investigation. No funding is available to repair this seasonal road."

Notice of the proposal was sent to all abutting property owners of the Subject Lands, as shown on Appendix "B", for comment. In this instance, there were 25 notices mailed, and the results are as follows:

In favour: 6 Opposed: 4 No comment: 1

Two of the opposed responses did not provide comment for the reason for their objection. One owner objected as they want to maintain a walking trail along the existing road allowance known as Binkley Road. One owner expressed concerns regarding road traffic, access to the rear of their property for future development, and trail enjoyment. Upon review of these comments, this road was open for half the year with public traffic and now has been closed by the City with no intention of reopening due to the extended costs of maintaining and restructuring the road. As a private road would not create the same level of traffic residents were accustomed to while the road was open, and as there is no City plan for this road to be used as a trail in the future, staff support the applications of the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

As there were no objections received from any City Departments, Divisions, or Public Utilities, and 4 objections received from abutting owners that staff have reviewed and determined would not any more affected by the closure and sale as if the road were to remain open for public use, staff support the applications from the owners of 29 Middletown Road, 107 Middletown Road, and 67 Middletown Road, Dundas, ON.

ALTERNATIVES FOR CONSIDERATION

The City could deny these applications, and the road allowances would remain public.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Built Environment and Infrastructure

Hamilton is supported by state of the art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

APPENDICES AND SCHEDULES ATTACHED

Appendix A: Aerial Drawing

Appendix B: Location Plan

Appendix C: Schedule of Land Applications

Appendix A
Report PW18081

PROPOSED CLOSURE OF PORTION OF ROAD ALLOWANCE

PART A - BINKLEY ROAD

PART B - ORIGINAL ROAD ALLOWANCE BETWEEN THE TOWNSHIPS OF BEVERLY AND WEST FLAMBOROUGH

PART C - ORIGINAL ROAD ALLOWANCE BETWEEN THE TOWNSHIPS OF BEVERLY AND WEST FLAMBOROUGH

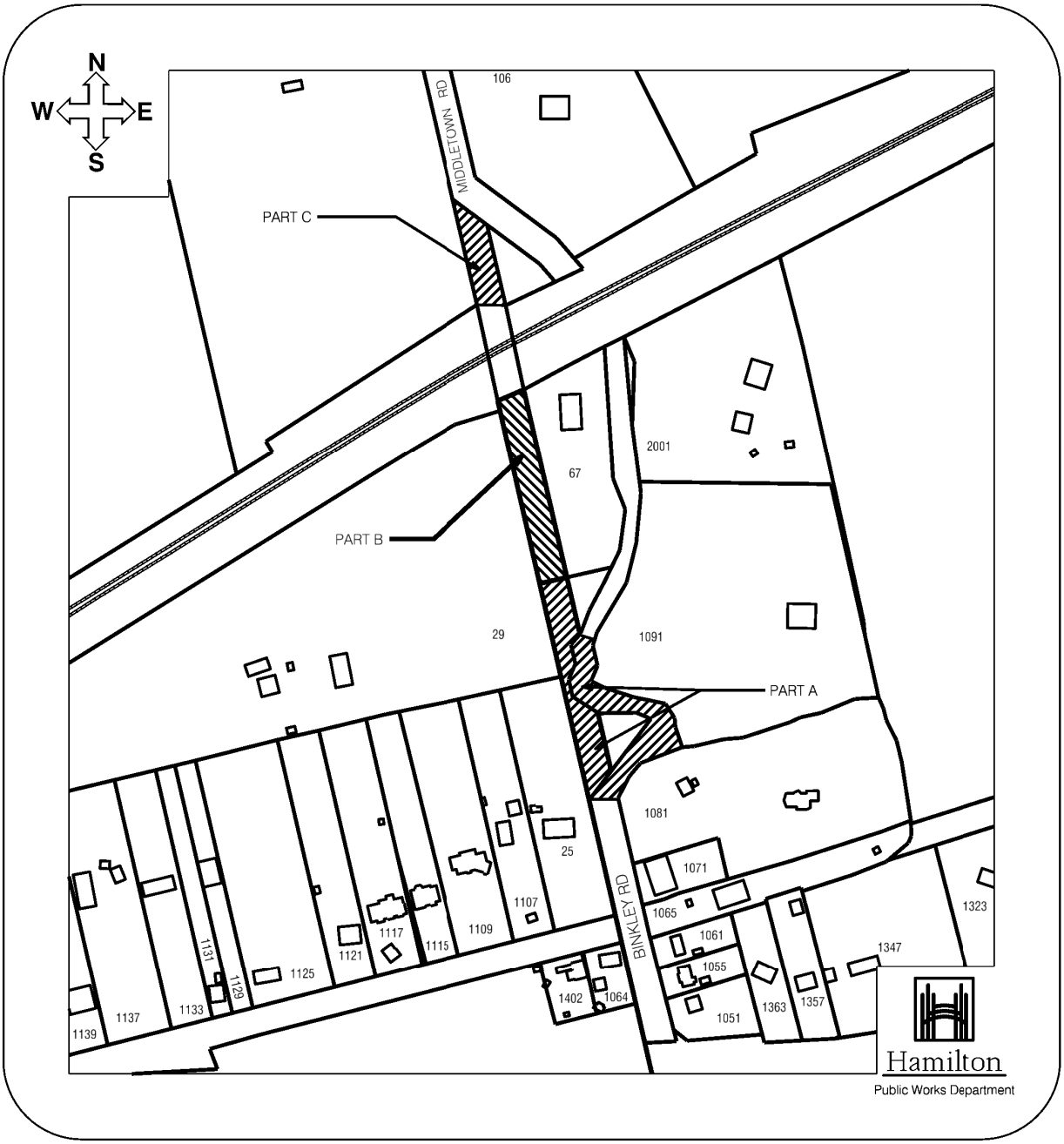
Hamilton

Geomatics & Corridor Management Section
Public Works Department

LEGEND

Lands to be Closed

NTS | 18/07/2018 | Sketch by: SC



LOCATION PLAN

PROPOSED CLOSURE OF
PORTION OF ROAD ALLOWANCE

PART A - **BINKLEY ROAD**

PART B - **ORIGINAL ROAD ALLOWANCE BETWEEN THE TOWNSHIPS OF BEVERLY AND WEST FLAMBOROUGH**

PART C - **ORIGINAL ROAD ALLOWANCE BETWEEN THE TOWNSHIPS OF BEVERLY AND WEST FLAMBOROUGH**

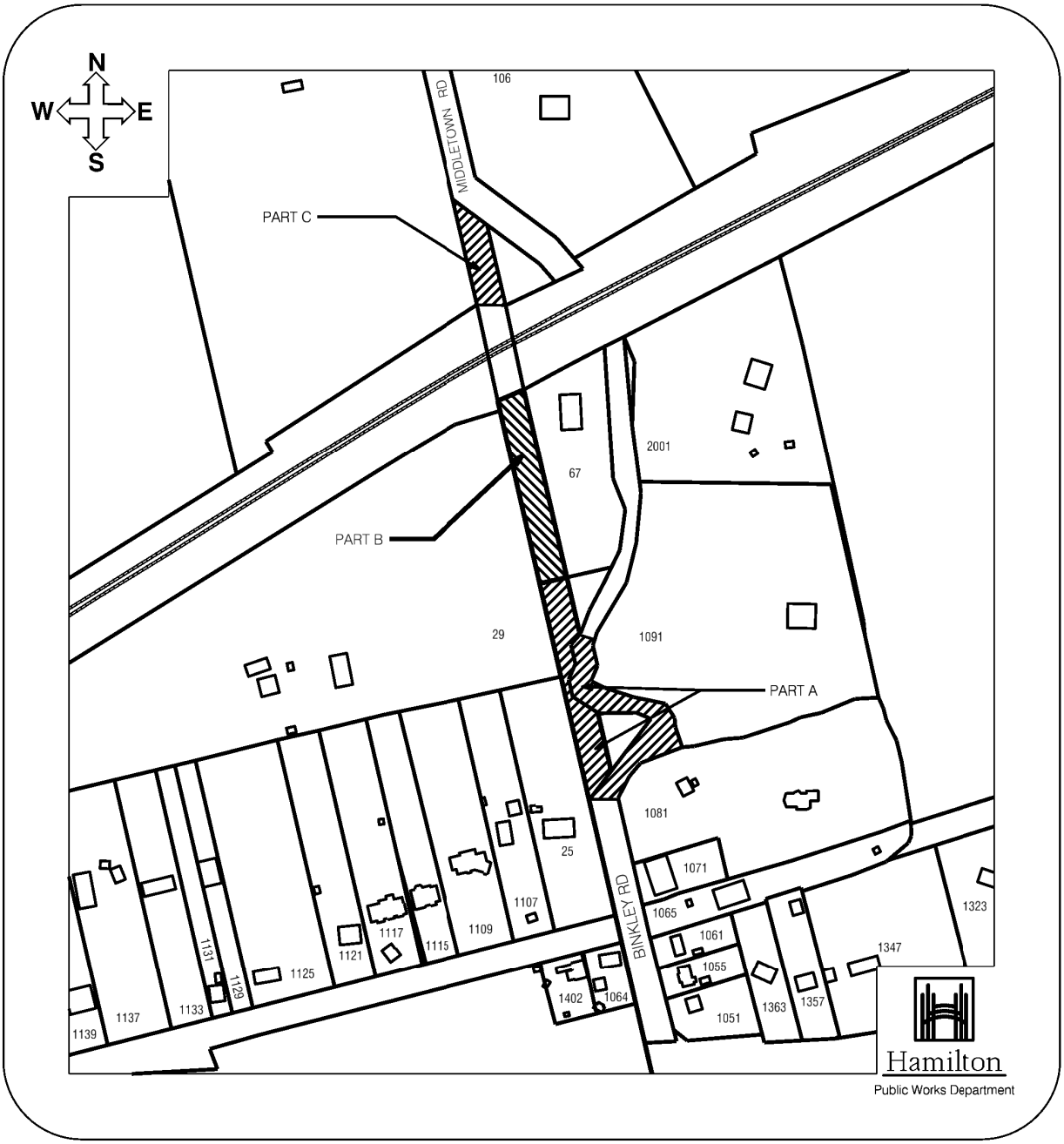
CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT

LEGEND

SUBJECT LANDS

DATE: JULY 18, 2018 | Not to Scale

REFERENCE FILE NO : PW18__



LOCATION PLAN

PROPOSED CLOSURE OF
PORTION OF ROAD ALLOWANCE

PART A - **BINKLEY ROAD - 29 Middletown Road**

PART B - **ORIGINAL ROAD ALLOWANCE BETWEEN THE TOWNSHIPS OF BEVERLY AND WEST FLAMBOROUGH-67 Middletown Road**

PART C - **ORIGINAL ROAD ALLOWANCE BETWEEN THE TOWNSHIPS OF BEVERLY AND WEST FLAMBOROUGH-107 Middletown Road**

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT

LEGEND

SUBJECT LANDS

DATE: JULY 18, 2018 | Not to Scale

REFERENCE FILE NO : PW18__

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Engineering Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Proposed Permanent Closure and Sale of a Portion of Moxley Road, Dundas, ON (PW18082) (Ward 14)
WARD(S) AFFECTED:	Ward 14
PREPARED BY:	Gary Kirchknopf, Senior Project Manager Corridor Management (905) 546-2424, Extension 7217 Cetina Farruggia, Road Programming Technician Corridor Management (905) 546-2424, Extension 5803
SUBMITTED BY: **SIGNATURE:**	Gord McGuire Director, Engineering Services Public Works

RECOMMENDATION

That the application of Lafarge Canada Inc., to permanently close and purchase the northerly portion of Moxley Road between Concession 4 West and Highway 5 Dundas, ON (“Subject Lands”), as shown on Appendix "A", attached to Report PW18082, be approved, subject to the following conditions:

(a) That the City Solicitor be authorized and directed to prepare all necessary by-laws to permanently close and sell the highway, for enactment by Council;

(b) That the Real Estate Section of the Planning and Economic Development Department be authorized and directed to sell the closed highway to Lafarge Canada Inc. in accordance with the City of Hamilton Sale of Land Policy By-law 14-204;

(c) The City Solicitor be authorized to complete the transfer of the Subject Lands to Lafarge Canada Inc. pursuant to an Agreement of Purchase and Sale or Offer to Purchase as negotiated by the Real Estate Section of the Planning and Economic Development Department

(d) That the City Solicitor be authorized and directed to register a certified copy of the by-law permanently closing and selling the highway in the proper land registry office;

(e) That the Public Works Department publish any required notice of the City's intention to pass the by-laws and/or permanently sell the closed highway pursuant to the City of Hamilton Sale of Land Policy By-law 14-204;

(f) That the applicant enters into agreements with any Public Utility requiring easement protection;

(g) That the applicant be fully responsible for the deposit of a reference plan in the proper land registry office, and that said plan be prepared by an Ontario Land Surveyor to the satisfaction of the Manager, Geomatics and Corridor Management Section, and that the applicant also deposit a reproducible copy of said plan with the Manager, Geomatics and Corridor Management Section;

(h) That the applicant is fully responsible for the construction of a cul-de-sac at the northern limit of the public road allowance, to City Standards, as determined by the Road Operations Division, Public Works Department.

EXECUTIVE SUMMARY

Lafarge Canada Inc. has made application to permanently close and purchase a portion of Moxley Road running North/South between Concession Road 4 West and Highway 5, Dundas, ON. The applicant proposes this closure as a product of Official Plan Amendment and Zoning By-Law Amendment approved by council on November 22, 2017 to facilitate the Lafarge Dundas South Quarry Extension. There was one objection received from Transportation Planning and no other objections received from any other City Departments, Divisions, or Public Utilities. Transportation Planning raised concerns regarding 568 and 588 Moxley Road losing road access, however, these properties are owned by Lafarge Canada Inc. and were included in PED17194 as part of the South Quarry Extension application and have been re-zoned and demolished. Corridor Management staff are satisfied that this objection has been addressed. There were 3 opposed responses received from land owners who abut the portion of Moxley Road that will remain open. 2 of the opposed did not provide reason for opposition. One provided concerns related to traffic impact and illegal parking on Highway 5 that impacts road safety. A traffic impact study was completed and reviewed by City Staff without any concerns, as a product of the Zoning Amendment By-Law application ZAC-13-051 and Official Plan Amendment Application RHOPA-13-015 as indicated in report PED17194 approved by Council on November 22, 2017. Furthermore, staff received correspondence from the applicant regarding the implementation of a driver education program as well as the site being opened as early as 4am to allow trucks to queue on-site during construction season. As such, staff are in support of the application to permanently close and sell the Subject Lands to Lafarge Canada Inc..

Alternatives for Consideration – See Page 5

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The applicant has paid the Council approved user fee of $4,454.00. The Subject Lands will be sold to Lafarge Canada Inc., as determined by the Real

Estate Section of the Planning and Economic Development Department, in accordance with the City of Hamilton Sale of Land Policy By-law 14-204.

Staffing: An agreement to purchase the Subject Lands will be negotiated by the Real Estate Section of the Planning and Economic Development Department.

Legal: The City Solicitor will prepare all necessary by-laws to permanently close and sell the Subject Lands and will register such by-laws in the Land Registry Office once Council has approved the by-law. The by-law does not take effect until the certified copy of the by-law is registered in the proper land registry office. The City Solicitor will complete the transfer of the Subject Lands to Lafarge Canada Inc., pursuant to an agreement negotiated by the Real Estate Section of the Planning and Economic Development Department.

HISTORICAL BACKGROUND

Lafarge Canada Inc. currently operates the Lafarge Dundas Quarry (ARA Licence #5473) which is located to the east of Moxley Road. Lafarge recently received OPA (RHOPA-13-015) and Zoning By-Law Amendment (ZAC-13-051) approval through PED17194 approved by Council on November 22, 2017. On April 9, 2018 Lafarge then received an Aggregate Resource Act license from MNRF for the Dundas South Quarry Extension (ARA Licence #625711) which include lands to the east and west of Moxley Road. As part of the pre-consultation process for the South Quarry Extension application, the City of Hamilton asked if Lafarge would consider applying to close a portion of Moxley Road if the South Quarry Extension licence was approved. On May 15, 2018, an application to close and purchase the Subject Lands was received in order to facilitate maximization of aggregate resource and more efficient operation and rehabilitation plans. Furthermore, the closure of this section of Moxley Road would remove the requirement for a road crossing between Phases 1 and 2, which will facilitate the transfer of material from Phase 2 to the processing area in the approved South Quarry to the east. The portion of Moxley road, being the Subject Lands, is currently travelled, but does not have any occupied residences fronting onto it. All the agricultural users and residences south of the Subject Lands will still maintain road access to Highway 5 from the southern portion of Moxley Road that will remain open.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

A by-law must be passed to permanently close the lands in accordance with the *Municipal Act, 2001.*

RELEVANT CONSULTATION

The following City Departments and Divisions and Public Utilities were provided with a copy of this application and invited to provide comments:

- Planning and Economic Development Department: Development Engineering, Building, Economic Development, Real Estate, and Planning

- Public Works Department: Engineering Services, Hamilton Water, Operations, Environmental Services, and Transportation
- Hamilton Emergency Services
- Corporate Services Department: Budgets and Finance
- Mayor and Ward Councillor
- Bell, Horizon Utilities/Alectra Utilities, Hydro One, Imperial Oil and Union Gas

There was one objection received from Transportation Planning and no other objections received from any public utilities, City departments and divisions.

Hydro One, Union Gas, and Imperial Oil have advised that they will require easement protection.

Corridor Management provided the following comments:

"There needs to be land dedicated at the end of the public road allowance to the City and a cul-de-sac constructed to City Standards."

Transportation Planning provided the following comments:

"Transportation does not support the road closure of Moxley Road as addresses 588 Moxley Road and 568 Moxley Road would lose access to their properties and become landlocked." However, the properties referenced within this comment are currently owned by Lafarge Canada Inc., have had their zoning amended through PED17194 as part of the Lafarge South Quarry Extension, and have begun being demolished. Therefore, staff are satisfied that this objection has been addressed.

Notice of the proposal was sent to all abutting property owners of the Subject Lands, as shown on Appendix "B", for comment. In this instance, there were 6 notices mailed, and the results are as follows:

In favour: 0 Opposed: 3 No comment: 1

Two of the three opposed responses did not provide comment for the reason to their opposition. One provided comments and concerns regarding traffic impact of accessing Highway 5 from Moxley Road as well as concerns related to illegal parking along Highway 5 which hinders sightlines and makes it difficult to safely turn onto Highway 5. With regards to the traffic impact, a full traffic study was completed and reviewed by City Staff as indicated in PED17194 as part of the Zoning Amendment By-Law and Official Plan Amendment applications which were approved by council on November 22, 2017. With regards to the illegally parked trucks along Highway 5, the applicant has advised staff that they have implemented a driver education program and during construction season opens its gates as early as 4am to allow for trucks to queue on-site which will rectify this issue.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

As there was one objection received from a City Department that staff are satisfied was not warranted, and there were no other objections received from any City Departments, Divisions, or Public Utilities, and staff were able to address the concerns raised by the opposing residents, staff are in support of the closure and sale of the Subject Lands to Lafarge Canada Inc.

ALTERNATIVES FOR CONSIDERATION

The City could deny the application and retain the lands as public highway.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Built Environment and Infrastructure

Hamilton is supported by state of the art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

APPENDICES AND SCHEDULES ATTACHED

Appendix A: Aerial Drawing

Appendix B: Location Plan

Appendix A
Report PW18082

Hamilton

PROPOSED CLOSURE OF
PORTION OF MOXLEY ROAD

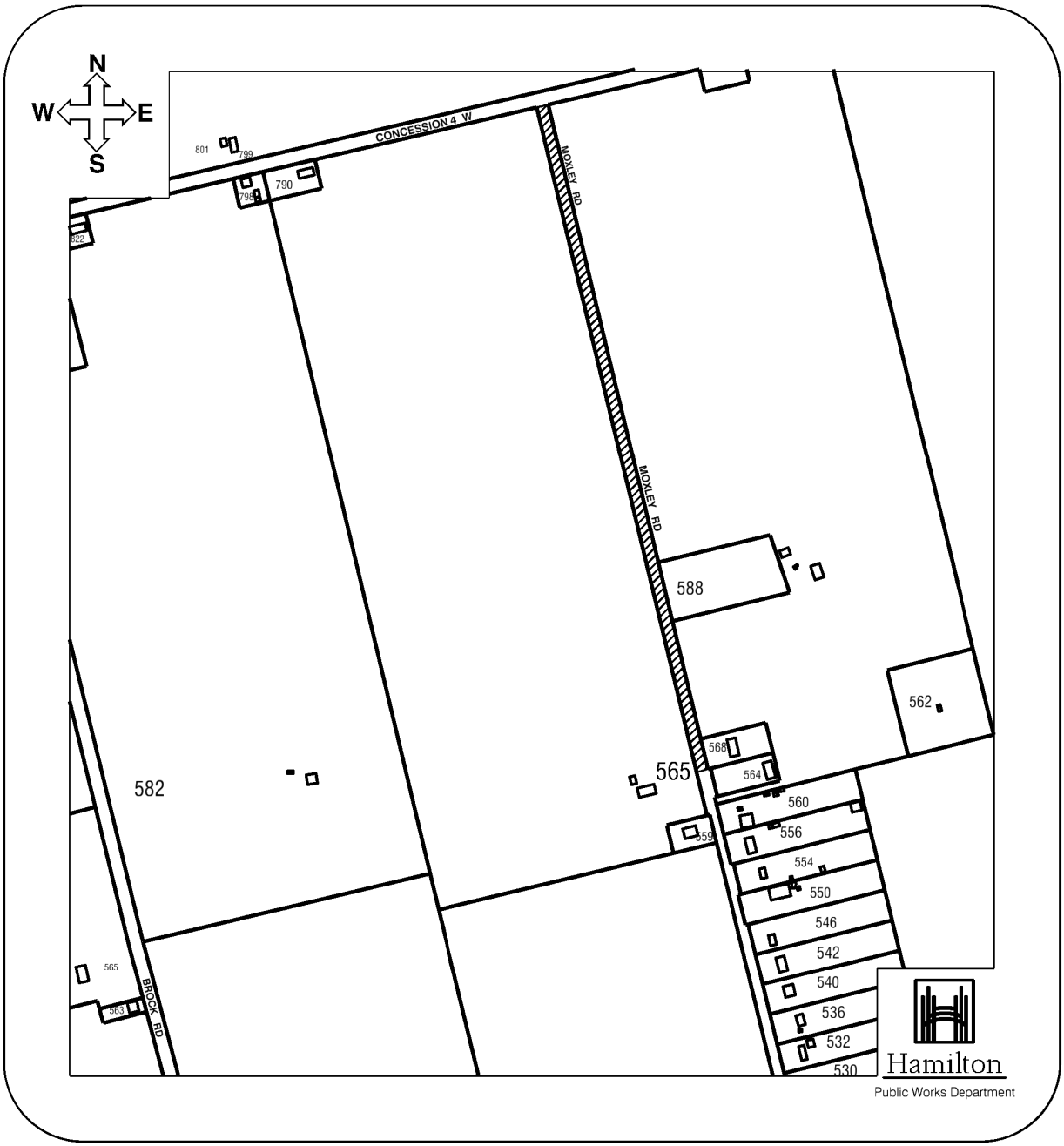
Geomatics & Corridor Management Section
Public Works Department

LEGEND

Lands to be Closed

NTS | 22/05/2018 | Sketch by:SC

Appendix B
Report PW18082



LOCATION PLAN

PROPOSED CLOSURE OF
PORTION OF

MOXLEY ROAD

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT

LEGEND

SUBJECT LANDS

DATE: MAY 22, 2018	Not to Scale

REFERENCE FILE NO : PW17__

INFORMATION REPORT

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Corrosion Control Program for the Woodward Drinking Water System (PW18080) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Susan Girt 905-546-2424, Extension 2671
SUBMITTED BY: **SIGNATURE:**	Andrew Grice Director, Hamilton Water Public Works

Council Direction:

The Public Works Committee, at its meeting dated November 16, 2015 approved the following:

(a) That the General Manager of Public Works be authorized and directed to implement corrosion control within the Woodward Drinking Water System (DWS) using a phosphate-based treatment approach with orthophosphate as the method for corrosion control (phosphoric acid as the treatment additive);

(b) That Capital Project ID 5141666110 in the amount of $4.95 Million be approved for the design and construction of a chemical addition, storage and metering facility at the Woodward Water Treatment Plant, including $2 Million WIP funding from Project 5141166110 (planned process upgrades at the Woodward facility);

(c) That the Water Operating Budget Forecast be increased by $310,000 in 2018 to support the annual ongoing cost of the Corrosion Control Program (substantially for purchase of the chemical);

(d) That the General Manager of Public Works be directed to develop and implement an Outreach Plan for the users of the Woodward DWS respecting the Corrosion Control Program;

(e) That one temporary Full-time Equivalent (FTE) is added to the Hamilton Water complement for a two-year period to support the implementation and monitoring associated with the Corrosion Control Program, anticipated to occur between 2016 – 2019;

(f) That a one-time increase of $250,000 be added to the Water Operating Budget Forecast in 2018 to support preparation of the Woodward DWS for chemical addition.

Information:

In 2007, changes to the Safe Drinking Water Act and Ontario Regulation 170/03 sought to improve the safety of drinking water as it relates to the presence of lead. The City of Hamilton obtained approval by both Council and the Ministry of Environment and Climate Change (MOECC now the Ministry of Environment, Conservation and Parks (MECP)), to implement a Corrosion Control Program (CCP). The objective of the program is to improve the quality of water by reducing the lead concentration at the tap to below the allowable limit of 10 µg/L, as defined in the Ontario Drinking Water Quality Standards (ODWQS).

Hamilton's Corrosion Control program is a system-wide approach that provides the ultimate level of protection to Hamilton residents from lead in drinking water.

This report, serves to highlight the progress of the Corrosion Control Program.

- Corrosion Control Plan, 2010

The Corrosion Control Plan for the Woodward Sub-System within the City of Hamilton's Drinking Water System (CH2M Hill, 2010) was submitted for review and approval to the MOECC in 2010 for compliance with Schedule 15.1 of O. Reg 170/03. The Corrosion Control Plan addressed the following:

a) Assessment of Corrosion in the City of Hamilton's Drinking Water System

b) Development of Alternative Corrosion Control Measures and Their Evaluation

c) Identification of the Preferred Measure for Corrosion Control

d) Implementation Plan and Post-Implementation Monitoring Plan

Based on a comprehensive review of the occurrence of lead measured at the tap, the number of lead services remaining in the system, the cost associated with Lead Service Line replacement and the experience of other municipalities with similar water quality conditions, a phosphate-based treatment approach was recommended for corrosion control in the City of Hamilton.

Orthophosphate is an effective corrosion inhibitor as it forms a thin protective coating on lead surfaces. This coating helps reduce corrosion and the leaching of lead from surfaces in contact with drinking water. Phosphate-based inhibition for Corrosion Control is also used in various communities including Toronto, ON (2014), Winnipeg, MB (2000), Halifax, NS (2002) Washington, DC (2004) and others.

- Health Related Concerns of Lead and Benefits of Orthophosphate

Consumption of even very small amounts of lead is harmful to human health, especially in infants, young children and pregnant women (impacts to foetus). There is no recommended level of lead ingestion that is considered safe.

Phosphorus is an essential mineral primarily used for growth and repair of body cells and tissues. Structurally it is found in bones and teeth and functionally, it is required for a variety of biochemical processes including energy production and pH regulation. It is found in many foods in the form of phosphate and as a food additive in the form of various phosphate salts used for non-nutrient functions during food processing.

As part of Hamilton's Corrosion Control Program, orthophosphate will be introduced into the Woodward DWS in small doses in the form of food-grade phosphoric acid, which is a clear, odourless liquid. The addition of orthophosphate into the Woodward DWS represents only a small fraction of phosphate that is consumed as part of a natural diet. To put this into perspective, an average person would need to drink more than 330 glasses of tap water to get the same amount of phosphate that is present in one glass of milk. See Table 1 in Appendix A for other dietary sources of phosphorus.

- Financial Implications

The Capital cost for the full-scale corrosion control chemical addition, storage and metering facility at the Woodward Water Treatment Plant (WTP) is estimated at $4.95M.

A breakdown of the estimated pre-and post-implementation annual operating costs are illustrated in Table 2 in Appendix A.

- Outreach Plan

Hamilton Water developed a comprehensive outreach plan that highlights, the health risks of lead exposure and the benefits of corrosion control. Stakeholders included residential, commercial, industrial and institutional customers as well as other water systems supplied by Hamilton Water (Haldimand County and Halton Region).

- Design & Construction (Capital Program)

The corrosion control chemical building at the Woodward Water Treatment Plant consists of storage tanks and pumps that will add phosphate to treated water prior to entering the distribution system. Phosphoric acid will initially be added at a concentration of between 1.8 and 3 mg/L as PO4 (phosphate). Preliminary design of the Capital Works program began in 2016 and Commissioning is on track to begin in October 2018

- Implementation and Contingency Planning

Baseline monitoring to understand the impact of orthophosphate on the distribution system has been completed and a post implementation monitoring program has been developed. Monitoring of lead concentrations at the tap will be incorporated into the monitoring plan once the system has stabilized.

The Woodward DWS Licence was amended August 17, 2017 to include Corrosion Control. Hamilton Water is on target to begin Corrosion Control Chemical addition in November 2018.

- Distribution Plan

Hamilton Water staff are actively flushing the water distribution network to prepare the system for phosphate addition. Upon implementation of the Corrosion Control Program it is possible to have some localized water quality issues such as cloudy water or taste and odour complaints. Hamilton Water will ensure staff are available to respond to any water quality complaints.

Appendices and Schedules Attached

Appendix A – Summary Tables

Table 1 – Dietary Sources of Phosphorus

Food/Beverage	Portion	Phosphorus (mg)
Cheddar cheese	50g	256
Milk, 1%	250mL	245
Yogurt, plain, 1%-2% MF	175mL	261
Salmon, pink, canned, drained with bones	75g	274
Lean ground beef, pan-fried	75g	174
Almonds, roasted	60mL	171
Baked beans with pork, canned	175mL	202
Peanut butter, natural	30mL	113
Instant oatmeal, plain	1 packet (186g)	132
Bread, whole wheat	1 slice (35g)	80
Peas, green, cooked	125mL	100
Potato, baked, flesh and skin	1 (173g)	121
Banana	1 (118g)	26
Cola beverage	1 can (355mL)	48
Milk chocolate bar	1 bar (50g)	104

Table 2 – Pre- and Post-Implementation cost allocation

Pre-implementation Costs (2016-2018)	Post-implementation Costs (commencing 2018)
○ $97,000 annually – 1 temporary 24 month FTE ○ $10,000 annually – laboratory analysis	○ $10,000 annually – laboratory analysis ○ $300,000 annually – chemical addition ○ Distribution Plan – one time increase of $250,000

Hamilton

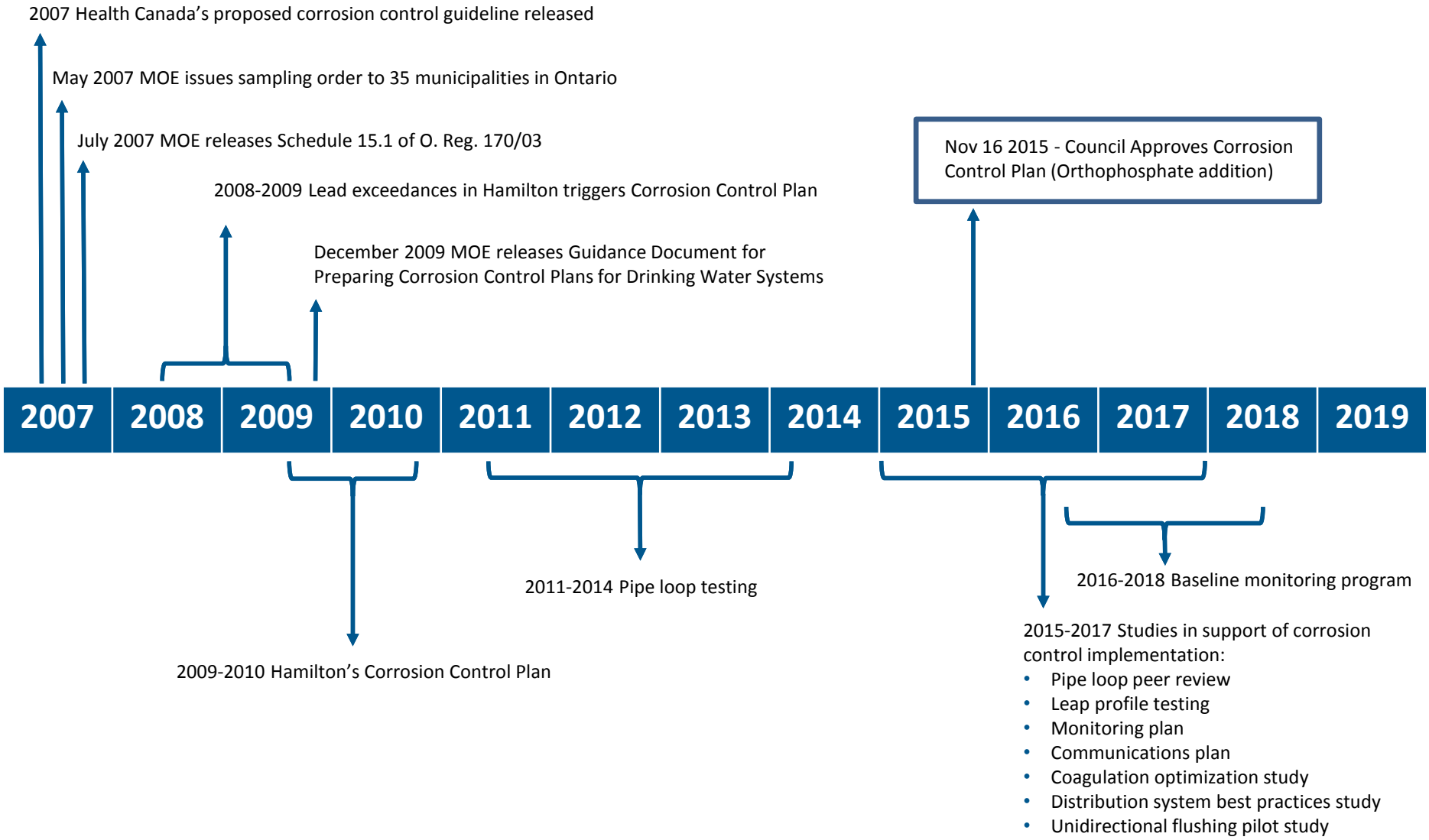
Corrosion Control Program Update - Woodward Drinking Water System

September 17, 2018

AGENDA

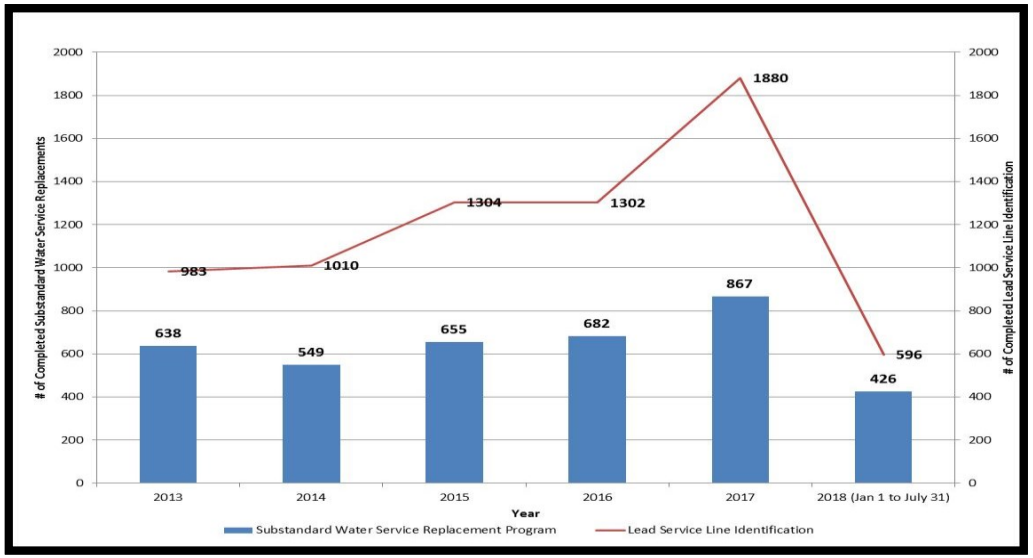
- Hamilton Corrosion Control Journey
- Health Benefits
- Implementation Update
- Financial Update
- Outreach Plan
- What to Expect

HAMILTON'S CORROSION CONTROL JOURNEY



EXISTING PROGRAMS FOR LEAD

- Active participation in sub standard and lead service line program
- 600 + filters handed out to residents
- Lead awareness and outreach (mailings and brochures)



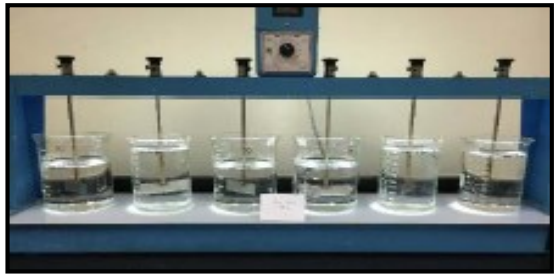
HEALTH BENEFITS

- Consumption of lead is harmful to health, especially in infants, young children and pregnant women (impacts to fetus)
- Taking action to decrease lead concentrations in tap water across the community will benefit Hamilton residents
- Orthophosphate is a proven method of reducing lead in drinking water and there are no known adverse health effects

IMPLEMENTATION UPDATE

FEATURE/ITEM	TIMELINE
Design and construction	On-going Completion Q4 2018
Implementation and Contingency Planning Including pre-monitoring	COMPLETE
Outreach - Residential & Industrial users	Q1 2018 – On-going
Flush the distribution system	Q2 2018 - On going
Update to surrounding municipalities supplied by Hamilton - Haldimand and Halton	Q3 2018
Regulatory Permitting - Update ECA	Q4 2018
Implement corrosion control - Post implementation Program	Q4 2018
Lead Service Line Replacement Program	On-going

IMPLEMENTATION UPDATE



FINANCIAL UPDATE

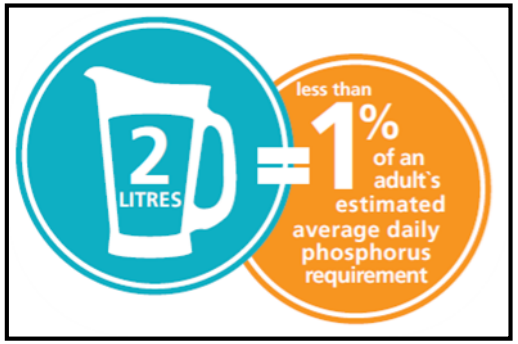
- Capital Construction - $5 Million
  (Clean Water and Wastewater Fund project)

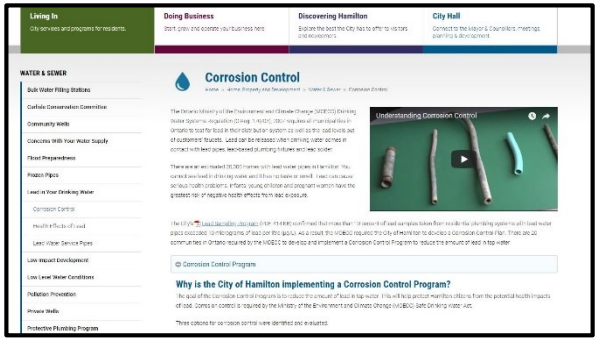
- Pre-implementation cost (2016-2018)
  - $97,000 annually for 1 temporary FTE (for a period of 2 year)
  - $10,000 annually for laboratory analysis

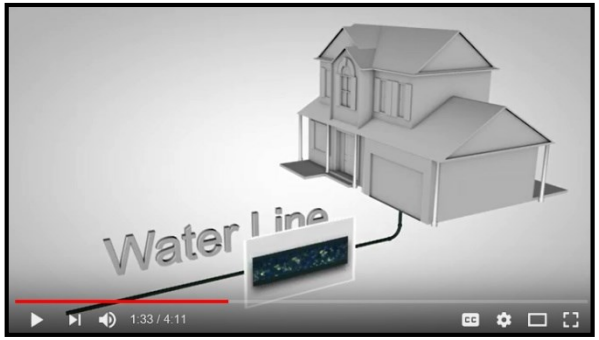
- Post-implementation annual operating costs
  - $300,000 annually for chemical addition
  - $10,000 annually for laboratory analysis

OUTREACH PLAN

- Lead Awareness Campaign
  - Targeted mailings
  - Bus shelter advertising
- Online
  - Website
  - Informational videos videos
  - Frequently asked Questions
- Presentations to the Industrial Sector







WHAT TO EXPECT

- Orthophosphate dosage begins in November 2018

- Potential for localized Water Quality issues
  - Cloudy water (Milky-white)
  - Rusty water
  - Possible taste and odour complaints

- The system-wide approach will protect Hamilton residents from lead in drinking water (Woodward Drinking Water System)

Hamilton

QUESTIONS ?

INFORMATION REPORT

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Red Hill Valley Project Integrated Environmental Monitoring Program Final Summary (PW18087) - (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Andrea McDonald (905) 546-2424, Extension 2738
SUBMITTED BY & SIGNATURES:	Craig Murdoch, B.Sc. Director, Environmental Services Public Works Edward Soldo, P.Eng. Director, Roads and Traffic Public Works Andrew Grice Director, Hamilton Water Public Works

Council Direction

Not Applicable

Information

The Red Hill Valley Project (RHVP) included the design, construction, and commissioning of:

- an 8 km, 4 lanes, controlled access freeway
- Re-alignment of over 7 km of Red Hill Creek

- 14 Storm water Quality Management (SWM) Facilities
- 3 Flood Control Facilities
- 2.9 km combined Sewer Overflow (CSO) pipe
- Landscape Management Plan.

Construction commenced on the North-South section in 2003 and the roadway, storm water management system, creek re-alignment, and combined sewer overflow pipe were completed in 2007.

Following the completion of the construction in 2007, the City began a multi-year environmental monitoring plan, developed as a condition of approvals from the regulating agencies, to confirm the effectiveness of the new infrastructure and associated environmental management system. This report provides a summary of the major findings and outcomes from the 5-year Red Hill Valley Project Integrated Monitoring Plan (RHVP IMP) as outlined in Appendix A attached to report PW18087.

The background to the project and associated environmental compliance monitoring requirements for the Red Hill Valley Project has been documented, and summarized in the following:

- Ministry of the Environment Exemption Order, 1997
- Red Hill Creek Watershed Plan, 1998
- Impact Assessment Design Process, 2003
- Master Permit Application, 2004
- Various Permitting Compliance Reports, 2004-2011
- Individual permits and authorizations specific to the respective construction contract phases (both Federal and Provincial)

At the outset of the RHVP IMP project, a Government Agency Committee (GAC) was formed, comprised of various members of the original approval agencies. Annual monitory reports were prepared, first following the 2008 monitoring year, up to the final annual monitoring report for the 2013 monitoring year.

Following the completion of the annual monitoring reports, a draft comprehensive 5-year updated Summary Report was prepared May 2015 and presented to the Joint Stewardship Board (JSB) in June 2015.

As the timing of the summary report was protracted due to delays with components of the RHVP scoped projects, staff recirculated the draft summary report to the GAC to ensure that all parties supported the summary. In Q2 2018, the final Comprehensive 5-Year Summary Report was circulated to GAC members and produced few comments, concluding that the report is deemed to be acceptable by the subject agencies. This circulation included the following agencies:

- Public Works-Policy & Programs
- Joint Stewardship Board (JSB)
- Hamilton Conservation Authority (HCA)
- Ministry of Transportation (MTO)
- Ministry of the Environment and Climate Change (MOECC)
- Ministry of Natural Resources and Forestry (MNRF)
- Environment Canada
- Department of Fisheries and Oceans Canada (DFO)

The Wood consulting team (formerly Amec Foster Wheeler) completed the Red Hill Valley Project Integrated Environmental Monitoring Plan 5 Year Summary which resulted in 22 recommendations for the various areas of environmental study. The recommendations are organized by discipline groups of groundwater, surface water and flood control facilities, water quality and sediment quality/quantity, creek morphology, fisheries and terrestrial ecology. As well, through engagement, the Haudenosaunee Development Institute (HDI) also commented with an additional 7 recommendations.

These final 29 recommendations were reviewed by Public Works staff (Roads & Traffic, Hamilton Water, Environmental Services) and Planning staff (Development Planning). Where recommendation alignment and expertise was available, recommendations were identified for staff to maintain and absorb into the work unit. Of the recommendations, 14 currently fall within the scope of work of various City divisions. In addition, 2 recommendations from the Haudenosaunee Development Institute (HDI) have been identified as aligning with City of Hamilton work units.

However, 13 recommendations from both Wood and HDI are not currently in staff portfolios or program work plans, and identified as out of scope. These recommendations include work that is not part of any City of Hamilton work group or project scope and budget. Notwithstanding, there may be opportunity for other levels of government, educational institutions and partners to champion these recommendations. It is possible for the City to work with agencies and institutions to investigate partnerships to implement the out of scope study recommendations.
Finally, 2 recommendations were identified as items to be further reviewed and a future determination of the scope and actions that may be required. A summary of the recommendations from both the consulting team and the Joint Stewardship Board outlined in Appendix B attached to report PW18087.

Appendices and Schedules Attached

Appendix “A”**:** Red Hill Valley Project Integrated Environmental Monitoring Plan 5-Year Summary (RHVP IMP)

Appendix “B”: RHVP IMP Recommendation Summary Table

INTEGRATED MONITORING PLAN
RED HILL VALLEY PROJECT
COMPREHENSIVE 5-YEAR SUMMARY

CITY OF HAMILTON

FINAL REPORT

Submitted to:
City of Hamilton, Ontario

Submitted by:

Amec Foster Wheeler
Environment & Infrastructure
3450 Harvester Road
Burlington, ON L7N 3W5

Tel: 905-335-2353
Fax: 905-335-1414

May 2015 (June 2018)

TABLE OF CONTENTS

PAGE

LIST OF APPENDICES

LIST OF DRAWINGS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Project History

Numerous studies have been conducted over the past several decades in support of the Red Hill Valley Project. The idea of a highway through the Red Hill Valley was initially proposed by the City of Hamilton in the 1950s. The project (encompassing both a north-south section through the Red Hill Valley, and an east-west section above the Niagara Escarpment) was subsequently approved by a Provincial Joint Hearing Board in 1985, with subsidy funding for the project approved by the Provincial cabinet in 1987. Funding for the north-south section (through the Red Hill Valley) was ultimately suspended by the Province in 1990; as such, the focus for the City then shifted to the east-west portion (to later become the Lincoln Alexander Parkway). Funding for the north-south section was ultimately restored in 1997. A complete re-design and environmental review process was undertaken at that time, with a focus on lessening the environmental impacts associated with the project.

A principal background document from this recent era of the Red Hill Valley Project is the "Red Hill Creek Watershed Plan", 1998. This document set out the planning framework, which supported an eco-system assessment of land use change on a watershed scale. The Red Hill Valley Project (RHVP) elements were all considered by the Watershed Plan, including the Parkway, creek management, stormwater management (SWM), combined sewer overflow (CSO) control and landscape enhancement. The Watershed Plan provided 'high-level' guidance for all subsequent planning and design initiatives.

Pursuant to the Watershed Plan, the City of Hamilton, through a process developed consultatively with lead agencies, stakeholders, partners, and the public, undertook an integrated assessment of the impacts of the RHVP and developed a design which comprehensively addressed each impact. This process, termed the "Impact Assessment and Design Process" (IADP), was completed for numerous discipline areas specific to this undertaking, including:

- Surface Water and Stormwater Quality
- Hydrogeology
- Fisheries
- Terrestrial Resources and Natural Heritage
- Natural Channel Design of Red Hill Creek
- Noise and Air Quality

Other related discipline areas covered by the IADP included human health, landscape management, transportation and land use planning.

These documents formed the cornerstone of the current roadway and associated management infrastructure. The resulting highway and supporting infrastructure reflects an integration of each of the discipline-specific recommendations related to the management of surface water and the area's natural resources.

The Red Hill Valley Project ultimately became much “more than a road”, constituting an environmentally integrated infrastructure project with numerous elements, including:

- 8 km, four-lane, controlled access freeway
- Re-alignment of 7 km of Red Hill Creek
- 14 Stormwater Management Facilities for water quality
- 3 Stormwater Management Facilities for flood control
- 2.9 km Combined Sewer Overflow Storage Pipe
- Landscape management plan

The final construction phase of the project ended in 2007, at which point, the City began a multi-year environmental monitoring program to confirm and technically demonstrate the effectiveness of the new infrastructure.

1.2 Permitting Requirements

Environmental compliance monitoring for the Red Hill Valley Project was required as outlined in the following documentation:

- MOE Exemption Order, 1997
- Red Hill Creek Watershed Plan, 1998
- Impact Assessment Design Process, 2003
- Master Permit Application, 2004
- Various Permitting Compliance Reports, 2004 to 2011
- Permits and Authorization specific to the respective contract phases

The City of Hamilton decided that rather than issue a series of individual monitoring reports for the various sub-disciplines and for the various governmental agencies, that environmental compliance monitoring requirements would be best addressed through an integrated monitoring plan, which would compile findings into a single, integrated report. The exception to this would be the Department of Fisheries and Oceans, which requested direct reporting for fisheries related monitoring work only, however for clarity this information was also retained in the overall documentation.

The purpose of the Integrated Monitoring Plan has been to:

1. Evaluate the performance of the Environmental Management System (i.e. design and mitigation techniques) constructed as part of the Red Hill Valley Project.
2. Provide the necessary information to adjust and/or optimize the plan recommendations through a process of Adaptive Management.

It has not been the purpose of the plan to monitor isolated management practices, rather it has been intended to identify the impacts associated with developing the whole of the Red Hill Valley Project on the natural environment, and thereby provide direction with respect to impact management.

1.3 Monitoring Scope

The general scope and duration of monitoring the impacts associated with the development of the Red Hill Valley Project varied depending on the discipline.

The following table presents the framework used for the different disciplines' frequencies and durations of monitoring:

Table 1.3: Monitoring Scope And Duration Summary

Component	Frequency	Reporting Years	Minimum Duration	Reference
Streamflow (in-stream)	Continuous: April 1 – November 30	All	Ongoing	N/A
Streamflow (SWM facilities)	Continuous: April 1 – November 30	All	5 Years	IADP
Water Quality (SWM facility)	3 times per year	All	2 Years per facility	IADP/PCR
Rainfall	Continuous: April 1 – November 30	All	Ongoing	IADP/PCR
Erosion / Stream Morphology	Annual	All	5 Years	IADP/PCR
Groundwater	Water levels spring/fall Chemistry bi-annual	All 1,3,5,7,9	10 Years	N/A
Vegetation 1.Regulatory Acceptance (DFO) 2. Habitat Creation & Enhancement 3. IADP Ecosystem Monitoring	Twice annually to 2012 Annually to 2012 Once every 5 years	2008, 2010, 2012 2007- 2012 2009+(?)	5 years 5 years 20 years	IADP
Breeding Birds IADP Ecosystem Monitoring	Once every 5 years	2010+	20 Years	IADP
Amphibians IADP Ecosystem Monitoring	Once every 5 years	2010+	20 Years	IADP
Special Terrestrial Monitoring Studies (Turtles, Flying Squirrel)	Varies depending on focus	2010+	? Years	IADP
Fish Communities and Populations (Red Hill Creek)	Annual	All	5 years post-construction	IADP/PCR
Assessment of Fish Passage (Red Hill Creek)	Spring freshet and low flow period	As appropriate	1 year post diversion	IADP/PCR
Benthic Invertebrates (Red Hill Creek)	Annual	All	5 years post-construction	IADP/PCR
Water Temperature (Red Hill Creek)	Continuous	All	5 years post-construction	IADP/PCR
Final Post-construction Habitat Assessment (Red Hill Creek)	Once	5 (2012)	N/A	IADP/PCR
Fish movement into Compensation Area 1	Annually	1, 3, 5 post-construction	5 years	Authorization/ PCR
Fish utilization of Compensation Areas 1 and 2 and Enhancement Area 5	Annually	1, 3, 5 post-construction	5 years	Authorization/ PCR

As evident from Table 1.3, the majority of the required environmental monitoring components have involved a 5-year post-construction timeframe (the exception being groundwater, as well as IADP requirements for vegetation and breeding birds/amphibian monitoring). These requirements were largely addressed in the 5-year period between 2008 and 2012 inclusive. Due to operational issues, water quality monitoring requirements were extended beyond this time frame, necessitating a further annual report in 2013, to summarize the results of the final water

quality sampling conducted in 2014. This is discussed in greater detail in Section 2.3 of the current report.

As per the approved Integrated Monitoring Plan (2007), a series of annual integrated monitoring reports have been prepared, with a cumulative summary/milestone report at the conclusion of major monitoring activities (the current document). All reporting for the Integrated Monitoring Plan has been submitted to the City of Hamilton, who has disseminated this information to members of the Government Agency Committee (GAC). The GAC has been comprised of representatives from all the City of Hamilton (City), Hamilton Conservation Authority (HCA), Department of Fisheries and Oceans (DFO), Ministry of Natural Resources and Forestry (MNRF), Ministry of Transportation (MTO), Niagara Escarpment Commission (NEC) and Ministry of the Environment and Climate Change (MOECC). The role of the GAC has been to review annual and milestone monitoring reports and provide comments and feedback to the Integrated Monitoring team. Annual reports were first submitted following the first year of monitoring in 2008. Based on feedback received from the GAC at that time, it was determined that annual meetings would not be conducted; rather GAC members would continue to receive and review the annual reports, but would await the findings of the Comprehensive 5-year Summary report (the current document) before providing final comments.

2.0 DISCIPLINE SPECIFIC MONITORING

2.1 Groundwater

2.1.1 Brief Background

A hydrogeological inventory and impact assessment of the Red Hill Creek watershed was carried out in 1997-1998. That study identified the geological and hydrogeological setting for the watershed and identified potential linkages between watershed hydrogeology and hydrology including aquatic and terrestrial aspects (i.e. baseflow and wetland linkages). Within the Red Hill Creek watershed, much of the surficial overburden consists of clay material which typically is of a low permeability which does not infiltrate or transmit water readily. There are limited deposits of permeable sands and gravels within the valley below the escarpment which allow for greater infiltration and transmittal of groundwater on a more local scale. Below the escarpment the underlying bedrock is a low permeable shale which has a reduced potential for transmitting water.

Extensive drilling within the Red Hill Creek corridor indicated the existing and realigned creek was situated on low permeability clay deposits and that the potential connection to the groundwater flow system was very low. Spot baseflow measurements, carried out during the watershed study, confirmed the lack of groundwater/surface water connection.

A groundwater discharge area was noted in the Montgomery Creek subwatershed approximately 50 metres below the creek outfall at Mt. Albion Road and Mud Street. This location is in the vicinity of the viaduct (the bridge structure where the RHVP descends the Niagara Escarpment). It was presented in the watershed study that the source of this groundwater discharge was from a more regional groundwater flow system.

The potential impacts to local groundwater recharge resulting from expressway construction were therefore assessed to be minor, particularly as it relates to groundwater discharge potential to Red Hill Creek.

A groundwater monitoring program has been carried out focusing on groundwater level trends in order to assess any potential changes to the recharge.

2.1.2 Major Findings

The water level monitoring results indicate there has been very little change since 1997 (Figure 2.1.1, Figure 2.1.2). There continues to be a consistent downward hydraulic gradient in the Mud Street wells on top of the escarpment (BH96-3). The wells adjacent to King's Forest Golf Course (BH96-1) continue to show a shallow horizontal gradient towards Red Hill Creek, as well as a component of downward gradient to the intermediate and deep wells. There is little vertical hydraulic gradient between the intermediate and deep wells.

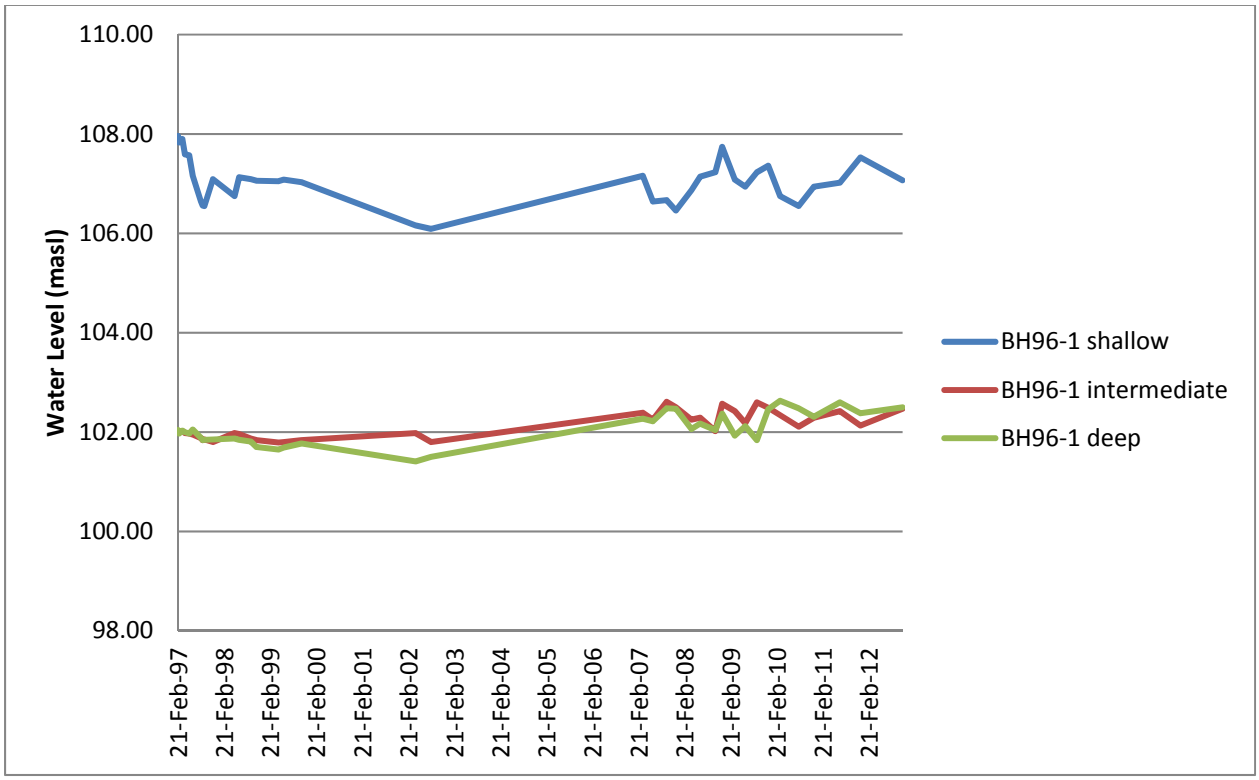


Figure 2.1.1: Recorded Groundwater Levels at Mud Street

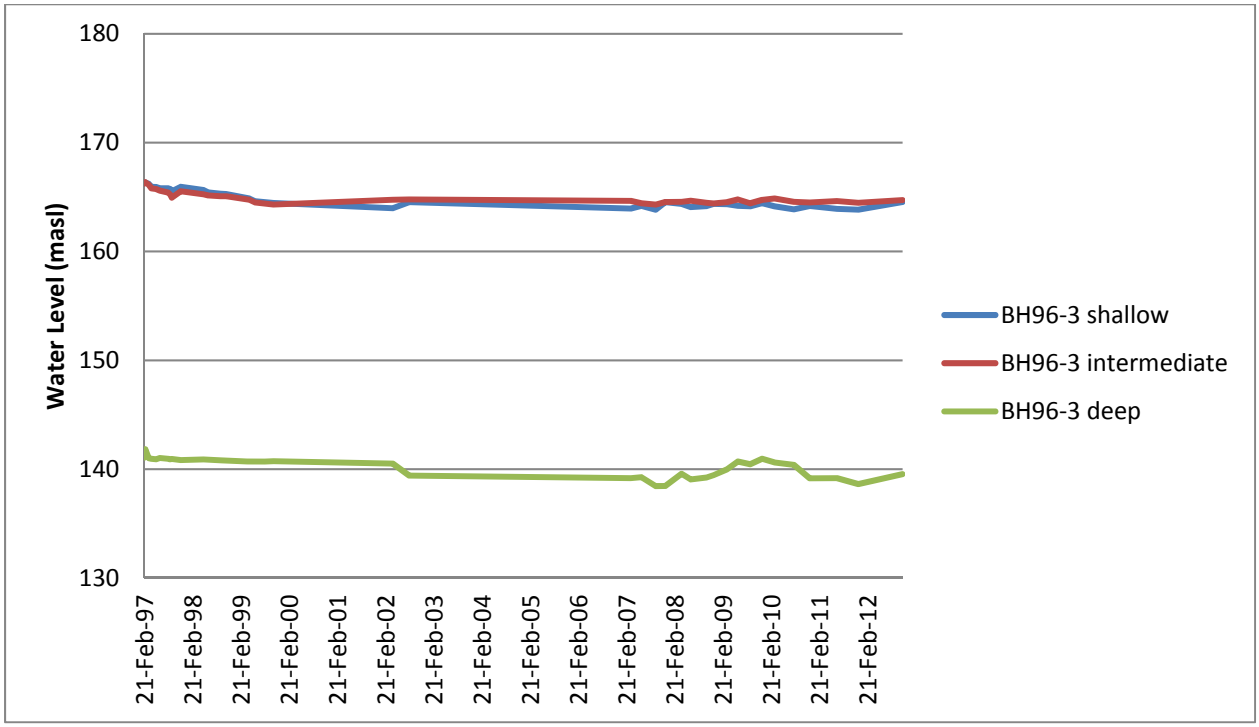


Figure 2.1.2: Recorded Groundwater Levels at King's Forest

Groundwater discharge in the vicinity of the viaduct remains consistent with discharge noted in the watershed study.

A comparison of the 2012 groundwater quality to the 1997 analysis in BH96-1 (intermediate depth) shows an increase in chloride and sulphate. The results for the remainder of the dissolved species are consistent between 1997 and 2012. A comparison of the results for BH96-1 (deep depth) shows no significant change in the dissolved species. The conductivity for both 2012 samples show a significant decrease which appears to be anomalistic compared to the dissolved concentrations. The increase in chloride and sulphate is consistent with a trend over the past 3 years in slight upward gradients between the deep and intermediate wells which could give rise to a mixing of the deeper groundwater, which has higher concentrations of chloride and sulphate, with the intermediate groundwater. Although there is a strong downward gradient between the shallow and intermediate wells, it is not expected that potential lower quality groundwater has migrated from the shallow system given the existence a 13 metre thick fine grained silt/clay layer. In addition high sulphate levels would not be expected to be associated with potential near surface groundwater quality degradation in the local setting.

2.1.3 Recommendations and Lessons Learned

Given the consistency in the various monitoring results over an extended period of time, it is recommended that the groundwater monitoring program be discontinued. Extending the monitoring program to the originally specified 10-year time frame is not considered warranted. It is however recommended to keep the existing monitoring wells for any future, more regional monitoring programs; this may require coordination with HCA and MOECC.

2.2 Surface Water and Flood Control Facilities

2.2.1 Brief Background

Streamflow Monitoring, Major Storms, and the RHVP

As per the Red Hill Valley Project Integrated Monitoring Plan (RHVP IMP), managing streamflow was a key aspect of the project, and monitoring the effectiveness of the measures which were implemented, is an important element of the IMP. Flow monitoring has been conducted for the overall Red Hill Creek system, to further assess watershed flows and the effectiveness of the flood control facilities, and watershed flows and system performance under major storm events.

A permanent flow monitoring station was re-established following construction of the RHVP by Water Survey of Canada at Melvin Avenue/Barton Street (Red Hill Creek at Hamilton – station ID 02HA014) which is slightly downstream from its pre-construction location at Queenston Road. A secondary gauge, previously in operation by Water Survey of Canada (Red Hill Creek at Albion Falls –station ID 02HA023) was ultimately not re-instated following construction.

These observed flow data were complemented by the network of rainfall gauges operated by both the City of Hamilton and the Hamilton Conservation Authority. As shown in previous annual

monitoring reports, the gauge network for the Red Hill Creek watershed is extensive, and the data collected from this system have been applied in the assessment of collected streamflow data.

For major storm events within the watershed (where observed peak flows would be well beyond the limits of developed rating curves), alternative methods of assessment have been employed. The previously developed (and calibrated) HSP-F hydrologic model for the Red Hill Creek has been employed in these cases to assess peak flows, using available radar-generated rainfall data in some cases, as well as point gauge data from the previously noted network of rainfall gauges within the watershed. Additional data, such as field reconnaissance and photographs, and high water marks have also been used were available and relevant.

Flood Control Facilities

The Red Hill Valley Project includes three major flood control facilities, namely: Dartnall Road, Greenhill, and Davis Creek (refer to Drawing 1 for locations). These systems have been designed to protect the Red Hill Valley Parkway (RHVP) and Queen Elizabeth Way (QEW) from major flooding (100 year level of service +/-). In order to verify the performance of these critical systems, it was considered necessary to include flow monitoring as part of the Integrated Monitoring Plan to confirm the attenuative function of these features (i.e. that they provide the designed peak flow reduction).

Temporary flow monitors were established by Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) specifically for the purpose of verifying the performance of these quantity control facilities. These gauges were installed for the duration of the surface water monitoring program (5 years: 2008-2012) during non-winter periods (April to November approximately).

The temporary gauges are self-contained sensors, which continuously record total pressure at set increments (15 minutes). An additional barometric sensor located within the Red Hill Valley was used to correct the data to represent actual water levels. At gauge locations, channel sections were surveyed, in order to assess channel width and flow area at varying depths. In stream velocity measurements were made at periods of both low and high flow, in order to calculate observed flows at known water levels. This information was used to develop rating curves for flow monitoring sites, which enabled the conversion of collected water level data into more useful flow data. These flow data were then used to more directly evaluate watershed flows and the attenuative function of the designed flood control facilities.

Given the magnitude of the peak flows throughout the Red Hill Creek watershed (and the corresponding depths and velocities), it was not possible to safely collect in-stream velocity measurements at higher flows. While developed rating curves were adjusted to fit to observed points at lower water levels and flows, the lack of field verified data at higher flows meant that the curve was approximate. However, all rating curves were estimated and fit using hydraulic modelling (rather than a simple trendline), which lent a higher degree of confidence to the interpretation of the results. Data checks and analyses were also conducted to ensure that flow estimates were reasonable, however as noted there is necessarily a degree of uncertainty in the estimated values.

Dartnall Road Flood Control Facility

The Dartnall Road facility is located at the upstream limits of Red Hill Creek above the escarpment. The quantity control component of the Dartnall Road facility involves a deliberately undersized culvert outlet between Hannon Creek and the Main branch of Red Hill Creek beneath the RHVP northbound on-ramp from Dartnall Road. This results in flood flows from Hannon Creek being impounded within the wide upstream valley system, and reduces contributing peak flows to Red Hill Creek.

In order to monitor facility performance, a gauge was placed directly on the upstream side of the culvert control. An additional gauge was placed on the downstream side (within Red Hill Creek) to assess the impact of tailwater levels on discharges due to the actual head differential across the outlet (2010 onwards). An additional gauge was placed at the upstream limits of Hannon Creek, in order to attempt to assess inflow rates to the facility. Refer to Drawing 1 for all gauge locations.

A key limitation associated with flow monitoring at this location is the extent of the backwater associated with the facility. Under even moderate storm events, backwater from the facility culvert control (or storage within the facility) extended to the upper reaches of Hannon Creek, rendering development of a rating curve for inflows impossible. Accordingly, the performance of the Dartnall Road facility has been largely evaluated on the basis of recorded peak operating levels within the facility and estimated peak discharges (using the measured head differential across the outlet) in comparison to hydrologic modelling data, where available.

Greenhill Flood Control Facility

The Greenhill facility is located along the main branch of Red Hill Creek, just downstream of King's Forest Golf Course (within Greenhill Bowl Park). The key component of the facility is a flood control berm, located along the east side of the channel. When water levels within the creek exceed the 2-year storm event, flows spill over the berm and into the remnant Red Hill Creek channel and valley system (refer to Drawing 1). Flood flows are then impounded within this channel and valley system, and then conveyed across the RHVP and into the Online (Retrofit) facility, where flows are further impounded before being directed back into the main channel of Red Hill Creek. In addition to creek flows, the remnant channel also receives periodic combined sewer overflow (CSO) discharges from the two CSO tanks located within Greenhill Bowl Park.

In order to monitor facility performance, a gauge was placed within the main branch of Red Hill Creek, upstream of the Greenhill flood control berm. A second gauge was placed along the main branch of Red Hill Creek, downstream of the flood control berm, in order to assess the reduction in peak flows provided by the berm. A third gauge was placed at the downstream limits of the remnant channel (upstream face of culvert crossing of the RHVP), in order to assess the amount of berm overflow in combination with CSO discharge. Recorded CSO discharges from the Greenhill CSO have been provided by City of Hamilton staff in order to better assess observed peak flows and volumes within the remnant channel, and separate creek overflows from CSO flows.

There were several limitations associated with flow monitoring at this location. First, given the magnitude of the creek flows at this location, it was not possible to safely obtain in-stream velocity measurements at higher flows. Rating curves at higher flows were therefore extrapolated based on hydraulic modelling, and associated peak flows estimated accordingly. Second, channel instabilities have made the establishment of a consistent rating curve extremely difficult, particularly at the upstream location, where channel grades are steeper. Channel sections at the monitoring gauge locations have been significantly altered multiple times due to major storm events over the monitoring period. Several gauge relocations were attempted to try and address this issue with minimal success. Third, several gauges were lost over the monitoring period, having been assumed to have been dislodged by high flows during major storm events. Accordingly, the uncertainty associated with the estimated observed flows should be taken into account as part of the associated facility performance assessment.

Davis Creek Flood Control Facility

The Davis Creek flood control facility is the third major flood control facility designed as part of the overall Red Hill Valley Project. The facility includes a permanent water level sensor and sluice gate (constructed on the upstream side of the RHVP Northbound on-ramp from King Street), which closes automatically at a pre-set water level (25-year or greater estimated return period). Flood waters are then impounded on the upstream side within the Davis Creek valley system, attenuating peak flows from the Davis Creek (largest subwatershed of the Red Hill Creek Watershed) to downstream reaches of Red Hill Creek.

Construction of the facility was completed in late 2012, with additional channel works undertaken in 2013. Although the facility is constructed, the flood control gate is not yet in operation, due to a combination of operational and regulatory issues. Given the delay in the construction and implementation of the Davis Creek Flood Control facility, it was not possible to include the surface water monitoring requirements for this facility as part of the current overall IMP reporting. The 5-year monitoring requirements will instead be undertaken and reported separately; the first year of monitoring was undertaken in 2014 (and the second year of monitoring underway in 2015), with the anticipation that the flood control gate will be fully operational shortly.

A gauge was installed within Davis Creek downstream of the flood control facility over the course of 2008 and 2009, with the intention of developing a rating curve ahead of facility construction. This gauge was ultimately not re-installed in 2010 due to the beginning of construction. However, the gauge provided useful data for some of the major storm events in 2008 and 2009.

Additional Facility Assessments

Although not a flood control facility, water level monitoring was conducted for Facility J over the 2011-2012 period (refer to Drawing 1 for location). Stormwater from this facility specifically flooded the RHVP on two occasions (July 7 and 9, 2010); accordingly, water level monitoring was recommended as part of the 2010 annual monitoring report in order to further assess facility performance with respect to major storm events. Gauges were installed both within the facility

itself, as well as within the downstream ponding area, in order to quantify the impact of tailwater levels from both Red Hill Creek and the remnant channel area upstream.

In addition, water level monitoring was conducted at the compensation wetland located at the RHVP/QEW interchange, also referred to as COMP 2 (refer to Drawing 1 for location). This was a recommendation of the 2008 annual monitoring report, in order to better understand the influence of backwater from the Harbour and assess facility performance.

2.2.2 Major Findings

Streamflow Monitoring, Major Storms, and the RHVP

In general, the 2008-2012 period is considered to have been wetter than normal. A comparison of monthly and annual (April-November) precipitation totals has been included in past annual monitoring reports based on Environment Canada's Hamilton Airport gauge station. This information has been compiled and compared against 1981-2010 climate normals; the results are presented in Table 2.2.1.

Table 2.2.1: Comparison of Annual Precipitation (April-November) to Climate Normals (mm)

Year	Annual Percent Difference from Normal	Minimum Monthly Percent Difference from Normal	Maximum Monthly Percent Difference from Normal
2008	+11%	-30%	+48%
2009	+21%	-65%	+116%
2010	+16%	-37%	+85%
2011	+21%	-49%	+103%
2012	-17%	-80%	+107%

As evident, 2008-2011 were all well above normal annual precipitation totals. 2012 was a drier year overall; however even within that year, one month (July) had a precipitation total 107% (or more than double) the monthly normal precipitation. Other years displayed similar trends, with months well below normal precipitation totals, and other monthly well above (near or above 100% in many cases).

As documented in previous annual monitoring reports, a number of major storm events occurred over the 2008 to 2012 period. An above average number of events were found to be greater than bankfull conditions (for the 2009-2011 period in particular), as discussed in greater detail in Section 2.4 with respect to stream morphology. With respect to the most formative recorded events (or those that resulted in some degree of flooding along the RHVP), there are four storms of particular interest:

- July 26, 2009
- July 7, 2010
- July 9, 2010
- July 22, 2012

All of the foregoing storms appear to have been convective-type thunderstorm events, all of which occurred within the month of July. Each of the storms has been discussed in detail within previous annual monitoring reports; however the major findings from these reports are summarized herein.

It should be noted that other formative storms were also identified within the monitoring period, August 29, 2009 in particular. However, this storm was of a comparatively lower magnitude and was not known to have resulted in any flooding along the RHVP, and thus had not been included in this discussion. Details of this storm event can be found in the 2009 Annual Monitoring report.

July 26, 2009 Storm Event

By far the most formative storm event observed during the monitoring period was the July 26, 2009 storm event. The storm event was a high intensity convective type storm event which tracked directly along the Red Hill Creek watershed from headwater to outlet, based on available radar imagery for the storm. Based on available rainfall data alone, the storm was well in excess of a 100 year event. The storm also occurred after a week of heavy rainfall, resulting in already saturated soils and minimal capacity for infiltration. The storm event resulted in widespread flooding and damage along the Red Hill Creek Valley system, and the closure of both the RHVP and also a section of the QEW. The event was listed as one of Environment Canada's Top Ten Weather Stories for 2009 (#8).

A supplemental hydrologic assessment was undertaken for this storm using the approved/calibrated HSP-F model for the Red Hill Creek watershed. Resolute radar-generated rainfall data for the watershed (ref. Kije Sipi Ltd., September 2009) was applied; the results indicated that the storm event was approximately equal to a 100-year storm event for the upper watershed (i.e. upstream of Davis Creek), with peak flows downstream of Davis Creek found to be approximately 1.5 times the expected 100-year values due to the large inflows from Davis Creek (estimated to be almost double the expected 100-year value). A post-storm event survey of high water levels further confirmed that the storm event was well in excess of the 100-year storm event.

As would be expected, given that the storm event was in excess of the design standard for the RHVP (100 year storm event), widespread flooding occurred. Direct creek flooding occurred primarily for downstream sections of the RHVP (in the vicinity of Barton Street and the CNR), as well as the QEW. Some direct creek flooding also appears to have occurred further upstream, near the confluence of Davis Creek and Red Hill Creek. Based on the results of the field reconnaissance post-storm, surface flooding was also noted at the upstream limits of the RHVP (near the Mud Street facility), adjacent to the Online (Retrofit Facility) and Facility D, as well as the King Street off-ramp from the RHVP north-bound.

July 7, 2010 Storm Event

In comparison to July 26, 2009, the July 7, 2010 storm event was not a particularly significant storm event; it was estimated to be in the range of a 2 to 5 year storm event based on available

rainfall data. However, the storm resulted in the closure of a portion of the RHVP in both directions.

Based on reporting within the Hamilton Spectator, it appears that the closure was related only to flooding at Facility J (a SWM quality control facility located within the Barton Street/RHVP Northbound on-ramp). It is understood that the box culvert outlet of Facility J was covered with a fine mesh grill at the time of the storm event. This grill is not shown on the original design drawings for the facility, and may have been added at a later date to help reduce the amount of debris entering Red Hill Creek, or possibly for safety reasons. While the grill would have served to achieve this purpose, it would also lead to potential outlet blockage, which would raise water levels within the Facility and direct overflow towards the RHVP, given that there is no defined overflow spillway for the facility.

The flooding of the RHVP caused by the July 7, 2010 storm event is therefore considered to be an isolated incident, due to the installation of an inappropriate grate on the outlet of Facility J. This issue has since been remediated.

July 9, 2010 Storm Event

Shortly after the storm event of July 7, 2010, a much more formative storm event was recorded on July 9, 2010. According to the Hamilton Spectator, this storm event resulted in 15 directly related vehicle accidents along the RHVP. Flooding for this storm event appears to have been more widespread than for the July 7, 2010 storm event, with flooding observed at multiple locations, including Facility J, the Online (Retrofit) facility and Facility D, and at the King Street off-ramp for the RHVP northbound (refer to Drawing 1 for locations). As with the July 7, 2010 storm event, the parkway was closed by City staff and police part way through the storm.

Based on available rainfall statistics, the July 9, 2010 storm event ranged from 5 to 10 year storm event based on volume, up to a 25 year storm based on peak rainfall intensity in some areas; much higher than the “one in two year” return period initially assigned to the storm by Environment Canada staff (as reported within the Hamilton Spectator). This does not account for the likely near-saturated antecedent moisture conditions within the watershed, due to the preceding storm event on July 7, 2010.

Similar to the July 7, 2010 storm event, the flooding of Facility J was again considered attributable to the blockage of the outlet grill. There were no reports of the grill being cleaned prior to the July 9, 2010 storm event. Based on reporting within the Hamilton Spectator, the outlet grill was not removed by City staff until sometime in August 2010.

Reported flooding at other locations (Online (Retrofit) facility and Facility D, as well as the King Street off-ramp) is consistent with observations from the more formative July 26, 2009 storm event, suggesting that these locations may be more flood susceptible than expected (i.e. flood for less than a 100 year storm event).

July 22, 2012 Storm Event

A significant storm event occurred on the afternoon of July 22, 2012, which was of relatively short duration and high-intensity. The storm event was highly spatially variable, with the majority of the storm focused in the upper sections of the Red Hill Creek watershed. Rain gauges in this area and radar data clearly characterized the storm event as being in excess of a 100 year storm event; while gauges in the lower reaches of Red Hill Creek characterized it as being a 2 year storm or less.

Similar to other formative storm events, a forensic assessment was conducted using the approved/calibrated HSP-F model for the watershed and available point rainfall data. The results of that assessment reflected the previously observed rainfall patterns. Peak flows above the Niagara Escarpment were estimated to be approximately 1.5 times the 100-year storm event, and approximately equal to the 100 year storm event within lower sections upstream of Davis Creek. Significant peak flows were estimated to have resulted from Davis Creek, well in excess of the estimated 100 year storm value. Likewise, peak flows within the Red Hill Creek downstream of Davis Creek were also considered to be equal, or in excess of, the 100 year storm event. Simulated results were also in approximate agreement with field observations near the peak of the storm event, which noted water levels approaching the edge of roadway between Barton Street and the CNR (where the channel was designed with a 100 year capacity with nominal freeboard).

The storm did not result in any known instances of flooding along the RHVP, and the RHVP remained open during the entirety of the storm event. The storm event caused extensive flooding of other areas within the City of Hamilton where the storm was focused, in particular within the community of Binbrook and areas of Hamilton and Stoney Creek Mountain.

Potential Remedial Actions

Based on the foregoing, over the 5 year plus monitoring period the RHVP itself experienced flooding on three occasions (July 26, 2009, July 7, 2010 and July 9, 2010). Although equal to, or in excess of, a 100-year storm event, the July 22, 2012 storm event did not result any reported flooding along the RHVP; this is considered attributable to the spatial distribution of the storm event, which was focused on the headwater areas of the watershed than the RHVP directly, as well as improved local drainage infrastructure (i.e. grill with fire mesh replaced with more appropriate system.

Of the three storm events in question, only the July 9, 2010 storm event resulted in some localized flooding which does not appear to be consistent with the approved design of the RHVP (less than 100 year standard) or not explained by external factors (the improper grate on the outlet of Facility J). Notwithstanding, as part of the 2010 annual monitoring report, a summary of locations which appeared to be more susceptible to localized flooding (rather than widespread creek flooding) was generated. The identified locations included:

- Mud Street area (observed water, debris and aggregate being washed onto the parkway under high flows)
- Online (Retrofit) Facility (flooding onto parkway, particularly from section closer to rail overpass)
- King Street off-ramp from RHVP northbound (ponding/flooding)
- Facility J (flooding onto parkway)

The 2010 annual monitoring report included a list of potential remedial measures for the above, with the exception of Facility J, where additional monitoring was recommended and subsequently conducted. Based on the results of that monitoring (2011-2012), it is considered that the most likely remedial measures in this case would be an improved overflow relief beneath the Barton Street overpass (either through re-grading or a new pipe/storm sewer), or secondary relief culverts/ditch inlets to ensure full equalization between Facility J, the downstream ponding area, Red Hill Creek, and the remnant channel area.

More detailed site specific assessment would be required to confirm the appropriateness of any of the previously referenced measures.

Climate Change

The potential impacts to the drainage systems along the RHVP (both the creek system and the various quantity and quality control SWM facilities) stemming from climate change were not assessed as part of the original assessment design works, largely due to the lack of available information and the state of the practice at that time.

Given the advances in climate change assessment techniques since that time, and the number of significant storm events which have been monitored within the Red Hill Creek watershed and surrounding areas, a climate change sensitivity analysis may be warranted. Such an assessment could take several different forms, including repeating the previously completed continuous simulation assessment with a shifted dataset (historic rainfall data increased by a set factor based on expected increases from climate change modelling simulations), or a more simplified sensitivity analysis using design storm type events. The results of such an assessment would assist in identifying potential changes in drainage system performance due to climate change, as well as confirming or verifying the most vulnerable/sensitive locations. Such an analysis could be used to complement an assessment of potential remedial actions as previously discussed.

<u>Flood Control Facilities</u>

Dartnall Road Flood Control Facility

As discussed previously, the assessment of the attenuative function of the Dartnall Road Facility is limited by the inability to accurately measure inflows to the facility under major storm events. Backwater from storage within the facility is so extensive that it affects the upstream reaches of Hannon Creek (and all attempted gauge locations) under even moderate storm events. It was considered both impractical to attempt to locate gauges sufficiently upstream in order to avoid all

facility backwater; further, this would not account for sources of inflow between these locations and the outlet itself.

Accordingly, the performance of the facility has been assessed on the basis of the recorded peak operating level, the associated approximate storage volume (based on the facility stage-storage-discharge rating curve within the approved/calibrated HSP-F hydrologic model for the watershed), and the estimated peak facility discharge (based on the observed maximum head differential across the outlet and the outlet dimensions). This information has been in turn compared against available data from forensic hydrologic assessments conducted using the approved/calibrated HSP-F hydrologic model for the watershed, as documented in previous annual monitoring reports. Results are presented in Table 2.2.2 for the largest recorded operating levels within the Dartnall Road Facility over the 5-year monitoring period.

Table 2.2.2: Summary of Major Storm Events Monitored for the Dartnall Road Facility

Date	Monitoring Data			Hydrologic Simulation Data (HSP-F)		
	Peak Operating Level (m)	Approximate Storage Volume[1] (m^3)	Estimated Actual Peak Facility Discharge[2] (m^3/s)	Peak Operating Level (m)	Storage Volume (m^3)	Peak Facility Discharge (m^3/s)
7/26/2009	185.63	336,000	NA	185.78	359,000	7.8
8/29/2009	184.05	126,000	NA	183.27	72,000	5.4
6/6/2010	184.09	133,000	5.2	NA	NA	NA
7/9/2010	183.47	85,000	4.6	184.00	120,000	6.2
9/28/2010	183.46	84,000	4.3	183.91	114,000	6.1
4/20/2011	183.73	102,000	5.3	NA	NA	NA
10/20/2011	183.96	117,000	5.3	NA	NA	NA
11/29/2011	184.26	150,000	5.7	NA	NA	NA
7/22/2012	185.62	334,000	6.8	187.13	630,000	9.4

1. Based on maximum observed water level and stage-storage-discharge rating curve within the approved HSP-F hydrologic model
2. Based on head differential across culvert (data from two monitoring gauges) and orifice equation
3. NA = Data is not available (gauge loss or unavailable with respect to monitoring data, event not modeled with respect to hydrologic simulation using HSP-F).

As evident from Table 2.2.2, for those storm events where a comparison is possible, the results are mixed. Peak operating levels and storage volumes for the July 26, 2009 storm event are generally very close between observed and simulated data; this is considered attributable to the high resolution radar-generated rainfall data employed for the simulation in this case. For the August 29, 2009 storm event, the monitoring data show a much greater operating level and storage than simulated; this is considered attributable to the high spatial variability of that storm event and the difficulty in obtaining representative rainfall data for modelling purposes. By contrast, for the other three storm events were a direct comparison is possible (July 9 and September 28, 2010, and July 22, 2012), the monitoring data show a lower operating level and storage than simulated. This may again be attributable to the spatial variability of the available rainfall data, as well as other potential factors.

It should be noted that although mixed results are indicated with respect to peak operating levels and storages, observed peak discharges are consistently below simulated values (where data are

available). While this is considered partially attributable to the differences noted previously, actual facility discharges also appear to be limited by tailwater from Red Hill Creek. Monitoring results suggest that actual peak discharges are in fact some 10% lower on average when tailwater levels are taken into account than when based on the peak facility operating level alone (which was likely the approach applied in the original hydrologic modelling development).

Greenhill Flood Control Facility

The attenuative function of the Greenhill Facility has been assessed based on data from the three temporary monitoring gauges at this location (refer to Drawing 1), in combination with recorded discharge data from the Greenhill CSO as provided by the City of Hamilton. A summary of storm events for which the Greenhill Facility berm appears to have been active is provided in Table 2.2.3. These events have been identified based both on the magnitude and difference in peak flows, as well as observed volumes within the remnant channel (which as noted previously, is due to a varying combination of CSO discharge and flood overflows across the berm).

Table 2.2.3: Monitored Operation Summary for the Greenhill Facility

Date	Monitored Peak Flow (m^3/s)			Monitored Volume (m^3)		
	Greenhill 3 (Upstream)	Greenhill 2 (Downstream)	Greenhill 1 (Flood Overflow+CSO)	Greenhill 1 (Overflow + CSO)	Recorded CSO Discharge Volume	Estimated Flood Overflow Volume
6/25/2009	38.9	32.5	3.6	8,759	0	8,759
7/26/2009	NA	166.6	NA	NA	180,558	NA
8/29/2009	70.3	55.8	13.2	232,666	109,818	122,848
7/9/2010	60.6	48.6	12.8	274,386	138,582	135,804
9/28/2010	59.4	46.5	12.6	175,263	73,572	101,691
6/8/2011	NA	33.6	5.3	28,864	NA	NA
10/20/2011[1]	17	20.6	12.0	480,118	254,736	225,382
7/22/2012	NA	42.7	11.8	102,470	9,780	92,690

1. Uncertain whether this storm event did in fact results in a overflow
2. NA = Data is not available (loss of gauge, etcetera)

The operation of the flood control berm appears to be consistent with the originally approved design; overflows are designed to begin when creek flows are above the 2-year storm event, approximately 26.5 – 30 m^3/s (based on the original Permitting Compliance Report). All storm events presented in Table 2.2.3 are above this threshold with the exception of the October 20, 2011 storm event. This storm event has been included on the basis of the significant discrepancy in overflow volumes which would suggest an overflow; however it is possible that gauge data at the Greenhill 1 location were impacted by a debris blockage (or that there is a discrepancy in the recorded CSO discharge data). A clear peak flow reduction is also evident in the monitoring data, with observed peak flows reduced by 20% on average due to the flood control berm.

The results presented in Table 2.2.3 also indicate the substantial volumes associated with not only the flood control berm overflows, but also CSO discharges. CSO discharges are equal to the flood control berm overflows for many storm events. Clearly CSO discharges from the Greenhill facility would therefore have an impact on available flood control storage volumes, in addition to negative impacts to downstream water quality.

As documented in previous annual monitoring reports, a large number of CSO events have been recorded over the monitoring period from the Greenhill CSO. A summary is presented in Table 2.2.4. Note that discharges to Red Hill Creek from other former CSOs (Lawrence Avenue, Queenston Road, and Melvin Avenue) have not been assessed; these former CSOs now outlet to the Red Hill CSO storage pipe (as of December 2011).

Table 2.2.4: Recorded CSO discharges from the Greenhill CSO

Year	Number of Recorded Overflows		Total Overflow Volume (m^3)	
	Calendar Year (January – December)	Monitoring Year (April – October)	Calendar Year (January – December)	Monitoring Year (April – October)
2008	10	3	1,553,244	284,988
2009	16	7	1,510,470	428,449
2010	11	7	1,621,827	524,383
2011	26	17	3,265,854	1,590,030
2012	2	2	269,996	269,996
TOTAL	**65**	**36**	**8,221,391**	**3,097,846**

As evident from Table 2.2.4, the number of recorded overflows from the Greenhill CSO over the monitoring period is significant. The City of Hamilton was ultimately required to undertake a review of the Greenhill CSO in late 2010 at the request of the MOECC, given concerns that the facility was not achieving the target of 1.7 CSO discharge events per year. The resulting report (Hamilton Greenhill CSO Tank Overflow Review, Hatch Mott MacDonald), indicated that the high number of overflows was in part due to the high number of significant storm events over the preceding several years. The report also noted a number of potential measures for improvement, including the implementation of a real-time control (RTC) system to better optimize storage, including co-ordination with the Red Hill Creek CSO storage pipe (i.e. release discharges from the storage pipe instead of the Greenhill facility, given that the storage pipe outlet is located much further downstream past Barton Street). It is understood that the City of Hamilton is continuing in its efforts to minimize CSO discharges, which as noted should benefit not only flood control volumes, but also clearly water quality within Red Hill Creek.

Davis Creek Flood Control Facility

Due to the timing of the construction of the facility, detailed monitoring analyses could not be included as part of the current summary. A separate 5-year monitoring program is currently underway for the Davis Creek Flood Control Facility.

Based on the details of the facility's operation, the gate would be expected to open once upstream water levels reach 90.45 m (21.2 m^3/s), which is slightly below the simulated 20 year return period peak flow of 23.1 m^3/s. Monitoring results from the 2008-2009 period suggest that the facility would have been expected to operate for the July 26, 2009 storm event, which was estimated to be in excess of a 100-year storm event at the outlet of Davis Creek. The July 26, 2009 storm event was used in the design/verification of the facility's operating parameters (rating curve).

There are limited available data to confirm whether or not the facility would have been expected to operate for any other storm event over the monitoring period. The exception would be for the July 22, 2012 storm event, which based on the previously noted hydrologic modelling, would have resulted in a peak flow well in excess of a 100-year storm event at the outlet of Davis Creek; the flood control facility would therefore have been expected to have been in operation for this storm event, if it had been in full service.

Additional Facility Assessments – Facility J

Water level monitoring of Facility J was completed over the 2011-2012 period for the reasons noted previously; detailed results are presented in the associated annual monitoring reports. The outlet grate (identified previously as a primary cause of flooding) was removed prior to the establishment of the additional monitoring, thus monitoring was intended to assess whether there were any residual concerns with respect to normal facility operation.

The average recorded permanent pool level over the 2011-2012 monitoring period was approximately 78.80 m +\- due to a blockage of the low flow (water quality) outlet pipe identified by Amec Foster Wheeler as part of the annual SWM facility inspection process (discussed in Section 2.3). Once this issue was repaired in November of 2012, the permanent pool dropped significantly, likely approaching the design permanent pool elevation of 78.30 m, and restoring a significant amount of available quantity control storage within the facility. However, given the timing of the repair, the available monitoring data do not represent the normal operating range of the facility.

Notwithstanding, the initial monitoring results indicate that based on the 2011 monitoring, tailwater levels were a frequent factor which impacted discharge from Facility J. Tailwater levels in 2011 were above the sill of the outlet culvert some 8 times in 2011, including a number of storms which were not considered to be particularly significant. In addition, water levels within Facility J were found to be correspondingly above tailwater levels for all storm events, by approximately 1 m for larger storm events. Peak facility operating levels during in 2011 were still some 1-1.5 m below the edge of roadway, however given that the elevated water levels were caused by relatively minor storm events, this was noted as a concern. Minimal results were noted from the 2012 monitoring data, given the lack of major storm events (with the exception of the July 22, 2012 storm, however this storm was focused mainly on headwater areas of the watershed).

As noted in the 2012 annual monitoring report, although the low flow pipe repairs were successful in restoring a significant amount of storage volume, modelling was considered as a potential option to better quantify the flood risk for the facility, given some of the results of the conducted monitoring (2011 in particular). This would also assist in further assessing the previously noted potential mitigation measures in this area.

Additional Facility Assessments – Compensation Wetland

Water level monitoring was also conducted for the compensation wetland located at the RHVP/QEW interchange (COMP 2) over the 2009-2012 period (refer to Drawing 1 for location). This was a recommendation of the 2008 annual monitoring report, in order to better assess facility performance. Summary results are presented in Table 2.2.5 along with recorded water levels within Lake Ontario (at Water Survey Canada's nearby Burlington monitoring site – 02HB017). All data presented are for the monitoring period (i.e. April to November).

Table 2.2.5: Summary of Observed Water Levels within the Compensation Wetland (COMP 2)

Year	Compensation Wetland			Lake Ontario at Burlington (02HB017)	
	Minimum Dry Weather Water Level (m)	Maximum Dry Weather Water Level (m)	Maximum Wet Weather (Storm Event) Water Level (m)	Minimum Monthly Lake Level (m)	Maximum Monthly Lake Level (m)
2009[1]	74.61	74.88	77.87	74.55	75.24
2010	74.49	74.92	76.32	74.63	74.99
2011	74.51	75.39	75.98	74.61	75.37
2012[1]	74.61	74.88	76.12	74.32	74.93
AVERAGE	**74.56**	**75.02**	**76.58**	**74.53**	**75.13**

1. Incomplete period of record; missing gauge data (gauge ran dry or was damaged for some portion of time)

The monitoring results presented in Table 2.2.5 suggest that dry weather water levels within the compensation wetland are generally correlated to water levels within Lake Ontario; minimum and maximum dry weather water levels within the compensation wetland are consistent with those observed within Lake Ontario.

The results presented in Table 2.2.5 also indicate a significant variation in water level within the compensation wetland during significant storm events, on the order of 1.5 m up to 3 m for the storm event of July 26, 2009. Although not intended as a formal flood control facility, given the significant surface area of this feature, it clearly provides a significant amount of informal flood storage volume for Red Hill Creek during major storms.

2.2.3 Recommendations and Lessons Learned

<u>Recommendations</u>

1. Surface water monitoring associated with the Davis Creek Flood Control facility was begun in 2014 and continues in 2015; this work should carry on for the originally specified 5-year timeframe to confirm that the facility is operating as intended (although it is noted that the outlet control system has not yet been activated). It should be noted however given that the system is intended to operate for storm events in excess of a 20 year return period, it is possible that the gate may not operate during the 5-year monitoring timeframe.
2. No further temporary flow monitoring is recommended for the balance of the RHVP system. The results of the monitoring work to-date suggest that the RHVP as a whole is largely operating as per the approved design.

3. Notwithstanding, the City of Hamilton may wish to consider further assessing the localized flooding locations previously noted, as well as the preliminary list of remedial measures. The City of Hamilton (and the MTO) may also wish to consider undertaking a climate change assessment in order to better understand the expected changes in drainage system performance over time and the most vulnerable/sensitive areas, and from this establish a plan to build in resiliency.
4. The City of Hamilton should continue its efforts to minimize CSO discharges to Red Hill Creek given the overall impacts to water quality and flood flows. CSO discharges at the Greenhill location should be targeted in particular given the impacts to flood storage volumes; the implementation of real-time control systems and the RHVP CSO super pipe storage system, should assist in this regard.

Lessons Learned

1. Gauge loss occurred numerous times within the Red Hill Creek system; this is considered primarily attributable to the significant flows and velocities. Any future monitoring should consider a more permanent installation to ensure gauge stability; at a minimum temporary gauges should be anchored within the creek bed to depths of 1 m or greater, or a more permanent gauge setup (such as at a bridge, or weir structure) should be considered.
2. Likewise, obtaining reliable water level and flow monitoring data from the steeper sections of Red Hill Creek was found to be extremely problematic given not only the higher velocities but the high degree of associated channel movement, particularly after formative storm events. This should be taken into account in any future monitoring efforts in similar circumstances; a more permanent gauge setup and channel form (i.e. a weir or otherwise) may be warranted depending on the location and circumstances.
3. In-stream velocity measurements cannot be safely obtained in larger creek systems such as Red Hill Creek at higher flows given the expected velocities and depths. Observed data points should be included to the extent possible, however the extrapolation of higher rating curve ordinates is considered to best addressed by fitting using a representative hydraulic model rather than a simple trendline (as has been done in this study). Reasonableness checks (such as runoff volume and comparison against hydrologic modelling) are a good way to ensure reasonably representative data.
4. A versatile, fully calibrated hydrologic model is an invaluable resource in assessing major storm events and expected system performance. The approved HSP-F model for the Red Hill Creek watershed has been applied numerous times over the course of the integrated monitoring program and has been found to be extremely useful and reliable.
5. Likewise, a resolute network of point rainfall gauges is an extremely useful resource in fully assessing major storm events. Radar-generated rainfall data are also a very useful tool in visualizing the spatial variability of storm events, and better understanding drainage system responses.

2.3 Water Quality and Sediment Quality/Quantity

2.3.1 Brief Background

Water Quality

A major component of the Red Hill Valley Project involved the construction of the stormwater management (SWM) system for the Red Hill Valley Parkway to address the expected increase in contaminant loading associated with the increase in impervious coverage and change in land use. End-of-pipe measures (extended detention wet ponds) were all originally designed based on MOECC "Enhanced" (Level 1) criteria, namely 80% average overall removal of total suspended solids (TSS). Monitoring of these facilities was a requirement of the original MOECC Certificates of Approval (C of A) in order to ensure that the SWM facilities function as designed.

A total of fourteen (14) SWM quality facilities were ultimately constructed as part of the RHVP, and have thus been included in the Integrated Monitoring Plan. The locations of these facilities are shown in Drawing 1; they included 11 City-owned facilities along the RHVP, and 3 MTO-owned facilities along the QEW corridor. Although these SWM facilities were primarily constructed and designed to address stormwater quality for the RHVP, several of the SWM facilities were also designed as retrofits to provide water quality treatment for previously untreated storm sewer outfalls in combination with providing treatment for the RHVP. The retrofit facilities include the Online (Retrofit) facility, Facility H, and Facility J (refer to Drawing 1 for locations).

Water sampling has been conducted in accordance with the protocol outlined in Section 7.4.1 of the Red Hill Valley Project Integrated Monitoring Plan (RHVP IMP, December 2007). In order to facilitate sampling, the 14 SWM facilities were divided into four separate groupings (2 groups of 4 facilities, 2 groups of 3 facilities), based on common location and inter-connectivity (where applicable). In general, it was considered practical to sample two separate groups of facilities in any given year, with three samples per year (generally representative of spring, summer, and fall conditions). Two separate years of sampling were required for each facility, resulting in 6 sampling sets for each facility.

Grab samples were collected from both SWM facility inlets during the onset of larger (typically > 15 mm) rainfall events. Approximately 12 hours after the onset of the rainfall event, grab samples were collected from the stormwater facility outlets (approximately representative of the average effluent concentration based on a 24-hour drawdown time). As was stated in the 2008 Monitoring Report, a single sample was to be collected from the inlet and outlet respectively. In the case of facilities with multiple inlets, either the major inlet was sampled only, or inlet concentrations were mixed, depending on the characteristics of the SWM facility in question.

Beginning in 2009, in-stream water quality monitoring was also conducted, coincident with facility inlet sampling. The intent of this additional sampling was to gain a more fulsome understanding of baseline/background stormwater quality within the watershed, as well as to compare in-creek contaminant concentrations to SWM facility effluent contaminant concentrations. Two in-creek sampling locations were ultimately selected; at Mount Albion Road and at Barton Street (the

approximate upstream and downstream limits of the Red Hill Valley system). Both locations are shown on Drawing 1.

All water quality grab samples were analyzed by an accredited laboratory for the parameters specified in the original monitoring plan. This included typical contaminants of interest, such as TSS, nutrients (Biochemical Oxygen Demand, Nitrogen and Phosphorous species), metals (Aluminum, Copper, Lead, Zinc, etcetera), faecal coliforms, as well as numerous other parameters. The full suite of sampling parameters and associated results are included in previous annual monitoring reports.

Water quality sampling for SWM facilities was originally intended to take place within the specified 5-year project timeframe (2008-2012). However, as documented in previous annual monitoring reports, a number of operational issues were noted with several SWM facilities starting in 2009 (MTO-owned facilities) and 2011 (City-owned facilities). It was considered appropriate to delay sampling of these facilities until such time as the issues could be addressed, in order to ensure stormwater quality sampling was conducted with the SWM facilities operating as intended. Given the delay in addressing these issues, no water quality sampling was conducted for MTO-owned facilities until 2013; given the requirement for 2 years of sampling data, water quality sampling necessarily extended into 2014. The results of the 2014 water quality sampling program have been incorporated into the current 5-year summary, rather than issue a separate stand-alone report. Operational issues for City-owned facilities were not addressed until late 2012 (and early 2013), accordingly the second year of sampling for many City-owned facilities was not collected until 2013. Stormwater quality sampling data therefore reflects the periods of 2008-2010 and 2013-2014 (i.e. no sampling was conducted in either 2011 or 2012).

Sediment Quality

The accumulation of fine sediments in the secondary collection areas of stormwater management facilities (i.e. after forebay treatment) can, if sufficiently contaminated pose a risk to resident biota, wildlife and downstream water quality if flushed. Accordingly, sediment quality testing was also included within the scope of the IMP.

As per the IMP, sampling was specified to be conducted every 3 years; given the 5-year monitoring time frame, sampling was conducted once over this period. Main cell sediment samples were collected from the 11 City-owned facilities in 2010; owing to ongoing operational issues and repair works, main cell sediment samples were collected from the 3 MTO-owned facilities in 2011. In addition to the main cells, sediment sampling was also conducted for forebay areas, in order to provide a better overall characterization of sediment contaminant levels.

In all cases, two samples were collected from each location (consistent with the IMP) in order to ensure a representative overall characterization. Owing to the significant pool depths, sediment samples were collected using a boat, along with a Wildco Standard Ekman sampler.

Sediment samples were then analyzed by an accredited laboratory for the parameters specified in the original monitoring plan. This included typical contaminants of interest, such as metals

(Copper, Lead, Zinc, etcetera), polyaromatic hydrocarbons (PAHs), herbicides and pesticides, and total organic carbon (TOC) which assisted in applying sediment quality criteria developed by the MOE (1993).

The full suite of sampling parameters and associated results is included in previous annual monitoring reports.

SWM Facility Bathymetry

Although not included within the scope of the original (2007) IMP, as per the recommendations of the 2008 and 2009 Annual Monitoring Reports, a bathymetric survey was undertaken for the water quality SWM facilities along the RHVP (i.e. survey of the base elevation of the pools within the facilities/top of sediment). It was considered worthwhile to gather this information for a number of reasons, including synergy with sediment sampling efforts (i.e. the need to use a boat to access those areas), and in order to confirm that as-built facility depths were consistent with design grades. This additional work was undertaken for City-owned SWM facilities only.

An initial bathymetric survey was undertaken in 2010, in parallel with main cell sediment sampling efforts. A subsequent bathymetric survey was undertaken in 2012, with the intention to better evaluate annual sediment accumulation rates, and forecast clean-out frequencies accordingly. This was considered important, as it was unclear from the 2010 bathymetric data alone how much of the measured sediment accumulation was due to construction activities as opposed to normal post-construction operation.

Detailed bathymetric survey results are included in the 2010 and 2012 annual monitoring reports.

SWM Facility Inspections

Although not included within the scope of the original (2007) IMP, as per the recommendations of the 2009 annual monitoring report, an inspection of all 14 water quality SWM facilities was undertaken in 2010. The original intent of the annual inspection was to verify whether or not any of the facilities had sustained damage from the major storm events in 2009, and to confirm whether or not there were any operational issues which could impact upon the treatment performance of any of the facilities. It was subsequently concluded that there was significant value in continuing the inspection on an annual basis; inspections were therefore undertaken annually since 2010.

Annual inspections have produced a summary table indicating all identified issues, and classifying them depending on the relative priority. A photographic inventory has also been produced annually in order to document facility condition. Based on the results of these annual inspections (as well as the previous bathymetric surveys), a number of priority works were identified (those which would be expected to have an impact on SWM facility performance). The priority items identified as part of the 2011 inspection (repairs to the Mud Street Facility, Facility C, Facility J, and Facility M) were ultimately undertaken in late 2012 and early 2013, which delayed the

completion of the water quality sampling program within the original 5-year timeframe, as noted previously.

A number of additional maintenance items were subsequently identified as part of the 2012 SWM facility inspection. The design and permitting for these additional repair works (to Facility B, Facility D, Facility F/G, Facility I, and Facility J) are currently ongoing, with construction anticipated for 2015. The documentation for these works will be included with the 2014 Annual Report (which documents the final year of required water quality sampling).

Detailed photographic inventories and facility inspection summaries can be found within all annual monitoring reports from 2010 onwards.

2.3.2 Major Findings

Water Quality

The water quality performance of SWM facilities is typically measured by comparing water quality before and after treatment by the facility (i.e. influent and effluent). The difference in contaminant concentrations between the inlet and outlet of the facility can be used to develop an approximate removal rate as a measure of the effectiveness of the facility in meeting water quality targets. As noted, all of the water quality facilities constructed as part of the RHVP were designed based on MOECC “Enhanced” (Level 1) criteria, namely 80% average overall removal of total suspended solids (TSS), which is the key measure for assessing SWM facility performance.

Removal rates for key contaminants (including TSS) have been presented in previous annual monitoring reports for individual sampling events. These results have been averaged, in order to assess the mean removal rates for each of the 14 facilities. Table 2.3.1 summarizes the average overall removal rates for each facility for key contaminants of interest.

It should be noted that consistent with the approach taken in previous annual monitoring reports, where an individual contaminant was not detected (i.e. below the laboratory’s reportable detection limit or RDL) concentration has been assumed to be equal to the RDL value for the purposes of calculating removal efficiencies. Values given in red represent negative removal efficiencies (i.e. on average contaminants concentrations are higher within the facility effluent than the influent).

Table 2.3.1: Average Calculated Removal Rates For Key Contaminants (all samples)

Facility (City ID)	Number of Samples	Contaminant Removal Rate (%)						
		TSS[3]	TKN[4]	Total P[5]	Aluminum	Copper	Lead	Zinc
Mud Street Facility (116)	6	83%	27%	37%	59%	56%	72%	59%
Escarpment Facility (117)	6	54%	-25%	-1%	67%	55%	78%	44%
Facility B (108)	6	54%	52%	61%	41%	70%	73%	76%
Facility C (109)	5[1]	79%	40%	74%	74%	70%	80%	74%
Facility D (110)	6	16%	-29%	-258%[6]	35%	72%	45%	68%
Online (Retrofit) Facility (110)	6	79%	4%	44%	85%	71%	71%	64%
Facility F/G (111)	6	33%	33%	52%	-2%	73%	21%	32%
Facility H (112)	6	21%	-28%	-27%	-24%	60%	40%	50%
Facility I (113)	5[1]	19%	-21%	-5%	24%	62%	59%	67%
Facility J (114)	6	28%	-2%	1%	25%	29%	36%	28%
Facility K/L (115)	6	-41%	9%	48%	-82%	26%	-32%	-34%
Centennial Facility (MTO Facility 8)	5[2]	69%	28%	60%	69%	61%	69%	63%
Facility M (MTO Facility 7)	5[2]	92%	28%	88%	89%	80%	90%	87%
Facility O (MTO Facility 4)	5[2]	-70%	9%	35%	1%	66%	21%	57%

1. For the June 13, 2008 sampling event, an outlet sample could not be collected for either Facility C or Facility I (SWM facility had already drawn down). Accordingly, a removal efficiency cannot be calculated for this event.
2. 2014 is the final year of water quality sampling for the MTO-owned facilities; to-date 2 or the 3 required annual samples have been collected, thus data is only available from 5/6 sampling sets overall.
3. TSS = Total Suspended Solids
4. TKN = Total Kjedahl Nitrogen (sum of organic Nitrogen, Ammonia, and Ammonium)
5. Total P = Total Phosphorous
6. Values are skewed by an excessively negative removal rate for the June 22, 2010 sampling event.

The results presented in Table 2.3.1 indicate that only 4 of the 14 SWM facilities approximately meet or exceed the original design criteria for 80% TSS removal (Mud Street Facility, Facility M, and Facility C and the Online (Retrofit) facility, the latter of which have average removal rates of 79%, which is considered approximately equal to 80%). Half (7) of the facilities have average TSS removal rates below 50%, and 2 of those have negative removal rates (Facility K/L and Facility O). Negative removal rates are also noted for a number of facilities for nutrients (nitrogen as TKN, and total phosphorous), as well as some metals (aluminum in particular). Overall however, metals removal rates are generally in line with literature reported values for wet ponds (60% +\-); note that no criteria are specified by the MOECC specifically for metals removal.

Low and negative removal rates have been discussed in previous annual monitoring reports. Based on a review of the water quality sampling data, it is considered that the primary reason for these results relates to comparatively low contaminant concentrations in the sampled influent. When influent concentrations are below expected values (TSS concentrations of approximately 50 to 100 mg/L on average for uncontrolled urban areas based on available literature), 80% removal rates cannot practically be achieved.

Low influent concentrations can be the result of numerous factors; the primary reasons are considered to be the inter-event period and sample timing. The inter-event period represents the dry weather period prior to the sampling event; an extended inter-event period means a higher surface contaminant build-up and wash-off (and higher resulting influent contaminant concentrations), while a shorter period typically results in lower contaminant levels. Sample

timing refers to the point at which the influent sample is collected; whether the initial most contaminated "first flush' is measured, or whether more dilute concentrations later into the storm event are measured. Both factors are inherent limitations of grab sampling methodology. It is not possible to sample under "ideal" conditions through this methodology (i.e. grab sampling); sampling is therefore inherently limited by the timing of storm events, the accuracy of weather forecasts, the ability to quickly move between sites, and numerous other factors.

In order to further validate the hypothesis that removal rates are significantly affected by influent contaminant concentrations, the results presented in Table 2.3.1 have been further assessed. Sample results where the TSS influent concentration is below 50 mg/L have been removed from the calculation of the average removal rate; results are presented in Table 2.3.2.

Table 2.3.2: Average Calculated Removal Rates For Key Contaminants (with Data Screening)

Facility (City ID)	Number of Samples	Contaminant Removal Rate (%)						
		TSS[3]	TKN[4]	Total P[5]	Aluminum	Copper	Lead	Zinc
Mud Street Facility (116)	6/6	83%	27%	37%	59%	56%	72%	59%
Escarpment Facility (117)	2/6	82%	-50%	-16%	87%	81%	79%	88%
Facility B (108)	5/6	88%	69%	73%	72%	87%	90%	90%
Facility C (109)	4/5[1]	88%	45%	79%	82%	73%	85%	78%
Facility D (110)	2/6	86%	10%	40%	89%	77%	82%	73%
Online (Retrofit) Facility (110)	5/6	86%	9%	48%	92%	78%	86%	77%
Facility F/G (111)	3/6	36%	49%	59%	-39%	59%	-16%	-24%
Facility H (112)	1/6	75%	-5%	37%	67%	77%	69%	66%
Facility I (113)	2/5[1]	79%	-43%	-34%	53%	76%	84%	87%
Facility J (114)	1/6	84%	-35%	-18%	41%	20%	54%	27%
Facility K/L (115)	1/6	96%	73%	87%	94%	87%	95%	92%
Centennial Facility (MTO Facility 8)	5/5[2]	69%	28%	60%	69%	61%	69%	63%
Facility M (MTO Facility 7)	4/5[2]	91%	25%	90%	90%	81%	90%	88%
Facility O (MTO Facility 4)	1/5[2]	90%	48%	79%	65%	85%	71%	90%

1. For the June 13, 2008 sampling event, an outlet sample could not be collected for either Facility C or Facility I (SWM facility had already drawn down). Accordingly, a removal efficiency cannot be calculated for this event.
2. 2014 is the final year of water quality sampling for the MTO-owned facilities; to-date 2 or the 3 required annual samples have been collected, thus data is only available from 5/6 sampling sets overall.
3. TSS = Total Suspended Solids
4. TKN = Total Kjedahl Nitrogen (sum of organic Nitrogen, Ammonia, and Ammonium)
5. Total P = Total Phosphorous

As evident from the results presented in Table 2.3.2, once samples with lower influent concentrations are screened, overall removal rates are significantly improved. In particular, all but 3 of the SWM facilities approximately meet or exceed the designed TSS removal rate of 80%. The 3 SWM facilities include Facility F/G (36%), Facility H (75%), and the Centennial Facility (69%). With respect to Facility F/G, it is considered that the low TSS removal rates may be partially attributable to the large amount of filling within the forebay area [samples were taken in 2008 and 2010; results from the 2010 bathymetric survey indicate the forebay was 78% full at that time]. The forebay of Facility F/G is proposed to be dredged and expanded as part of the forthcoming SWM repair works (2015); this should assist in improving removal rates for Facility F/G. With respect to Facility H, with data screening included, the calculated rate is based on a single dataset, and is considered to be reasonably close to the design removal rate of 80%. With respect to the Centennial Facility, it is considered that the slightly lower removal rate of 69% is

attributable to the facility outlet orientation. The outlet in this case is typically submerged by water levels within the receiving watercourse; as such the outlet sample is a mix of the facility effluent and the watercourse rather than the facility effluent alone.

Based on the foregoing, the results suggest that the water quality SWM facilities are generally meeting or achieving their intended design function. In addition to TSS removal rates, nutrient removal rates (TKN and Total P) are generally equal to, or above, literature reported values for wet ponds (30-50% +\-); where lower or negative removal rates are indicated in Table 2.3.2, the results are generally based on a limited number (1-3) of samples. Metals removal rates are generally consistent with literature reported values for wet ponds (60% +\-), with the exception of Facility F/G (which as noted previously, may be due to a deficient forebay feature).

As a further comparison, average contaminant concentrations for all available samples have been compared between creek sampling locations and SWM facility effluent. The results are presented in Table 2.3.3, along with a comparison to MOECC guideline values (Provincial Water Quality Objectives, or PWQOs) where available.

Table 2.3.3: Average Contaminant Concentrations for Creek and SWM Facility Effluent Samples

Location/Facility (City ID)	Number of Samples	Contaminant Concentration (mg/L, CFU/100 mL for E. Coli)							
		TSS[3]	TKN[4]	Total P[5]	Aluminum	Copper	Lead	Zinc	E. Coli
PWQO Criteria	**NA**	**NA**	**NA**	**0.03**	**0.075**	**0.005**	**0.001**	**0.02**	**100**
RHC at Mount Albion	***8***	***180***	***1.24***	***0.315***	***3.70***	***0.020***	***0.013***	***0.195***	***42,500***
RHC at Barton Street	***10***	***370***	***1.88***	***0.465***	***4.66***	***0.018***	***0.015***	***0.174***	***51,370***
Mud Street Facility (116)	6	36	2.95	0.203	2.60	0.006	0.002	0.022	5,543
Escarpment Facility (117)	6	11	0.71	0.040	0.07	0.001	0.001	0.019	2,200
Facility B (108)	6	22	0.73	0.166	0.55	0.008	0.004	0.041	35,672
Facility C (109)	5[1]	26	1.01	0.066	1.13	0.006	0.002	0.017	43,340
Facility D (110)	6	20	1.37	0.262	0.45	0.004	0.002	0.015	5,022
Online (Retrofit) Facility (110)	6	32	1.73	0.218	0.64	0.007	0.003	0.027	11,567
Facility F/G (111)	6	51	2.75	0.172	2.17	0.006	0.006	0.051	5,548
Facility H (112)	6	14	2.53	0.298	0.35	0.006	0.002	0.018	23,000
Facility I (113)	5[1]	18	2.06	0.276	0.65	0.005	0.002	0.017	17,800
Facility J (114)	6	13	1.26	0.119	0.32	0.007	0.003	0.033	109,333
Facility K/L (115)	6	22	1.22	0.097	0.96	0.009	0.005	0.038	38,488
Centennial Facility (MTO Facility 8)	5[2]	26	0.96	0.057	0.82	0.008	0.004	0.043	14,000
Facility M (MTO Facility 7)	5[2]	12	0.63	0.018	0.33	0.003	0.001	0.007	9,040
Facility O (MTO Facility 4)	5[2]	43	1.13	0.088	0.96	0.006	0.006	0.031	6,096

1. For the June 13, 2008 sampling event, an outlet sample could not be collected for either Facility C or Facility I (SWM facility had already drawn down). Accordingly, a removal efficiency cannot be calculated for this event.
2. Only 2 of the 3 required annual samples could be collected for the MTO-owned facilities in 2014 (last year of sampling), thus data is only available from 5/6 sampling sets overall.
3. TSS = Total Suspended Solids
4. TKN = Total Kjedahl Nitrogen (sum of organic Nitrogen, Ammonia, and Ammonium)
5. Total P = Total Phosphorous

The results indicate that, as would be expected, contaminant levels within Red Hill Creek are significantly higher than SWM facility effluent (by an order of magnitude or greater in many cases). The average SWM facility effluent TSS concentration is 25 mg/L, which is considered fairly low (there is no PWQO criteria for comparison purposes). Metals concentrations (Copper, Lead, and Zinc) are generally near, or below, PWQO criteria for SWM facility effluent, concentrations for Aluminum are significantly above PWQO criteria, however these can be affected by naturally occurring levels within soils in some cases. Effluent results for nutrients are variable, with concentrations of Total Phosphorous typically well above PWQO criteria. Likewise, effluent E. Coli concentrations are significantly above PWQO criteria (as are those within Red Hill Creek itself), however SWM facilities do not provide effective treatment of bacteriological contaminants.

Overall, once low contaminant concentrations within influent samples are accounted for, the results indicate that the water quality SWM facilities are largely performing as per the approved design criteria with respect to contaminant removal rates. While some PWQO exceedances have been noted with respect to SWM facility effluent, concentrations are well below levels within the receiving watercourse (an order of magnitude or greater in many cases). It should also be noted that PWQO criteria are guidelines only, and given that expected removal rates are being met, achieving those targets for SWM facility effluent is likely impractical.

Sediment Quality

Sediment quality sampling results are typically compared against the MOECC's Guidelines for Sediment Quality (1993). The guidelines distinguish between the *No Effect, Lowest Effect*, and *Severe Effect* levels of contaminant concentration:

- A *No Effect Level* (NEL) indicates that no toxic effects have been observed on aquatic organisms. This is the level at which no bio-magnification through the food chain is expected. Other water quality and use guidelines will also be met at this level.
- A *Lowest Effect Level* (LEL) indicates a level of sediment contamination that can be tolerated by the majority of benthic organisms.
- A *Severe Effect Level* (SEL) indicates the level at which pronounced disturbance of the sediment-dwelling community can be expected. This is the sediment concentration of a compound that would be detrimental to the majority of benthic species (MOE, 1993).

The results from main cell sediment sampling (2010 for City-owned facilities, 2011 for MTO-owned facilities) are presented in Table 2.3.4. As noted, forebay sampling was also conducted (2009 for City-owned facilities, 2011 for MTO-owned facilities), however the focus of the IMP has been upon main cell contaminants; in addition, contaminant concentrations and patterns are generally consistent between forebay and main cell sampling results. Complete results can be found in previous annual monitoring reports.

Table 2.3.4: Comparison of Average Main Cell Sediment Contaminant Concentration for Key Parameters

Location	Contaminant Concentration (µg/g or ppm)								
	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	p,p-DDE[1]	Total PCB[2]	Total PAH[3]
Lowest Effect Level Guideline	**0.6**	**26**	**16**	**31**	**16**	**120**	**0.005**	**0.07**	**4**
Severe Effect Level Guideline	**10**	**110**	**110**	**250**	**75**	**820**	**NA[4]**	**NA[4]**	**NA[4]**
Mud Street Facility (116)[6]	0.1	24.5	30	21	25.5	115	ND[5]	ND[5]	ND[5]
Escarpment Facility (117)	1.05	18	31.5	77.5	22.5	350	ND[5]	ND[5]	1.25
Facility B (108)	0.95	35.5	49	51.5	22.5	325	ND[5]	ND[5]	0.85
Facility C (109)	0.6	33.5	40.5	40	22.5	230	0.042	ND[5]	0.65
Facility D (110)[6]	0.95	19.5	41.5	65.5	21.5	310	ND[5]	ND[5]	2.53
Online (Retrofit) Facility (110)	0.9	26	52	62	29	400	ND[5]	ND[5]	2.87
Facility F/G (111)	1	18	30.5	56.5	21.5	300	0.017	ND[5]	1.43
Facility H (112)	0.9	30	67.5	60	24.5	365	0.037	ND[5]	15.0
Facility I (113)	0.8	24	33	40.5	26.5	235	0.009	ND[5]	0.43
Facility J (114)	2	62	105	108	20	627	ND[5]	ND[5]	39.5
Facility K/L (115)	0.85	34.5	56.5	60	23	365	ND[5]	ND[5]	5.21
Centennial Facility (MTO Facility 8)	0.9	49.5	101	97.5	27	600	ND	ND	8.92
Facility M (MTO Facility 7)[6]	0.2	16.5	25.5	19	16.5	76.5	0.07	ND	1.09
Facility O (MTO Facility 4)	0.55	31.5	51	73.5	24.5	325	0.01	0.08	2.65

1. p.p-DDE = dichlorodiphenyldichloroethylene, a common breakdown product of DDT (a well-known pesticide/insecticide)
2. PCB = polychlorinated biphenyls (known toxic carcinogen used widely in past electrical products)
3. Total PAH (polyaromatic hydrocarbons) has been calculated as the sum of individual average concentrations of each tested PAH. Where value was not detected, concentration equal to zero given variability in laboratory detection limits.
4. NA = Not applicable (Severe Effect Level is variable depending on the amount of Total Organic Carbon per sample)
5. ND = Not detected (below the laboratory's detection threshold).
6. Main cell of SWM facility was dredged after sampling, thus results may no longer be representative of in-situ contaminant concentrations

The results generally indicate that metals exceedances of the LEL are common, however there are no reported exceedances of the SEL. Exceedances are far less common for pesticides and PCBs, with only a few facilities showing any measured concentration above the laboratory detection limit. Based on the detailed results in previous annual monitoring reports, where those values are detected above the LEL, they are still typically an order of magnitude or greater below the SEL. PAHs were generally found in all facilities, but at concentrations typically below the LEL. Total PAH concentrations were the highest within Facility H, and in particular Facility J, which had PAH concentrations of an order of magnitude or greater than other SWM facilities. In both cases, the higher PAH concentrations are considered attributable to the facility type; both are retrofit facilities which receive runoff predominantly from adjacent residential/commercial/industrial land uses. The particularly high PAH concentrations within Facility J may be attributable to a large proportion of contributing commercial/industrial land use. In both cases, measured concentrations were still typically an order of magnitude less than the SEL.

Overall, the sediment contaminant concentrations presented in Table 2.3.4 appear reasonably consistent, with the previously noted exceptions. There are limited literature sources to provide meaningful comparatives of expected concentrations. The results presented in Table 2.3.4 may be useful in assessing likely disposal options for future clean-outs. In general, it is considered that the potential for re-suspension and downstream flushing of settled main cell sediments is low, given the typical pool depths within SWM facilities. Detailed site-specific hydraulic modelling would be needed to assess the risk in further detail. In general, it is considered that the risk of sediment flushing can be best addressed through regular inspection and maintenance to avoid excessive sediment build-up, which would likely be a major contributor to flushing risk.

SWM Facility Bathymetry

Given that the bathymetric surveys of City-owned SWM facilities were not part of the scope of the original IMP, detailed results are not included herein. Detailed results can be found in previous annual monitoring reports, in particular the 2012 report (which includes the results of both the 2010 and 2012 surveys).

In general, the bathymetric surveys were extremely useful in identifying infilling within SWM facilities, and targeting those which required immediate dredging to restore design treatment volumes. It should be noted that where dredging has been subsequently completed (or is planned), the results presented in previous reports are clearly no longer valid.

The 2012 annual monitoring report also attempted to better evaluate annual sediment accumulation rates under “normal” operating conditions (based on the differences between the 2010 and 2012 surveys), and forecast clean-out frequencies accordingly. The results of this effort were largely inconclusive. In many cases sediment accumulations were found to be minimal, or in some cases negative. This may be in part attributable to unavoidable differences in the collected data points from the bathymetric survey (points in different locations, thus different sediment depths). Notwithstanding the lack of sediment accumulation over the two year period remains counterintuitive. This may be the result of weather conditions (dryer than average) or potentially lower than expected sediment concentrations in contributing drainage areas, however the precise reason remains unknown. The latter would be consistent with the observations with respect to water quality sampling (lower than expected TSS concentrations within SWM facility influent).

Based on the foregoing, the high sediment accumulations in certain SWM facilities (those which have been, or will be targeted for dredging and clean-out) would appear to be the direct result of original construction activities. SWM facilities were not surveyed prior to assumption by the City of Hamilton (or MTO). Alternatively, some of the higher sediment accumulations could be due to instabilities post-construction, or deposition from the major storm events of 2009.

SWM Facility Inspections

As noted, annual SWM facility inspections were not part of the scope of the original IMP, and as such, detailed results are not included herein. Detailed results can be found in previous annual monitoring reports from 2010 onwards.

In general, the facility inspections were extremely useful in identifying maintenance issues which could impact upon facility operation and treatment capacity, which could in turn impact upon water quality sampling results. The results of the annual inspections have resulted in a number of works by both the City and the MTO, primarily related to facility dredging and erosion repairs (re-grading, additional rip-rap stone, etcetera). Regular inspection and maintenance is key to ensuring the proper operation and stability of all SWM facilities.

2.3.3 Recommendations and Lessons Learned

Recommendations

1. Although some low and negative removal efficiencies have been noted with respect to SWM facility water quality sampling, additional sampling is not considered warranted. As noted, the results are considered primarily attributable to low contaminant concentrations within sampled influent; once these results were screened, SWM facility removal rates are generally consistent with design values. Selected water quality sampling may be considered in the future if there is a particular concern with a SWM facility, however it is not considered warranted at this time. Should the City or other regulatory agencies wish to assess SWM facility water quality in greater detail, a further alternative would be to consider implementing continuous water quality monitoring at one specific trial location, either through the use of an auto-sampler, or a continuous water quality gauge in combination with grab sampling. This would serve to validate the previously noted conclusions regarding the water quality performance of the SWM facilities along the RHVP.
2. By contrast, additional water quality sampling within the overall Red Hill Creek system may be warranted. Based on the in-stream water quality sampling conducted, water quality within Red Hill Creek continues to be heavily degraded, likely owing to the large proportion of the watershed without stormwater quality controls. Targeted water quality sampling could be beneficial in assessing the most degraded areas and likely locations for future remediation, where feasible.
3. Although not directly assessed as part of the IMP, CSO discharges to Red Hill Creek clearly have a negative impact on water quality. The City of Hamilton should continue its effort to minimize overflows, through ongoing monitoring, system optimization, additional storage, sanitary sewer disconnection, and other such measures. The Red Hill CSO “superpipe” constructed as part of the RHVP should assist in this regard; it is understood that this feature has been active as of December 2011, and limits CSO discharges from three former CSO points at Lawrence Avenue, Queenston Road, and Melvin Avenue. The Red Hill CSO does not however collect overflows from the two CSO tanks at Greenhill.
4. The sediment quality sampling conducted to-date should be considered as informative only; additional sampling should be conducted prior to any dredging or excavation work so that

appropriate disposal and health and safety precautions are taken into account. Particular attention should be given to retrofit facilities and those where higher contaminant levels were noted (Facility J in particular).

5. The City of Hamilton and the MTO should consider repeating a bathymetric survey of all SWM facilities sometime in the next 5-10 years, in order to assess the need for SWM facility clean-outs and ideally better establish sediment accumulation rates in comparison to the 2010 and 2012 bathymetric survey results.
6. The City of Hamilton and the MTO should consider continuing annual SWM facility inspections in order to proactively assess SWM facility condition and respond to potential maintenance issues. The Operations and Maintenance Manual for the RHVP SWM Facilities should also assist in this regard.

Lessons Learned

1. The limitations associated with water quality grab sampling should be clearly understood. While grab sampling is still considered useful to provide an indication of water quality, it should be understood that it represents data at a single point in time, which depending on timing, may not be representative of overall patterns. Likewise, grab samples are impacted by a number of factors, including antecedent conditions and storm characteristics; it is never possible to consistently sample under the same “ideal” conditions applied in design. Accordingly, water quality sampling results should always be interpreted with caution and careful thought.
2. Based on sampling results, municipal storm sewers (residential/commercial/industrial land uses) appear to generate much higher contaminant levels than those from the Red Hill Valley Parkway itself. Commercial and industrial land uses in particular seem to be significantly higher. In some cases, the lower loading levels associated with the Red Hill Valley Parkway may be due to the pre-treatment provided by grassed swales in the medians, which are not directly accounted for in design calculations. Such pre-treatment may also explain some of the frequent low influent concentrations. This should be interpreted and recognized as a positive.
3. An as-constructed/as-built bathymetric survey should be mandatory prior to assuming any SWM facility. This ensures that the constructed facility is consistent with the approved design, and that the ultimate owner (City/MTO) is not responsible for dredging sediment associated with construction rather than the intended operation.
4. Regular inspection of SWM facilities is clearly the best way to ensure efficient operation and to proactively address maintenance requirements.

2.4 Creek Morphology

2.4.1 Brief Background

An approximate 7,200 m reach of Red Hill Creek between the confluence of the Butternut Falls tributary (upstream of King's Forest Golf Course) and north of the CNR railway was re-aligned during the period June 2004 - April 2007 using natural channel design (NCD) principles. Channel re-alignment was undertaken to accommodate the expressway corridor while minimizing interactions between the roadway and the creek alignment. Additional efforts were undertaken to rectify approximately 60 years of adverse impacts to the creek corridor from urbanization and various historical channelization methods.

The design was based upon site investigations of Red Hill Creek during the period 1996 – 2004, assessments of comparable watercourses in similar geology and slopes, and using the current state of knowledge in both theoretical research and practice (WRIS 2002). Post-construction monitoring methods and metrics used to evaluate channel dynamics were consistent with the methods employed during the investigation period prior to construction which included surveys of: channel cross sections, longitudinal profile, and substrate in addition to visual inventories.

2.4.2 Major Findings

Analyses were based upon the bankfull channel characteristics which coincide with the morphological channel forming flow. This flow regime has been shown to maintain the channel form and bed material transport over a long period of time which is well document in literature (Leopold et al., 1964; Schumm et al., 1984; Annable et al., 2012). The rate of channel change is based upon the frequency and duration of flows exceeding bankfull discharge where it is also widely accepted that large magnitude low frequency discharge events (severe floods) may cause significant channel alterations that disrupt the ongoing trends of the bankfull flows (Leopold et al., 1964).

Prior to 2004, discharge analyses used in assessing channel erosion and change were based upon two Environment Canada gauge stations along Red Hill Creek at Queenston Ave. (02HA014) and Mount Albion Falls (02HA023) for their respective periods of records. Prior to roadway construction, the Mount Albion Falls station was discontinued. After channel construction was completed, the Queenston Ave. gauge was moved to Barton St. to capture a larger portion of the catchment area. The adopted hydrologic analysis is based upon the Barton St. gauge as it has maintained the longest period of record (and captures the largest proportion of the watershed). Forensic hydrology modelling results undertaken by Amec Foster Wheeler were also used for the high magnitude low frequency flood events observed on July 26, 2009 and July 22, 2012.

Over the period of record of the Barton St. gauge (02HA014) since 1978, a median of 10 annual events exceed bankfull discharge (flows begin to access the floodplain) with minimum and maximum annual ranges of 1 and 19 events respectively; where the 25th and 75 percentile are 6 and 13 events respectively (Figure 2.4.1). These findings are consistent with those observed

prior to creek construction (WRIS, 2002). Ready access of flood waters to the adjacent floodplain was, and is, a key element in the proper functioning of the creek system. Between 2009 and 2011 an increased number of convective storms occurred resulting in an increased frequency in bankfull events (all exceeding the 84th percentile). Only four discharge events exceeded bankfull discharge in 2012 – falling below the 20th percentile in discharge frequency observations. Based exclusively upon the increased frequency of bankfull discharge (between 2009 and 2011), higher than average channel erosion and migration rates would be anticipated during the same time frame (discussed further).

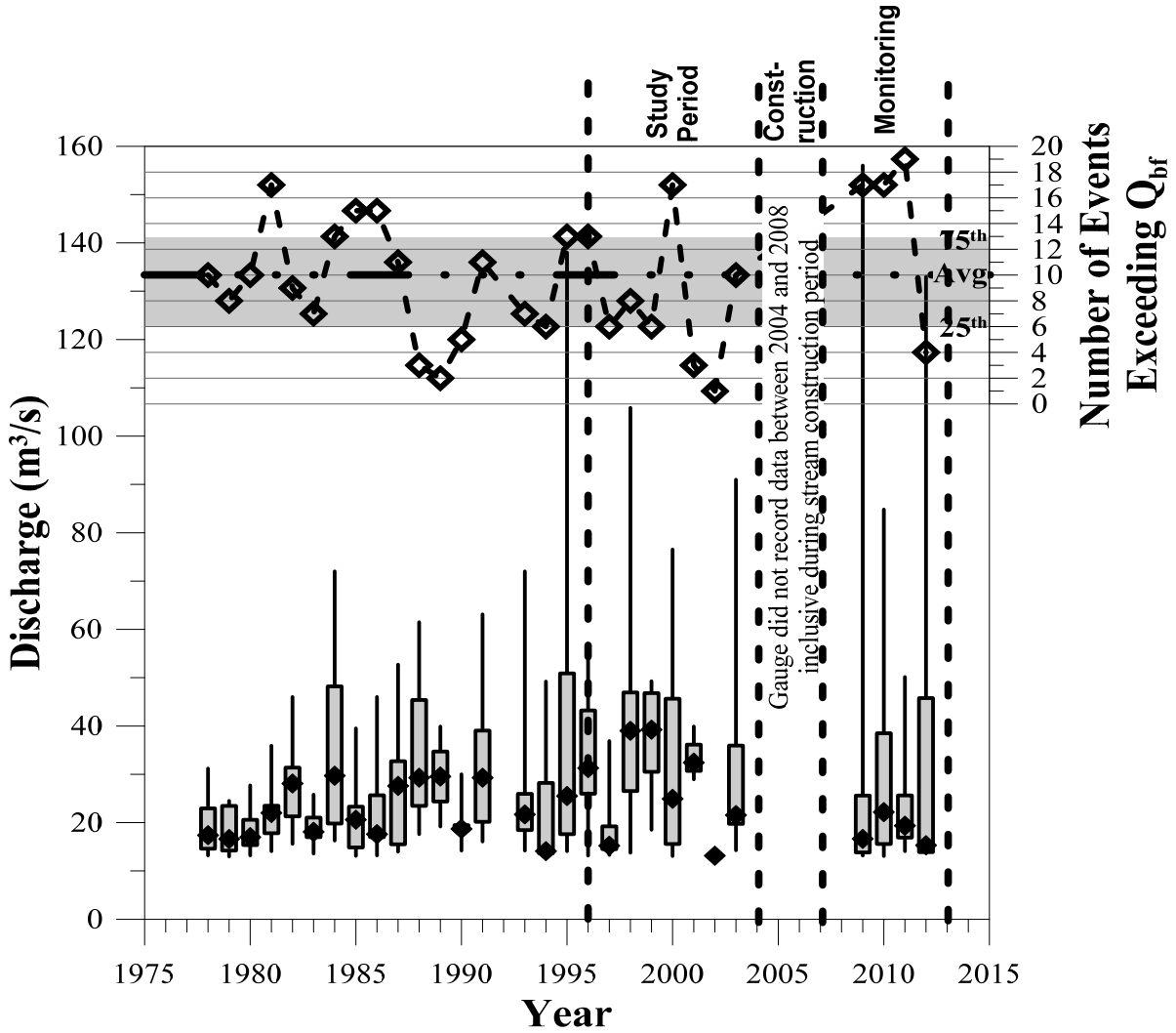


Figure 2.4.1 Box-and-whisker plot of annual range in flows exceeding bankfull discharge and annual frequency of events exceeding bankfull discharge (Barton ST. gauge 02HA014)

As noted, two rare low frequency high magnitude discharge events occurred subsequent to the creek construction on July 26, 2009 and July 22, 2012. The 2009 event represents the largest flood for the period of discharge record which exceeded the 100-year return period through the Red Hill Creek valley corridor. The flood on July 22, 2012 was lower in magnitude yet also exceeded the 100-year return period upstream of Davis Creek (as forensically assessed by Amec

Foster Wheeler). The stream channel responded in a fashion consistent with the response to high magnitude low frequency events where significantly larger rates of in-stream channel erosion and deposition were observed (relatively to bankfull flows). Common in such flood flows are observations that the planometric location of channels can significantly change (by several channel widths), existing channel locations may be abandoned and new channel alignments and/or significant vertical erosion observed. This was not the case along the rehabilitated reach of the Red Hill Creek where the alignment stayed within the design corridor.

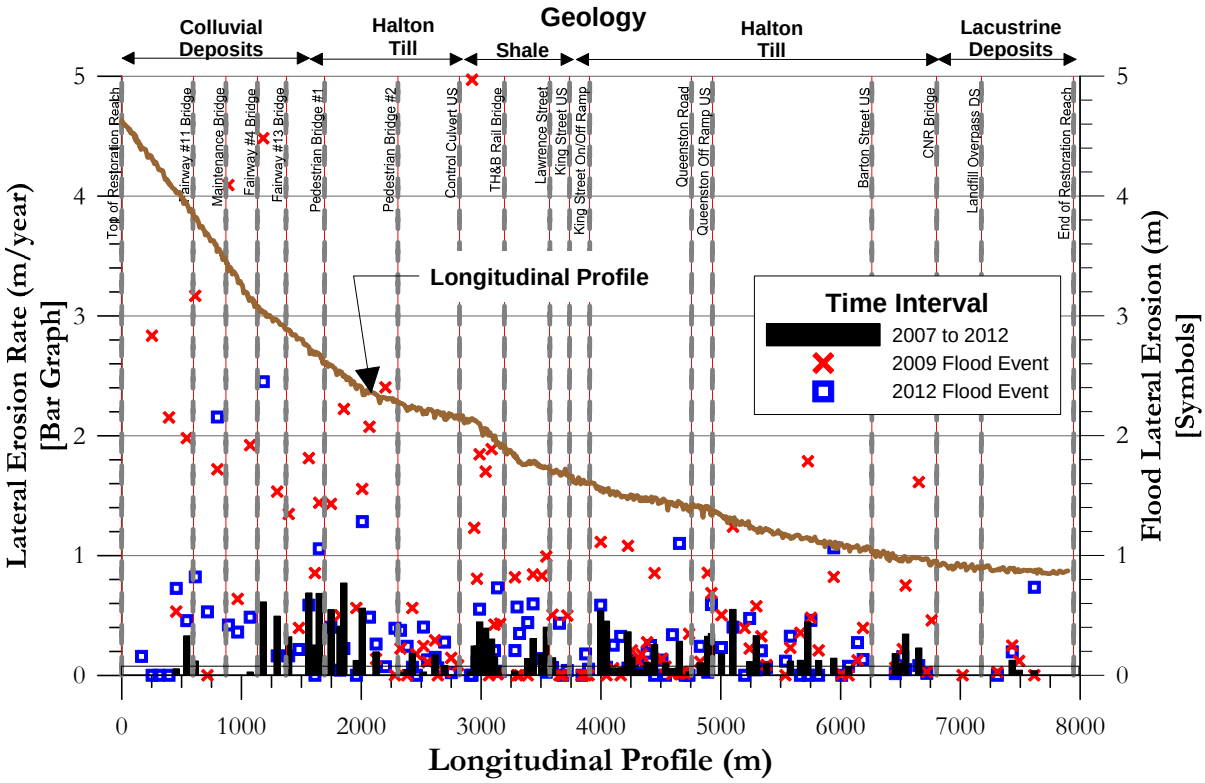


Figure 2.4.2 Bankfull channel annual lateral erosion rate (monitoring period 2007 – 2012) and net erosion for major flood events. Note: vertical axis of longitudinal profile not shown.

The assessment of bankfull channel erosion rates, changes in cross sectional area and centerline meander migration rates were based upon annual field surveys of 118 permanently benchmarked cross sections laid out at approximately equal intervals along the rehabilitated reach. During the July 26, 2009 event, 58 cross sections observed lateral erosion exceeding 0.3m which predominantly occurred upstream of the TH&B railway where the channel slope is the steepest or the channel flows directly over shale (Figure 2.4.2). The maximum amount of lateral scour that was observed occurred within King's Forest Golf Course where on one particular bend (where the greatest amounts of lateral erosion would be anticipated) 4.1m and 4.3m of lateral erosion resulted at two cross sections. Correspondingly, 34 of the cross sections observed net lateral erosion of less than 0.05m (measurement error) during the same flood event. There is notably one scour location that was observed downstream of the stormwater control culvert which resulted in 4.9m of lateral scour, however, this location was related to culvert expansion scour rather than river mechanics processes. The average annual observed lateral erosion rate over the monitoring

period (2007 – 2012) was calculated to be 0.17 m/year which includes the episodic results from the July 2009 and July 2012 storms. The amount and extent of lateral erosion that occurred from the 2009 flood is considered relatively minor for the magnitude of the discharge event.

The flood event of 2009 also initiated an erosion cycle in the creek between the toe of Mount Albion Falls and the confluence with the Buttermilk Falls tributary (just upstream of the rehabilitated site). Based upon field evidence and comparisons with previous surveys of the creek (Annable, 1996), the bankfull channel doubled in width at some sections and vertically incised by in excess of a meter. This channel reach had previously demonstrated no signs of instability and based upon field indicators, had maintained a relatively stable channel form for several decades to possibly centuries. The response of this previously stable section further demonstrated the severity of the July 2009 storm but also raised concern for the rehabilitated reach downstream. The recently destabilized reach has been (since July 2009) generating notable quantities of cobble-sized bed material which are being transported and deposited through the upper portion of the rehabilitated reach. The constructed channel was never designed to handle/receive the increased volume of bed material transport (as the reaches upstream of Mount Albion Falls are dominantly fine-grained material). The response of the rehabilitated channel receiving the coarse bed material through the King's Forest Golf Course and above, during flood flows, has been increased rates in in-channel deposition leading to infilling of the bankfull channel or flanking of in-stream structures. This response is expected to persist into the near future (likely decades) requiring in-stream maintenance until the upstream reach erosion is either mitigated or the erosional cycle diminishes.

The July 2009 flood also presented limitations in the creek corridor design as a result of some design choices. The creek design by WRIS (2002) identified that the minimum bridge spans to maintain channel stability should be no less than 32m throughout the creek corridor. This design recommendation was followed through the valley corridor with the exception of golf cart bridge crossings along the King's Forest Golf Course. In these locations, a constraint was placed upon the creek design to minimize nuisance flooding to the golf course and limited the golf cart bridge spans to 22 m. The July 2009 flood demonstrated limitations in these constraints where the greatest rates of both lateral (Figure 2.4.2) and vertical scour were observed downstream of the cart bridges of anywhere along the 7.2 km rehabilitated reach. At these locations flow contraction scour occurred leading to accelerated rates of channel scour and the failure of in-stream structures. The design constraints remained in place after the July 2009 flood (with the exception of the golf course maintenance bridge which was increased to a 38 m span) and alterations were made to the in-stream structures in attempts to further mitigate the limited bridge spans and floodplain corridor. Scour and erosion was further exacerbated along the golf course reach as a result of the increased cobble material transport and deposition originating from the erosion source downstream of Mount Albion Falls and corresponding limited growth of herbaceous size vegetation along the creek margins.

The erosion assessment following the July 2012 flood event identified 30 cross sections with observed lateral erosion exceeding 0.3 m and 35 cross sections with net lateral erosion less than 0.05 m (measurement error) during the same flood event. Similar to the July 2009 event, the highest lateral erosion was observed upstream of the TH&B railway where the channel slopes are

the steepest. The decreased number of monitoring cross sections observing erosion in excess of 0.3 m is a combined result of the lower magnitude event, relative to the July 2009 event, enhancements made to many of the in-stream structures further mitigating channel erosion (discussed further), and the increased density in riparian vegetation downstream of King's Forest Golf Course. Subsequent to observing the channel responses from the July 2012 storm and based upon continued monitoring and adaptive management, the initial design constraints of limited floodplain width and golf cart bridge spans, narrower that those recommended and constructed for the remainder of the rehabilitated reach, were re-addressed. In the spring of 2014, golf cart bridge spans were increased to 38 m and installed. In the winter and summer of 2015, increased floodplain connectivity by widening the existing creek floodplain corridor and the re-construction of the in-stream structures with further enhancements are currently underway (Figure 2.4.3).

Figure 2.4.3 2015 channel works through King's Forest Golf course which shows increased golf cart bridge spans, floodplain benches and modified in-stream structures.

Net erosion rates, as calculated in Figure 2.4.2, do not account for any deposition which may occur in portions of the bankfull channel at any given cross section (Figure 4.2.4). To assess a dynamically stable channel, as designed in this project using NCD techniques, requires that both erosion and deposition be accounted for. This approach recognizes that in a dynamically stable channel, the channel is allowed to move and adjust and does so at a relatively slow rate consistent with the frequency and duration of channel forming flows observed. The quasi-stable criteria and NCD approach allows for movement, however, the long-term change in average cross sectional area along the entire rehabilitation reach, should remain relatively close to zero.

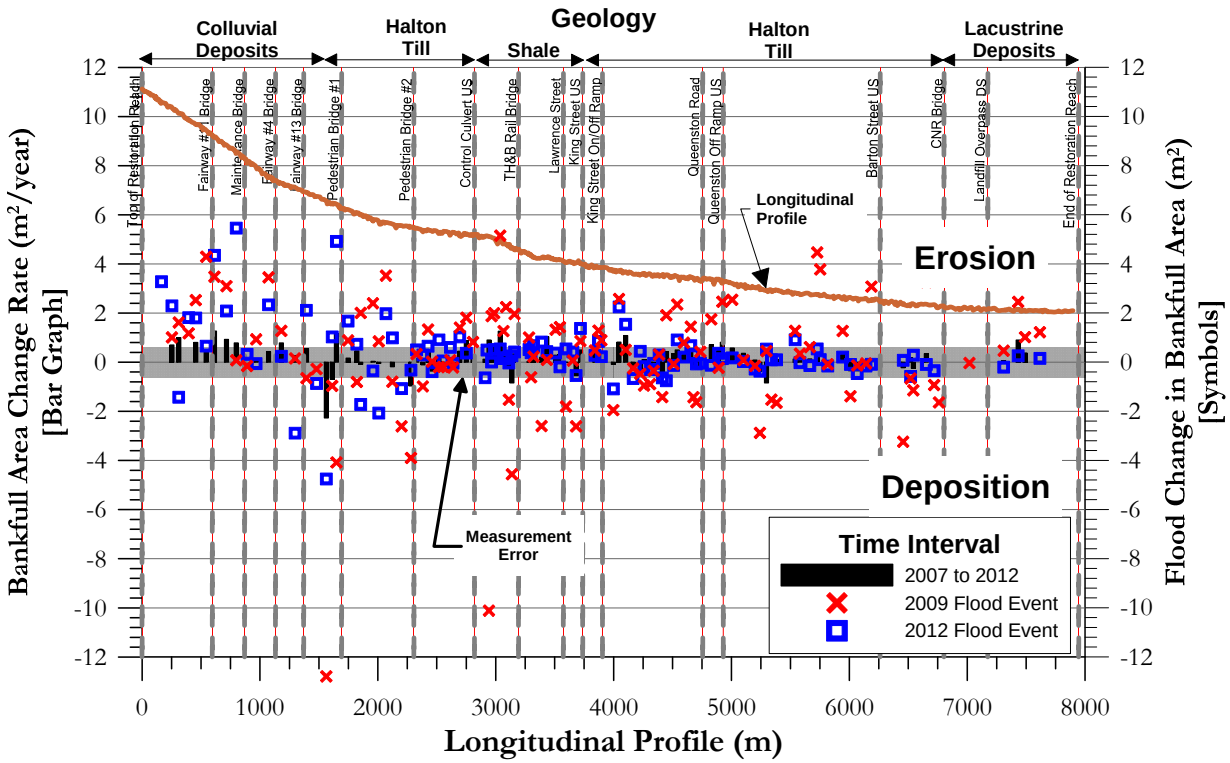


Figure 2.4.4 Bankfull channel annual cross sectional area change rate (monitoring period 2007 – 2012) and net cross sectional area change for major flood events. Note: vertical axis of longitudinal profile not shown.

The change in bankfull cross sectional area from the July 2009 flood resulted in 40 sections having net increases in cross sectional area greater than 1.0 m^2 (standard measurement error) whereas 21 cross sections decreased in cross sectional area by greater than 1.0 m^2 (Figure 2.4.4). The analysis of the July 2012 storm identified 18 and 6 cross sections where increased and decreased cross sectional area occurred in excess of $\pm$1.0 m^2 respectively. The average change in cross sectional area for all cross sections along the rehabilitated reach was calculated to be +0.21 m^2/year which is within the standard measurement error. Larger volumes of both erosion and deposition are observed within and above King's Forest Golf Course where the channel slopes are steepest, contraction scour was occurring downstream of golf cart bridges and the channel was attempting to transport the increased coarse-grained bed material originating upstream of the rehabilitated reach.

The bankfull channel centerline, meander migration rate is the most representative metric to evaluate planform change in the river corridor which accounts for both the erosion and deposition that may be occurring in any given cross section. This is also the method employed by WRIS (2002) in assessing the long-term quasi-equilibrium channel migration rates prior to creek rehabilitation. The analysis of the pre- and post-flood cross sectional surveys from the 2009 event identified net channel centerline migrations exceeding 0.3 m at 33 of the cross sections and net migrations less than 0.05 m (measurement error) at 70 cross sections (Figure 2.4.5). The July 2012 flood identified 10 and 67 cross sections experiencing lateral migration in excess of 0.3 m and below 0.05 m respectively. Similar to previous observations, the decrease in observed larger

migration adjustments from the July 2009 to the July 2012 floods at monitoring sections, is a result of the lower magnitude flood event, improvements made to in-stream structures and increased vegetation along the riparian corridor downstream of King's Forest Golf Course.

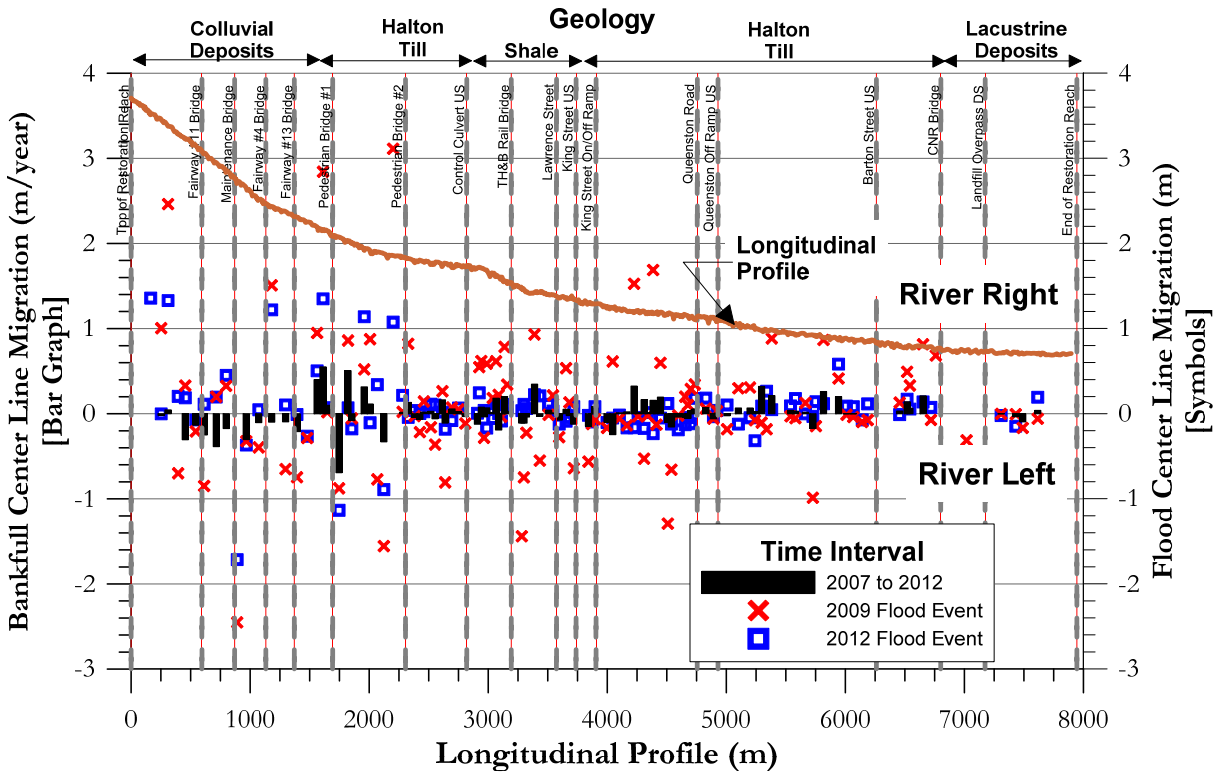


Figure 2.4.5 Bankfull channel centerline migration rate (monitoring period 2007 – 2012) and net channel centerline migration for major flood events. Note: vertical axis of longitudinal profile not shown.

The average meander migration rate for the entire rehabilitated reach over the monitoring period (2007 – 2012) was calculated to be 0.10 m/year. WRIS (2002) identified from field observations along Red Hill Creek in the Halton Till that the natural meander migration rates for a series of similar cross sections (where no in-stream structures existed) was, on average, 0.07 m/year. The 0.07 m/year was used as a design target for the long-term morphological forming flow migration rate employed in the NCD procedure. If post-construction monitoring cross sections along the rehabilitated reach where Halton Till dominates the channel boundaries are exclusively considered, the average channel centerline migration rate was found to be 0.11 m/year. A higher average annual rate for the coarser colluvial deposits within, and above the King's Forest Golf Course reach of 0.13 m/year, was calculated.

The channel centerline meander migration rates are notably biased as a result of the 2009 and 2012 flood events and the ensuing reconstruction of many of the in-stream structures (particularly in the upper 2.2 km of the rehabilitated reach). Higher lateral migrations were observed in many of the cross sections subsequent to the 2009 and 2012 flood events as illustrated in Figure 2.4.5. However, the re-construction of many of the in-stream structures in 2010 and those that are

occurring in 2015 also re-establish the creek banks which are used in the erosion assessment. The only way to further refine the rates of channel change and to remove the current 2009 and 2012 flood biases would be through continued channel monitoring after 2015 channel works.

It is common practice in channel rehabilitation to employ a series of in-stream structures to maintain grade control (mitigate the channel from vertical erosion) and planform location (mitigate the channel from laterally migrating). Final structure locations and structure configurations occur during the construction process to address field issues and properly field-fit each structure to the local conditions, as occurred on the Red Hill Creek project. Alterations to structures commonly occur post-construction after the structures are exposed to flood flow forces above bankfull discharge, where they begin to adjust to the local forces of discharge events and scour. Such alterations typically decrease with time until in-frequent adjustments or reconstruction are required (Figure 2.4.6 up to the pre-2009 flood period).

The July 2009 flood, however, demonstrated both resiliency and limitations in the channel design under the extreme flood flow conditions. Although many structures experienced undermining, flanking around structures or failure, the channel remained in its design alignment thus demonstrating the robustness of the design and the ability of the in-stream structures to absorb change (as evidenced by the low bankfull channel centerline migration rates similar to the design targets). This is particularly important in urban or urbanizing watersheds where there is significant infrastructure either crossing or in in close proximity to the river corridor. Such storm events do not exclude the requirement for in-stream structures to be re-constructed or altered which is akin to man-made infrastructure that requires infrequent maintenance from rare events beyond the design envelope.

Many of the in-stream structures did not experience any adverse effects from the July 2009 storm (in particular through the Greenhill area and between Queenston Ave. and Barton St.), many others though were undermined, flanked or failed (in particular though the steepest channel reach in and upstream of the King's Forest Golf Course where design constraints were imposed). A total of 128 modifications to 99 of the 192 in-stream structures were required after the 2009 flood (Figure 2.4.5). Many of the post-flood design modifications along the entire watercourse added sills into the floodplain of existing structures to mitigate flanking. Sills were not part of the initial design process (only where they were deemed critical to maintain lateral constraints).

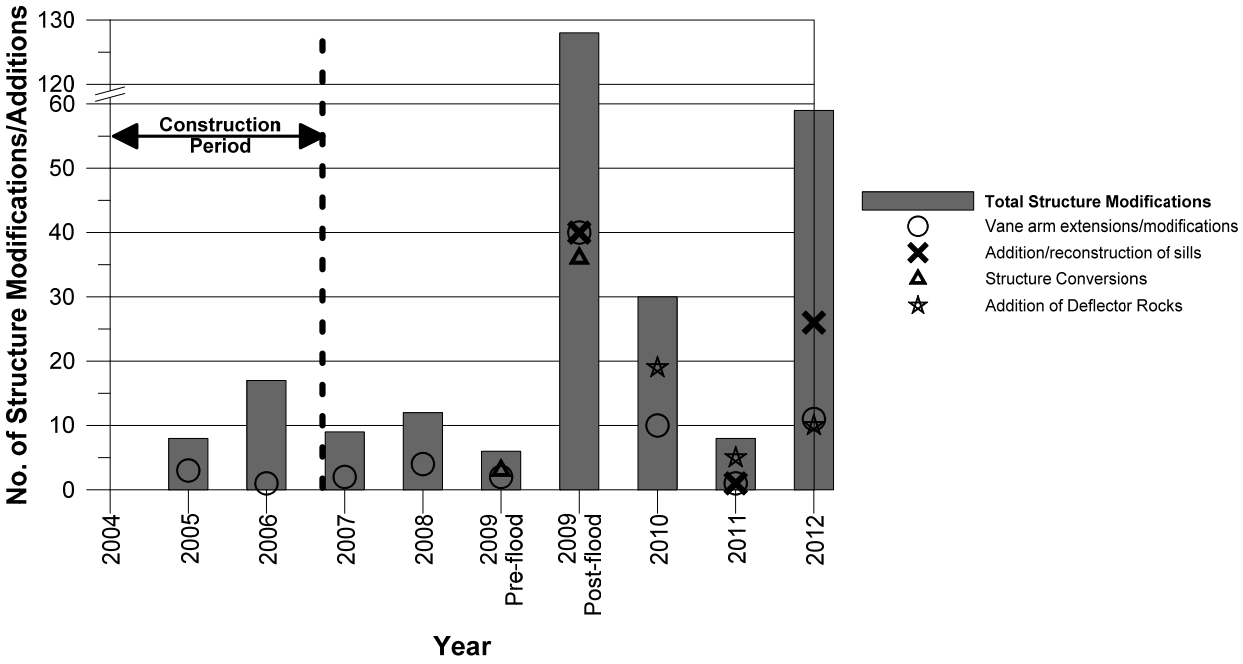


Figure 2.4.6 Annual in-stream structure inventories requiring modification or maintenance. Note: bar graph illustrates the net number of in-stream structures requiring modification where many structures were accounted more than once to identify separate structure components requiring modification. Symbols show the major structure revisions included in the total inventory.

The majority of structure conversions and the addition of deflector rocks to mitigate localized downstream structure scour occurred along the reach in, and above, the King's Forest Golf Course. This section maintains the steepest channel slopes, is the most vulnerable to scour and erosion, has had to accommodate the limited bridge span and floodplain design constraints (up to 2014), is transporting the coarse-grained bed material sourced from the newly eroding reach upstream of the Buttermilk Falls tributary and has developed limited rooting density of floodplain vegetation to mitigate bank scour. The alterations to the in-stream structures within this section were undertaken to accommodate all of the competing channel degradation challenges identified above.

Re-construction of in-stream structures occurred during the winter of 2010 and similar to the initial construction phase, the number of post-construction modifications began to decrease until the flood of July 2012 (Figure 2.4.6). In this flood, all in-stream structure flankings, undermings and failures were limited to the channel section within, and above the King's Forest Golf Course. In-stream structures in the remaining 5 km of the rehabilitated reach did not experience any adverse effects from the July 22, 2012 storm event.

2.4.3 Recommendations and Lessons Learned

Recommendations

Although the average bankfull meander migration rates are similar to the design target (0.07 m/year) for the entire rehabilitated reach (0.11 m/year), the inclusion of the 2009 and 2012 storms and the subsequent creek works in 2010 and those occurring during 2015 introduce significant bias in the long-term erosion and meander migration rates to assess channel performance. A stronger understanding of these rates can only be achieved by continued monitoring along the creek corridor (in particular for the upper 2.2 km of the rehabilitated reach).

Maintenance along the creek corridor will continue to be a future requirement. The creek corridor should be considered natural infrastructure and intermittent maintenance will be required to maintain its current alignment (particularly after large magnitude flood events). Anthropogenic material discarded into the creek remains a constant challenge which is common to most urban watersheds. Annual creek cleanup days should be organized to rid the channel of discarded materials (in particular shopping carts, water bottles, tires, etc.).

Removal of debris jams in-and-around culverts (particularly the Greenhill flood control facility culvert, TH&B railway, King St.) are key to maintaining channel function and for mitigating adverse flooding.

Addressing the channel erosion upstream of the Buttermilk Falls tributary (upstream of the rehabilitated site) to the toe of Mount Albion falls is of long-term importance for maintaining downstream channel stability. The rehabilitated channel reach was never designed to handle/receive the bed material load that is currently being generated by the upstream reach destabilized in the July 2009 flood. Measures should be taken to mitigate erosion in this reach and provide enhanced geotechnical slope stability. The extent and future duration of re-occurring impacts through this sub-reach is unpredictable, as the magnitude and frequency of significant future flood discharge events are unknown.

Channel works occurring over the winter and summer of 2015 in the upper 2.2 km in the King's Forest Golf Course reach, to offset previous design constraints, are recommended to be monitored for erosion for at least five years to verify that the design revisions are functioning properly and to more accurately assess the design bankfull channel centerline meander migration rates.

Lessons Learned

Many lessons were gained in the practice of NCD techniques from the July 2009 and July 2012 floods. In particular, limitations were identified in the scour patterns of in-stream structures constructed in relatively steep slopes (those that occur in and above the King's Forest Golf Course) which have never been identified on any other NCD in North America. No other known NCD projects of similar length and variation in slopes in an urban watershed has ever been exposed to the magnitude frequency in discharges events observed on July 26, 2009 and

July 22, 2012. Design alterations and knowledge gained from these events were integrated into post-flood in-stream structure modifications, and the findings from these analyses are also disseminated in scholarly works and river channel design presentations.

Sills along each structure should have been included in the initial channel design. The expense of installing these minor features during the initial construction phase may have reduced the number of in-stream structures requiring 2009 post flood modification in the lower reaches of the rehabilitated reach (downstream of the TH&B railway) and minimized subsequent disturbances to the riparian corridor.

Design constraints through the King's Forest Golf Course were discussed however due to economic reasons and other factors were not explicitly applied. However, as there are fewer case-studies of NCD projects on steeper slopes and in similar geology, the fate of the channel response to flood flow conditions was not and continues to be less certain. An adaptive management approach was exercised within this reach where the cart bridge and limited floodplain limit constraints were reassessed in 2014.

2.5 Fisheries

2.5.1 Brief Background

Monitoring of the fish and benthic invertebrate communities and water temperature began in 2004 in Red Hill Creek and in two reference sites, one in Indian Creek and one in Spencer Creek, prior to channel realignment, and was conducted annually until 2012. The abundance and biomass of each fish species present was estimated in representative sections of channel that included pool, riffle and run habitats, the King Street culvert and, prior to realignment, a portion of the concrete channel at Queenston Road. Each reach was characterized with respect to width, depth, water velocity, substrate and cover. Benthic invertebrate species composition and abundance was also assessed annually at representative locations. Samples were collected using a t-sampler and organisms were identified to lowest practical level. Beginning in the summer of 2003, and continuing until the autumn of 2012, water temperature was logged at 15 minute intervals using Hobo WaterTemp Pro® loggers (Onset Computer Corporation) at six (6) locations along the Red Hill Creek, at one location in Davis Creek, and at one location each in Indian Creek and Spencer Creek, used as reference locations. Air temperature was also logged at a shaded location near the base of the Niagara Escarpment within the Red Hill Creek valley. As sections of Red Hill Creek were realigned, monitoring was relocated to the new channel. The dates when sections of the creek were switched to their new alignment and the fish sampling locations are presented in Figure 2.5.1. The upstream extent of white sucker (*Catostomus commersonii*) and Pacific salmon (primarily Chinook, *Oncorhynchus tshawytscha*) spawning migrations has also been observed following re-alignment.

2.5.2 Major Findings

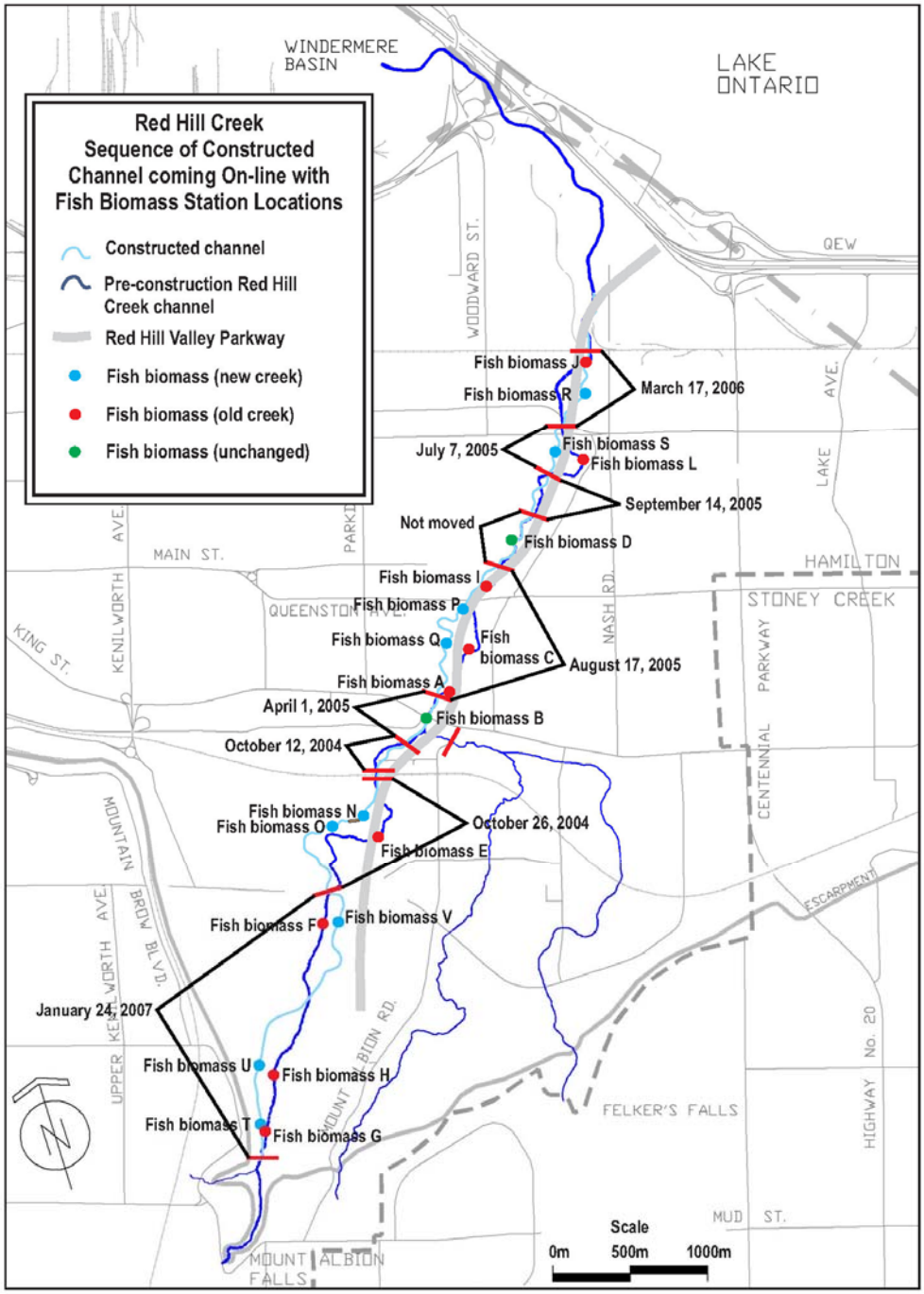


Figure 2.5.1: Sequence of channel realignment and sites where fish abundance and biomass were estimated in Red Hill Creek.

The habitat in Red Hill Creek was characterized in 1997, from a point near Brampton Street upstream to the north end of the King's Forest Golf Course, as was the habitat in lower Davis Creek. In 1998, Red Hill Creek was characterized through the King's Forest Golf Course, as the

length of the proposed realignment was extended. This characterization was repeated in 2012 using the same methodology, to allow comparison of pre- and post-realignment conditions.

A number of events occurred during the course of the study that were not related to the realignment of Red Hill Creek but that affected, or had the potential to affect, the fish and benthic invertebrate communities. A fish kill was documented in the Red Hill Creek downstream from Queenston Road in September of 2004 due to a release of water containing chlorine into the creek via the storm sewer system. Another fish kill, the cause of which is unknown, occurred in the Davis Creek and in Red Hill Creek downstream from the confluence with Davis Creek in June of 2012. A fish kill also occurred in the Spencer Creek reference area in July of 2007 (after the annual sampling was conducted) as a result of douse water entering the creek from a fire at a pesticide packaging facility. The Indian Creek reference site was realigned during the course of the study. Weather-related events, most notably the large floods on July 26, 2009 and July 22, 2012, but also a drought during the summer of 2007, also had potential to affect the biological communities, although both floods occurred after the fish sampling for that year had been completed.

Fish Community

The fish community in Red Hill Creek, based on overall mean density (ref. Figure 2.5.2), is dominated by blacknose dace (*Rhinichthys atratulus*; 43%), longnose dace (*Rhinichthys cataractae*; 37%), and creek chub (*Semotilus atromaculatus*; 14%). This has not changed.

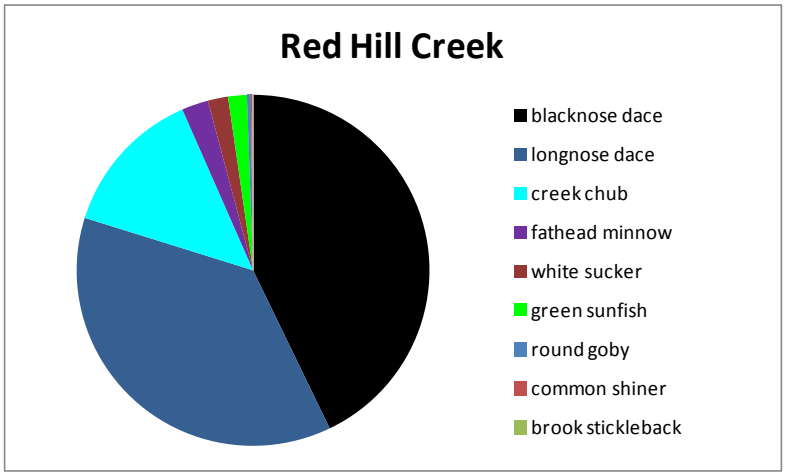


Figure 2.5.2: Dominant fish species in Red Hill Creek based on mean estimated densities for all reaches and years combined.

When the data for all reaches and years were combined, the mean density of fish (number of fish per m^2) and the mean biomass (number of grams of fish per m^2) was highest in Spencer Creek, lowest in Indian Creek, and intermediate in Red Hill Creek (Ref. Table 2.5.1). The difference in overall mean biomass between Spencer and Red Hill was much smaller than the difference in overall mean density, reflecting the presence of larger fish in Red Hill Creek. This is primarily because the fish community in Spencer Creek was dominated by small fish species, including several species of darter.

Table 2.5.1: The Estimated Number of Fish per m^2 and Estimated Number of Grams of Fish per m^2 for All Reaches Combined, by Year, for Each Creek.

	Number of fish per m^2			Grams of fish per m^2		
Year	**Indian Creek**	**Red Hill Creek**	**Spencer Creek**	**Indian Creek**	**Red Hill Creek**	**Spencer Creek**
2004	0.11	0.91	1.84	0.48	4.58	7.84
2005	0.24	0.29	1.72	2.09	3.20	6.22
2006	0.29	1.22	1.38	2.74	8.54	5.24
2007	0.17	1.42	4.48	1.32	7.40	14.41
2008	0.30	1.09	0.80	3.00	5.02	3.07
2009	NA	1.11	1.64	NA	6.60	6.52
2010	0.23	1.20	0.66	1.31	8.00	2.06
2011	0.19	1.23	3.20	1.30	6.41	10.90
2012	0.17	1.35	3.37	0.93	7.81	9.52
all	0.21	1.10	2.12	1.65	6.42	7.31

In Red Hill Creek both mean fish density and mean fish biomass were lowest in 2005, with fish density being markedly lower than in any other year. This was not the case in either Spencer Creek or Indian Creek, indicating that the cause was specific to Red Hill Creek. The Red Hill Creek summary data are confounded somewhat by differences in the reaches sampled among years, but examination of the data on a reach by reach basis indicates that density and biomass were not lower in 2005 at locations F, G and H, located upstream from any of the realignments that had occurred prior to the 2005 sampling, and upstream of the fish kill that occurred downstream from Queenston Road in September 2004. Both the realignment and the fish kill may have contributed to the marked decline in abundance in the lower reaches in 2005. Regardless of the cause of lower fish density and biomass in Red Hill Creek in 2005, density and biomass rebounded in 2006 and has exceeded the 2004 (pre-realignment) levels every year since.

Abundance and biomass were more variable on an individual reach and habitat basis than the overall composite values suggest. The year-over year patterns were not consistent among reaches or even among habitats within the same reach, suggesting that factors operating at the local scale were more influential than factors acting at the reach or entire creek scale, such as year-to-year variation in flow. As an example, Site F was a natural pool-riffle channel prior to realignment. Realignment occurred in January of 2007. The corresponding Site V in the re-aligned channel was initially a series of step-pools that evolved into a series of pools and riffles. Sites F1 and F2 and sites V1 and V2 were contiguous. Fish abundance in the pool (pre-2007) or step-pool (2007-2012) habitat type was very low from 2007-2009 and then much higher than at any previous time in 2011 and 2012 (ref. Figure 2.5.3, FV1) due to increases in the numbers of all three dominant species (blacknose dace, longnose dace and creek chub). In the riffle habitat, fish abundance was highest in 2009 and lowest in 2011 (ref. Figure 2.5.3, FV2).

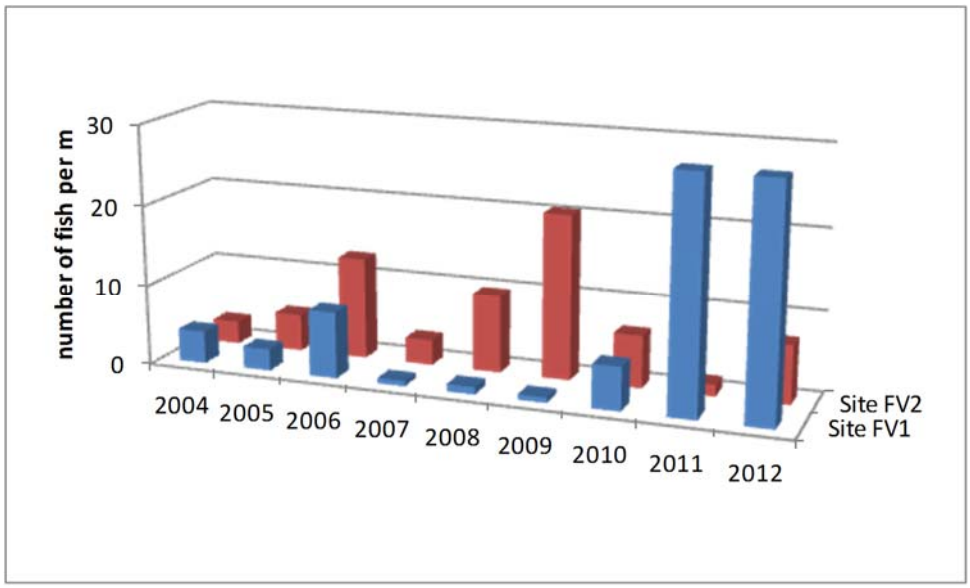


Figure 2.5.3: Number of fish per meter of creek length in Sites F (2004-2006) and V (2007-2012).

Benthic Invertebrate Community

When all years and stations were combined, the benthic invertebrate community was dominated by chironomid larvae, which comprised 59% of the organisms (ref. Figure 2.5.4). Individuals of the genus Cricotopus were the most abundant of the chironomids; they alone accounted for 36% of the benthic organisms. Oligochaete worms, primarily Nais elinguis, and immature tubificids without hairs, accounted for 18% of the benthic invertebrates and the isopod *Ceacidotea intermedius* accounted for 16%. Trichoptera (caddisflies) accounted for only 3% of all benthic invertebrates, with most either hydropsychids of the genus *Cheumatopsyche* or hydroptilids of the genus *Hydroptila.* Ephemeroptera (mayflies), which accounted for 1% of the total number of benthic orgamisms, were primarily (95%) *Baetis flavistriga*.

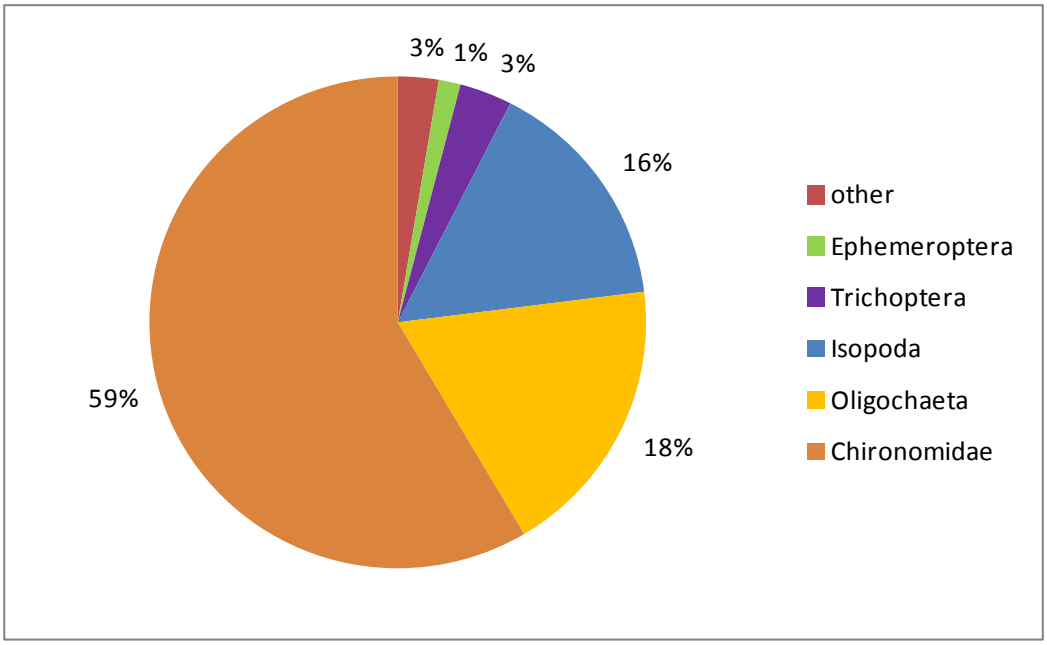


Figure 2.5.4: Dominant benthic invertebrate groups, expressed as a percentage of all samples combined.

The mean Hilsenhoff Biotic Index (HBI) values for samples from riffles in each of the reaches do not indicate any major differences among locations or years (ref. Figure 2.5.5). The mean HBI scores (Hilsenhoff, 1987) were typically in the “fair” (5.51-6.50), “fairly poor” (6.51-7.5) or “poor” (7.51 – 8.5) ranges. There was no evidence of significant changes as a consequence of the channel realignment, which is not unexpected because the HBI index is designed to reflect changes in organic enrichment. Shannon-Weaver diversity (Shannon and Weaver, 1949) was more variable in both space and time than the HBI scores, and tended to increase in a downstream direction (ref. Figure 2.5.6). Most values were in the moderately polluted range (between 3 and 1). Diversity values in 2012 were among the highest observed during the study period at most sites.

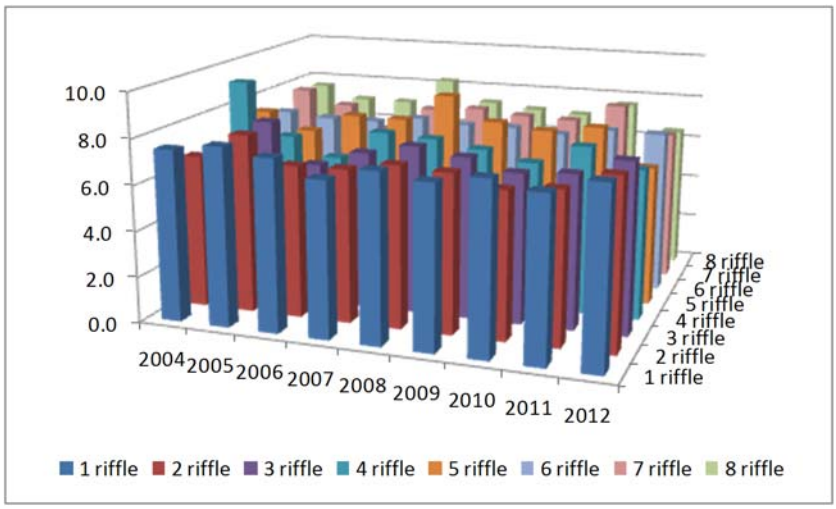


Figure 2.5.5: Mean Hilsenhoff biotic index of samples from riffles, by reach and year. Reach numbers increase in a downstream direction.

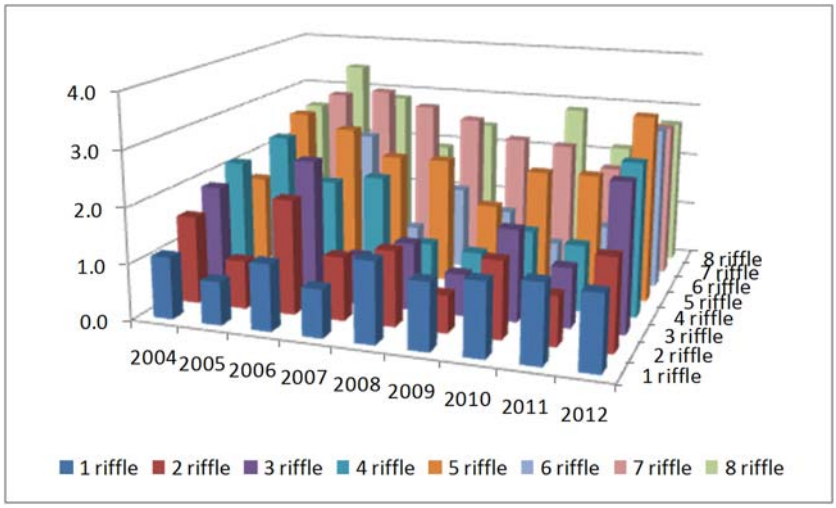


Figure 2.5.6: Mean taxa diversity of samples from riffles, by reach and year. Reach numbers increase in a downstream direction.

Water Temperature

Mean summer (July-August) water temperature at each monitoring location in Red Hill Creek was correlated with mean summer air temperature (ref. Figure 2.5.7), with temperatures increasing in an upstream to downstream direction. Any attempt to look for a post-realignment trend-through-time has also been complicated by the fact that 2011 and 2012 had the warmest July-August during the ten-year period. Comparing the mean July-August water temperatures in 2004 (pre-realignment) and 2009 (post-realignment), which had identical, cool July-August mean air temperatures suggests that the re-alignment has not had a major impact on mean July – August water temperature. Mean July-August water temperatures were slightly (0.2 C°) lower in 2009 at locations 3 and 5 and 0.5 C° higher at location 6.

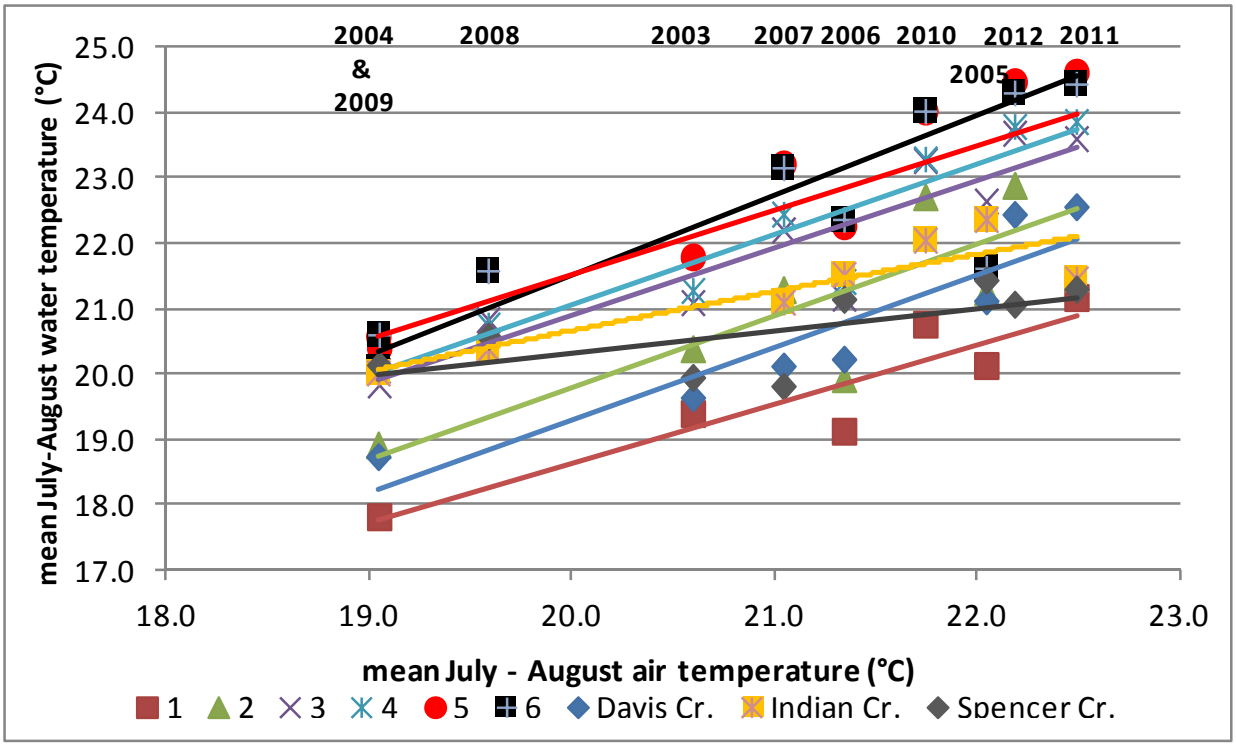


Figure 2.5.7: Mean July – August water temperature at each logging location versus mean July – August air temperature. The lines are derived from simple linear regressions. The year during which each set of data were collected are shown at the top. Logger locations are shown in Figures 2.5.1 and 2.5.2.

Fish Passage

Prior to the realignment of Red Hill Creek the long, shallow concrete channel at Queenston Road was a barrier to the upstream migration of Pacific salmon in the autumn and, in springs when flows were low, to the upstream spawning migration of white sucker. The King Street culvert was also an impediment to upstream migrations when flows were low and a concrete saddle upstream from King Street was the upstream limit of white sucker migration. There do not appear to be any barriers to upstream migration in the realigned channel, which has eliminated the concrete section at Queenston Road and all of the concrete saddles. During the spawning run, white sucker were observed to have migrated upstream at least as far Rosedale Park every year from 2006 through 2012. The King Street culvert continues to impede upstream migrations during periods of low flow. This is more often a factor during the autumn salmon migrations than during the spring white sucker migrations because low flows tend to occur more often during the fall.

Comparison of the Pre- and Post-Realignment Stream Habitat

Comparison of the measurements taken prior to realignment (in 1997-1998) and after realignment (2012), the total length of channel between a point near Brampton Street and the south end of the King's Forest golf course was reduced by 193 m which is 3% of the pre-realignment length (ref. Table 2.5.2). This is less than the length of the concrete channel at Queenston Road that was eliminated by the realignment. The sum of the increase in pool and run length exceeds the

reduction in riffle length (ref. Table 2.5.2). The trends in the changes in wetted area were similar to those for length.

Table 2.5.2: The length and area of various types of habitat prior to the channel realignment and after realignment and the change in absolute terms and as a percentage of the pre-realignment condition.

Habitat Type	Length (m)				Wetted area (m^2)			
	1997-1998	2012	Change (m)	Change (%)	1997-1998	2012	Change (m^2)	Change (%)
Pool	1187	1299	+113	+9	10007	10795	+788	+8
Riffle	3299	2610	-688	-21	26962	20187	-6775	-25
Run	1989	2730	+741	+37	16090	23410	+7321	+45
Culvert	331	235	-97	-29	2674	1482	-1192	-45
Concrete Saddle	50	0	-50	-100	508	0	-508	-100
Concrete Channel	212	0	-212	-100	2328	0	-2328	-100
Total	7068	6875	-193	-3	58568	55875	-2694	-5

Comparing wetted area by substrate type prior to realignment (in 1997-1998) and after realignment (2012), confirms the large reduction in the area of concrete (ref. Table 2.5.3). In addition to the channel at Queenston Road, other concrete sections were eliminated at the Barton Street culvert (which was replaced by a bridge), immediately upstream and downstream from the King Street culvert (replaced by natural substrate), and at four concrete saddles that protected underlying sewers (replaced by natural substrate). The one new culvert has concrete baffles across the bottom that retain natural substrate. Bedrock, clay, cobble and gravel substrate increased in area, while boulder, sand and mud/silt substrate decreased.

Table 2.5.3: Wetted Area of Various Substrate Types Prior to the Channel Realignment and after Realignment and the Change in Absolute Terms and as a Percentage of the Pre-Realignment Condition

Substrate Type	Wetted Area (M^2)			
	1997-98	2012	Change (M^2)	Change (%)
Concrete	4945	439	-4506	-91
Bedrock	6940	7736	+796	+11
Clay	1725	3924	+2199	+127
Boulder	4817	3433	-1384	-29
Cobble	12637	13550	+913	+7
Gravel	18052	20194	+2142	+12
Sand	8656	6620	-2036	-24
Mud/Silt	583	0	-583	-100
Total	58355	55896	-2459	-4

Cover provided by undercut banks, tree roots and woody debris, and gabions was greatly reduced or eliminated as a result of the realignment (ref. Table 2.5.4). The total amount of cover more than doubled as a result of the large area of interstitial spaces between the armour stone used in the

realigned channel. These estimates do not take into account the cover provided in spaces beneath substrate particles.

Table 2.5.4: Area of Cover (m^2), by Cover Type, Prior to the Channel Realignment and After Realignment and the Change in Absolute Terms and as a Percentage of the Pre-Realignment Condition. Cover Provided by Substrate is not Included.

Type Of Cover	1997-98	2012	Change (M^2)	Change (%)
Armour stone	101	3431	+3330	+3297
Gabions	567	0	-567	-100
Tree roots	302	29	-272	-90
Undercut banks	209	33	-176	-84
Rock ledge	8	0	-8	-100
Woody debris	371	12	-360	-97
Total	1557	3505	+1948	+125

Summary

The results indicate that the effect of the re-alignment of Red Hill Creek on the fish community may have been negative in some, but not all, locations in the first year following re-alignment, but that fish abundance and biomass rebounded quickly. This is not unexpected, given that the resident fish community is composed of short-lived, tolerant fish species, many of which first reproduce at one or two years of age. Similarly, the benthic invertebrate community appears to have rebounded quickly from any short-term effect of realignment.

There has been no substantial change in the composition of the resident fish community as a consequence of the channel realignment, nor was any expected. Red Hill Creek was, and still is, an urban watercourse with a simple fish community dominated by tolerant resident species and migratory species, primarily white sucker and the introduced Pacific salmons. The potential of other stream resident species to colonize Red Hill Creek is limited. They would have to travel a considerable distance from other streams with more diverse resident fish communities through habitats in Cootes' Paradise and/or Hamilton Harbour and/ or Lake Ontario that are generally unsuitable for them. If it is desired to establish a more diverse fish community in Red Hill Creek, then transplanting suitable native stream fishes from other area watercourses will likely be necessary.

Three "concrete habitats" were sampled during the study and the results confirmed that reaches consisting of bare concrete support no or very few fish. The number of fish present inside the King Street culvert tended to increase as the proportion of the bottom with rocks large enough for fish to hide under increased. Based on these results, the conversion of bare concrete habitat to natural substrate will improve fish habitat even if the natural substrate is on top of concrete. It was initially intended to reduce velocities through the King Street culvert by placing a structure downstream and creating a backwater condition. It was expected that this would increase depth and allow natural substrate to accumulate within the culvert. Unfortunately, attempts to achieve this were unsuccessful and the culvert continues to support few fish. The results of this study suggest that conversion of concrete habitat to habitat with natural substrate is a very effective method of increasing fish abundance and that a reduction in habitat area when that area is bare concrete would have little or no negative effect.

Both white sucker and Pacific salmon appear to move upstream through the natural channel design sections with little difficulty unless flows are very low. The King Street culvert continues to impede or block upstream progress of Pacific salmon at low flows. There is no evidence that the new culvert that was constructed with baffles to retain natural substrate and focus low flows into a narrower cross-section impedes upstream movement. This design appears to be a viable method of providing fish passage when it is not possible to construct a culvert with an open bottom.

The differences in year-to-year trends in fish density among reaches of Red Hill Creek, and even among contiguous sections of the same reach were surprising and indicate the need for monitoring programs to sample an adequate number of reaches and habitats. Preliminary results suggest that the number of hiding places under stones is one factor affecting the density of both longnose dace and blacknose dace, but other factors are clearly also at play. It is possible that the differences among reaches and habitats are due to transient conditions which the study did not measure. Flow influences many aspects of habitat and it would have been helpful if flow had been continuously monitored throughout the study (i.e. if flow monitoring had been maintained during the construction period).

2.5.3 Recommendations and Lessons Learned

Recommendations

If it is desired to establish a more diverse fish community in Red Hill Creek, then transplanting suitable native stream fishes from other area watercourses will likely be necessary. This should be discussed with regulatory agencies.

As noted in previous sections, the Red Hill CSO storage pipe was not fully functional until December 2011. This new system now eliminates three former CSO points at Laurence Avenue, Queenston Road, and Melvin Avenue. Given that only one of the five monitoring years (2012) reflects these conditions (i.e. with an expected reduced number of CSO discharges to the creek), and the pipe was only functional for approximately 6 months prior to the 2012 benthic invertebrate sampling, follow-up monitoring, particularly with respect to benthic invertebrates, should be considered in the future, potentially within the next 5 years +\-.

Although not directly assessed as part of the fisheries monitoring, consideration should be given to implementing carp control within the lower reaches of Red Hill Creek and associated wetland areas, as has been done in other areas such as Cootes' Paradise and the Windermere Basin. This is also consistent with the recommendations from terrestrial ecology monitoring (Section 2.6). Given the difficulties with implementing effective control over extended periods however, this may not be feasible. Further discussions with regulatory agencies would be required accordingly.

Lessons Learned

Given the observed differences in year-to-year trends in fish density among reaches of Red Hill Creek, and even among contiguous sections of the same reach, there is a clear need to ensure that future monitoring programs sample an adequate number of reaches and habitats.

The results of this study suggest that conversion of concrete habitat to habitat with natural substrate is a very effective method of increasing fish abundance, even when that natural substrate is placed over concrete. This should be considered in the design of hydraulic structures in the future where fish habitat and passage would be a factor.

Likewise, although open-bottomed culverts are considered preferable, a modified culvert design such as the one employed at King Street (with baffles to retain natural substrate, and graded to focus low flows into a narrower cross-section is a viable alternative method of providing fish passage.

2.6 Terrestrial Ecology

2.6.1 Brief Background

The Integrated Monitoring Plan (IMP) for the Red Hill Valley Project (RHVP) was developed to ensure environmental compliance required by the various agencies involved in the planning and approval process (Philips Engineering Ltd., 2007). The purpose of the IMP was to evaluate the performance of the Environmental Management System for the Red Hill Valley Project, and to provide adjustments to the plan recommendations through a process of adaptive management.

In so far as Terrestrial Ecology, the Red Hill Valley Project encompassed construction and landscaping activities related to the new Parkway, relocated Creek, and associated infrastructure (i.e. stormwater management facilities). It incorporated major habitat protection, creation, restoration and enhancement initiatives:

- RHVP Impact Assessment and Design Process (IADP) (1999-2003)
- RHVP Landscape Management Plan (Envision et al 2003),
- Detailed design for Parkway and QEW interchange works (2005-2007),
- RHVP Landscape Design and Habitat Enhancement Plan (D&A 2005)
- RHVP Ecological Restoration and Landscaping Project (SNEOG 2006),
- Rennie/Brampton St. Landfill Remediation (1999-2005), and
- East Hamilton Trail and Waterfront Link (2008-2011).

This section summarizes monitoring based on the Impact Assessment and Design Process (IADP) recommendations and agency approval conditions, profiled areas, and key lessons learned and challenges of terrestrial ecology-related aspects of the RHVP.

Monitoring of the natural heritage aspects within the Red Hill Valley Project study area focused on three levels to address agency requirements and planning objectives:

- ***DFO Conditions of Approval (DFOCOA)*** - ensure that slope, channel and wetland plantings will be dominated by indigenous riparian species.
- ***Landscape Management Plan (LMP)*** - ensure that habitat restoration and enhancement works achieve objectives.
- ***Impact Assessment and Design Process Ecosystem Monitoring (IADPEM)*** - assess ecosystem level diversity and functions in the longer term.

For detailed methods and results for each year of the terrestrial monitoring program, refer to the 2008-2012 annual reports.

2.6.1.1 Goals and Objectives

Objectives for the terrestrial ecology component of the Integrated Monitoring Plan were:

- Regulatory monitoring of riparian vegetation along the Creek (DFOCOA)
- Monitoring of vegetation within wetland compensation areas and within Stormwater Management (SWM) facilities (DFOCOA);
- Survey wildlife (i.e. breeding birds and amphibians) and vegetation long-term monitoring stations to collect baseline data (IADP);
- Watershed and valley-level Ecological Land Classification (ELC) updates and characterization (IADP);
- Monitor vegetation planted within the wetland enhancement areas (LMP);
- Determine the Free-to-Grow status of habitat restoration areas (LMP)
- Survey invasive exotic species within the riparian area of the Red Hill Creek.

<u>Department of Fisheries and Oceans Conditions of Approval (DFOCOA)</u>

Riparian Vegetation

Primary questions to be addressed for riparian vegetation monitoring were:

1) What is the structure and composition of riparian vegetation along the Red Hill Creek?
2) What spatial and temporal patterns occurred within the riparian vegetation community from 2008-2012?
3) Which species define the riparian vegetation community along the Red Hill Creek in terms of relative importance?

These questions were addressed with the following monitoring approaches:

- 38 permanent transects, each with 6 plots, spaced 250 m apart along 9.5 km of the Red Hill Creek and along Van Wagner's Pond channel, sampled over a 5-year period;

- Annual photomonitoring of each transect;
- Quantitative sampling of all transects in 2008 and alternating even- and odd-numbered transects 2009-2012. Data included species presence, plant and bare soil cover, and species height values; Frequency, Average Cover, Relative Cover, Relative Frequency, Importance, and Relative Importance values were calculated;
- Findings were compared to historical conditions (from Goodban 2006).

Wetland Compensation and Stormwater Management Facility Vegetation

Primary questions to be addressed for monitoring stormwater management facilities and wetland compensation areas (referred to as 'ponds') were:

1) What is the structure and composition of vegetation within and surrounding the ponds,
2) What spatial and temporal patterns in vegetation occurred within and among ponds from 2009-2012.

These questions were addressed as follows:

- 8 of 14 ponds (including stormwater ponds and wetland creation sites) located along the Red Hill Valley Parkway and near the QEW interchange were sampled each August from 2009-2012.
- The Red Hill Marsh enhancement area (ENH5, Figure 1) was monitored in 2011 and 2012 using a similar approach.

Impact Assessment Design Process (IADP)

Ecological Land Classification

In 2010 GIS data compiled from existing sub-watershed studies were used to provide updated Ecological Land Classification (ELC) community mapping for the Red Hill Creek Watershed, to compare with 1997 estimates of vegetation cover. Key areas were visited in 2010 - 2012 to remap the ELC at Community Series level, to answer the following questions:

1) How did the land cover within the Red Hill Creek Watershed and Red Hill Valley change from 1997 to 2012, and;
2) Were wetland compensation targets achieved?

The changes in land cover across the watershed, and the Red Hill Valley Project Study Area are summarized in Section 4.3 of Appendix A.

Permanent Vegetation Monitoring Plots

Permanent vegetation and wildlife monitoring stations was established in the Red Hill Creek Valley in 2010 according to biomonitoring protocols developed by Environment Canada's Ecological Monitoring and Assessment Network (EMAN 1996). The 2010 surveys determined

baseline conditions of species richness and community composition for future comparison of changes within these areas over the long term.

Permanent Wildlife Monitoring Plots

Amphibian and breeding bird monitoring stations were established and monitored in April through June 2010 to cover the majority of breeding habitats and estimate species diversity and abundance in key areas (see Figure 1 in Appendix A). This included:

- 12 nocturnal amphibian call stations (*i.e.* frog and toad) according to the Marsh Monitoring Program (MMP) protocols (BSC 2003);
- 14 breeding bird monitoring stations according Ontario Breeding Bird Atlas protocols (OBBA 2001)

Data were compared to 2011 and 1012 data from the Urban-Rural Biomonitoring & Assessment Network (URBAN), a citizen-science program based at McMaster University in Hamilton, Ontario.

Landscape Management Plan

Ecological restoration works within the Red Hill Valley were undertaken under the direction of City staff by Kayanase, an ecological restoration contractor that employed science-based techniques and adaptive management, along with Haudenosaunee cultural values and ecological knowledge, to carry out this design-build restoration and enhancement project (2007-2012).

The overriding goals of the ecological restoration plan were to:
- Protect and conserve existing native plants and plant communities to the maximum extent possible;
- Restore degraded habitat areas through sustainable ecological restoration efforts; and,
- Increase the connectivity and size of natural habitat areas.

The Red Hill Valley Project Ecological Restoration and Landscaping Proposal (SNEOG 2006) and Red Hill Valley Ecological Restoration Detailed Design Plan Report (Kayanase 2006) provide summaries of approaches.

Additional Terrestrial Monitoring

Invasive Exotic Species (IES) Surveys (2009)

In 2009, the City of Hamilton requested more detailed mapping of the extent of invasive exotic species (IES) along the riparian zone, to assist in restoration planning. A field protocol supported by GIS mapping was developed and applied in the summer of 2009.

Free-to-grow Monitoring (2012)

In 2009 and 2011 Kayanase conducted plot-based surveys in-pre-selected restoration polygons to identify restoration areas that were 'free-to-grow' (i.e. areas that had a viable woody stem density/ha that met target densities outlined by Kayanase and the City of Hamilton). A 'free-to-grow' is capable of self-regeneration. In 2012, the City requested resampling of ten percent of the 'free-to-grow' plots sampled in 2011 (12 plots) to allow third-party verification of the results obtained in 2011 using the methodology employed in Kayanase surveys.

2.6.2 Major Findings

2.6.2.1 Department of Fisheries and Oceans Conditions of Approval (DFOCOA)

Riparian Vegetation

Photomonitoring - Photos taken annually of each vegetation transect demonstrated substantial growth and successional transitioning of vegetation along reaches of the creek, documenting substantive changes to woody and herbaceous structure and composition, and effects of channel dynamics.

Species Composition – 311 plant vascular plant species were observed in the immediate riparian zone between 2008 and 2012; 176 (56.6%) were native, and 135 (43.4%) were considered exotic (refer to Table 2 in Appendix A). The percentage of native species was comparable all years. New species observed increasing by approximately 25 species per year between 2009 and 2012, with the overall increase in the final year (2012) being primarily due to new records of native species. This finding suggests that species richness within the riparian zone was adequately captured by the timeframe and extent of sampling.

Historical Comparison - Goodban (1996) listed 287 species occurring within riverine, marsh, and deciduous floodplain woodland habitats within the Red Hill Valley from 1995 surveys and historic records. Although Goodban's list included 129 native species and 26 exotic species not observed during the monitoring for this study, 84 native species and 95 exotic species were observed that were not listed in Goodban. The two lists have 130 species in common, including 90 native and 40 exotic species. In terms of site-level floristic quality, the vascular plant list reported by Goodban (1996) had an FQI of 53.96, whereas the list value generated for this Study was 47.71.This 6 point difference was due to a higher richness of native species recorded in the Goodban study (221 vs. 176). However, the current monitoring was focused on the immediate riparian zone of the reconstructed channel which is in an early successional state, whereas Goodban's data encompassed more extensive habitat areas within the valley.

Relative Importance of Species - Change in relative importance of the species observed is a good gauge of changes in community composition, and can be more sensitive to community changes on shorter time-scales. It identifies which specific species are important, or are changing in importance through time. An increase in the cumulative importance of the top-20 ranked species was observed between 2008 and 2012, with a slight decline in the years 2010 and 2011,

and a spike in 2012 due to an increase in the frequency and importance of exotic species, the highest for all of the monitoring years. The years 2009 and 2010 showed the highest incidence of top-ranked native species and the highest cumulative importance for native species.

Wetland Compensation and Stormwater Pond Vegetation

Species Composition - The total vascular flora observed in ponds and wetland compensation areas (2009- 2012) was 247 species plus 45 identified to genus. The percentage of native species observed was 57%, and was consistent in each year of monitoring (min= 56.0% in 2011, max = 58.3% in 2010). Species richness within ponds and wetlands was stable across 4 years of monitoring, with native species slightly dominant over exotic species. New species observed in annual surveys were 67 in 2010, to 44 in 2011, and 28 in 2012. Cumulative species richness across all features continued to increase each year through 2012. Average species richness within ponds increased annually to 2011, but dropped significantly in 2012 due primarily to fewer native species; exotic species also declined over the four monitoring years. Average FQI decreased from 2009 (4.07) to 2012 (3.40), though annual changes were insignificant.

2.6.2.2 Impact Assessment Design Process (IADP)

Ecological Land Classification (2010-2012)

Changes in Vegetation Cover - The most significant changes in the Red Hill Creek Watershed between 1997 and 2012 were the increase in aquatic ELC cover types, from approximately 4.62 ha to 34.08 ha (638% increase); shoreline communities also increased. Contributing areas included specific wetland creation projects (Comp1 and Comp2, and new wetland at the Escarpment Viaduct), construction of stormwater ponds within the Valley and in the upper watershed, and conversion of former creek sections to stormwater functions.

Agricultural and successional communities decreased in area within the watershed between 1997 and 2012 due to urban development above the Escarpment. Successional communities also decreased by 50 ha (-7% of 1997 area), explained in part by increases in anthropogenic woodlands (32.92 ha to 119.78 ha) and anthropogenic open space (481.37 ha to 572.36 ha). There was a slight net increase of natural woodlands and forest (0.34 ha; 0.09%) between 1997 and 2012. The distinction of successional communities under the ELC is also more refined than with pre-ELC mapping.

Prior to construction of the Parkway, in 2003 wetland vegetation communities were estimated at 13.28 ha of the Study Area, while aquatic communities occupied 19.02 ha. Snell (1987) estimated that there was 76.4% wetland loss in Hamilton-Wentworth since settlement; as of 1997 wetland cover constituted only 0.3% of the Red Hill Creek Watershed. The total estimated area of aquatic and wetland cover within the Red Hill Creek watershed as of 2012 was 61.05 hectares.

The Terrestrial Resources IADP Report (Dougan & Associates, 2003) predicted a 5.04 ha loss of wetlands (3.3 ha in Study Area 1, Mud Street Interchange to the CNR; and 1.74 ha in Study Area 2, CNR to the QEW). At detailed design in 2005, the estimated loss of wetlands within the

project study area increased to 5.22 ha. Based on the recommended minimum 2:1 replaced ratio identified in the IADP, this would require the creation of 10.45 ha of new wetland through the construction of stormwater management facilities (wet ponds, wetlands, and grass swales), restored floodplain functions under natural channel processes, and conversion of the abandoned channel sections into wetlands.

Overall wetland cover in the Parkway Study Area increased from 20.32 ha pre construction, to 27.54 ha as of 2012. The gain of new, non-SWM wetland within the Parkway Study Area was 4.47 ha; functional enhancement works within the Red Hill Marsh added a further 3.23 ha, which was considered equivalent to a 50% gain (1.62 ha) based on the 2005 estimates. This is not included in the estimated total gain of wetland cover.

In a separate project, approximately 11 ha of wetland was created within Windermere Basin between 2010 and 2012, providing a restored estuarine ecosystem with wildlife habitat for species such as Common Tern, Northern Pike, Large Mouth Bass, and White Sucker. The Windermere Basin project included a barrier to Common Carp, an introduced fish species that has constrained the spread of emergent marsh cover in Comp1 and Comp2, as well as in Enh5. This feature, enhancement works in the Red Hill Marsh (Enh5), plus the Comp1/Comp2 wetland creation, provide a substantial increase in habitat for wildlife, improving connectivity of the riparian and wetland habitats along the lower Red Hill Creek, and to the Lake Ontario shoreline.

The overall increase in wetland area is 15.9 ha (including Windermere Basin, but excluding SWM facilities and Enh5 functional enhancement), exceeding the 10.45 ha targeted in 2005, and representing a 76.17% increase.

Ecological Monitoring and Assessment Network Plots (2010)

A total of 92 vascular plant species were detected within the permanent vegetation plots (refer to Figure 1 in Appendix A) sampled in 2010, including 8 specimens identified to genus level. Of the total, 57 (67.9%) are native species, and 27 (32.1%) are exotic. No species of conservation concern were recorded.

Wildlife

Surveys in 2010 detected forty-two (42) species of birds, 39 of which were considered possibly breeding or on territory. Great Blue Heron, Black-crowned Night-Heron and Turkey Vulture were detected flying over the study area, but were not considered breeding in the vicinity. Of the 39 breeding species, two are introduced (non-native): three are considered Special Concern (COSEWIC 2012 and/or CASSARO 2013). None are designated as Threatened or Endangered; most are considered common or abundant, and widespread, within the City of Hamilton (Curry 2003). However, Wood Duck, Green Heron and Belted Kingfisher, are considered uncommon and widespread within the City (Curry 2003). At a regional level, six species have been designated as priority land bird species by Partners in Flight in BCR 13 (Lower Great Lakes/St. Lawrence Plain) (OPIF 2006); BCR 13, the Lower Great Lakes – St. Lawrence Plain, corresponds roughly with the area south of the Canadian Shield.

Four species of amphibians were detected during RHVP monitoring surveys in 2010: all four species are considered abundant within the City of Hamilton (Lamond and Duncan 2003). Green Frog was the most widespread, while Northern Leopard Frog was the least widespread; Gray Treefrog and American Toad were also detected. Amphibian surveys in 2011 and 2012 by URBAN were competed at 3 of the same locations sampled as 2010 RHVP monitoring. All results are reported in Appendix A.

Two McMaster University undergraduate students undertook follow-up monitoring studies related to wildlife utilization of the Escarpment viaduct. Tentative observation of utilization of artificial tree structures (constructed by the City under the viaduct) by Southern Flying Squirrels (SFS) was photo-documented. Dr. Pat Chow-Fraser at McMaster indicated that apart from the work by URBAN, no further monitoring studies have been completed on the SFS or other wildlife.

2.6.2.3 Landscape Management Plan

Restoration Activities

No annual reporting of Kayanase restoration activities was provided by the City beyond the 2009 monitoring season. The Kayanase stock and planting records provided by the City have been reviewed to prepare a brief summary. Based on GIS data provided by the City, the total treatment area within the Red Hill Valley Project was 100 hectares, and involved 305 distinct restoration units with an average size of 0.33 ha. Areas restored extend from the Lincoln Alexander Parkway to the Lake Ontario Shoreline, and included early successional, thicket, and forested communities within escarpment, riparian, wetland, and shoreline environments. Table 6 in Appendix A provides a summary of restoration templates in terms of coverage and species richness. From 2007 to 2012, 242 locally sourced native species were seeded or planted by Kayanase in restoration areas within the Red Hill Creek Valley. During riparian vegetation monitoring, 75 of the 242 (31%) species planted were encountered.

Invasive Exotic Species (IES) Surveys (2009)

IES sub-units were mapped, along with species of particular concern, and accompanied the 2010 annual report. As of the 2009, most (88.7%) of the areas surveyed in the riparian zone of the Red Hill Creek had moderate to high levels of invasive exotic species. The most problematic species included Common Reed (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Crown Vetch (*Coronilla varia*), Sweet Clovers (Melilotus spp.), Manitoba Maple (*Acer negundo*), Tatarian Honeysuckle (*Lonicera tatarica*), Common Buckthorn (*Rhamnus cathartica*), Black Locust (*Robinia pseudo-acacia*), exotic Willows (Salix spp.), Garlic Mustard (*Alliaria petiolata*), and Dames Rocket (*Hesperis matronalis*). A complete list of problematic species, and mapping of the severity of infestation has been provided. Many of the most problematic species and areas were subsequently treated during restoration works by Kayanase. Many invasive species persist, in particular exotic grasses and shrubs.

Free-to-grow Monitoring (2012)

Resampling of a sub-set of Kayanase 'free-to-grow' plots was completed in May 2012. Of 12 plots resurveyed, 11 exceeded the Kayanase estimates for stem density (stems/m^2) taken in 2011; all plots qualified as 'free-to-grow' according to density criteria.

2.6.3 Recommendations and Lessons Learned

Recommendations

The following are key conclusions and recommendations:

1. High-disturbance areas of the Red Hill Creek (i.e. upper reaches) would benefit from further restoration work focused on enhanced riparian vegetation cover along the creek bank, which would aid in mitigating the effects of flooding and erosion.
2. Future monitoring at 5-10 year intervals is recommended to evaluate long-term changes within the riparian zone of the Red Hill Creek, and to better understand the success of the restoration efforts on a more ecologically meaningful time scale.
3. Invasive plant species that are prevalent in the Valley were documented during this monitoring project; some were targeted by specific management during the implementation of the Landscape Management Plan. In order to ensure the long-term ecological integrity of the Red Hill Valley, future monitoring and management of these species is warranted to eradicate these species or prevent their further spread.
4. The wetland enhancement area within Red Hill Marsh (ENH5) should be further monitored as only two years of monitoring have been completed to date. Particular focus should be on invasive species such as Reed Meadowgrass (*Glyceria maxima*), which currently occupies a substantial area within the marsh, and Common Reed (*Phragmites australis*).
5. Monitoring of created habitats and built initiatives (such as QEW culvert) is recommended to evaluate their effectiveness in supporting local wildlife populations and habitat functions.
6. No conclusive research has been conducted indicating the effectiveness of the escarpment viaduct as a wildlife movement corridor for the population of Southern Flying Squirrels (*Glaucomys volans*) that was documented between 1999 and 2001; this remains a key knowledge gap.
7. Turtle population status within the Red Hill Marsh and Van Wagner's Ponds, as well as habitat enhancement areas, should be updated.
8. Common Carp is prevalent within the lower Creek and connected aquatic habitats. Further measures to control Common Carp populations should be undertaken, as has been done in Windermere Basin and Cootes Paradise. As noted within Section 2.5 however, the implementation of such control is considered difficult and would require further discussion and assessment.
9. Permanent vegetation plots were established in 2010 to document native vegetation communities found within the Red Hill Creek Valley. Monitoring should be repeated at regular intervals.

10. Wetland cover has increased by 15 ha within the Red Hill Valley since 2003, primarily as a direct result of habitat enhancement and wetland works. ELC cover should be periodically updated, preferably as part of watershed updates or new project undertakings.
11. This section provides only a brief summary of ecological restoration work completed by Kayanase under the direction of City staff. A separate report would be valuable to address the full scope of this work.

Project Level Learning

The Red Hill Valley Project brought many innovations to the planning and implementation for a major regional highway project; these included:

- Completion of the 1997 Watershed study and comprehensive Action Plan from public and interdisciplinary consultations; resulted in significant design changes for the Parkway and associated infrastructure works;
- The IADP provided a detailed focus on ecological issues such as significant habitats and species, wildlife corridors, regional bird migration, road noise, road salt, and identification of ecological restoration opportunities; precedent-setting targets for wetland and general habitat compensation on a watershed basis; prescribed monitoring at project and watershed scales;
- The RHVP Landscape Management Plan paralleled the IADP process and effectively combined Parkway and creek construction with a range of landscape restoration initiatives that addressed Watershed Action Plan and mitigation principles and objectives, encompassing areas such as landfill re-use, trails, and wetland impact mitigation.
- Detailed Design of the Parkway and QEW works, CSO, stormwater management systems, landfill re-use and trail system works, all built upon previous experience and integrated IADP and LMP principles and objectives, allowing testing and improving a variety of innovative approaches.
- Assignment of Kayanase's ecological restoration role in the project was pivotal to the initiation of numerous site-specific and science-based approaches, with more than 300 polygons treated, representing the targeted 100 ha of works to compensate for Parkway and Creek relocation works.
- Separating the major terrestrial mitigation efforts from the Parkway construction was a success in allowing enough time (5 years) to implement and follow up on a variety of measures which will continue to provide benefits as the restored communities undergo succession and proliferation;
- The City's Environmental Coordinator enabled efficiencies, integration for synergies with other City projects, and follow-up between numerous construction and mitigation activities.

Terrestrial Monitoring Program Learning

The terrestrial monitoring work provided an opportunity to observe ecological changes within a naturalized urban system. Primary findings include:

- The riparian monitoring and underlying planting and restoration works achieved the terrestrial goals of the DFO Authorization. The Cumulative Relative Importance Values

indicate that native (indigenous) species dominated the immediate riparian zone through to 2012.

- In terms of spatial patterns, an increased native species presence was observed, floristic quality, and ground cover from transect 1 (upper Red Hill Creek) to transect 37 (lower Red Hill Creek), but significant variation within and between transects. Diversity was relatively stable along the length of the creek, but decreased through specific reaches along the lower creek due to relatively stable conditions and resultant lower environmental heterogeneity.
- Minor temporal changes in the structure and composition of the riparian vegetation community were observed between 2008 and 2012. Variation between years likely reflects annual environmental variation as much as successional changes. The monitoring time frame was relatively short, and represents primarily early-successional stages of the various plant communities present. Literature indicates that declines in species richness in early successional communities may be expected ~5 years after disturbance due to establishment of long-lived perennials and competitive exclusion of early-colonizing species (Prach et al. 2007).
- Disturbances are important factors influencing establishment of vegetation and the stability of vegetation communities. Before the Parkway and creek construction, most of the valley had undergone significant disturbances since settlement. Flood events in 2009 and 2012 demonstrated the character of potential catastrophic flow events, and highlighted areas most sensitive to these events, primarily in the upper valley. Human impacts such as the creation of informal trails and disposal of garbage (e.g. shopping carts) may be compromising the function of the constructed channel and restoration works.
- Recurring flooding and creek bank erosion also posed technical challenges to monitoring, as vegetation transect markers were washed out.
- Stormwater management facilities were consistently native-dominant (57%) across the 4 years of monitoring, but varied from year-to-year in composition. Based on species accumulation, the estimate of site-level species richness is likely low.
- Kayanase restoration works created or enhanced approximately 100ha of upland, riparian, and wetland habitats within the Valley. This involved site preparation (i.e. soil amendments, invasive species removal, and enhancement of topography), planting and seeding, and free-to-grow monitoring.
- The targeted 2:1 wetland gain has been exceeded, including RHVP works and the Windermere Basin wetland creation; coverage within the Red Hill Valley is now ~35.78 ha (4.80%), compared to 20.31 ha (2.73%) in 1997, and watershed wetland cover is now ~39.59 ha (0.58%), compared to 22.83 ha in 1997.
- Wetland succession has been impeded by impacts from Common Carp. Exclusion of this introduced species was first attempted in Cootes Paradise and was very beneficial to wetland diversity. The wetland creation completed in Windermere Basin in 2011 has also applied a carp barrier. In the lower Red Hill Valley, key opportunities for carp exclusion exist in Comp1 and Comp2, new backwater channels created within ENH5 (Red Hill Marsh), and the north Van Wagner's Pond along with connecting waterways.

3.0 INTEGRATED SUMMARY

3.1 Overall Performance Assessment

The Red Hill Valley Parkway Flood Management

The Red Hill Valley Parkway (RHVP) was designed to a 100-year storm event performance standard for flood protection. The parkway would be expected to flood for storm events in excess of a 100-year storm. The storm event of July 26, 2009 has been characterized as being well in excess of a 100-year storm event, particularly for the section of Red Hill Creek in the vicinity of and downstream of Davis Creek (King Street), where peak flows indicate a storm approximately 1.5 times greater than the 100-year event. The storm event of July 26, 2009 was also preceded by a week of heavy rainfall, which saturated soils and limited the infiltration ability of pervious areas of the watershed. The recorded flooding of the RHVP for the July 26, 2009 was therefore to be expected, and is consistent with the originally approved design.

No flooding of the RHVP was experienced for the July 22, 2012 storm event, which was characterized as being approximately 1.5 times a 100-year storm event for the upper reaches of the watershed. For lower sections of the watershed (downstream of Davis Creek), the storm event was approximately equal to a 100-year storm event, however no flooding was reported during this event.

Flooding of the RHVP was noted for two other storm periods during the monitoring period, July 7 and July 9, 2010. In both cases, the primary location of parkway flooding was Facility J, a stormwater management facility located within the RHVP northbound/Barton Street interchange. This flooding has been shown to have been the result of a fine-meshed grill placed over the outlet structure, which was not part of the original design. This grill resulted in an accumulation of debris leading to flow blockage and as would then be expected, excess ponding and flooding. This grill has since been removed; no flooding in this location has been noted since.

Localized flooding of the RHVP in other locations was noted for the July 9, 2010 storm event, as well as for more formative storms (July 26, 2009). These locations include the Mud Street area, the Online (Retrofit) SWM Facility, the King Street off-ramp from the RHVP northbound, and SWM Facility J. A detailed list of potential remedial measures for these areas was provided as part of the 2010 Annual Monitoring report. For Facility J, subsequent monitoring was conducted (2011-2012) and determined that improved overflow relief would be the most likely solution. The City of Hamilton should consider these measures as part of future works.

Red Hill Creek System

The reconstructed channel (Red Hill Creek) has been subjected to two major flooding events equal to or exceeding the 100 year storm event over the 5-year monitoring period (July 26, 2009 and July 22, 2012). In addition, it has been demonstrated that a particularly high number of flows above bankfull conditions were experienced over the 2009-2011 period. As such, higher than average rates of channel erosion would naturally be expected during the monitoring period. In

general, average bankfull meander rates are still reasonably close to the design targets set for the reconstructed channel portion of Red Hill Creek. The channel alignment also stayed relatively consistent over the monitoring period, despite the high magnitude of flows during the July 26 2009 and July 22 2012 storm events. Some adjustments to channel form and in-stream structures were necessarily required following these storm events, with reconstruction works undertaken in 2010 and again in 2015. The 2015 reconstruction works through the King's Forest Golf Course have included widening bankfull creek geometry and golf cart bridge spans, as well as repairing in-stream structures; these modifications should further assist in increasing the stability of this section of Red Hill Creek in the future. However, it should be clearly understood that the channel is "natural infrastructure" and will always require some degree of maintenance, particularly after large magnitude flooding events, such as those previously noted.

Riparian vegetation (i.e. vegetation along Red Hill Creek) monitoring has demonstrated that planting and restoration works have achieved the original goals of the project. Vegetation indices have indicated that native (indigenous) species dominate the immediate riparian zone through to the end of 2012 (the last year of monitoring). It should be noted however that the majority of the areas surveyed in the riparian zone are considered to have moderate to high levels of invasive exotic species; this will continue to require maintenance and management. High disturbance areas of the riparian zone (i.e. upper reaches within the steepest section of Red Hill Creek) would also benefit from some enhanced riparian cover along the banks to further minimize erosion.

Groundwater and baseflow monitoring within Red Hill Creek has shown that there has been no observed decrease in creek baseflows as a result of the construction of the RHVP. Water temperature has also remained largely unchanged as compared to pre-construction levels. Water quality concentrations within Red Hill Creek, particularly during wet weather events, continues to be a concern. As evident from water quality sampling however, this issue is considered to be on a watershed scale, and unrelated to stormwater runoff from the RHVP itself (for which the constructed stormwater management quality control facilities are considered to be functioning largely as intended). Contaminant concentrations within Red Hill Creek runoff upstream of the RHVP were found to be well in excess of Provincial Water Quality Objectives (PWQOs); elevated concentrations were also noted further downstream within Red Hill Creek. These contaminants appear to be primarily sourced from municipal storm sewers, and from commercial and industrial land uses in particular (likely constructed in the era that pre-dates requirements for stormwater quality controls).

Combined Sewer Overflows (CSOs) have a negative impact on creek water quality, in addition to increasing creek flows and potentially erosion (through additional suspended sediment and solids). A number of overflows were recorded by the City of Hamilton to Red Hill Creek over the monitoring period, including the Greenhill CSO. The City of Hamilton has investigated these observations as part of a separate assessment, and found that these overflows were primarily attributable to the excessive wet weather conditions over several years. The City has since taken several further initiatives, including the implementation of real time control (RTC) over its sanitary and combined sewer system, and the operation of the Red Hill Valley Storage Pipe, which was constructed as part of the RHVP, but did not become operational until December 2011. This

storage pipe eliminates three former CSO discharge points (at Lawrence Road, Queenston Road, and Melvin Avenue), and should assist in minimizing future discharges to Red Hill Creek.

The delay in the operability of the Red Hill Valley Storage Pipe may be a factor in the interpretation of the results of the benthic invertebrate sampling within Red Hill Creek. The results of this sampling work indicated no substantial change in the composition of the benthic invertebrate community as a consequence of the RHVP works. Likewise, no substantial change was noted in the composition of the fisheries community within Red Hill Creek over the monitoring period. Some differences were noted in year-to-year trends in fish density, which were considered to be somewhat surprising. However, it has been noted that this variation could be attributable to sampling numbers and other transient factors not assessed as part of the current study. In general, it is noted that Red Hill Creek is an urban watercourse, with a simple fisheries community dominated by tolerant species; this composition does not appear to have substantially changed as a result of the construction of the RHVP.

Stormwater Management Facilities and Wetland Areas

A number of stormwater management (SWM) facilities and wetland areas were designed and constructed as part of the Red Hill Valley Project (RHVP) in order to provide the required flood control, stormwater quality control, compensatory wetland habitat, and ecological function.

A total of three (3) major flood control facilities were designed and constructed as part of the RHVP: the Dartnall, Greenhill, and Davis Creek Flood Control Facilities (latter has been constructed, but as of the timing of this report, not yet commissioned). Monitoring results for the Dartnall Flood Control Facility (located at the confluence of Hannon Creek with Red Hill Creek) indicate that observed peak discharges from the facility were consistently below expected simulated values, confirming the original design. Likewise, monitoring results from the Greenhill Flood Control Facility (located within Greenhill Park) confirm that the flood control berm operates as per the intended design (i.e. creek flows in excess of the 2-year storm event). The Davis Creek Flood Control facility is not yet commissioned, and therefore cannot yet be assessed. A separate integrated monitoring program (5-year duration) has been commenced for this facility to satisfy regulatory requirements; this program is expected to extend from 2014 to 2018 inclusive.

A total of fourteen (14) stormwater quality control facilities were designed and constructed along the RHVP (11 of which are City-owned, and the remaining 3 of which are MTO-owned). Based on the results of a multi-year stormwater quality sampling program, these facilities are largely performing as per their approved design criteria (80% average annual removal of total suspended solids). For those facilities were performance was less than expected, the results may be due to operational conditions which makes field sampling difficult (such as a submerged outlet pipe), or due to maintenance/operational issues, which are currently, or have been, addressed by City staff. Contaminant levels from stormwater quality control facilities have been noted to be far lower than concentrations within Red Hill Creek itself (typically an order of magnitude lower or greater in many cases).

Similar to the observations along the riparian corridor, native (indigenous) species of vegetation were found to dominate within wetlands and SWM facilities; this observations was generally consistent year over year. Likewise, species richness was found to be stable year over year, although this richness was considered to be low within these areas. The initial design target of a 2:1 wetland gain has been exceeded, including RHVP works and the Windermere Basin wetland creation (constructed separately from the RHVP works by others). The overall increase in wetland area is some 15.9 ha, greater than the 10.45 ha targeted. These estimates also do not account for SWM facilities and enhancement work within the Red Hill Marsh.

The Red Hill Valley

The Integrated Monitoring Program (IMP) has considered numerous other environmental factors within the Red Hill Valley, which are not addressed by the preceding categories.

An assessment of groundwater levels, baseflows, and groundwater quality within the Red Hill Valley has shown that there has been no negative impact to these systems from the completion of the Red Hill Valley Project.

Over 100 hectares of restoration activities have been undertaken by Kayanase, an ecological restoration contractor that employed science-based techniques and adaptive management, along with Haudenosaunee cultural values and ecological knowledge, to carry out this design-build restoration and enhancement project (2007-2012). These works have been carried out along the entirety of the Red Hill Valley, from the upstream limits at the Lincoln Alexander Parkway, to the downstream limits at Lake Ontario. Many of the most problematic areas with respect to exotic invasive species were also treated as part of these restoration works.

Wildlife surveys were also undertaken as part of the overall RHVP IMP. A total of 42 species of birds were found as part of this survey work within the valley, 39 of which are possibly breeding or on territory. Four (4) species of amphibians were also found within the valley as part of monitoring survey work. Some work has been undertaken by researchers at McMaster University to assess the artificial tree structures created within the viaduct area to provide for the movement of the Southern Flying Squirrel. However, no conclusive research has yet emerged to confirm the effectiveness of the viaduct or these structures in this regard.

3.2 Recommendations and Future Monitoring/Maintenance Requirements

Based on the findings of the Integrated Monitoring Program, a number of recommendations and future monitoring/maintenance requirements have been identified:

Groundwater

1. Existing groundwater monitoring wells should be left in place for any future more regional monitoring program. The Hamilton Conservation Authority (HCA) or other governmental agencies should be contacted to confirm whether they would be interested in taking over the monitoring of these wells, potentially as part of the Ontario Groundwater Monitoring Network.

Surface Water

2. The Davis Creek Flood Control Facility monitoring program which was commenced in 2014 should continue, with the anticipation that the facility will become commissioned soon. The program is scheduled to last 5 years, consistent with the balance of the RHVP IMP monitoring activities.
3. The City of Hamilton may wish to further monitor and assess localized flooding locations identified within this summary (as well as the 2010 Annual Monitoring Report), as well as consider the preliminary list of proposed remedial measures.
4. The City of Hamilton and the Ministry of Transportation (MTO) may wish to undertake a climate change assessment, to better understand the potential vulnerabilities along the RHVP, and develop appropriate resiliency plans.

Water Quality

5. The City of Hamilton should continue to monitor combined sewer overflow (CSO) discharges to the Red Hill Valley over time to verify the effectiveness of the Red Hill Valley Storage Pipe, and whether any additional measures are warranted.
6. The City of Hamilton may wish to consider future continuous stormwater quality sampling of stormwater management facilities using an auto-sampler in order to better assess their performance. The City may also wish to consider further grab sampling or continuous sampling of Red Hill Creek during wet weather events given the high observed contaminant levels. This monitoring effort could be used to determine which areas of the watershed have relatively higher contaminant level contributions, and should be targeted for potential future remedial stormwater quality controls.
7. The City of Hamilton should consider undertaking repeat bathymetric surveys of stormwater quality management facilities in the next 5 to 10 years to better assess sediment accumulation rates and forecast future clean-out scheduling.
8. The City of Hamilton (and the MTO) should continue annual inspections of all stormwater management facilities in order to assess and proactively respond to any identified issues. The RHVP SWM Facility Operations and Maintenance Manual (to be completed later in 2015 by Amec Foster Wheeler) should assist in this regard.

Creek Morphology

9. The City of Hamilton may wish to continue monitoring erosion and along the Red Hill Creek corridor to continue to assess the bankfull meander migration of the channel over time. Recent channel works (2014/2015) within the King's Forest Golf Course in particular are recommended to be monitored for at least 5 years.
10. Maintenance of the Red Hill Creek corridor will continue to be required, particularly after large magnitude flood events. The corridor should be viewed as part of the City's "natural infrastructure", with associated ongoing maintenance requirements.
11. The City of Hamilton and its partners (such as the Hamilton Conservation Authority) should continue efforts to clean up anthropogenic material within Red Hill Creek (such as shopping carts) through annual creek clean-up days. The City (and potentially the HCA) should likewise continue to monitor and remove any potential debris jams at culverts and other hydraulics structures.
12. The ongoing erosion and sediment contribution upstream of the Buttermilk Falls tributary should be addressed in order to maintain downstream channel stability within Red Hill Creek. The rehabilitated channel reach was never designed to handle/receive the bed material load that is currently being generated by the upstream reach destabilized in the July 2009 flood. Measures should be taken to mitigate erosion in this reach and provide enhanced geotechnical slope stability.

Fisheries

13. The City of Hamilton, and affected regulatory agencies (Hamilton Conservation Authority, Ministry of Natural Resources and Forestry, Department of Fisheries and Oceans, Royal Botanical Gardens, Bay Area Restoration Council) may wish to consider transplanting suitable native stream fishes from other area watercourses, if a more diverse fish community in Red Hill Creek is desired. Further discussion would however be required on this subject.
14. The City of Hamilton and affected regulatory agencies should consider implementing carp control within the lower reaches of Red Hill Creek (as has been done in Windemere Basin). Key opportunities for carp exclusion exist in compensation wetlands Comp1 and Comp2, as well as new backwater channels created within ENH5 (Red Hill Marsh), and the north Van Wagner's Pond along with connecting waterways. Further discussion would again be required on this subject.
15. Benthic invertebrate sampling should be considered in the future, potentially within the next 5 years +\-, in order to assess potentially positive impacts of the Red Hill Valley Storage Pipe. This feature, which should reduce the number of combined sewer overflow discharges to Red Hill Creek, did not begin operating until December 2011; as such the monitoring data (ending in 2012) would not reflect the benefit of implementing this feature.

Terrestrial Ecology

16. Future terrestrial ecology monitoring of the riparian zone is recommended at 5 to 10 year intervals in order to evaluate long-term changes. Additional restoration efforts for high-disturbance areas of the riparian zone (i.e. upper reaches) would also be beneficial and should be considered.
17. It is recommended that the City of Hamilton consider future monitoring and management of invasive species within the Red Hill Valley in order to eradicate them or prevent any further spread.
18. It is recommended that the City of Hamilton undertake additional monitoring of the wetland enhancement areas (ENH5), given that only 2 years of data have been collected thus far.
19. It is recommended that turtle population status within the Red Hill Marsh and Van Wagner's Ponds, as well as habitat enhancement areas, be updated.
20. The City of Hamilton should consider undertaking repeat monitoring of permanent vegetation plots within the valley.
21. The City of Hamilton should consider periodically updating Environmental Land Classification (ELC) cover databases as part of any future watershed updates or new projects.
22. The City of Hamilton should consider completing a separate stand-alone report to summarize and address the full scope of the restoration works undertaken by Kayanase.

3.3 Lessons Learned – Application to Future City Projects

Given the scope and duration of the Red Hill Valley Project Integrated Monitoring Plan, a significant number of lessons have been learned. These lessons apply not only to specific disciplines and technical matters, but also to the overall process and study form. These lessons are presented herein so that the knowledge gained through this study can be applied to future City projects to their benefit.

Overall Project

1. The City of Hamilton's Environmental Coordinator enabled efficiencies, integration for synergies with other City projects, and follow-up between numerous construction and mitigation activities. For future large-scale projects which involve an environmental component, the involvement of an Environmental Coordinator would be invaluable.
2. The planning and design process for the RHVP was very successful from an ecological perspective. Documents such as the 1997 Watershed study and comprehensive action plan, the IADP, and the RHVP Landscape management plan resulted in significant design changes to the Parkway with a focus on ecological issues, and a range of restoration activities.

Surface Water

3. Flow monitoring within larger creek systems (such as Red Hill) is likely best done with a permanent installation to ensure gauge stability and avoid equipment loss. Gauge installation locations should also be chosen in areas with stable conditions where possible (i.e. shallower/less steep sections). In other areas temporary gauge installations are likely acceptable, but need to be securely anchored to the channel bed, likely to a minimum depth of 1 m.
4. In-stream velocity measurements cannot be safely obtained at higher flows (i.e. typically greater than 0.8 m depth), although this varies depending on the flow velocity. Other methods of obtaining velocity measurements at high flows are usually impractical or cost-prohibitive. As such, rating curves (the developed relationship between depth and flow for a given monitoring sections) should be developed using a hydraulic model rather than a simple trendline, which would not reasonably account for expect variations at higher depths. Reasonableness checks should also be incorporated into this process (i.e. verification of runoff volumes, comparison to other calibrated/verified models or local observed streamflows).
5. Fully calibrated hydrologic and hydraulic models are invaluable tools for any watershed. The calibrated HSP-F model of the Red Hill Creek watershed developed as part of previous studies was invaluable in conducting the forensic assessments of major storm events, such as the July 26 2009 and July 22 2012 storms. Developing such models, and continuing to maintain and update them as development proceeds within a watershed is invaluable in understanding watershed flows and rapidly assessing major storm events or development scenarios.
6. In addition to the benefit of calibrated hydrologic and hydraulic models, there is significant value in the City of Hamilton's network of point rainfall gauges. This network has been relied upon in the forensic assessment of major storm events, including in the calibration of radar-generated rainfall data. Over time, this network will provide a long-term local rainfall dataset that could be used for multiple purposes, including continuous simulation, climate change assessments, intensity-duration-frequency rainfall statistics, and other projects.

Water Quality

7. Water Quality grab sampling provides a general indication of contaminant concentrations and potentially stormwater management facility performance. However, its limitations should be clearly understood. Grab samples characterize only a single point in time. Although best efforts are, and have been, made to collect samples at representative times, actual storms are unpredictable and impacted by a number of factors, including the accuracy of forecasts, weather patterns, and antecedent rainfall. Real world storm events rarely match the idealized "design" conditions, and a single sample is rarely sufficient to characterize conditions, particularly influent concentrations. Although continuous water quality sampling (using auto-samplers) is typically preferable, the high costs associated with obtaining this equipment and the associated laboratory costs to test the additional samples, typically makes this option cost-prohibitive for most projects.
8. The results of this monitoring effort indicated that municipal storm sewers tend to be much worse sources of stormwater pollutants than the Red Hill Valley Parkway. Commercial and

industrial land uses in particular appear to contribute the highest concentrations (as might be expected), particularly given that many of these areas pre-date requirements for stormwater quality controls. Ultimately, the long-term health of Red Hill Creek depends on further addressing these external contributors.

9. An as-constructed bathymetric survey of all stormwater management facilities should be mandatory before the City of Hamilton assumes control. The results of the analyses conducted for this study suggest that a large portion of the accumulated sediment likely resulted from construction activities, and was never restored to design levels.
10. Regular SWM inspections (annual at least) of stormwater management facilities are the best way to ensure efficient operation and to proactively address maintenance requirements as required.

Creek Morphology

11. A great deal of insight has been gained as a result of this project with respect to natural channel design techniques, particularly in steep slopes. These lessons should be applied to other channels within the City with similar conditions (i.e. channel sections immediately below the Niagara Escarpment in particular).
12. When constructing future in-creek structures, sills should be considered. These features are relatively low cost and have been shown to minimize disturbances and damage to in-stream structures.
13. All creek systems should be viewed as being part of the City's "natural infrastructure" and will always require some degree of maintenance, particularly after major storms.

Fisheries

14. Fisheries inventories need to ensure that an adequate number of reaches and habitats are sampled to confirm that year-to-year comparisons are reasonable.
15. The conversion of concrete habitat to natural substrate has been demonstrated to be very effective in increasing fish abundance, even when placed over concrete. This should be considered in the design of hydraulic structures where fish habitat and passage would be a factor. Likewise, although open-bottomed culverts are preferable, modified culvert designs can be considered using traditional closed culverts, whereby natural substrate is retained with baffles and a narrower low flow channel is included.

Terrestrial Ecology

16. Separating the major terrestrial mitigation efforts from the Red Hill Valley Parkway (RHVP) construction was a success in allowing enough time (5 years) to implement and follow up on a variety of measures which will continue to provide benefits as the restored communities undergo succession and proliferation;

17. Disturbances are important factors influencing establishment of vegetation and the stability of vegetation communities. Before the construction of the RHVP and the re-construction of Red Hill Creek, most of the valley had undergone significant disturbances since settlement. Flood events in 2009 and 2012 demonstrated the character of potential catastrophic flow events, and highlighted areas most sensitive to these events, primarily in the upper valley. Human impacts such as the creation of informal trails and disposal of garbage (e.g. shopping carts) may be compromising the function of the constructed channel and restoration works.
18. Recurring flooding and creek bank erosion also posed technical challenges to monitoring, as vegetation transect markers were washed out. Future studies in areas subject to similar conditions should consider more resistant markers.

References

AMEC Earth & Environmental. August 2010. Integrated Monitoring Plan, Red Hill Valley Project. 2009 Annual Report. City of Hamilton.

AMEC Earth & Environmental. July 2011. Report on the Design of a Dam – Davis Creek Flood Control Facility. City of Hamilton.

AMEC Earth & Environmental. August 2011. Integrated Monitoring Plan, Red Hill Valley Project. 2010 Annual Report. City of Hamilton.

AMEC Environment & Infrastructure. November 2012. Integrated Monitoring Plan, Red Hill Valley Project. 2011 Annual Report. City of Hamilton.

AMEC Environment & Infrastructure. November 2013 (Updated March 2014). Integrated Monitoring Plan, Red Hill Valley Project. 2012 Annual Report. City of Hamilton.

AMEC Environment & Infrastructure. August 2014. Integrated Monitoring Plan, Red Hill Valley Project. 2013 Annual Report. City of Hamilton.

Annable WK. 1996, Database of Morphologic Characteristics of Watercourses in Southern Ontario. Ontario Ministry of Natural Resources, Queen's Printer for Ontario: Toronto, Ontario, ISBN # 0-7778-5112 -1, 212 p.

Annable W.K, C.C Watson, P.J. Thompson, 2012, Quasi-Equilibrium conditions of urban gravel-bed stream channels in Southern Ontario, Canada, River Res. Applic. 28(3):302-325.

City of Hamilton. July 2003. The Red Hill Valley Project – Impact Assessment and Design Process, Summary Report.

Goodban, A.G. 1996. The Vegetation and Flora of the Red Hill Valley and Environs. In: Hamilton Naturalists' Club. 1996. (ed.). Biological Inventory of the Red Hill Valley: 1995. Prepared for the Hamilton Region Conservation Authority, Ancaster, Ontario. 235 pp.

Hatch Mott MacDonald Final Report – Hamilton Greenhill CSO Tank Overflow Review. City of Hamilton.

Hamilton Spectator. July 9, 2010. "Red Hill runneth over".

Hamilton Spectator. July 10, 2010. "Water World".

Hamilton Spectator. July 10, 2010. "Downpour causes chaos".

Hamilton Spectator. July 16, 2010. "Drainage screens likely cause of flooding".

Hamilton Spectator. August 16, 2010. “Red Hill ‘safe for drivers”.

Kayanase. 2006. Red Hill Valley Ecological Restoration Detailed Design Plan Report.

Kije Sipi Ltd. September 2009. City of Hamilton Storm Characterization Study – Major Rainfall Event of July 25-26, 2009.

Kije Sipi Ltd. February 2010. City of Hamilton Storm Characterization Study – Major Rainfall Event of August 28-29, 2009.

Leopold LB, MG Wolman, JP Miller. 1964. Fluvial Processes in Geomorphology. W. H. Freeman and Company, San Francisco, California, 522 pp.

Ontario Ministry of the Environment. August 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario.

Ontario Ministry of the Environment and Energy. July 1994. Water Management – Policies Guidelines Provincial Water Quality Objectives.

Philips Engineering Ltd., February 2004. Permitting Compliance Report, Red Hill Creek Valley Project, Detailed Design Contracts 5 and 6. City of Hamilton.

Philips Engineering Ltd., December 2007. Integrated Monitoring Plan, Red Hill Valley Project. City of Hamilton.

Philips Engineering Ltd. April 2009. Integrated Monitoring Plan, Red Hill Valley Project. 2008 Annual Report. City of Hamilton.

Prach, K., Leps., J., Rejmanek, M. Old Field Succession in Central Europe: Local and Regional Patterns. In: Cramer, V.A., Hobbs, R.J. (eds). 2007. Old Fields: Dynamics and Restoration of Abandoned Farmland. Island Press, Washington. 334pp

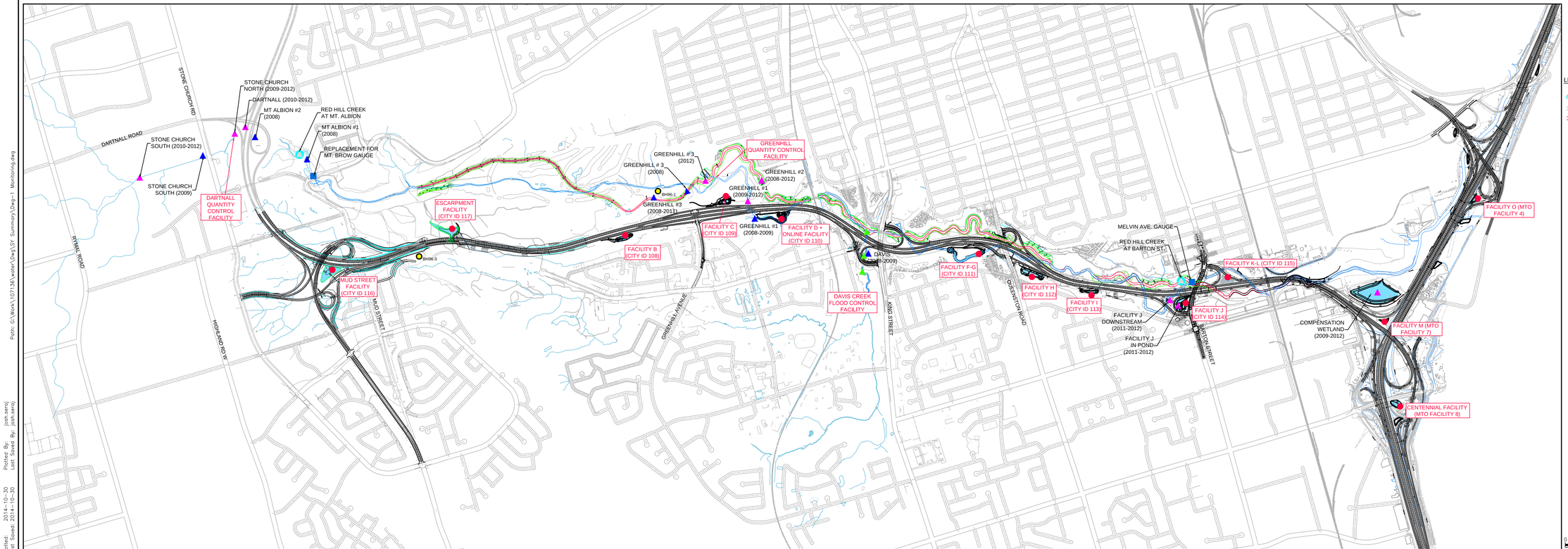
Region of Hamilton-Wentworth. October 1998. Red Hill Creek Watershed Action Plan – First Generation Plan.

Schumm SA, Harvey MD, Watson CC. 1984. Incised Channels: Morphology, Dynamics and Control. Water Resources Publications: Littleton, Colorado, ISBN 0918334-53-5, 200 p.

Snell, EA, 1987, Wetland Distribution and Conversion in Southern Ontario. Working Paper No 48, ISBN 0-662-15077-5, Canada Land Use Monitoring Program, Inland Waters and Lands Directorate, Environment Canada, Ottawa.

SNEOG (Six Nations Economic Opportunities Group). 2006. Red Hill Valley Project Ecological Restoration and Landscaping Proposal. Prepared by Grand River Employment and Training Inc. (GRETI) for the City of Hamilton. March 2006. 73 pp + appendices.

WRIS, 2002, A Stream Network, Inventory, Fluvial Geomorphologic Assessment, Impact Assessment, and Preliminary Natural Channel Design of Red Hill Creek, City of Hamilton, Hamilton, Ontario, Canada. Special Projects Office, June 2002.



RED HILL CREEK VALLEY PROJECT
INTEGRATED MONITORING PLAN
CITY OF HAMILTON

LEGEND

- STORMWATER FACILITY LOCATION
- PREVIOUS RED HILL CREEK ALIGNMENT
- CURRENT RED HILL CREEK ALIGNMENT
- INSTREAM FLOW GAUGES (BY OTHERS)
- SWM FACILITY PERFORMANCE MONITORING
  - Water Quality
  - Sediment
- IN-STREAM WATER QUALITY MONITORING LOCATION
- GROUNDWATER MONITORING SITE
- PREVIOUSLY ESTABLISHED (2012) AMEC WATER LEVEL AND FLOW MONITORING LOCATIONS
- PREVIOUS AMEC WATER LEVEL AND FLOW MONITORING LOCATIONS
- CURRENT (2014) AMEC WATER LEVEL AND FLOW MONITORING LOCATIONS FOR DAVIS CREEK FLOOD CONTROL FACILITY

DRAWING 1 MONITORING LOCATIONS

SCALE 1 : 15000

0 100 200 400

Path: G:\Work\107136\water\Dwg\SY Summary\Dwg-1 Monitoring.dwg
Plotted By: josh.seroj
Last Saved By: josh.seroj
Plotted: 2014-10-30
Last Saved: 2014-10-30

APPENDIX A

City of Hamilton

Red Hill Terrestrial Monitoring

Executive Summary

October 2014 (June 2018)

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. BACKGROUND

The Integrated Monitoring Plan (IMP) for the Red Hill Valley Project (RHVP) was developed to ensure environmental compliance required by the various agencies involved in the planning and approval process (City of Hamilton, 2006). The purpose of the IMP was to evaluate the performance of the Environmental Management System for the Red Hill Valley Project, and to provide adjustments to the plan recommendations through a process of adaptive management (City of Hamilton, 2006).

The Red Hill Valley Project encompassed construction and landscaping activities related to the new Parkway, the relocated Creek, and associated infrastructure (i.e. stormwater management facilities) but also incorporated major habitat protection, creation, restoration and enhancement initiatives that included:

- RHVP Impact Assessment and Design Process (IADP) (1999-2003)
- RHVP Landscape Management Plan (Envision et al 2003),
- Detailed design phases for the Parkway and the QEW interchange works (2005-2007),
- RHVP Landscape Design and Habitat Enhancement Plan (D&A 2005)
- RHVP Ecological Restoration and Landscaping Project (SNEOG 2006),
- Rennie/Brampton St. Landfill Remediation (1999-2005), and
- East Hamilton Trail and Waterfront Link (2008-2011).

This report deals primarily with monitoring based on the Impact Assessment and Design Process (IADP) recommendations and agency approval conditions. However it also provides profiles of some key areas where a broader range of study, design and restoration initiatives were undertaken. It includes a summary of key lessons learned and challenges associated with the implementation and monitoring of terrestrial ecology-related aspects of the RHVP.

Monitoring of the natural heritage aspects within the Red Hill Valley Project study area focused on three levels to address agency requirements and planning objectives:

- *DFO Conditions of Approval (DFOCOA)* - identify plantings to be replaced; ensure that slope, channel and wetland plantings will be dominated by indigenous riparian species.
- *Landscape Management Plan (LMP)* - ensure that habitat restoration and enhancement works achieve objectives.
- *Impact Assessment and Design Plan Ecosystem Monitoring* (*IADPEM)* - assess ecosystem level diversity and functions in the longer term.

This summary report provides an overview of the work undertaken to evaluate the success of RHVP activities, and presents: methods used in monitoring; major results and findings of monitoring: and challenges and lessons learned during the process. For detailed methods and results for each year of the monitoring program, please refer to the 2008-2012 annual reports.

1.1. GOALS AND OBJECTIVES

The following objectives were developed for the terrestrial ecology component of the Integrated Monitoring Plan in order to meet agency requirements (see Table 6.1 in IMP):

- Regulatory monitoring of riparian vegetation along the Red Hill Creek (DFOCOA);
- Monitoring of vegetation planted within wetland compensation areas and within Stormwater Management (SWM) facilities (DFOCOA);
- Survey wildlife (i.e. breeding birds and amphibians) and vegetation long-term monitoring stations to collect baseline data (IADP);
- Watershed- and valley-level Ecological Land Classification (ELC) updates and characterization (IADP);
- Monitor vegetation planted within the wetland enhancement areas (LMP);
- Determine the Free-to-Grow status of habitat restoration areas (LMP)
- Survey invasive exotic species within the riparian area of the Red Hill Creek.

Specific questions for each component of the monitoring programs are outlined in the relevant methodology sections below.

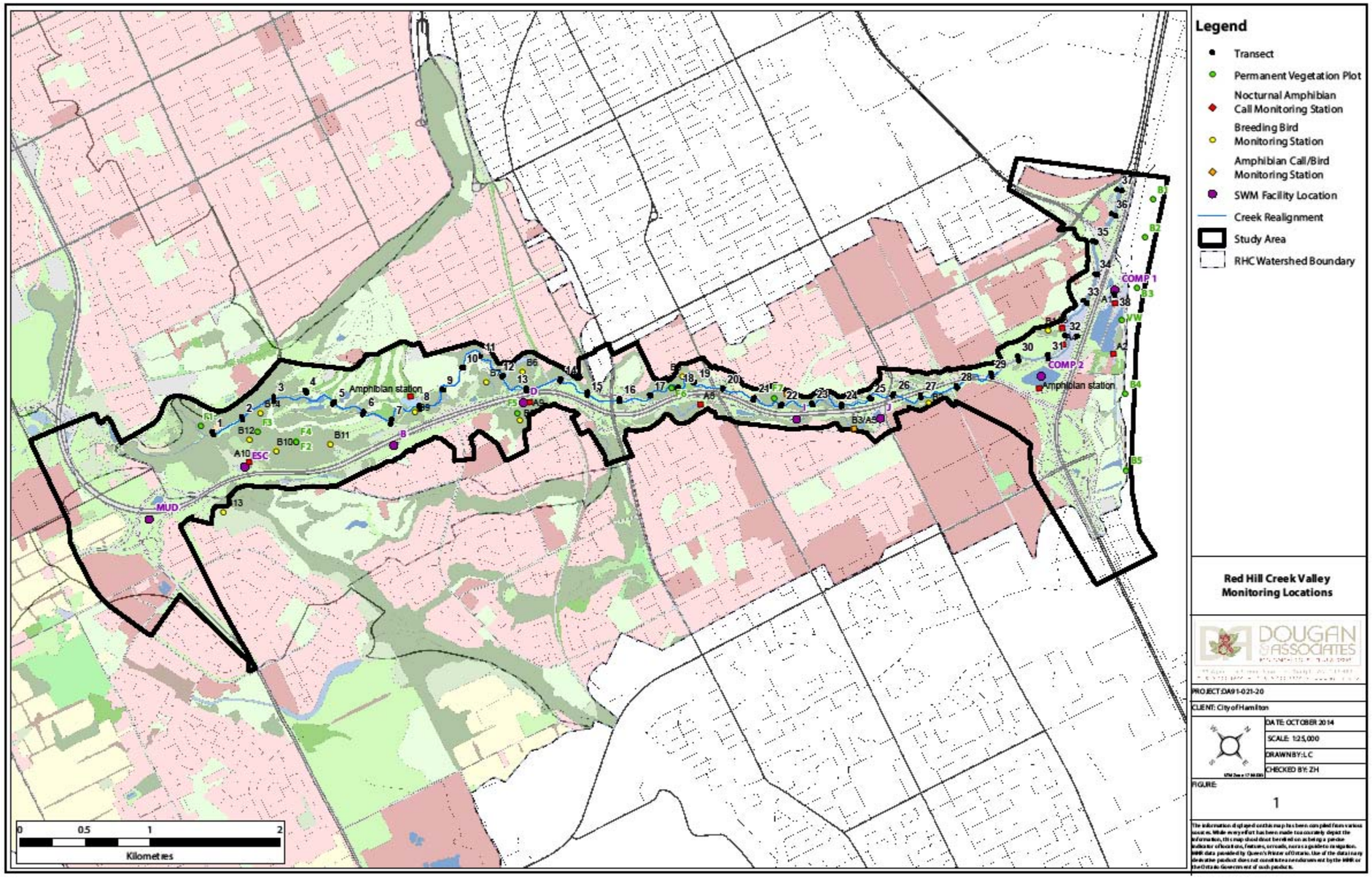
1.1.1. METHODOLOGY

The tasks completed from 2008-2012 as part of the Integrated Monitoring Plan are shown in Table 1. The methodology used for each component of the terrestrial monitoring program is summarized in the sections that follow. The primary study area and locations of the RHVP terrestrial monitoring are shown in Figure 1; the scope and scale of watershed level monitoring activities is addressed later in this report.

Table 1. Terrestrial Ecology Monitoring Timeline. Tasks were completed in shaded years.

Task	Year				
	2008	2009	2010	2011	2012
Riparian Vegetation Monitoring					
Wetland Compensation and SWM Monitoring					
Ecological Land Classification Updates					
EMAN Plot Monitoring					
Wildlife Plot Monitoring					
ENH5 Monitoring					
Invasive Exotic Species (IES) Surveys					
Free-to-Grow Evaluations					

Figure 1. Red Hill Valley Terrestrial Monitoring Locations



1.1.1.1. DFOCOA

Riparian Vegetation

The primary questions to be addressed for riparian vegetation monitoring were:

1) What is the structure and composition of riparian vegetation along the Red Hill Creek,
2) What spatial and temporal patterns occurred within the riparian vegetation community from 2008-2012, and
3) Which species define the riparian vegetation community along the Red Hill Creek in terms of relative importance?

These questions were addressed using 37 permanent transects spaced 250m apart along the length of the Red Hill Creek which were sampled repeatedly over the 5-year monitoring period. Six 1m x 1m quadrats (plots) were placed along each transect for a total of 222 sampling locations along the 9.5km length of creek. The length of transects ranged from 6m (average length 6.2 m), generally 3+ meters from edge of channel to each end in most locations, but one extended up to 52m for transect 32 through Red Hill Marsh Enhancement Area (Enh5). An additional transect with six plots was established on a section of the Red Hill Creek channel that connects to Van Wagner's Pond north of the QEW.

Each transect was photographed annually with a scale bar to document changes in vegetation, as shown in Figure 2. Quantitative sampling of vegetation at each transect took place at all transects in 2008, and alternating "even" (i.e. 2, 4, 6 etc.) and "odd" (i.e. 1, 3, 5 etc.) transects each year until 2012. Within each quadrat, the following data was collected: species presence/absence, estimated cover, and height values of individual species. Cover estimates were also recorded for mosses and liverworts, which were grouped as "non-vascular plants", and the area of bare soil and/or rock was also recorded. When observed, soils deposited during seasonal flooding were noted.

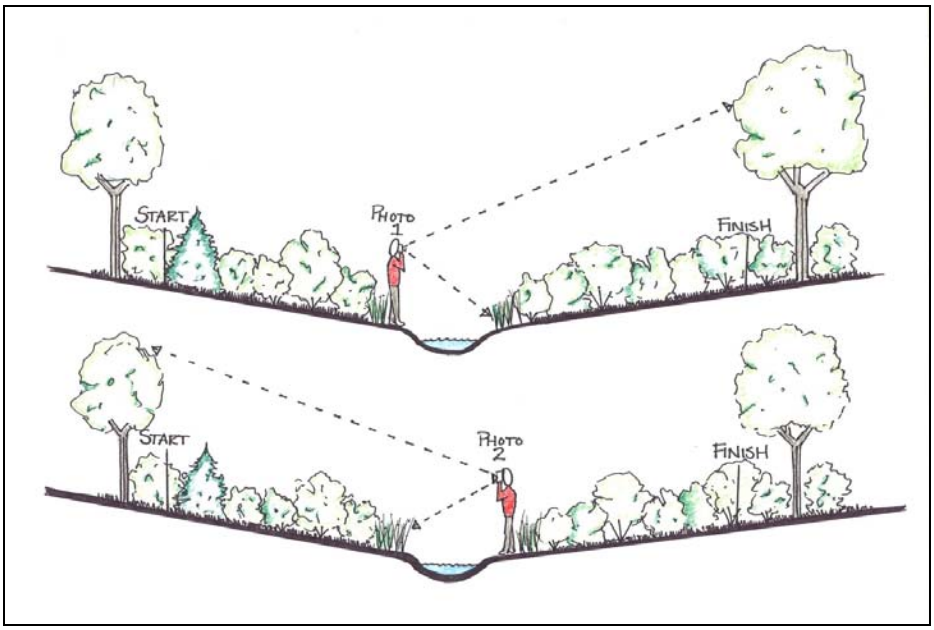


Figure 2. Approach for transect photomonitoring.

Several metrics associated with plant abundance and community diversity were calculated for each 1m^2 quadrat, and averaged to produce transect and site-level estimates. These metrics included: species richness (exotic and native), Shannon Diversity Index (H) and Pielou's Evenness Index (J), and Floristic Quality Index (FQI).The Floristic Quality Index is a useful tool for monitoring habitat restoration (Oldham et al. 1995). For each species, Frequency, Average Cover, Relative Cover, Relative Frequency, Importance, and Relative Importance values were calculated. These metrics were used to evaluate changes in community structure and composition over the 5-year monitoring period, as well as to compare to historical conditions.

In order to compare the riparian vegetation community along the reconstructed Red Hill Creek Channel to pre-construction conditions, data from "The Vegetation and Flora of the Red Hill Valley and Environs" (Goodban 1996) was used which provided a comprehensive list of plant species reported up to 1996 within the Red Hill Valley, and therefore serves as a valuable reference for baseline plant diversity. As discussed later in this report, the sampling methods used in the monitoring study were quite different than the historical flora approach of Goodban (1996); our sampling approach was intensive and focused within the

newly constructed and modified riparian environments of the Red Hill Cree.

We summarized the species listed by Goodban (1996) attributed to riverine, marsh/meadow marsh, and deciduous floodplain woodland valley habitats. These habitat types are most similar to those monitored within the riparian zone in this study. For each species, we applied the same set of species attributes used in this study (i.e. native/exotic, conservation status, Coefficient of Conservatism, Floristic Quality, growth form, etc),to the Goodban data to compare the characteristics of the current vegetation communities to those reported from the Red Hill Creek circa 1995.Throughout the results summarized in this report, our findings are compared to those provided in Goodban (1996).

To evaluate differences in vegetation community performance between transects and reaches, standardized measures were applied: species richness, proportion of native species, floristic quality index, Shannon diversity index, and ground cover in each quadrat. The results were further standardized using "z-scores" (variable-mean/standard deviation), and averaged across all years at the transect level. Standardized values are between -1 and 1, with 0 being the mean of all plots. This approach allows for the comparison of transects to each other, given the average conditions for the site. Z-scores for each metric were then averaged for each transect to obtain an overall score. These values were then plotted and mapped to show variation in vegetation community performance along the Red Hill Creek.

Shannon Diversity and Pielou's Evenness Index values were calculated using the Vegan Package in the "R" statistical software (Oksanen 2012) and statistical analysis was performed in JMP 11.0.0 (2013 SAS Institute Inc). "Even" and "odd" transects were analyzed separately within each year for variation in measures of species richness, floristic quality, and diversity using an ANOVA, with plot nested within transects, and both treated as random factors. Transect distance along the creek (reach distance) and plot positions were each treated as fixed factors. Full results of the statistical analysis are not provided in this report, but are summarized to highlight the patterns observed.

Wetland Compensation and Stormwater Pond Vegetation

The primary questions to be addressed through monitoring the stormwater management facilities and wetland compensations areas (referred collectively to as 'ponds') were:

1) What is the structure and composition of vegetation within and surrounding the ponds, and
2) What spatial and temporal patterns in vegetation occurred within and among ponds from 2009-2012.

Fourteen (14) ponds are located adjacent to the Red Hill Parkway along the length of the Red Hill Creek and near the QEW interchange (Table 2; Figure 1). In 2009, seven were chosen for quantitative sampling based on key attributes (e.g. extent of surrounding roads and natural vegetation cover) in order to represent the variety of conditions present among ponds. We categorized ponds based on similarity of attributes, including; the surroundings (road vs natural/naturalized), size, and re-vegetation efforts. Those in Category 1 (MUD, J, COMP1), being the least natural, were typically surrounded by roads on all sides and with minimal natural features in the vicinity, whether natural or part of a restoration initiative. In contrast, SWMs and wetlands in Category 3 (ESC and COMP2) were the most natural, being in proximity to only one or no roads, and having the most extensive natural features in the vicinity. Those in Category 2 (B and I) were intermediate. This categorization ensured that SWM facilities and wetlands of varying quality and setting were represented, and allowed for randomized selection within each category. Wetland Compensation Area 2 (COMP2) was also surveyed from 2010 – 2012 for a total of 8 within the study area.

Vegetation sampling of the pond was also conducted using transects, four per pond, and three quadrats per transect, except for the Escarpment viaduct pond, which had fewer transects installed due to ongoing construction, and more quadrats per transect to account for larger area. In total, 99 pond quadrats were sampled each August from 2009-2012.

A nested ANOVA was used to determine if vegetation community quality varied among years, ponds, and transects nested within ponds, with category included as a fixed factor.

1.1.1.2. IADP

Ecological Land Classification

In 2010 GIS data was compiled from existing sub-watershed studies to aid in producing an updated (current to 2009 orthophotography) base map of Ecological Land Classification (ELC) communities for the Red Hill Creek Watershed, which could then be compared to 1997 estimates of vegetation cover to detect changes in cover between 1997 and 2009. Key areas were visited in 2010, 2011, and 2012 to remap, if necessary, to at the ELC Community Series level. We used this updated mapping to answer the following questions:

1) How did the landcover within the Red Hill Creek Watershed and Red Hill Valley change from 1997 to 2012, and;
2) Were wetland compensation targets achieved?

We provide a summary of the changes in land cover across the Red Hill Creek watershed, as well as the Red Hill Valley, and address the achievement of wetland compensation targets outlined in the DFO approval conditions in Section 4.3.

Permanent Vegetation Monitoring Plots

A network of permanent vegetation and wildlife monitoring stations was established in the Valley in the spring of 2010 according to the terrestrial vegetation biomonitoring protocols developed by Environment Canada's Ecological Monitoring and Assessment Network (EMAN 1996). The intent of these vegetation plots is to track representative vegetation types and habitats, and changes within these areas over the long term. For the surveys conducted in 2010, our goal was to determine baseline conditions in terms of species richness and community composition. Seven permanent (10m x 10m) vegetation monitoring plots were installed and sampled at forest sites using the

methods outlined in Chambers and Lee (1992) with some modifications. In addition to the forest plots, Van Wagner's Ponds and Beach was added as an additional site to improve representation of the different habitats present in the area. We also used a transect-based monitoring approach at these locations. The IADP recommended the re-sampling of these EMAN plots on a five year cycle, for a minimum of 20 years. For more details specific to the EMAN protocols, refer to EMAN (1996), and for our adaptation of the methodology see the Integrated Monitoring Plan Red Hill Valley Project 2010 Annual Report (AMEC 2010).

Permanent Wildlife Monitoring Plots

A total of 12 nocturnal amphibian call (*i.e.* frog and toad) and 14 breeding bird monitoring stations were established in the Red Hill Creek study area in December 2008 with the purpose of estimating species diversity and abundance in key areas (Figure 1). The selection of nocturnal amphibian call monitoring stations was carried out with the objective of covering the majority of potentially suitable amphibian breeding habitats in the valley. Nocturnal amphibian call surveys were monitored according to the Marsh Monitoring Program (MMP) protocols (BSC 2003), except that monitoring sites were not restricted to marsh habitats. Three surveys were conducted for amphibians on April 30, May 20 and June 27, 2010.

Two breeding bird surveys were also conducted in 2010 for each sample point shown on Figure 1, with the first round taking place on May 25 and 26, and the second taking place on June 15 and 17, 2010. The surveys followed the protocols outlined by the Ontario Breeding Bird Atlas (OBBA 2001).

The Urban-Rural Biomonitoring & Assessment Network (URBAN), a citizen-science program based at McMaster University in Hamilton, Ontario, also completed breeding bird and amphibian surveys according to the MMP at three locations within the Red Hill Valley in 2011 and 2012. The sites surveyed were Van Wagner Marsh (amphibians in 2011), Rosedale Marsh (amphibians in 2011 and 2012, birds in 2011), and Compensation Area 2 (both 2011 and 2012). Where possible, we will compare our findings to URBAN`s.

ENH5 Monitoring

The wetland enhancement area within Red Hill Marsh (ENH5, Figure 1) was monitored during the 2011 and 2012 mid-summer season. The approach to monitoring this feature was similar to that used in the stormwater ponds. We installed 13 transects that extended from the edge of the vegetation within the channels to the top of the adjacent mounds, with 3 1m x 1m quadrats along each, as in the pond monitoring. This allowed for a more detailed and comprehensive survey of the vegetation within this important wetland feature. Data was collected and summarize in the same fashion as for the ponds.

1.1.1.3. LANDSCAPE MANAGEMENT PLAN

Ecological restoration works within the Red Hill Valley were undertaken by Kayanase, an ecological restoration contractor and native plant nursery based at Six Nations in Oshweken, ON. This new company employed science-based techniques and adaptive management, along with Haudenosaunee cultural values and ecological knowledge, to carry out this design-build restoration and enhancement project over a 6-year period (2007-2012). The preliminary design concepts, contained within the RHVP Landscape Design and Habitat Enhancement Plan (D&A 2005), were adopted and expanded by Kayanase to develop detailed design plans in order to guide the ecological restoration and landscaping works. These initial plans were augmented to account for invasive species, to test new approaches such as direct seeding of woody species, and to better utilize and improve the function of existing natural features. In doing so, a relatively large area (just over 100 ha) of the Red Hill Valley Study Area received restoration and enhancement treatments (Kayanase 2006). The following is a brief overview of the restoration plan and works undertaken. The Kayanase work was directed by City staff; D&A provided technical guidance on matters such as invasive species and 'free to grow' interpretation, but were not provided with any reports by the City after 2009. For a detailed account of the Kayanase work plan, refer to the Red Hill Valley Project Ecological Restoration and Landscaping Proposal (SNEOG 2006) and Red Hill Valley Ecological Restoration Detailed Design Plan Report (Kayanase 2006).

The overriding goals of the ecological restoration plan were to:

- Protect and conserve existing native plants and plant communities to the maximum extent possible;
- restore degraded habitat areas through sustainable ecological restoration efforts; and,
- increase the connectivity and size of natural habitat areas.

The detailed restoration plans were developed by initially conducting existing habitat assessments of all areas to be restored to identify and delineate existing environmental and habitat conditions which were used to define working Restoration Units (Polygons). Using this information, an appropriate Reference Model (i.e. Ecological Land Classification ecosite model) was chosen. Reference Models were based on 1) intact and/or remnant elements of healthy ecosites and vegetation communities with similar abiotic conditions within the RHV, 2) documented historical vegetation communities with comparable environmental conditions, and 3) adaptations of these existing or historical features based on sound ecological reasoning. Using these Reference Models, plant diversity and density metrics were applied to each Restoration Unit, and serve as restoration targets and objectives for each area.

In order to achieve the diversity and density targets applied to each restoration unit, a number of Restoration Templates were developed which included the plant species and quantities required to meet the targets. Restoration Templates include a range and diversity of species that may occur along a continuum of overlapping Reference Model community types. Therefore, each Restoration Unit was assured a minimum diversity and density of plant material, while allowing for a number of possible ecological communities (i.e. Reference Models) to develop over a long-term successional trajectory. Specific Reference Models and Restoration Templates are described in the RHVP Ecological Restoration Plan (Kayanase 2006).

Summaries of profiled areas are provided in Appendix 1, including an overview of site history, restoration works undertaken and key findings from monitoring work.

1.1.1.4. ADDITIONAL TERRESTRIAL MONITORING

Invasive Exotic Species (IES) Surveys (2009)

Following submission of the 2008 annual monitoring report, the City of Hamilton requested that D&A develop more detailed mapping of the extent of invasive exotic species (IES) along the riparian zone, to assist in the direction to be given to their restoration contractor. Field assessments and discussion with City and D&A staff familiar with the new creek channel and its landscaping were undertaken in the spring of 2009. A field protocol supported by GIS mapping was developed and applied.

The study area for the assessment of Invasive Exotic Species (IES) included the riparian zone of the lower Red Hill Creek, with some additional adjacent areas of concern. Using the framework provided by the existing creek transects, the riparian zone was split into 36 transect units (labelled according to the corresponding transect) approximately 250m in length, with five 50 m long IES sub-units within each on either side of the creek. Each IES sub-unit was field assessed by botanists to determine the presence and extent of IES, along with additional data used to estimate the successional stage of each IES sub-unit.

The IES data was compiled and analyzed to provide an overall value and condition for each IES sub-unit, then prioritized sub-units for intervention to manage invasive exotic species. Furthermore, the data identified which type(s) of IES are prevalent (grasses, clovers/vetches, trees/shrubs/ other herbs), and summarized additional abiotic factors affecting the establishment of native species (e.g. prevalence of bare soil, shade). The information was summarized, and mapped using GIS onto aerial photos.

Free-to-grow Monitoring (2012)

In 2009 and 2011 Kayanase conducted plot-based free-to-grow surveys in-pre-selected restoration polygons. The objective of these surveys was to identify restoration areas that were 'free-to-grow', i.e. areas that had a viable woody stem density/ha that met target densities outlined by Kayanase and the City of Hamilton. Once designated as 'free-to-grow', an area is considered capable of self-regeneration and thus does not require further restoration effort.

In 2012, Dougan & Associates was retained by the City of Hamilton to resample ten percent of the 'free-to-grow' plots sampled in 2011 (12 plots). The purpose of this resample was to produce a third-party verification of the free-to-grow results obtained in 2011, based on the exact methodology employed by Kayanase in their surveys. A separate report on findings was submitted to the City in 2012.

2. MAJOR FINDINGS

2.1.1. DFOCOA

Riparian Vegetation

Photos of each vegetation sampling transect were taken annually from approximately the same distance and aspect as those taken in 2008. This proved difficult due to bank erosion, and in some cases the line of sight was obscured by vegetation growth during the latter years of monitoring. However, the photos demonstrate substantial growth and transitioning of vegetation, in particular woody vegetation, along reaches of the creek, as well as changes in the composition of herbaceous vegetation. These photos also provide a visual record to track areas where the creek bank eroded or the channel migrated over the monitoring period. This provides useful information when evaluating quantitative monitoring parameters. Photographs documenting each year for two transects are shown in Figure 3 below.

The total number of vascular plant species observed in the immediate riparian zone between 2008 and 2012 totaled 311, of which 176 (56.6%) were native species, and 135 (43.4%) were considered exotic (Table 2). This percentage of native species was comparable to the average of ~56% observed across all years. The addition of new species observed between 2008 and 2012 was steady, increasing by approximately 25 species per year between 2009 and 2012, with the overall increase in the final year (2012) being primarily due to new records of native species. This finding suggests that species richness within the riparian zone was adequately captured given the timeframe for monitoring and the extent to which we sampled. The continued observation in increased native species richness successional changes in the riparian community.

Goodban (1996) listed 287 species occurring within riverine (2 species), marsh or meadow marsh (78 species), and deciduous floodplain woodland habitats (249 species) within the Red Hill Valley from surveys conducted in 1995 and earlier (Table 2). Some species occurred within multiple habitat types. This list was comprised of 221 (77%) native species, which is higher than the 56% we observed in the immediate

area of the new creek. Both marsh and floodplain woodland habitats were dominated by native species, at 82% and 76%, respectively. The Goodban (1996) list included 129 native species and 26 exotic species not observed during our monitoring, whereas we observed 84 native species and 95 exotic species that were not listed in Goodban (1996). The two lists have 130 species in common, including 90 native and 40 exotic species.

Figure 3. Photo monitoring images for transects 15 (left) and transect 19 (right) from 2008 – 2012.

In terms of site-level floristic quality, the vascular plant list reported by Goodban (1996) had an FQI of 53.96, whereas our list value was 47.71.This 6 point difference was due to a higher richness of native species recorded in the Goodban study (221 vs. 176). We observed a slightly higher average coefficient of conservatism (3.63 vs. 3.58), suggesting a slightly higher affinity of species for specific natural habitats (Oldham et al. 1995); however, this difference nominal. Furthermore, the FQI does not take into account exotic species, which have apparently increased over historical conditions.

Table 2. Comparison of species richness by growth form and native status, and Floristic Quality, between surveys conducted by Goodban (1996) and D&A (2008-2012) for Riverine, Meadow Marsh, and Deciduous Floodplain Forest Habitats within the Red Hill Valley.

Origin	Dougan	Goodban	Species in Common to Both Studies
Native Species	176	221	90
Exotic Species	135	66	40
Total Species	311	287	130
Floristic Quality Assessment			
Sum Coefficient of Conservatism (CC)	633	791	-
Average (CC)	3.60	3.58	-
Floristic Quality Index (FQI)	47.71	53.96	-
Growth Form			
Ferns	1	7	1
Forbs	182	154	69
Grasses	34	24	13
Rushes	4	5	3
Sedges	19	24	9
Shrubs	34	38	19
Trees	24	26	11
Herbaceous Vines	9	4	2
Woody Vines	4	5	4

In terms of growth forms, both lists are dominated by forbs (i.e. broad-leaved herbaceous flowering plants). We documented more forbs, grasses, and herbaceous vines than Goodban (1996); however, his study documented a higher richness of ferns, rushes, sedges, shrubs, trees, and woody vines which is not surprising given the focus of our monitoring (immediate creekside environment) vs Goodban's broader habitat coverage.

The overall richness of native species was higher within the riparian habitats of the Red Hill Creek historically (pre 1996) than detected in the post-construction monitoring of the Red Hill Expressway (2008-2012).These findings do not imply a loss of some native species (i.e.129 native species reported by Goodban were not encountered during our monitoring), or the introduction of new exotic species not previously recorded (95 species). Rather, the habitat in the immediate vicinity of the reconstructed channel is in a younger successional state than the historic Red Hill Creek, and it is expected that more disturbance-tolerant and early-successional species, which are typically exotic, would be more frequently encountered during our monitoring. D&A monitoring was focused on the immediate riparian zone of the reconstructed channel (Figure 1), whereas Goodban (1996) encompassed more extensive habitat areas within the valley. The Goodban (1996) data also included previous observations from historic data sources, reported between 1976 and 1995. As a result, the coverage in Goodban (1996) was more comprehensive in terms of habitat coverage, which would increase the number of species observed.

Variation in mean overall species richness at the plot level was not significantly different between years for 'even' or 'odd' numbered transects. Species richness was highest in 2009 (even) and 2010 (odd), and lowest in the final sampling year (2012) for both sets of transects. The results for native species richness were consistent with these findings, with a decline in richness over the 5-year monitoring period, but these changes were relatively minor and more likely reflect temporal variation in patterns of succession rather than long-term trends. These trends reflect literature findings for old field succession over time (Prach et al, 2007). It should be noted that most areas of the Red Hill Creek Valley, including the Escarpment / King's Forest area as well as the

downstream floodplain and many valley slope areas, were affected at various times since settlement by clearing, intensive agriculture, monoculture plantations, land filling, utility corridors, and infrastructure works. In essence the valley ecosystem has been in a perpetual recovery mode. The restoration of flooding and natural channel functions due to the creek reconstruction, and restoration works (including plantings by Kayanese of more than 240 native species) have long term implications for species richness that extend well beyond the 5-year timeframe of this monitoring program.

In terms of spatial patterns, variation in species richness was higher among plots nested within transects than among transects, regardless of the year or subset of transects analyzed (i.e. odd or even numbered transects). This implies that processes occurring at the local scale (e.g. environmental variation within individual transects) were more influential on species richness than differences among transects (e.g environmental variation among creek reaches). We found that in some years, species richness was slightly higher for plots farthest from the creek (i.e. top of bank) than those closest, though this relationship was not statistically significant. Disturbance processes, such as erosion and deposition, play a strong role in limiting species richness along the creek banks by constraining vegetation establishment, or removing fragile-rooted cover (e.g. Figures 4 and 5). The Red Hill Creek experiences strong storm event flows due to the urbanized watershed and presence of steep gradients just below the Escarpment, resulting in localized reaches where active erosion and deposition are accentuated. Significant flow events occurred in 2009 and 2012 that exceeded the 100 year event in magnitude, resulting in overbank flooding and bank scouring in the upper reaches.

Figure 4. Extensive erosion of the creek channel and embankment following the flood on July 29th, 2009. King's Forest between transects 2 and 3.

Figure 6 shows standardized values for the 3-year average of species richness, proportion of native species, FQI, Shannon Diversity Index, and ground cover at each transect along the creek. Values above 0 are above the average observed for the whole site, and values below 0 are below average. The 'cubic splines' (smoothed lines) show longitudinal patterns for each metric based on predicted values. The proportion of native species, ground cover, and the proportion of native species each increased along the length of the creek, whereas FQI, Species Richness, and the Shannon Diversity Index were each lowest across specific reaches of the creek. Below-average FQI values coincide with transects that either had few native species, or had native species with low Coefficients of Conservatism (i.e. "weedier" species). For instance, the lowest FQI observed was between transects 5 -7, located within the King's Forest Golf Course. Riparian plantings were limited in this area, particularly of woody species (Figure 5). As a result, non-native species have persisted, with lower opportunity for recruitment or establishment of native species, thus depressing the FQI below average. This area is

also more affected by major flow events than down-stream reaches, as indicated by below-average ground-cover, inhibiting the establishment of a native-dominant riparian vegetation community (Figure 5).

Transects 32-35 were also lower in terms of species richness and Shannon diversity, though they maintained a high proportion of native species, ground cover, and FQI. This pattern is expected through this section of the creek as these transects are located largely within riparian wetlands, including the Red Hill Marsh (transect 32) and riparian fringe wetlands downstream (transects 33-37), and are dominated by relative monocultures of native species such as Cattails (*Typha latifolia* and *T. angustifolia*), water smartweed (*Polygonum amphibium*), Bugleweeds (*Lycopus sp*), Reed Canary Grass (*Phalaris arundinacea*), and Softstem Bulrush (*Schoenoplectus tabernaemontani*).

Figure 5. Red Hill Creek post-flood event on August 9th, 2012 showing extensive scouring of the channel bank and loss of vegetation in King's Forest Golf Course.

The average of all scores combined increased with transect number, indicating that overall riparian community quality increased from the

high-energy, more frequently disturbed reaches of the upper Red Hill Creek, to the lower-energy, more stable reaches of the lower Creek. Though individual transects results are highly variable, transects 1-13 are generally below-average in terms of species richness, native dominance, FQI, Shannon diversity, and ground cover, whereas transects 14-37 are at or slightly above-average. These patterns are likely due to the increased vulnerability of the upper channel reaches to channel disturbances, in particular through and above the golf course (Annable et al. 2012, Figure 5), as well as limitations on restoration efforts and less opportunity for natural recruitment of higher-quality native species.

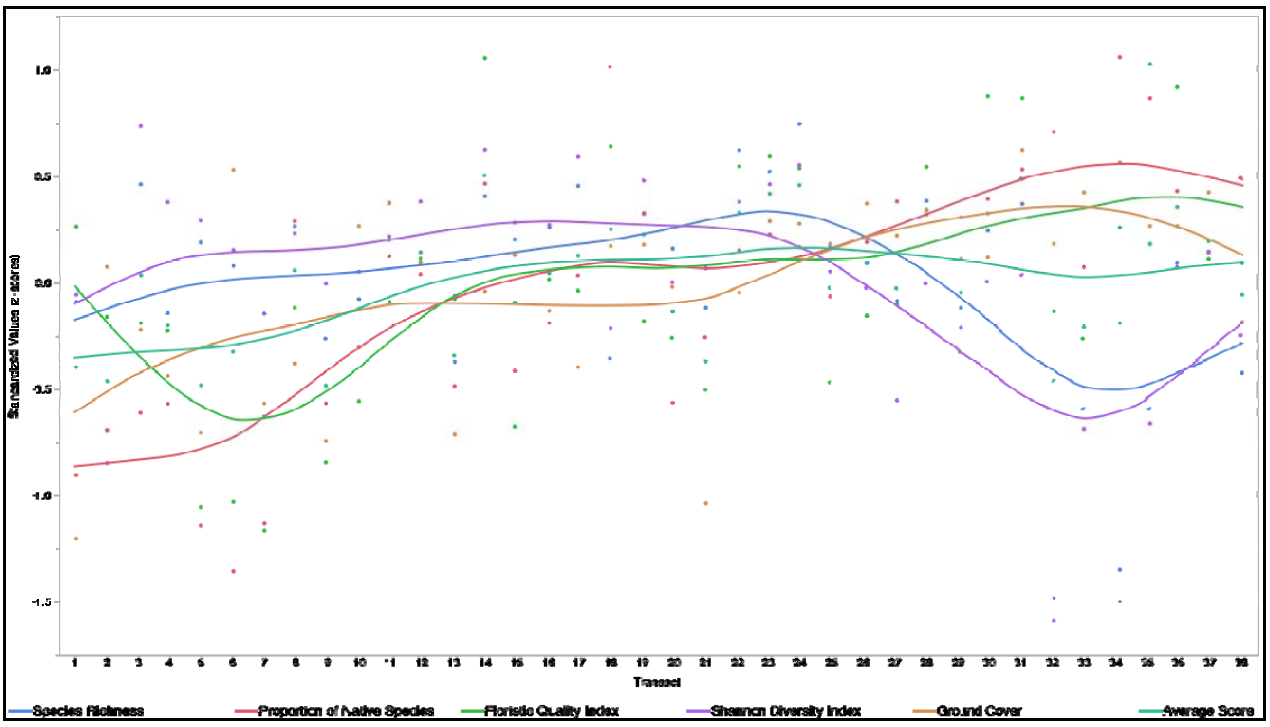


Figure 6. Standardized scores (z-score) for mean species richness, proportion of native species, FQI, Shannon Diversity Index, and Ground Cover by transect. Individual points are averages for each transect across 5 monitoring years.

In addition to the metrics discussed above (i.e. species richness, floristic quality, etc), the change in relative importance of the species observed is a good gauge of changes in community composition. Because relative importance incorporates species abundance in addition to presence/ absence, it can be more sensitive to community changes on shorter time-scales. Furthermore, it identifies which specific species are

important, or are changing in importance through time. As shown in Table 3, we observed an increase in the cumulative importance of the top-20 ranked species between 2008 and 2012, with a slight decline in the years 2010 and 2011. The spike in relative importance in 2012 is due to an increase in the frequency and importance of exotic species, which was the highest for all of the monitoring years. The years 2009 and 2010, both the second round of monitoring for even and odd transects, showed the highest incidence of top-ranked native species and the highest cumulative importance for native species.

Table 3. Cumulative Relative Importance Values (RIV) for the top 20-ranked species in each monitoring year.

Year (group)	RIV of the top 10 species			Number of species	
	Total	Exotic	Native	Exotic	Native
2008 (all)	56.00	22.34	33.65	10	10
2009 (even)	56.14	13.60	42.54	6	14
2010 (odd)	55.64	12.10	43.53	6	14
2011 (even)	55.84	14.87	40.97	8	12
2012 (odd)	59.28	22.51	36.77	9	11

Wetland Compensation and Stormwater Pond Vegetation

The total number of vascular plant species observed in stormwater management ponds and wetland compensation areas from 2009 to 2012 was 247; not including those specimens identified only to genus (45). The percentage of native species observed over the monitoring period was 57%, and was consistent with each year of monitoring (min= 56.0% in 2011, max = 58.3% in 2010). This suggests that species richness within these features was stable across the 4 years of monitoring, with native species being slightly dominant over exotic species. For details regarding the conservation status and rarity of species recorded, please see Appendix F7 in the 2012 annual monitoring report.

The number of new species observed in ponds each year declined from 67 in 2010, to 44 in 2011, and 28 in 2012. Cumulative species richness across all features continued to increase with each year of sampling through to 2012. Therefore, our estimates of species richness at the site-level for stormwater management facilities and wetland compensation areas are likely conservative. Average species richness within ponds increased annually to 2011, then dropped significantly in 2012. This drop in average species richness was due to fewer native species primarily, though the number of exotic species also declined over the four monitoring years as well. Average FQI also decreased from 2009 (4.07) to 2012 (3.40), though annual changes were insignificant.

2.1.2. IADP

Ecological Land Classification (2010-2012)

Vegetation community mapping was updated over the five year monitoring period for the Red Hill Creek Valley Study Area and for selected areas in the Red Hill Creek watershed in 2012, to determine the extent to which land cover had changed between the 1997 Watershed Study and 2012 conditions. This work was primarily scoped to focus on wetlands and areas transitioning to wetland ecotypes in the Valley, either due to natural succession or restoration work. The original cover mapping was prepared prior to the adoption of the MNR's Ecological Land Classification system (introduced in 1998) and was reliant in part on vegetation cover mapping contained in the 1995 Red Hill Biological Inventory (HFN 1995) which was adopted for the Parkway planning and design studies (including the 2003 Final Impact Assessment Report – Terrestrial Resources) since it was the most current available information.

The most significant changes in the Red Hill Creek Watershed between 1997 and 2012 were in aquatic ELC cover types (OAO, SAF, and SAS), which increased from approximately 4.62ha to 34.08ha (638% increase) and shoreline (BBO) communities. The increase in open aquatic

communities was due to specific wetland creation projects (Comp1 and Comp2, and new wetland in the vicinity of the Escarpment Viaduct), the construction of numerous stormwater management facilities within the Valley and in the upper watershed, and conversion of several sections of the former creek to stormwater management functions.

Agricultural (AGR) and successional (BLO, CUM, CUT, and HR) communities decreased in area between 1997 and 2012. Agricultural lands have undergone urban development above the Escarpment, which has contributed to this change. Successional communities also decreased over this time period by 50ha (-7% of 1997 area), which is explained in part by increases in anthropogenic woodlands (32.92ha to 119.78ha) and anthropogenic open space (481.37ha to 572.36ha). There was a slight net increase of natural woodlands and forest (0.34ha; 0.09%) between 1997 and 2012, despite continuing development within the watershed. The distinction of successional communities under the ELC is also more refined than was the case using the pre-ELC 1995 mapping.

Prior to construction of the Parkway in 2003, wetland vegetation communities were estimated at 13.28 ha of the Parkway Study Area shown on Figure 1, while aquatic communities occupied 19.02 ha. Wetland communities were more extensive prior to the urbanization of the Red Hill Creek Watershed; Snell (1987) estimated that there was 76.4% wetland loss in Hamilton-Wentworth since settlement; as of 1997 wetland cover constituted only 0.3% of the Red Hill Creek Watershed. The total estimated area of wetland cover within the Red Hill Creek watershed as of 2012 was 61.05 hectares.

The Terrestrial Resources IADP Report (Dougan & Associates, 2003) was based on preliminary design of the Parkway, Creek and QEW works, and predicted a 5.04ha loss of wetlands (3.3ha in Study Area 1, Mud Street Interchange to the CNR; and 1.74ha in Study Area 2, CNR to the QEW). At the time of the detailed design in 2005, the estimated loss of wetlands within the project study area (including fish habitat) had increased to 5.22 ha (estimate on file with Dougan & Associates, 2005). Based on the recommended minimum 2:1 replaced ratio identified in the

IADP, this would require the creation of 10.45 ha of new wetland through the construction of stormwater management facilities (wet ponds, wetlands, and grass swales), regular floodplain inundation through the restoration of natural channel processes, and conversion of the abandoned channel sections into wetlands.

Based on cover mapping that was re-classified under ELC and progressively updated during the monitoring project, overall wetland cover in the Parkway Study Area increased from 20.32 ha pre construction, to 27.54 ha as of 2012. This gain in 7.22 ha includes 2.76 ha of open and shallow aquatic communities constituted by SWM facilities. The gain of new, non-SWM wetland within the Parkway Study Area was 4.47ha; functional enhancement works within the Red Hill Marsh treated a further 3.23 ha, considered equivalent to a 50% gain (1.62 ha – not included in total area gain) based on the 2005 estimates. Table 4 summarizes the relative gains and losses by ELC types.

In a separate project, approximately 11 ha of wetland was created within Windermere Basin between 2010 and 2012, providing a restored estuarine ecosystem with wildlife habitat and recreational trails within this highly industrialized area of the lower watershed. The restored basin includes three wetland zones across an aquatic-upland gradient with both terrestrial and aquatic habitat features for species such as Common Tern, Northern Pike, Large Mouth Bass, and White Sucker. The Windermere Basin project included a barrier to Common Carp, an introduced fish species that has constrained the spread of emergent marsh cover in Comp1 and Comp2, as well as in Enh5. This feature complements the restoration and enhancement works completed upstream in the Red Hill Marsh (Enh5), plus the Comp1/Comp2 wetland creation, thereby providing more overall habitat for wildlife, and improving connectivity of the riparian and wetland habitats along the lower Red Hill Creek, and to the Lake Ontario shoreline.

Factoring in the Windemere Basin works, the overall increase in wetland area (not including SWM facilities and Enh5 enhancement) has achieved 15.47 ha, compared to the 10.45 ha targeted in 2005. This represents a 76.17% increase in wetland cover within the Red hill Valley.

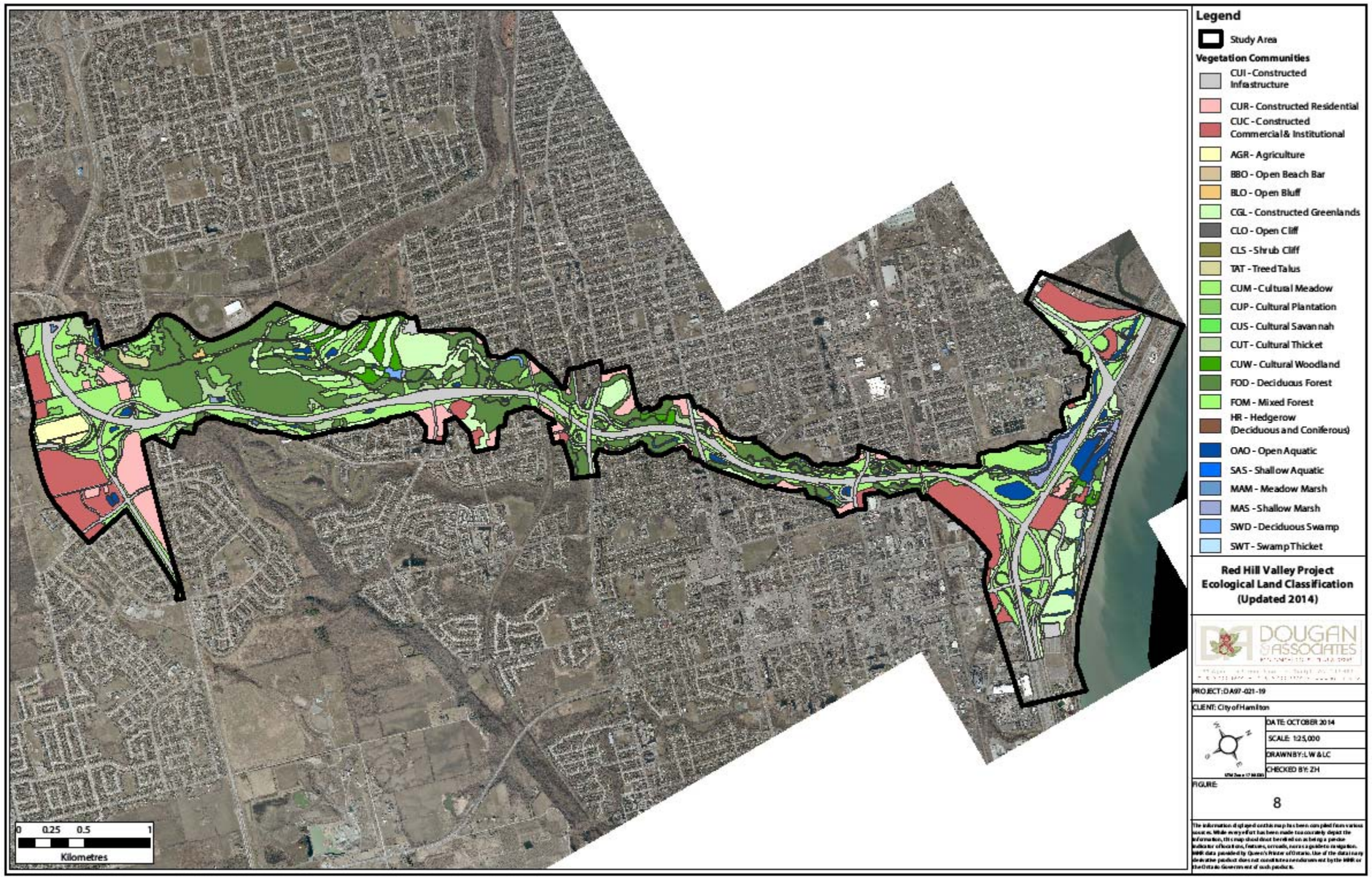
Table 4.Summary of change in vegetation cover types between 1997 and 2012 within the Parkway Study Area.

Wetland Type	ELC Code	2003		2012		Change in Area from 2003 to 2012	
		Area(ha)	%Cover*	Area(ha)	%Cover*	Area(ha)	% Change
Swamp Thicket	SWT	0.00	0.00	1.27	0.17	1.27	-
Deciduous Swamp	SWD	0.68	0.09	1.69	0.23	1.01	149
Meadow Marsh	MAM	2.65	0.36	2.7	0.36	0.05	2
Shallow Marsh	MAS	9.95	1.34	7.23	0.97	-2.72	-27
Open Aquatic	OAO	2.19	0.29	11.36	1.53	9.17	419
Shallow Aquatic	SAS	4.84	0.65	0.53	0.07	-4.31	-89
Total		**20.31**	**2.73%**	**24.78**	**3.33%**	**4.47**	**22%**
Other Features**							
Open Aquatic (SWM Ponds)	OAO	-	-	2.32	0.31	-	-
Shallow Aquatic (SWM Ponds)	SAS	-	-	0.44	0.06	-	-
Red Hill Marsh Enhancement (Enh5)	MAS	-	-	1.62	0.22	-	-
Total				**4.38**	**0.59**		

* Percentage of total estimated Parkway Study Area, calculated as 744.71 ha in the 2003 IADP, based on the 1997 Watershed Study mapping.
** Not included in wetland change total.

Figure 7. Shallow marsh developing within former floodplain forest near Rosedale Park following restoration. Photo taken July 4th 2014.

Figure 8. Ecological Land Classification for Red Hill Creek Project Study Area



Ecological Monitoring and Assessment Network Plots (2010)

A total of 92 vascular plant species were detected within the permanent vegetation plots (Figure 1) sampled in 2010, including specimens identified to genus only (8 in total). Of the total identified to species, 57 (67.9%) are native species, and 27 (32.1%) are considered exotic. No species of conservation concern were recorded.

In terms of total species richness, the plot containing the highest species diversity was Forest Plot 1, which is located on the Niagara Escarpment near Buttermilk Falls, while the lowest diversity plot was in Forest Plot 3. The total Floristic Quality Index (FQI) for these plots also ranged considerably, from 6.42 for Forest Plot #6 to 18.14 for Forest Plot #1. The transects established at Van Wagner's Beach showed a low FQI for the site, due primarily to a high proportion of exotic species (60%), which reflects the level of human disturbance in this area. The northern half of Van Wagner's Pond showed a high proportion of native species (88%) and a moderate FQI value (9.22), however, overall species richness was not high (17 species in total).

Wildlife

During the surveys conducted by Dougan & Associates in 2010, forty-two (42) species of birds were detected. Of these, 39 were considered as possibly breeding or on territory. Great Blue Heron, Black-crowned Night-Heron and Turkey Vulture were detected flying over the study area, but would not be considered breeding in the vicinity. Of the 39 breeding species, two are introduced (non-native): European Starling and House Sparrow. Eastern Wood-pewee is listed as Special Concern by COSSARO (COSSARO 2013) and COSEWIC (COSEWIC 2012), and Wood Thrush is listed by COSSARO as Special Concern (COSSARO 2013) and Threatened by COSEWIC (COSEWIC 2012). Of the remaining 35 species, none are designated as species at risk by COSEWIC or OMNR (COSEWIC 2014; OMNR 2009), and most are considered either common or abundant, and widespread, within the City of Hamilton (Curry 2003). The only exceptions are Wood Duck, Green Heron and Belted Kingfisher, which are considered uncommon and widespread within the City (Curry 2003).

At a regional level, six species – Belted Kingfisher, Northern Flicker, Eastern Wood-Pewee, Wood Thrush, Rose-breasted Grosbeak and Baltimore Oriole – have been designated by Partners in Flight as priority landbird species in BCR 13 (Lower Great Lakes/St. Lawrence Plain) (OPIF 2006); BCR 13, the Lower Great Lakes – St. Lawrence Plain, corresponds roughly with the area south of the Canadian Shield. Partners in Flight, from which the list of priority landbird species was obtained, is a coalition of government agencies and organizations led by Environment Canada Ontario Region (EC) and the Ontario Ministry of Natural Resources (OMNR), in partnership with Bird Studies Canada (BSC).

Figure 9. Red-tailed Hawk on a raptor perching pole on north side of the Red Hill Creek near transect 13. Photo taken June 3, 2011.

The highest level of breeding evidence obtained was fledged young seen of the following five species: American Robin, European Starling, Northern Cardinal, Song Sparrow and Common Grackle. The second highest level of breeding evidence was probable breeding, represented by territorial males, based on being present singing at the same location on both surveys, and pairs. This evidence was obtained for 15 species: Great Crested Flycatcher, Warbling Vireo, Red-eyed Vireo, Blue Jay,

Northern Rough-winged Swallow, House Wren, American Robin, Gray Catbird, Cedar Waxwing, Yellow Warbler, Song Sparrow, Northern Cardinal, Red-winged Blackbird, Baltimore Oriole and American Goldfinch. The next highest level of breeding evidence was possible breeding, represented by singing males; this evidence was obtained for 25 species. For details on the breeding bird surveys, please see Appendix F16 in the 2010 annual report.

Figure 10. Juvenile Black-crowned Night Heron utilizing riparian habitats along the lower Red Hill Creek. Photo taken April 4 2010.

Additional breeding bird monitoring was completed by URBAN in 2011 within close proximity to our B9 site (Figure 1), which is located near Rosedale Marsh. At this location, we detected the same number of individuals in 2010 as they did in 2011, however the average number per point count was lower for their surveys (Table 5).

Table 5. Comparison of breeding bird data collected by Dougan & Associates and URBAN at Station B9.

Indicator	D&A (2010) (1st/2nd survey)	URBAN (2011)
Total Number of Birds	16 / 14	16
Average Number of Birds per Point Count	15	8
Total Species Richness	8 / 10	5
% Wetland-Dependent	0	0

Four species of amphibians were detected during the three nocturnal amphibian surveys conducted in 2010: American Toad, Gray Treefrog, Green Frog and Northern Leopard Frog. All four species are considered abundant within the City of Hamilton (Lamond and Duncan 2003). Green Frog was the most widespread, detected at eight of the 12 point counts, while Northern Leopard Frog was the least widespread, detected at only three of the 12 point counts. Gray Treefrog and American Toad were detected at eight and seven of the 12 point counts, respectively. The only point counts to have all four species present were A9 and A12.

Amphibian surveys by URBAN were competed at 3 of the same locations sampled in 2010 RHVP monitoring, but in 2011 and 2013. These locations included A1 (Van Wagner's), A11 (Rosedale Marsh), and A5 (COMP 2; see Figure 1). At A1, URBAN detected only Gray Treefrog in 2011 and 2013 at moderate abundance, whereas we detected only Greenfrog at moderate abundance in 2010. At A11, URBAN detected two additional species (Wood Frog and Spring Peeper) in 2011 and 2013 than we did in 2010 (Gray Treefrog, Green Frog, and American Toad), increasing the species richness from 3 to 5 species at this site. However, abundance for all species was low across all years at this location. At station A5, URBAN observed

It should be noted that some of the point counts, especially those adjacent to the Queen Elizabeth Way (Q.E.W.) (A1, A2, A3, A4 and A5), were particularly noisy, even late at night. This may have affected both the species and number of individuals detected.

Additional wildlife species were noted incidentally during creek monitoring, including Milksnake (observed near transect 18 during the creek monitoring), Green Heron (foraging along marsh edges in Red Hill Marsh), Peregrine Falcon (nesting on a hydro wire structure near Van Wagner's Ponds), Red-tailed Hawk (Figure 9), and Black-crowned Night Heron (Figure 10).

Two McMaster University undergraduate students have done follow-up studies related to wildlife utilization of the Escarpment viaduct. Christina Huminski (2007) devoted her honours thesis project to a Fall 2006 wildlife assessment, focused on the 17 artificial trees constructed beneath the viaduct. While she was unable to demonstrate that Southern Flying Squirrels (SFS) were utilizing the structures, she found evidence of activity of dogs, deer and raccoons at 9 of the 17 structures, and postulated that SFS might be avoiding the structures due to lack of vegetation cover. Subsequently City of Hamilton staff consulted with other SFS researchers and added cross-beams with protective plastic tubes to provide more cover for SFS that could be using the structures, as they are cavity-users and actively avoid exposure to nocturnal predators such as owls and raccoons. On March 12, 2012, the Hamilton Spectator published an interview with another McMaster biology student, Ashley Cantwell, who had documented suspected SFS using the structures, using an infrared automatic camera. In preparation for this Executive Summary report, we contacted Dr. Pat Chow-Fraser at McMaster, who indicated that other than the work by URBAN (see above), no further monitoring studies have been completed on the SFS or other wildlife.

2.1.3. LANDSCAPE MANAGEMENT PLAN

Restoration Activities

No annual report of Kayanase restoration activities was provided to Dougan & Associates by the City beyond the 2009 monitoring season. We reviewed the Kayanase stock and planting records provided to date by the City of Hamilton to provide this brief summary.

Based on GIS data provided by the City of Hamilton, the total treatment area within the Red Hill Valley Project was 100 hectares, and involved 305 distinct restoration units with an average size of 0.33ha (Figure 11; Table 6). The areas restored extend from the Lincoln Alexander Parkway to the Lake Ontario Shoreline, and included early successional, thicket, and forested communities within escarpment, riparian, wetland, and shoreline environments. Nearly half of the areas restored were based on template 1; however, there is considerable overlap in target community types between each template. Table 6 provides a summary of each restoration template in terms of coverage and species richness.

Figure 11. Ecological Restoration Sites based on mapping by Kayanase from 2008 - 2012.

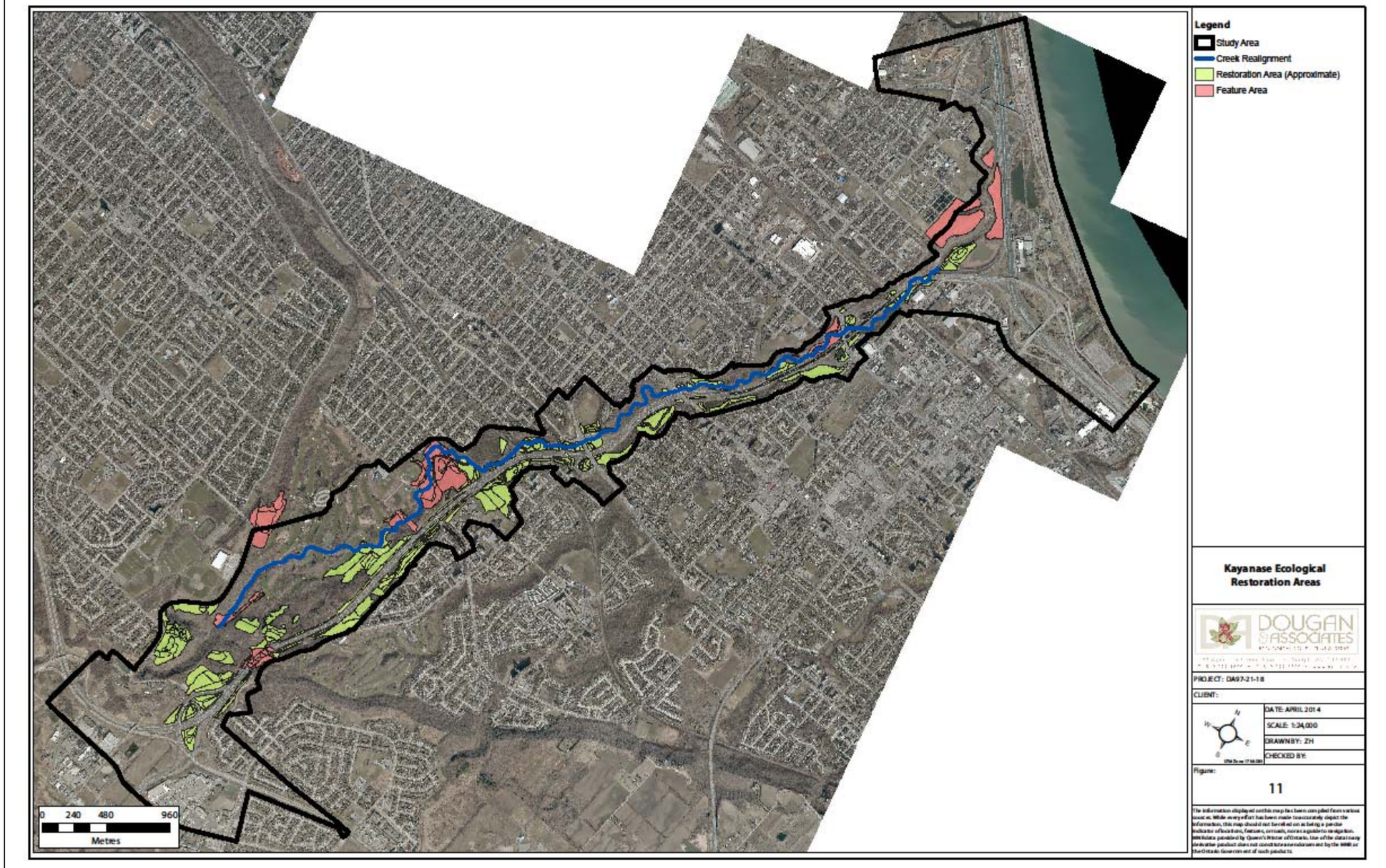


Table 6. Summary of Restored Areas within the Red Hill Valley, 2008 - 2012

Template	Target ELC Ecosite*	Total Area (ha)	Restoration Units (# of polygons)	Species Richness by Canopy (Trees, Shrubs, Herbaceous)
1	FOD2, FOD3, FOM2, FOM4, FOM5	46.57	104	Open: 22, 33, 42 Partial: 25, 43, 61 Closed: 10, 14, 18
2	FOD7, FOD8, FOD9, FOM5, SWM3	19.28	73	Open: 27, 28, 48 Partial: 31, 33, 75 Closed: 12, 13, 24
3	FOD1, FOD2, FOD3, FOM5	0.80	4	All: 5, 31, 7
4	CL, AL, TAS/TAT1	9.67	32	Open: 23, 34, 43 Partial: 23, 43, 69 Closed: 10, 13, 31
5	FOD2, FOD3, FOD9, FOM2, FOM4, FOM5	2.47	17	All: 16, 23, 62
6	NA	0.55	1	NA
NPS	NA	6.31	26	NA
Special Case	e.g. Baltimore Fen	13.52	44	9, 11, 31
TB	NA	0.87	4	NA
Total		100.03	305	See text for full summary

* FOD1 - Dry-fresh Red Oak Deciduous Forest, FOD2 - Dry-Fresh Oak Maple Hickory Deciduous Forest, FOD3 - Dry-Fresh Poplar-White Birch Deciduous Forest, FOD7 - Fresh-Moist Lowland Deciduous Forest, FOD8 - Fresh-Moist Poplar Deciduous Forest, FOD9 - Fresh-Moist Oak-Maple-Hickory Deciduous Forest, FOM2 - Dry-Fresh White Pine-Maple-Oak Mixed forest, FOM3 - Dry-Fresh Hardwood-Hemlock Mixed Forest, FOM4 - Dry-Fresh White Cedar Mixed Forest, FOM5 - Dry - Fresh White Birch-Poplar-Conifer Mixed Forest, FOM7 - Fresh-Moist White Cedar-Hardwood Mixed Forest, SWM3 - Birch-Poplar Mineral Mixed Swamp, SWD1 - Oak Mineral Deciduous Swamp, CL/AL - Carbonate Cliff Rim and/or Alvar, TAS/TAT1 - Shrub Talus and/or Treed Talus

From 2007 to 2012, 242 locally sourced native species were seeded or planted by Kayanase in restoration areas within the Red Hill Valley (Figure 5). Among these species, 60 families were represented, with the most species-rich groups being the asters (Asteraceae; 33 species), the rose family (Rosaceae; 23 species), and the sedge family (Cyperaceae; 20 species). Within these families, 129 genera of plants were represented with the most species-rich being the sedges (Carex; 17 species). Forbs

were the most common growth form represented, with 112 (46%) species, followed by 41 shrubs species and 40 tree species. Grasses, sedges, rushes, ferns, and woody and herbaceous vines were also widely planted. During riparian vegetation monitoring, we encountered 75 of the 242 (31%) species planted.

Invasive Exotic Species (IES) Surveys (2009)

The conditions determined for each IES sub-unit were mapped by D&A, along with species of particular concern, and accompanied the 2010 annual report. As of the 2009, most (88.7%) of the areas surveyed in the riparian zone of the Red Hill Creek had moderate to high levels of invasive exotic species according to our rating system. A small number of areas had healthy, native dominated cover, or required further monitoring due to their early successional stage. The most problematic species included Common Reed (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Crown Vetch (*Coronilla varia*), Sweet Clovers (Melilotus spp.), Manitoba Maple (*Acer negundo*), Tatarian Honeysuckle (*Lonicera tatarica*), Common Buckthorn (*Rhamnus cathartica*), Black Locust (*Robinia pseudo-acacia*), exotic Willows (Salix spp.), Garlic Mustard (*Alliaria petiolata*), and Dames Rocket (*Hesperis matronalis*). A complete list of problematic species was provided to the City of Hamilton, along with mapping of the riparian zone along the Red Hill Creek with ratings based on the severity of infestation. As a result of this work, many of the most problematic species and areas were subsequently treated during restoration works by Kayanase. Despite this, many invasive species persist, in particular exotic grasses and shrubs.

Free-to-grow Monitoring (2012)

Our resampling of the 'free-to-grow' plots was completed on May 17th, 24th and 30th, 2012. We found that, of the 12 plots resurveyed 2012, 11 exceeded the Kayanase estimates for stem density (stems/m^2) taken in 2011, confirming their status as 'free-to-grow' according to the density criteria. Though our estimate was lower than Kayanase's for the remaining plot, all were above the threshold for 'free-to-grow' status.

3. LESSONS LEARNED

This executive summary outlines the methods and key findings from 5 years of monitoring terrestrial ecology. Here, we discuss the primary outcomes and lessons learned as a result of this monitoring work as well as the overall RHVP implementation.

Project Level Learning

The Red Hill Valley Project brought many innovations to the planning and implementation for a major regional highway project. These included:

- Completion of the 1997 Watershed study to guide preliminary design; this produced a comprehensive Action Plan from public and interdisciplinary consultations and resulted in significant design changes for the Parkway and associated infrastructure works;
- The IADP provided a detailed focus on ecological issues such as significant habitats and species, wildlife corridors, regional bird migration, road noise, road salt, and identification of ecological restoration opportunities; it also identified precedent-setting targets for wetland and general habitat compensation on a watershed basis, and prescribed monitoring at both project and watershed scales;
- The RHVP Landscape Management Plan paralleled the IADP process and effectively combined Parkway and creek construction with a range of landscape restoration initiatives that addressed Watershed Action Plan and mitigation principles and objectives, encompassing many areas such as landfill re-use, trails, and wetland impact mitigation.
- The Detailed Design of the Parkway and QEW works, CSO, stormwater management systems, landfill re-use and trail system works, all built upon previous experience (i.e. Lincoln Alexander Parkway landscape performance, Dartnall Road Interchange) and integrated IADP and LMP principles and objectives, allowing testing and improving a variety of innovative approaches for

environmental protection and management, construction, and impact mitigation.
- The negotiation and assignment of Kayanase's ecological restoration role in the project was pivotal to the initiation of numerous site-specific and science-based approaches, with more than 300 polygons treated, representing the targeted 100 ha of works to compensate for Parkway and Creek relocation works. Kayanese has continued to be a leading practitioner in habitat restoration in southern Ontario;
- The strategy of separating the major terrestrial mitigation efforts from the Parkway construction was a success in allowing enough time (5 years) to implement and follow up on a variety of measures (such as invasive species management and custom native species propagation and planting) which will continue to provide benefits as the restored communities undergo succession and proliferation;
- The City's engagement of an Environmental Coordinator enabled efficiencies, integration for synergies with other City projects, and follow-up between numerous construction and mitigation activities.

Terrestrial Monitoring Program Learning

The terrestrial monitoring work completed within the Red Hill Valley, in particular along the riparian zone of the reconstructed creek, provided an opportunity to observe ecological changes within a naturalized urban system. The primary findings from this work include:

- The riparian monitoring and underlying planting and restoration works achieved the terrestrial goals of the DFO Authorization. The Cumulative Relative Importance Values (Table 3) indicate that native (indigenous) species dominated the immediate riparian zone when monitoring was initiated in 2008, and this dominance was maintained up to the end of monitoring in 2012.
- In terms of spatial patterns, we observed increased native species presence, floristic quality, and ground cover from transect 1 (upper Red Hill Creek) to transect 37 (lower Red Hill Creek). However, there was significant variation within and between transects in each of these metrics. This indicates spatial patterns in community composition at multiple scales (i.e. the watershed, reach, and creek

bank). Species richness and Shannon Diversity Index were relatively stable along the length of the creek, but decreased through specific reaches along the lower creek due to relatively stable conditions and resultant lower environmental heterogeneity.

- Minor temporal changes in the structure and composition of the riparian vegetation community were observed between 2008 and 2012. We saw variation between years that likely reflects year-to-year environmental variation as much as successional changes in the riparian vegetation community. The monitoring time frame was relatively short, however, and represents primarily the early-successional stages of the various plant communities present. Declines in species richness in early successional communities may be expected ~5 years after disturbance due to the establishment of long-lived perennials and competitive exclusion of early-colonizing species (Prach et al. 2007). However the flow dynamics of the creek are a factor which triggers more volatility of diversity in areas where more extreme flow effects are experienced. The continued availability of native plant propagules to re-populate disturbed bank areas is a key requirement to ensure a resilient native flora throughout the creek system; however, adequate riparian habitat that is unconstrained by conflicting landscape maintenance objectives (such as golf course and recreational playing field maintenance) is also essential to maintain sites that perpetuate the species that are more adapted to volatile conditions. Our findings suggest that the upper reaches would benefit from more extensive riparian habitat.
- Disturbances due to ongoing natural and anthropogenic factors are important factors influencing establishment of vegetation and the stability of vegetation communities within the riparian zone of the Red Hill Creek. Before the Parkway and creek construction, most of the valley had undergone significant disturbances since settlement. The flood events that occurred in 2009 and 2012 demonstrated the character of potential catastrophic flow events, and also highlighted areas most sensitive to these events, which are primarily in the upper valley. At smaller scales, human impacts such as the creation of informal trails and disposal of garbage (e.g. shopping carts) may be compromising the function of the constructed channel and extensive restoration works that have

been completed. Anecdotal evidence suggests that these trails have an impact on species richness and abundance through trampling and soil compaction, which may subject the creek bank to further erosion and degradation.

- Recurring flooding and creek bank erosion also posed technical challenges to monitoring, as many of the t-bars used to mark permanent vegetation transects were washed out. This made relocation of these plots difficult and time consuming. The changes to the creek bank morphology as a result of these events also resulted in the loss of several plots along the edge of the creek, which could not be resampled. Future monitoring of this kind should incorporate such unpredictability into the sampling design in such a way that these forms of disturbances are accounted for as both technical factors and causal processes.
- Stormwater management facilities were consistently native-dominant (57%) across the 4 years of monitoring, but varied from year-to-year in composition. Based on species accumulation, our estimate of site-level species richness is likely low. Because these facilities function to store water and regulate hydrology within the RHV, the environment within these ponds (e.g. water level, nutrients) likely changes annually based on factors such as precipitation. As a result, species composition will shift annually as opportunities for colonization are presented during dry years where water levels are low, or limited during wet years by high-water levels.
- Restoration work completed by Kayanase has resulted in the creation and enhancement of approximately 100ha of upland, riparian, and wetland habitats within the Red Hill Valley. This work involved site preparation (i.e. soil amendments, invasive species removal, and enhancement of topography), planting and seeding, and free-to-grow monitoring. The 242 native species used were taxonomically and functionally diverse, and were sourced from within xxkms of the Red Hill Valley to ensure that locally-adapted genotypes were represented. We detected 31% of these species while monitoring riparian areas of the Red Hill Creek.
- The targeted 2:1 wetland gain within the RHVhas been exceeded, including RHVP works and the Windemere Basin wetland creation,

with a total gain of 15.47 ha. Watershed wetland cover now is 39.59ha, compared to 22.83ha in 1997.

- Wetland succession has been impeded by impacts from Common Carp. The potential to restrict access for this introduced species was first attempted in Cootes Paradise and its exclusion was determined to be very beneficial to wetland diversity. The wetland creation completed in Windemere Basin in 2011 has also applied a carp barrier. In the lower Red Hill Valley there are several key opportunities for carp exclusion; in particular Comp1 and Comp2, new back channels created within Enh5 (Red Hill Marsh), and the north Van Wagner's Pond along with connecting waterways would all benefit from carp elimination.

3.1. CONCLUSIONS AND RECOMMENDATIONS

Based on the findings from this study, we offer the following conclusions and recommendations relating to ongoing biological monitoring at the site:

1. High-disturbance areas of the RHC (i.e. upper reaches) would benefit from further restoration work focused on providing greater bank stability and enhanced vegetation cover along the creek bank, which would aid in mitigating the effects of flooding and erosion. This would also promote the diversity and resilience of native species within these areas, increase connectivity between escarpment habitats and the lower reaches, and increase the overall quality of the riparian vegetation community.
2. Future monitoring at 5-10 year intervals is recommended to evaluate long-term changes within the riparian zone of the Red Hill Creek, and to better understand the success of the restoration efforts on a more ecologically meaningful time scale.
3. Invasive plant species are prevalent within the Red Hill Valley and were documented during this monitoring project; these include Common Buckthorn (*Rhamnus cathartica*), Garlic Mustard (*Alliaria petiolata*), Black Locust (*Robinia pseudoacacia*) and Common Reed (*Phragmites australis*) which were targeted by specific management

during the implementation of the Landscape Management Plan. In order to ensure the long-term ecological integrity of the Red Hill Valley, surveys for invasive or otherwise problematic species should be conducted as part of future monitoring to ensure that established populations and new introductions of these species are managed appropriately, and that action can be taken to eradicate or prevent their spread.

4. The wetland enhancement area within Red Hill Marsh (ENH5) should be further monitored to ensure that native plant species persist and continue to establish, as only two years of monitoring have been completed to date. Particular focus should be paid to invasive species such as Reed Meadowgrass (*Glyceria maxima*), which currently occupies a substantial area within the marsh, and Common Reed (*Phragmites australis ssp. australis*). Documenting and preventing the spread of these and other exotic invasive species will help ensure that the flora of Red Hill Marsh is predominantly of native species.
5. Monitoring of wildlife habitats would be valuable to assess the various created habitats and built initiatives (such as QEW culvert) to be evaluated to determine their effectiveness in supporting local wildlife populations and habitat functions. City staff had originally contemplated that university and college partners could become engaged in more extended wildlife monitoring. Currently, the Urban-Rural Biomonitoring & Assessment Network (URBAN) has engaged community volunteers to continue monitoring amphibians and birds in wetlands within the RHV; however, these are limited in extent (i.e. number of monitoring locations) and have not obtained yearly data at each station. Our own findings suggest that not all species have been detected, and that road noise at some locations may inhibit detection. Additional locations in less noisy environments would be beneficial.
6. No conclusive research has been conducted indicating the effectiveness of the escarpment viaduct as a wildlife movement corridor for the population of Southern Flying Squirrels (*Glaucomys volans*) that was documented between 1999 and 2001; this remains a key knowledge gap. Turtle population status within the Red Hill Marsh and Van Wagner's Ponds, as well as habitat enhancement areas, should also be updated.

7. Common Carp is prevalent within the lower Red Hill Creek and connected habitats. This species poses a direct threat to native fish and wildlife species, water quality in wetlands, and ecosystem functions, by disturbing sediments and uprooting aquatic vegetation (Hill, 1999). As a result, attempts to control Common Carp populations should be undertaken, as has been done in Windermere Basin and Cootes Paradise.
8. The permanent vegetation plots established in 2010 were intended to document the native vegetation communities found within the Red Hill Creek Valley. The results indicate moderate to high levels of diversity and floristic quality in plots located in low disturbance areas, such as the Niagara Escarpment, in contrast to areas such as Van Wagner's Beach that showed relatively low native species diversity and floristic quality, and which are subject to higher levels of human disturbance. These plots do not provide a comprehensive documentation of the plant diversity found within these vegetation communities, as they covered only a relatively small area. However; they will serve as an effective means of tracking changes in these vegetation communities over time if monitoring is repeated at regular intervals, such as on a 5-10 year cycle.
9. Our findings indicate that wetland cover has increased by 15.47 ha within the Red Hill Valley since 2003, most of which is the result of habitat enhancement and wetland restoration work. In order to track the progress of wetland and aquatic habitats within the watershed,
   ELC cover should be periodically updated, preferably as part of watershed updates or new project undertakings.
10. This report provides only a brief summary of ecological restoration work completed by Kayanase under the direction of City staff. A separate report would be valuable to address the full scope of this work.

4. REFERENCES

AMEC. 2010. Integrated Monitoring Plan Red Hill Valley Project 2010 Annual Report.

AMEC. 2012. Integrated Monitoring Plan Red Hill Valley Project 2012 Annual Report.

Goodban, A.G. 1996. The Vegetation and Flora of the Red Hill Valley and Environs. In: Hamilton Naturalists' Club. 1996. (ed.). Biological Inventory of the Red Hill Valley: 1995. Prepared for the Hamilton Region Conservation Authority, Ancaster, Ontario. 235 pp.

Hamilton Naturalists' Club. 1996. (ed.). Biological Inventory of the Red Hill Valley: 1995. Prepared for the Hamilton Region Conservation Authority, Ancaster, Ontario. 235 pp.

Hill, K.R. 1999. Evaluation of the impact of common carp on an intensively managed largemouth bass, channel catfish, and panfish fishery. Federal aid to fish restoration completion report: small reservoir investigations, project no. F-160-R. Iowa Department of Natural Resources.

JMP,Version 11.00, SAS Institute Inc, Cary, NC, 1989-2007.

Prach, K., Leps., J., Rejmanek, M. Old Field Succession in Central Europe: Local and Regional Patterns. In: Cramer, V.A., Hobbs, R.J. (eds). 2007. Old Fields: Dynamics and Restoration of Abandoned Farmland. Island Press, Washington. 334pp

Kayanase. 2006. Red Hill Valley Ecological Restoration Detailed Design Plan Report.

R Development Core Team. 2010. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Snell, EA, 1987, Wetland Distribution and Conversion in Southern Ontario. Working Paper No 48, ISBN 0-662-15077-5, Canada Land Use Monitoring Program, Inland Waters and Lands Directorate, Environment Canada, Ottawa.

SNEOG (Six Nations Economic Opportunities Group). 2006. Red Hill Valley Project Ecological Restoration and Landscaping Proposal. Prepared by Grand River Employment and Training Inc. (GRETI) for the City of Hamilton. March 2006. 73 pp + appendices.

The Red Hill Valley Project. Impact Assessment and Design Process. Summary Report. 2003. The City of Hamilton, Ontario. 144 pp.

	Red Hill Valley Project (RHVP) Integrated Environmental Monitoring Project (IMP) Recommendations	Lead Division/ Name	To be Implemented Yes/No/TBD	Comments from: (HW) Hamilton Water, (RT) Roads & Traffic, (PL) Development Planning, (PK) Parks Operations
Ground Water				
1	Existing groundwater monitoring wells should be left in place for any future more regional monitoring program. The Hamilton Conservation Authority (HCA) or other governmental agencies should be contacted to confirm whether they would be interested in taking over the monitoring of these wells, potentially as part of the Ontario Groundwater Monitoring Network.	Hamilton Water /Source Water Protection	TBD	(HW) Groundwater wells are managed by the Water & Wastewater Systems Planning Section of Hamilton Water. Info has been requested from consultant so that a budget impact of taking over the wells can be identified. There would be ongoing maintenance costs in addition to costs of future sampling & analysis. The depth, construction, condition, and location of these wells will need to be assessed by Systems Planning before an implementation decision can be made.
Surface Water				
2	The Davis Creek Flood Control Facility monitoring program, which commenced in 2014, should continue with the anticipation that the facility will become commissioned soon. The program is scheduled to last 5 years, consistent with the balance of the RHVP IMP monitoring activities.	Roads & Traffic	Yes	(RT) It is anticipated that the facility will be commissioned in 2019. Some materials that were stolen during construction will be reinstalled next year. This facility will be recognized by the Province as a dam structure. It will be operated per the requirements of the Province. After review of the scope of work required refurbishing the structure, an additional $300k for capital costs has been requested in 2019 Capital Budget. Original request was for $250k. Future operating costs of the structure will be identified once the operation and maintenance manual has been developed by the consultant

				preparing the design to refurbish the structure.
3	The City of Hamilton may wish to further monitor and assess localized flooding locations identified within this summary (as well as the 2010 Annual Monitoring Report), and consider the preliminary list of proposed remedial measures.	Roads & Traffic	Yes	(RT) Known flooding areas are actively monitored by the City. They are inspected before, during and after major storm events. The effort of this work is reflected in the current budget planning; no additional monies are required.
4	The City of Hamilton and the Ministry of Transportation (MTO) may wish to undertake a climate change assessment, to better understand the potential vulnerabilities along the RHVP, and develop appropriate resiliency plans.	Out of Scope	TBD	TBD This is an out of scope issue, there may be potential to include as part of liaison meetings between the City (Engineering) and MTO.
Water Quality				
5	The City of Hamilton should continue to monitor combined sewer overflow (CSO) discharges to the Red Hill Valley over time to verify the effectiveness of the Red Hill Valley Storage Pipe, and whether any additional measures are warranted.	Hamilton Water	Yes	(HW) This is done by Hamilton Water on a permanent basis to satisfy other operational and regulatory needs.
6	The City of Hamilton may wish to consider future continuous stormwater quality sampling of stormwater management facilities using an auto-sampler in order to better assess their performance. The City may also wish to consider further grab sampling or continuous sampling of Red Hill	Roads & Traffic	Yes	(RT) A plan to monitor the effectiveness of the City's stormwater management facilities is under development.

	Creek during wet weather events given the high observed contaminant levels. This monitoring effort could be used to determine which areas of the watershed have relatively higher contaminant level contributions, and, should be targeted for potential future remedial stormwater quality controls.			
7	The City of Hamilton should consider undertaking repeat bathymetric surveys of stormwater quality management facilities in the next 5 to 10 years to better assess sediment accumulation rates and forecast future clean-out scheduling.	Roads & Traffic	Yes	(RT) The City has implemented a (City-wide) plan to monitor sediment levels with City owned stormwater management facilities. It should be noted that 5 of 8 stormwater management facilities along the RHVP have been dredged of sediment (works performed in 2015). The tendered value of the work was $1.39 Million.
8	The City of Hamilton (and the MTO) should continue annual inspections of all stormwater management facilities in order to assess and proactively respond to any identified issues. The RHVP SWM Facility Operations and Maintenance Manual (to be completed later in 2015 by Amec Foster Wheeler) should assist in this regard.	Roads & Traffic	Yes	(RT) The City's SWM Pond Assets are inspected at least once a year by City Staff. Asset deficiencies are reported to the Capital Rehabilitation & Technical Operations Section for resolution.
H3	Testing for pharmaceuticals in the surface water, downstream of Municipal sewer overflows is recommended. Pharmaceuticals can negatively effecting fish and aquatic life.	Out of Scope	No	(HW) Stream quality monitoring is outside of Hamilton Water's mandate and scope of responsibility.

H4	Options to not introduce Municipal sewer water in the valley creeks should be studied.	Hamilton Water	Yes	(HW) This is already an objective of Hamilton Water on an ongoing basis. Introduction of wastewater overflows to the environment is reduced or avoided where feasible. Hamilton Water will continue its efforts to reduce discharges of sanitary sewer overflows to the environment through our existing infrastructure planning programs.
Creek Morphology				
9	The City of Hamilton may wish to continue monitoring erosion along the Red Hill Creek corridor and continue to assess the bank full meander migration of the channel over time. Recent channel works (2014/2015) within the King's Forest Golf Course in particular are recommended to be monitored for at least 5 years.	Roads & Traffic	Yes	(RT) Responsibility for ongoing City owned watercourse maintenance is being reviewed at the City. A visual review of all City owned watercourses was undertaken in 2016. Evidence of erosion, sedimentation, debris build-up was logged as part of this activity. Another visual watercourse review is scheduled for 2021 (5-Year cycle). (HW) Hamilton Water's mandate/scope in regard to erosion in natural channels needs clarification and additional budgetary resources.
10	Maintenance of the Red Hill Creek corridor will continue to be required, particularly after large magnitude flood events. The corridor should be viewed as part of the City's "natural infrastructure", with associated ongoing maintenance requirements.	Roads & Traffic	Yes	(RT) This recommendation is addressed in the comments provided under items 3 and 9 above.

11	The City of Hamilton and its partners (such as the Hamilton Conservation Authority) should continue efforts to clean up anthropogenic material within Red Hill Creek (such as shopping carts) through annual creek clean-up days. The City (and potentially the HCA) should likewise continue to monitor and remove any potential debris jams at culverts and other hydraulics structures.	Roads & Traffic	Yes	(RT) Any anthropogenic material noted in the inspection of the watercourse will be removed by the City. The City will continue to work with any partners in this regard. Debris jams at culverts and other structures will be removed by the City. Such debris may be identified through the watercourse or culvert inspection program or may be identified through the “hot spot” inspection prior to a major storm.
12	The ongoing erosion and sediment contribution upstream of the Buttermilk Falls tributary should be addressed in order to maintain downstream channel stability within Red Hill Creek. The rehabilitated channel reach was never designed to handle/receive the bed material load that is currently being generated by the upstream reach destabilized in the July 2009 flood. Measures should be taken to mitigate erosion in this reach and provide enhanced geotechnical slope stability.	Out of Scope	No	This type of work is not currently identified as part of any city mandate
H2	Testing and a management plan of areas where road salt is present in soil and surface water is recommended. Road salt can change the chemistry in surface water and can negatively affect fish and aquatic life downstream and in the lake.	Roads & Traffic	Yes	(RT) Winter de-icing material storage and loading/handling practices at our Operation Yards are addressed by our Council approved Salt Management Plan.

Fisheries				
13	The City of Hamilton, and affected regulatory agencies (Hamilton Conservation Authority, Ministry of Natural Resources and Forestry, Department of Fisheries and Oceans, Royal Botanical Gardens, Bay Area Restoration Council) may wish to consider transplanting suitable native stream fishes from other area watercourses, if a more diverse fish community in Red Hill Creek is desired. Further discussion would however be required on this subject.	Out of Scope	No	
14	The City of Hamilton and affected regulatory agencies should consider implementing carp control within the lower reaches of Red Hill Creek (as has been done in Windemere Basin). Key opportunities for carp exclusion exist in compensation wetlands Comp1 and Comp2, as well as new backwater channels created within ENH5 (Red Hill Marsh), and the north Van Wagner's Pond along with connecting waterways. Further discussion would again be required on this subject.	Out of Scope	No	
15	Benthic invertebrate sampling should be considered in the future, potentially within the next 5 years +\-, in order to assess potentially positive impacts of the Red Hill Valley Storage Pipe. This feature, which should reduce the number of combined	Out of scope	No	

	sewer overflow discharges to Red Hill Creek, did not begin operating until December 2011; as such the monitoring data (ending in 2012) would not reflect the benefit of implementing this feature.			
Terrestrial Ecology				
16	Future terrestrial ecology monitoring of the riparian zone is recommended at 5 to 10 year intervals in order to evaluate long-term changes. Additional restoration efforts for high disturbance areas of the riparian zone (i.e. upper reaches) would also be beneficial and should be considered.	Planning	Yes	(PL) Planning has completed biophysical inventories of Core Areas every 10 years. However, this program may not continue in the future. Planning does not have the staff required to conduct the inventories, and would require funding to hire a consultant to do the work. Could partner with McMaster students or organize citizen science program to gather data.
17	It is recommended that the City of Hamilton consider future monitoring and management of invasive species within the Red Hill Valley in order to eradicate them or prevent any further spread.	Parks	Yes	(PK) Planning and implementation to be reviewed, budget impacts anticipated.
18	It is recommended that the City of Hamilton undertake additional monitoring of the wetland enhancement areas (ENH5), given that only 2 years of data have been collected thus far.	Out of Scope	No	
19	It is recommended that turtle population status within the Red Hill Marsh and Van Wagner's Ponds, as well as habitat enhancement areas, be updated.	Out of Scope	No	

20	The City of Hamilton should consider undertaking repeat monitoring of permanent vegetation plots within the valley.	Out of Scope	No	NEC does EMAN monitoring plots on the escarpment.
21	The City of Hamilton should consider periodically updating Environmental Land Classification (ELC) cover databases as part of any future watershed updates or new projects.	Planning	Yes	(PL) Planning has updated its ELC on all core areas periodically (every 10 years). However, this program may not continue in the future. This recommendation refers to “future watershed updates of new projects”, so it does not appear to be referring to regular updates in any particular timeframe. This could therefore be the role of either Planning (Secondary plan) or Public Works (new infrastructure), depending on the “new project”.
22	The City of Hamilton should consider completing a separate stand-alone report to summarize and address the full scope of the restoration works undertaken by Kayanase.	Out of Scope	No	
H1	A follow-up Haudenosaunee Medicinal Plant survey is recommended.	Out of Scope	No	
H5	Request a copy of the proposed Kayanase restoration work report when completed.	Out of Scope	No	The City will continue to liaise with the Joint Stewardship Board regarding this recommendation through the Joint Stewardship Board (a stakeholder/partner group established during the design and construction of the Red Hill Valley Parkway).
H6	If not already considered, a study of the entomological world (Insects) in the affected valley areas should be undertaken.	Out of Scope	No	(PL) Planning periodically updates its species occurrence data in core areas, which includes dragonflies and damselflies, butterflies and moths, bees. However, this program may not continue in the future.
H7	All the recommendations presented in the 5-	See above	No	

	Year 2015 Summary report should be approved and implemented, as listed in Appendix A: Summary of Recommendations Supported by Haudenosaunee.			

Note: H comments derived from the HDI review 2015

Red Hill Valley Project
Integrated Monitoring Plan

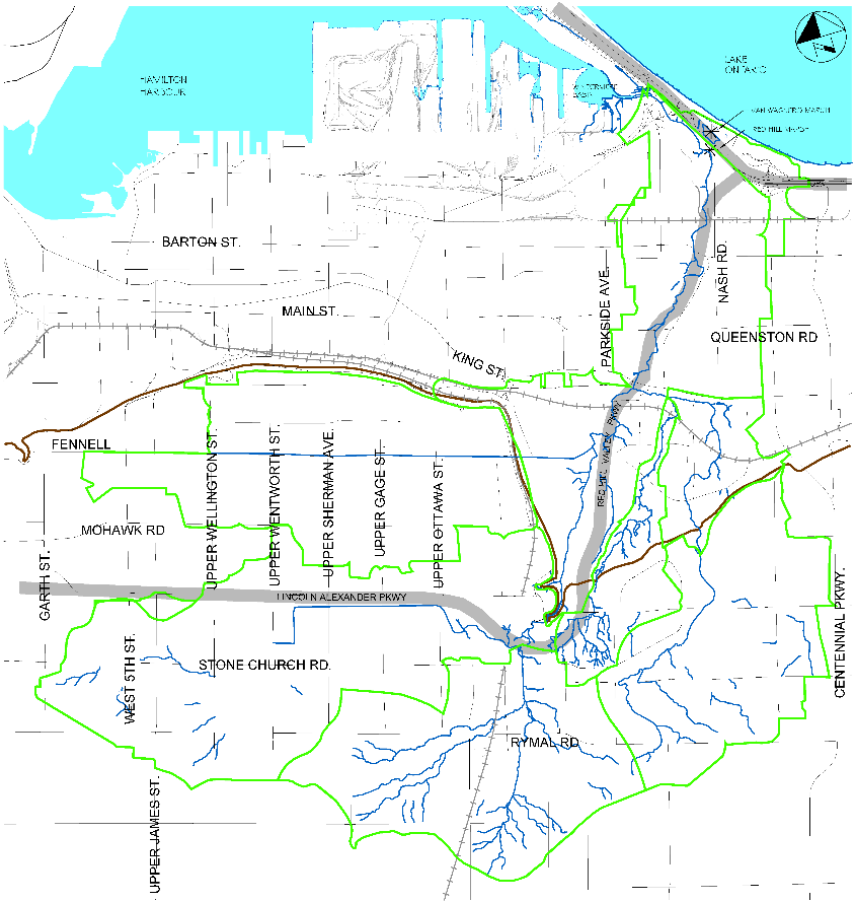
Public Works Committee
September 17, 2018

Presentation Outline

1. Project History Summary
2. Engagement
3. Findings / Recommendations
4. Conclusions

1. Project History Summary

1. Project History Summary



1. Project History Summary

- The idea of a highway through the Red Hill Valley was initially proposed in the 1950s
- Approved by Provincial Joint Hearing Board in 1985, funding in 1987
- Funding for Red Hill Valley section suspended by Province in 1990 (focus on East-West Section – “the Linc”)
- Funding restored in 1995, with a re-design process initiated in 1997 (Red Hill Watershed Action Plan – 1998)
- Subsequent Impact Assessment and Design Process completed in 2003

1. Project History Summary

Project Scope

- The Red Hill Valley Project was an environmentally integrated infrastructure project with several components, including:
  - An 8 km, four-lane, controlled access freeway
  - The re-alignment of over 7 km of Red Hill Creek
  - 14 Stormwater Quality Management (SWM) Facilities
  - 3 Flood Control Facilities
  - A 2.9 km Combined Sewer Overflow (CSO) Storage Pipe
  - A Landscape Management Plan (trails, parks…)
- ***Final construction phase ended in 2007, at which point the City began a multi-year environmental monitoring plan developed as a condition of multiple agency approvals to confirm the effectiveness of the new infrastructure and associated environmental management system***

1. Project History Summary

Requirements

- Environmental compliance monitoring for the Red Hill Valley Project was required as outlined in the following documentation:
  - MOE Exemption Order, 1997
  - Red Hill Creek Watershed Plan, 1998
  - Impact Assessment Design Process, 2003
  - Master Permit Application, 2004*
  - Various Permitting Compliance Reports, 2004-2011
  - Individual Permits and Authorizations specific to the respective construction contract phases (both Federal and Provincial)

**Innovative new process combining all permitting documentation into an integrated submission*

1. Project History Summary

Purpose

- The purpose of the Integrated Monitoring Plan is to:
  - Evaluate the performance of the Environmental Management System (i.e. design and mitigation techniques) constructed as part of the Red Hill Valley Project
  - Provide the necessary information to adjust and/or optimize the plan recommendations through a process of Adaptive Management

- The Monitoring Plan is considered to be *integrated* and *holistic*, in that the intent is to assess the entirety of the environmental impacts of the project, rather than individual attributes of the natural system

1. Project History Summary

Scope

Monitoring Component	What is monitored?
Groundwater	• Groundwater levels • Baseflow • Groundwater quality
Surface Water	• Water levels and flows (flood control facilities) • Water levels and flows (other features)
Water Quality	• SWM Facility (and creek) water quality • SWM Facility sediment quality
Stream Morphology	• Form and stability of channels • Rates of channel erosion and deposition • Channel substrate material
Fisheries	• Fish numbers and diversity • Benthic invertebrates • Water temperature • Fish passage and habitat
Terrestrial Ecology	• Vegetation (quantity and diversity) along creek and at SWM Facilities • ELC Mapping • Monitoring of breeding birds and amphibians • Review of special studies by others (turtles, flying squirrels)

2. Engagement

2. Engagement

Government Agency Committee (GAC)

- City of Hamilton
- Hamilton Conservation Authority
- Department of Fisheries and Oceans
- Ministry of Natural Resources and Forestry
- Ministry of the Environment and Climate Change (now Ministry of the Environment, Conservation and Parks)

Objective

- Provide input to scope through permitting and review
- Annual reporting and associated feedback from GAC

2. Engagement

Joint Stewardship Board

Meetings and Presentations held:

- February 2014
- June 2015

Objective

- To communicate findings and receive feedback on findings

3. Findings / Recommendations

3. Findings / Recommendations

Red Hill Valley Parkway Flood Management System

- 100 year performance standard established
- July 26, 2009 event greater than a 100 year storm (1.5x)
- Forensic study has determined all infrastructure to be operating per design objectives
- Some minor Operation and Maintenance improvements recommended

3. Findings / Recommendations

Red Hill Creek System

- Subjected to numerous large storms shortly after construction
- Caused some initial instabilities and erosion
- Adjustments to channel form and structures required (2010 / 2015) particularly through Kings Forest Golf Club
- Riparian zone is well established with predominantly native species

3. Findings / Recommendations

Stormwater Management Facilities and Wetlands

- Flood Control Facilities
  - Dartnall, Greenhill, Davis (Ongoing)
  - Operating per design requirements
- Stormwater Quality Control Facilities
  - Eleven (11) City owned; three (3) Ministry of Transportation owned
  - Largely performing per design requirements; some ongoing improvements being conducted by City

3. Findings / Recommendations

Red Hill Valley

- No negative impacts from roadway on groundwater (quantity / quality) and creek base flows
- 100+ ha of valley restoration undertaken by Kayanase
- Wildlife surveys
  - Forty-two (42) species of birds
  - Four (4) species of amphibians

3. Findings / Recommendations

1. Continue to monitor:

- Groundwater levels
- Surface water (flood control facilities, including Davis Creek Facility)
- CSO Discharges
- Water quality (including SWM facility effectiveness, watershed monitoring)
- Erosion (including King's Forest GC)
- Riparian zone / vegetation (including invasive species)
- Benthic invertebrates
- Turtles

Intent is to support operations and management (adaptive practices)

3. Findings / Recommendations

2. Review Operations and Maintenance practices related to:

- Minor localized flood susceptible locations (2010 report)
- Stormwater management facility sediment accumulation and inspections
- Localized erosion
- Corridor maintenance (‘natural’ infrastructure)

3. Consider Climate Change resiliency study with the Ministry of Transportation Ontario (MTO)

4. Assess / address bed load from Buttermilk Falls reach upstream of King’s Forest

3. Findings / Recommendations

5. Consider / support ‘cleanout’ days with Public or other partners

6. Consider transplanting local native fishes

7. Consider carp control in lower wetlands / marshes

8. Review / assess need for further valley restoration / management and invasive species monitoring/management

9. Consider preparation of a stand-alone report documenting the full scope of the work by the Kayanase

4. Conclusions

4. Conclusions

- Red Hill Valley Project Integrated Monitoring Plan has been completed in accordance with the full requirements of the approval agencies
- The environmental management systems, designed as part of the roadway's implementation, are meeting their intended purpose to mitigate impacts and improve the ecosystem's function
- A set of future works has been identified to be integrated into existing City programs and / or conducted through agreements with other stakeholders (e.g. Hamilton Conservation Authority)

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Energy, Fleet & Facilities Management Division and Environmental Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	William Connell Fieldhouse: Tender C13-34-18 Award (PW18086) (Ward 8)
WARD(S) AFFECTED:	Ward 8
PREPARED BY:	Robyn Ellis (905) 546- 2424, Extension 2616 Cynthia Graham (905) 546- 2424, Extension 2337
SUBMITTED BY: **SIGNATURES:**	Rom D'Angelo Director, Energy, Fleet and Facilities Management Public Works Department Craig Murdoch Director, Environmental Services Public Works Department

RECOMMENDATION

(a) That the General Manager, Public Works Department be authorized to negotiate, enter into and execute a Contract and any ancillary documents required to give effect thereto with acceptable lowest bidder of Tender C13-34-18, in a form satisfactory to the City Solicitor; and,

(b) That the following funding strategy for an additional $1.7M be approved in order to complete the final phase of the project as well as cover any ancillary project costs and fees:

(i) $330k be approved from the Ward 8 Area-rating reserve 108058 and transferred to PID 7101654802;

(ii) $980k be advanced from the 2019 Budget Forecast for William Connell Fieldhouse and be approved in 2018 from the Recreational Facilities

Development Charges Reserves 110320/110321 and be transferred to PID 7101654802;

(iii) $390k from the Outdoor Recreation Development Charges Reserves 110316 ($367.5 K) & 110317 ($22.5 K) be transferred to PID 4401356124.

EXECUTIVE SUMMARY

This report is in response to Tender C13-34-18 (William Connell Fieldhouse – New Build) that closed on June 12, 2018. Due to the bid results exceeding the budget by more than $250k, in accordance to the City of Hamilton's Procurement Policy; Council Approval is required prior to the tender being awarded. Staff recommendation is to negotiate and enter into a contract with the low bidder, Bestco Construction (2005) Ltd, and that the funding strategy for this award be approved as recommended.

Staff from both Facilities & Landscape Architect Services (LAS) was working collaboratively in association with the costing consultant. It was determined by all parties that the last two phases scheduled for 2018 & 2019 could be accomplished and blended into one final phase and tendered in 2018 in order to accelerate the project completion by the Summer of 2019 opposed to 2020. Additionally, the decision was premised on the consultant's pre-tender estimate of $1.8M (including contingencies & taxes) which fell within the City's budget parameters. Once the tender closed it was realized the lowest compliant bid of $3.2M was over the budget estimate. The differential was not anticipated based on pre-tender estimates, therefore in order to award Tender C13-34-18 (William Connell Fieldhouse – New Build) a supplementary $1.4M will be required, plus $300k will be required to cover ancillary soft costs & project fees.

Furthermore, Staff has been receiving enquiries from the public asking when the playing fields will be open. As a result staff felt that it is important for the public and user groups to be able to have use of the playing fields in 2019 after the Fieldhouse construction is completed. Not tendering or awarding remaining work until 2019 would mean completion in late 2019 or early 2020, thereby missing the 2019 season. Delaying the project would mean that public and user groups would wait for another year to get onto the sports fields. Therefore, staff moved all remaining work from phase 3 of the project, originally budgeted for 2019 and incorporated it into the phase 2 tender document issued in early 2018. Consequently, the planned request for Phase 3 funds in the 2019 Capital Budget in the amount of $980K will no longer be required.

Alternatives for Consideration – See Page 7

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The tender was anticipated by staff at approximately $1.8M based on pre-tender estimates, including contingencies & taxes, but came in at $3.2M all inclusive of applicable taxes. This differential of $1.4M was not anticipated based on the pre-tender estimates, at minimum this will be required in order to award Tender C13-34-18. Adding remaining project fees and ancillary soft

costs for the project at a value of $300k will result in the total additional request of $1.7M

Once $980k is pulled forward from the 2019 Budget Forecast for William Connell Fieldhouse and approved in 2018 for tender award C13-34-18 from the Recreational Facilities Development Charges Reserves 110320 to project 7101654802 via Report PW18086, the remaining shortfall is $720k.

The remaining funds are available from a combination of the Ward 8 Area-rating reserve 108058 and Outdoor Recreation Development Charges Reserves.

The William Connell Community Park (Outdoor Rec) and the William Connell Park Washroom Fieldhouse (Indoor Rec) were included in the 2014 DC Background Study as 100% growth projects. A 100% growth project for a park / recreation facility can receive a maximum 90% of its funding from DCs. The proposed funding model is consistent with this requirement and requests the relative share of DCs from each set of DC reserves based on the actual tender. The additional funding required will be considered in the 2019 DC Background Study.

The outdoor recreation DC (LAS) is in a deficit position and making annual improvements of approximately $500K. Per the DC Reserve policy, an individual service can be in a deficit as long as the service is forecasted to be returned to a surplus within 10 years. This request could delay the anticipated return to surplus date by up to one year.

Staffing: Operating Impacts were captured in the original Council approvals for the project and the various phases.

Legal: All agreements and contracts will be in a form acceptable to the City Solicitor.

HISTORICAL BACKGROUND

Project Scope:

This project at William Connell Park includes a new 6400 square foot Fieldhouse containing a concession, covered patio, men's washroom, women's washroom, two all-gender barrier-free washrooms, sports equipment storage, two referee change rooms, a first aid room and four all-gender barrier-free team change rooms. Patrons will have access to football and soccer fields, splash pad, tennis courts, sun shelter and nature trails. The 20 hectare parcel on West 5th Street between Stone Church and Rymal roads will provide City-Wide public amenities in a location that is central to population increase and young families on the mountain.

Neighbourhood Plan:

Approved in 2008 the master plan for the Sheldon Neighbourhood shows William Connell Park and the purchased expansion lands as a park with city-wide distinction

that has redevelopment opportunity. The concept plan was created with help from a citizen's committee to guide the development. In 2011, the Outdoor Recreation study provided guidance to staff and references the needs for the parkland at William Connell Park. Since that time, those needs have been studied and refined to the concept of what is being developed today at William Connell Park. Further programming consideration at William Connell Park was approved by Council on November 8, 2017, Report 17-020 Item 7.2 and winter programming and amenity opportunities presented in Report PW18046 to Council Committee June 18, 2018.

Council Approved Budgets & Phase 1 Construction Progress:

Through the 2016-2018 Capital Budget processes, funding of $2.7M was approved for the Phase 1 & 2 Indoor Rec Fieldhouse at William Connell Park (7101654802) with $980k identified as a recommended funding source for 2019. During the same timeline, $5.4M was approved by Council for outdoor park amenities and sports fields.

The design as tendered was the successful result of months of collaboration between the design team, the Architect, and City Staff across Departments and Divisions (e.g. Recreation, Planning, Facilities and Landscape Architectural Services).

The Building Permits were obtained and Phase 1 construction began in 2017, currently wrapping up. The scope of Phase 1 construction at this site included the sports fields, tennis courts, splash pad, sun pavilion, maintenance storage shed & washrooms, as well as all the site servicing for Phase 1 & 2: hydro, gas, water, sewer, storm water Management, etc.

Phase 1 Grand Opening:

On August 18, 2018, the city and community gathered to celebrate the opening of Phase 1 of William Connell Park. The ceremony included a ribbon cutting, and special guest speakers such as, Mayor Eisenberger, Ward Councillor Terry Whitehead as well as a relative of Dr William Connell, who spoke about the land being bequeathed to the City of Hamilton for the purposes of park development, and how the late Dr Connell would be pleased to see the city-wide park opened for public use by the residents of Hamilton.

Phase 2 Construction Timeline:

Tender for the Phase 2 Fieldhouse facility at William Connell Park, C13-34-18, is anticipated to be awarded in October following Council Approval, with construction started one month later. Following this, the contractor's construction schedule is expected to take up to 10 months from the time of contract award to the time of Occupancy. Once construction begins, the construction area within William Connell Park (playing fields) will remain closed to the public until Occupancy/Substantial Performance. This does not impact the spray pad, play structure, walking trails, etc.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

Tender Award: Under City of Hamilton By-law #17-064, Procurement Policy #2 – Approval Authority, "The Client Department in conjunction with the Procurement Section shall submit a report to Council and the appropriate standing committee recommending award of a RFT or RFP if ANY of the following conditions apply:

(a) The value of the Bid being recommended for award and any contingency allowance are in excess of the Council approved budget including any contingency allowance, or (b) for capital projects, when the final cost of the proposed project exceeds the amount provided in the Council approved capital budget for that project by $250,000 or greater."

RELEVANT CONSULTATION

The following Departments/Divisions/Sections have reviewed and contributed to this report:

Corporate Services, Procurement

- To review the Procurement implications in the report.

Corporate Services, Financial Planning, Administration and Policy

- Was engaged in reviewing the financial section of the report, as well as financial recommendations.

Healthy & Safe Communities, Recreation

- Was engaged in reviewing the indoor and outdoor Recreation scope of this report.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

Reasons for additional funding request:

The additional funds requested based on the tender results requires explanation to Council.

(a) Multi-Phase Project & 2019 Cash Flow: Staff tendered all remaining work together in order to enable the sports fields to open in 2019. This way, the playing fields could be used by the public sooner and the construction impact to user groups and the public could be minimized. Cost estimates from the prime consultant indicated that all remaining work would fall within budget for 2018. There was originally to be phase 3 for the project which included 2019 budget items that Council notionally approved for $980,000. These funds earmarked for 2019 on this project are not yet considered Council-approved and available for award. When Phase 2 work was tendered, it included all remaining project work (including work originally planned for Phase 3). Based on pre-tender pricing from the consulting team, it appeared that the existing approved 2018 budget was sufficient to accomplish work originally planned for 2019;

(b) Soil Conditions: An issue was discovered by the architect & City staff through routine due-diligence testing prior to tendering Phase 2. This led to last minute foundation redesign to incorporate concrete lean mix and other necessary structural design enhancements costing approximately $100,000. The City is consulting with Legal Services and Procurement regarding the City's options to recover the additional expense, since soil compaction work completed in Phase 1 by the contractor do not meet technical specifications;

(c) Architect's pre-tender information out of line with tender results: The prime design consultant provided pre-tender information to staff that was much lower than the tender results. It is unclear if this was miscalculated or possibly misjudging the ensuing market conditions we are experiencing today;

(d) Market Conditions: Market competitiveness must be considered in light of this overage. This can be due to a number of factors including but not limited to: season, market saturation, material prices, labour availability & rates, etc. It is unknown if steel prices and the early June tariffs and material cost speculation played a role in the tender price for this project;

(e) Class C estimate & tight budgeting: In addition to the Architect's pre-tender information, staff utilized a Class C cost estimate from a certified cost estimator as further confirmation of anticipated pricing. The Class C estimate at an early stage of document readiness indicated to staff that tender results would be approximately $1.8M, however it was significantly more at $3.2M (inclusive of contingency & tax);

Given what we are seeing in the market place recently, staff recommend whenever possible to add 25-40% budget to Class C & D early estimates. This recommendation is in line with recommendations by the Government of Canada and the Association for the Advancement of Cost Engineering International (AACEI).

Budget variance is explainable given consideration of the above items.

Benefits and Priority to the Community and the City:

It is important to the public and user groups to have use of the playing fields in 2019. Not tendering or awarding remaining work in 2018 would mean that public and user groups would wait until 2020 to get onto the sports fields. William Connell Park will be a central attraction within the city, offering outdoor education, sport, recreational, and leisure opportunities to the community. The 20- hectare parcel has been planned to offer a number of City-Wide public amenities. These amenities include, a new 6400 square foot Fieldhouse containing a concession, covered patio, men's washroom, women's washroom, two all-gender barrier-free washrooms, sports equipment storage, two referee change rooms, a first aid room and four all-gender barrier-free team change rooms. Patrons will have access to football and soccer fields, splash pad, tennis courts, sun shelter and nature trails. The park location also benefits the Community as its

location is central to population increase and is a priority to young families on the mountain.

ALTERNATIVES FOR CONSIDERATION

Besides the recommended option of awarding Tender C13-34-18 to the low bidder and approving additional funding for the award, the Project Team has provided alternatives for consideration:

Alternative – Significant Change of Project Scope, Redesign and Retender:

It is estimated that this option could delay the project by up to a year and will add to the design costs and permit fees. This option is not recommended due to the level of refinement of the design at the tender stage and that decreasing square footage of the facility will impact programming.

The option of cancelling the tender and the project is not considered because this is a Council-Approved Project with benefits and priority to the Community and the City.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Clean and Green

Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure

Hamilton is supported by state of the art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

APPENDICES AND SCHEDULES ATTACHED

Not applicable.

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Environmental Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Third Party Processing of Green Bin Organic Material and Temporary removal of Grass and Leaf & Yard Waste from the Green Bin Program (PW18088) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Emil Prpic (905) 546-2424, Extension 4203 Joel McCormick (905) 546-2424, Extension 5601
SUBMITTED BY: **SIGNATURE:**	Craig Murdoch, B.Sc. Director, Environmental Services Public Works

RECOMMENDATION

(a) That Council approve the single source procurement, pursuant to Procurement Policy #11 – Non-competitive Procurements, for one or more third-party service providers to process all, or a portion of the City's organic material collected through the City's Green Bin program, as outlined in this Report and that the General Manager, Public Works Department be authorized to select, negotiate, enter into and execute short-term Contracts and any ancillary documents required to give effect thereto with third-party service providers selected, in a form satisfactory to the City Solicitor;

(b) That the cost associated with the short-term contact(s) referred to in recommendation (a) be funded from the Central Composting Facility contractual services operating account 55916-512725;

(c) That the City of Hamilton temporarily remove grass and leaf & yard waste as acceptable materials within the City's Green Bin program;

(d) That $50,000 from the Central Composting Facility contractual services operating Account 55916, Dept. ID. 512725 be allocated for communicating with City residents about the temporary removal of grass and leaf & yard waste from the

City's Green Bin program and to promote the use of the curbside Leaf & Yard Waste program.

EXECUTIVE SUMMARY

On June 24, 2018, as a result of odour issues at the City's Central Composting Facility (CCF), the City voluntarily began the controlled shutdown of the CCF operations on a temporary basis. Since the temporary closure of the CCF, all City generated organic material collected through the Green Bin program has been going to the Glanbrook Landfill for final disposal.

To maintain program consistency and to achieve maximum waste diversion during the temporary shutdown, City staff have encouraged residents to continue placing their food waste and soiled paper products into their green bin, while utilizing the City's Leaf & Yard Waste (LYW) collection program for the recycling of grass and LYW.

In order to reduce the amount of City green bin organics from being landfilled, Staff are currently investigating the availability of processing capacity at alternative processing facilities, which can process all or a portion of the City's green bin organic material. As a result, Staff is requesting delegated authority from Council to single source to one or more third party processors for the processing of City generated organic material derived from the Green Bin program, and to enter into short-term processing contracts until the CCF is partially or fully operational. The request for delegated authority is being recommended for the following reasons:

- To expedite the process, thereby reducing the amount of organic material being sent to landfill; and

- To maintain flexibility in order to quickly enter into short-term processing agreement(s) when capacity comes available.

Acceptable materials in the City's Green Bin program include food waste, soiled paper products, grass and LYW. As mentioned, staff are currently encouraging City residents to use their green bins for only food waste and soiled paper products, while utilizing the City's LYW collection program to recycle grass and LYW. Staff are recommending the temporary removal of grass and LYW as acceptable materials in the Green Bin program for the following reasons:

- To reduce the amount of organic material currently being landfilled because of the temporary closure of the CCF. Processing grass and LYW at the City's outdoor composting facility will assist in the overall diversion rate and create a beneficial end product;

- Removing grass and LYW from the City's Green Bin program may open available capacity at alternative processing facilities that only accept food waste but not grass and/or LYW. Through staff's early investigations, it has been determined a large portion of the alternative processing facilities for organic waste do not accept grass and LYW due to processing difficulties and odours caused by these materials; therefore, reducing the potential third party processing options for City collected green bin organics;

- The City currently has a LYW curbside collection program that provides residents with weekly collection of grass and LYW, 52 weeks a year. This collected material is then processed at the City's outdoor composting facility located adjacent to the Glanbrook Landfill at a much lower cost than food waste composting; and

- To reduce the amount of LYW being transported to, and processed at an alternative processing facility. Sending only food waste and soiled paper products to an alternative processing facility will reduce the potential cost associated with alternative processing.

Alternatives for Consideration – See Page 5

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: As a result of the temporary closure of the CCF, the operating budget for the processing of organics collected through the Green Bin program is available. Staff recommend using this available 2018 operating budget to fund the third-party processing of green bin organic waste. Staff are proposing funding the cost of the third-party processing from Account #55916, Dept. Id #512725, which currently has a remaining budget of approximately $1.2M.

Based on staff's understanding of market value of processing a tonne of organic material, the remaining budget could allow for approximately 8,000 to 9,300 tonnes of City green bin organic material processed at an alternative processing facility, although early indications are that we will not find this much third-party processing capacity in Ontario.

Staffing: There are no staffing implications associated with the recommendations in this report.

Legal: There are no legal implications associated with the recommendations in this report.

HISTORICAL BACKGROUND

On June 24, 2018, the City began the process of voluntarily shutting down operations at the CCF in response to odour issues. As part of the temporary shutdown, the City immediately stopped accepting organic material from the City's Green Bin program.

Due to the temporary shutdown of the CCF, all organic material collected through the Green Bin Program is being redirected to the Glanbrook Landfill for final disposal. As of August 30, 2018, approximately 5,700 tonnes of organic material collected through the Green Bin program has been landfilled.

Following the temporary shutdown, the City issued two media releases and shared information via media interviews and social media encouraging residents in all parts of the city to continue participating in Hamilton's composting, yard waste and recycling programs. In order to maintain program consistency and maximize waste diversion, the City notified residents to dispose of their organic waste in the following manner:

- Food scraps and soiled paper products should continue to go in the green bin
.
- All yard waste should go in a paper yard waste bag or other clearly marked open top reusable rigid container. All yard waste will continue to be composted at the City's outdoor composting facility located adjacent to the City's Glanbrook Landfill.

City residents were also encouraged to leave their grass clippings on their lawns to reduce the amount of grass being picked up at the curb. Residents who do not wish to leave grass clippings on their lawns were advised to place grass with their LYW for curbside pickup.

As part of the waste management services provided to all City residents, the City offers designated, curbside collection of LYW which includes grass as an acceptable material. This 52 weeks a year service is unlimited in the amount of leaf & yard waste that can be placed at the curb.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

Procurement Policy

The request for a single source is being carried out in accordance with the City of Hamilton's Procurement Policy, Bylaw 17-064, Procurement Policy #11 – Non-competitive Procurements. Since the expenditure for these services is expected to exceed $250,000, Council approval of this single source procurement is required.

Hamilton's Solid Waste Management Master Plan
The development of the waste transfer and disposal contracts supports the City's Solid Waste Management Master Plan's guiding principles:

(1) The City of Hamilton must lead and encourage the changes necessary to adopt the principle of Waste Reduction.

(2) The Glanbrook Landfill is a valuable resource. The City of Hamilton must minimize residual waste and optimize the use of the City's diversion and disposal facilities.

(3) The City of Hamilton must maintain responsibility for the residual wastes generated within its boundaries.

RELEVANT CONSULTATION

The recommendations in this report were prepared in consultation with staff from the Corporate Services Department, Financial Services Division, Procurement Section. Staff consultation will continue as part of the next steps to complete the procurement process and finalize the contract requirements.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

With the temporary closure of the CCF, organic material collected through the Green Bin program is currently being disposed of at the Glanbrook Landfill. As a result, Staff have been investigating the option of sending all, or a portion of the City's green bin organic material to a third-party service provider(s) for processing.

Staff have been in contact with industry experts and have been notified that there is limited organic waste processing capacity within Ontario. Due to the limited capacity, it is beneficial to maintain flexibility in order to quickly enter into short–term processing agreement(s) with one or more processors. Employing a single source procurement policy would provide the flexibility for staff to enter into a contract(s) expeditiously and, to divert recyclable material that is currently going to landfill because of the temporary closure of the CCF.

The City's Green Bin program accepts food waste, grass, and LYW. During the temporary closure of the CCF it is proposed that all grass and LYW be removed as acceptable materials from the Green Bin program based on the following:

- To reduce the amount of organic material currently being landfilled because of the temporary closure of the CCF. Processing grass and LYW at the City's

outdoor composting facility will assist in the overall diversion rate and create a beneficial end product;
- Temporarily removing grass and LYW from the City's Green Bin program may open available capacity at alternative processing facilities that only accept food waste and not grass and/or LYW;

- The City currently has a LYW curbside collection program that provides residents with weekly collection of grass and LYW, fifty-two weeks a year. This collected material is then processed at the City's outdoor composting facility located adjacent to the Glanbrook Landfill; and

- To reduce the amount of LYW being transported to, and processed at an alternative processing facility. Sending only food waste and soiled paper products to an alternative processing facility will reduce the potential cost associated with alternative processing.

ALTERNATIVES FOR CONSIDERATION

If Council does not approve the recommendations in this report then Staff will issue a Request for Proposal (RFP) for third party processing of the City's organic material derived from the Green Bin program on a short-term basis. The disadvantage of issuing a RFP is that it will prolong the amount of time that it takes to hire a third-party service provider. Since there is limited and/or short-term organic material processing capacity within the province, it is key to have flexibility to quickly enter into a contract with an alternative processing provider as capacity becomes available.

Another alternative is to continue to accept grass and LYW waste in the Green Bin program. The disadvantages of this alternative are as follows:

- Sending grass and LYW, along with food waste and soiled paper products to a third party processor for recycling will have a significant cost. The City currently has a grass and LYW curbside collection program were all grass and LYW can be diverted and recycled at a much lower cost;
- Through staff investigations, it has been determined that many third-party processors of organic material do not allow grass and LYW into their processing systems due to the odours that can be caused; therefore, significantly limiting the available processing capacity for City green bin material;
- Continuing to allow grass and LYW into the green bin can result in the continued landfilling of recyclable organic material if third party processing of the City's green bin material is not found.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Clean and Green

Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

APPENDICES AND SCHEDULES ATTACHED

N/A

CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Environmental Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	City of Hamilton's Waste Transfer and Disposal System Request for Proposals C11-08-18 Selection of Successful Proponent(s) (PW16059f) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Raffaella Morello (905) 546-2424, Extension 3926
SUBMITTED BY: **SIGNATURE:**	Craig Murdoch, B.Sc. Director, Environmental Services Public Works

RECOMMENDATION

(a) That Waste Connections of Canada Inc. be selected as the Successful Proponent for Project A of Request for Proposals Contract C11-08-18, for the operation and maintenance of the City's three Transfer Stations, three Community Recycling Centres, the Reuse Centre at the Mountain Community Recycling Centre, haulage of materials from the Transfer Stations and Community Recycling Centres to end markets and the Glanbrook Landfill, and marketing of specified recyclable materials from the Transfer Stations and Community Recycling Centres;

(b) That Waste Management of Canada Corporation be selected as the Successful Proponent for Project B of Request for Proposals Contract C11-08-18, for the operation and maintenance of the Glanbrook Landfill and Leaf and Yard Waste Composting site;

(c) That the General Manager of Public Works be authorized and directed to finalize the terms and conditions of the contract with Waste Connections of Canada Inc. in accordance with the provisions of Request for Proposals Contract C11-08-18 for Project A.

(d) That the General Manager of Public Works be authorized and directed to finalize the terms and conditions of the contract with Waste Management of Canada Corporation in accordance with the provisions of Request for Proposals Contract C11-08-18 for Project B; and

(e) That the Mayor and City Clerk be authorized and directed to execute all necessary documents to implement recommendations (c) and (d) with content acceptable to the General Manager of Public Works and in a form acceptable to the City Solicitor;

EXECUTIVE SUMMARY

The existing contracts for the operation of the City's waste transfer and disposal facilities will end on February 28, 2020. To facilitate the provision of continued service in 2020, staff initiated the procurement process to obtain service providers, prepare contracts, and to provide the service providers sufficient time to acquire the resources necessary to begin the new contracts.

On April 20, 2018, the City issued a Request for Proposals (RFP) for the operation and maintenance of the City of Hamilton's Waste Transfer and Disposal System (RFP C11-08-18) which maintain existing service levels. RFP C11-08-18 is for the operation and maintenance of the City's three Community Recycling Centres, three Transfer Stations, Reuse Centre at the Mountain Community Recycling Centre, Glanbrook Landfill, and the leaf and yard waste composting site. The service contracts are for a ten-year period starting on March 1, 2020 to February 29, 2030. The RFP's scope of work maintains existing service levels to avoid impacts on public services.

RFP C11-08-18 closed on June 15, 2018, followed by the evaluation of proposals including the review of the proponents' technical and financial submissions. Based on the results of the technical and financial evaluation, it is recommended that the contract for the operation and maintenance of the Community Recycling Centres, Transfer Stations and Reuse Centre is awarded to Waste Connections of Canada Inc. (formerly named BFI Canada Inc.). Waste Connections of Canada Inc. will be using Community Living Hamilton as their not-for-profit subcontractor to operate the Reuse Centre. It is recommended that Waste Management of Canada Corporation is awarded the contract for the operation of the Glanbrook Landfill and the leaf and yard waste composting site. The successful proponents are the same contractors that are providing the current services.

Staff's target is to execute the contracts with the successful proponents by the third quarter of 2018 in order to allow the successful proponents sufficient time to procure vehicles and equipment for commencement of operations on March 1, 2020.

As a result of favourable pricing received in the RFP, staff anticipates an annual operating savings of approximately $2.3 Million for the operation of the waste transfer and disposal facilities when the new contracts begin on March 1, 2020.

Alternatives for Consideration – See Page 7

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The 2018 operating budget for the operation of the Transfer Stations and Community Recycling Centres is $7.45 Million, and $3.52 Million for the operation of the Glanbrook Landfill and leaf and yard waste composting site for a total of $10.97 Million. The landfill operating cost includes the landfill compaction incentive which is paid to the contractor if they exceed the City's compaction targets as a measure to preserve landfill capacity.

As part of the Evaluation Process set out in the RFP, a detailed financial analysis was completed on the Project options which assessed the prices submitted in the RFP proposals. Table 2 attached to Report PW16059f as Appendix "A" in the Analysis and Rationale section in this report includes the operating cost for Year 1 of the contract, estimated at $8.62 Million based on 2018 dollars.

Bidders were directed to submit their costs in 2018 dollars and that CPI would be applied in 2019 and 2020 for year one of the operating contracts. This cost will be approximately $9.14 Million when the contracts begin on March 1, 2020, which considers cost escalation for consumer price indices and fuel indices.

The overall contract costs for Projects A and B represents an annual operating savings of approximately $2.35 Million when the new contracts begin in 2020, with the cost reduction associated with lower pricing received for Project A.

The ten year forecasted cost for the operation and maintenance of the waste transfer and disposal facilities will be approximately $117 million based on escalation factors and estimated waste tonnages identified in RFP C11-08-18. Other variables such as the performance of the City's waste diversion programs and population growth would also impact future operating costs.

Staffing: There are no staffing implications associated with the recommendations in this report.

Legal: Legal Services staff provided assistance with the RFP preparation and evaluation process and will be involved with the contract preparation and execution of the agreement with the successful proponents.

A contract will be finalized with Waste Connections of Canada Inc. and Waste Management of Canada Corporation, pending approval by Council. RFP C11-08-18 included a draft copy of the contract which will form the basis of the final contract in addition to the successful proponents' proposal and all applicable clarifications accepted by the City. If the successful proponent(s) fail to enter into the contract and provide all ancillary documents required under the RFP and the contract, the City reserves the right to take other actions which include:

- terminating discussions with the successful proponent(s);
- selecting another proponent as the successful proponent and enter into contract discussions to finalize and execute the contract;
- revise and reissue the RFP, or cancel the RFP; or
- pursue any other rights or remedies available under the RFP.

HISTORICAL BACKGROUND

Existing Waste Transfer and Disposal Contracts

The existing 10-year waste transfer and disposal contracts began on March 1, 2010. The City currently has two separate contracts for waste transfer and haulage, and the operation of the Glanbrook Landfill and the leaf and yard waste composting site.

Waste Connections of Canada Inc. (formerly named BFI Canada Inc.) is the current contractor for the operation of the Transfer Stations, Community Recycling Centres, haulage of materials to end markets, and marketing of divertible materials collected at the Transfer Stations and Community Recycling Centres. The operation of the Reuse Centre located at the Mountain Community Recycling Centre is sub-contracted by Waste Connections of Canada Inc. to Community Living Hamilton.

The operation of the Glanbrook Landfill and the leaf and yard waste composting site is currently under contract with Waste Management of Canada Corporation.

Contract Development

The City's contracts for waste transfer and disposal will expire on February 28, 2020. Information on the 2020 waste management system and the preparation for the waste transfer and disposal contracts has been provided to Council through several reports including PW16059, PW16059a, and PW16059b. Through Report PW16059b, staff received direction to initiate the competitive procurement process for the operation of the City's Transfer Stations, Community Recycling Centres, Glanbrook Landfill, and the leaf and yard waste composting site. After receiving direction from Council in 2017 staff began

the work required to prepare and issue the RFP document for the waste transfer and disposal contracts, which was issued on April 20, 2018 and closed on June 15, 2018.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

Procurement Policy

The Request for Proposals procurement process was carried out in accordance with Bylaw 17-064, the City of Hamilton's Procurement Policy.

Hamilton's Solid Waste Management Master Plan

The development of the waste transfer and disposal contracts supports the City's Solid Waste Management Master Plan's guiding principles:

(1) The City of Hamilton must lead and encourage the changes necessary to adopt the principle of Waste Reduction.
(2) The Glanbrook Landfill is a valuable resource. The City of Hamilton must minimize residual waste and optimize the use of the City's diversion and disposal facilities.
(3) The City of Hamilton must maintain responsibility for the residual wastes generated within its boundaries.

RELEVANT CONSULTATION

The recommendations in this report were prepared in consultation with staff from the Corporate Services Department, Financial Services Division, Procurement Section and Financial and Administration Section, and, Legal Services Division. Staff consultation will continue as part of the next steps to complete the procurement process and finalize the contract requirements.

The Waste Management Advisory Committee received regular updates on the City's waste management system development and the progress on the procurement process for the Waste Transfer and Disposal RFP.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

The information and recommendations outlined in this report have City wide implications related to the City's waste management service contracts. This report also directly impacts Wards 5, 6, 11, and 13 where the waste transfer and disposal facilities are located.

RFP Overview

The RFP's scope of work maintains the existing service levels at the City's waste transfer and disposal facilities. The RFP allowed proponents to bid on one or more of the following projects:

- Project A for the operation and maintenance of the three Transfer Stations, Community Recycling Centres, Reuse Centre, material haulage, and marketing acceptable divertible materials;
- Project B for the operation and maintenance of the Glanbrook Landfill and the Leaf and Yard Waste composting site; and
- Project C to provide all services included in Project A and Project B.

To be considered for Project C, the proponent was required to submit a proposal for both Project A and Project B.

RFP C11-08-18 included a two-step process with the first step being the review of the proponents' technical submission, and the second step being the financial evaluation. The technical submissions were scored based on the evaluation criteria described in RFP C11-08-18, which included the company's capabilities, their operating details including labour and equipment to be used for the contract, and proposed work plan to undertake the services. Proponents were required to meet a minimum score on their technical submission before they could proceed to the second step which is the financial evaluation of the price submissions. The preferred proposal(s) from the financial evaluation were determined based on the lowest estimated annual contract value for each Project. Subject to the rights and privileges reserved to the City in the RFP, the RFP would be awarded based on the lowest combined cost of Project A and Project B or lowest cost for Project C.

RFP Results

Upon close of the RFP, the City received eleven submissions in total for Projects A, B, and C. Proposal scores for the technical evaluation were determined on a consensus basis with input from all members of the RFP evaluation team. Table 1 attached to Report PW16059f as Appendix A summarizes the results of the technical evaluation of the RFP proposals.

The proposals which met or surpassed the minimum score proceeded to the financial evaluation. As part of the financial review, the City received four compliant bids for Project A, one compliant bid for Project B, and one compliant bid for Project C. Three price submissions could not be considered for the financial review since they since were non-compliant with the terms outlined in the RFP.

Waste Connections of Canada Inc. had lowest Year 1 costs for Project A and Waste Management of Canada Corporation had the lowest Year 1 costs for Project B, both of which are the current operators of their respective contracts. It is not recommended to proceed with Project C, since the cost received for Project C was higher than the combined cost for Project A and Project B. The estimated annual contract value for Year 1 was calculated based on the component prices in the price submission which are stated in 2018 dollars. Table 2 attached to Report PW16058f as Appendix "A" outlines the results of the financial evaluation for the lowest cost proposals.

Recommended Successful Proponents

The recommendation for the operation and maintenance of the waste transfer and disposal facilities is to award Project A to Waste Connections of Canada Inc. and Project B to Waste Management of Canada Corporation. Both companies are the existing contractors for the operation of the waste transfer and disposal facilities which will also result in time savings and a seamless transition between the current and future contract periods.

Waste Connections of Canada Inc. has been in operation since 1996, and previously operated as BFI Canada Inc. They have operated the City's Community Recycling Centres and Transfer Stations since 2010. Their experience includes operation of approximately 14 transfer stations and 2 landfills located in Ontario, as well as 280 other waste management facilities located in North America. Waste Connections of Canada Inc.'s proposal indicated that Community Living Hamilton would be used as their not-for-profit subcontractor to operate the Reuse Centre.

Waste Management of Canada Corporation has been in operation for more than 50 years. They are a wholly owned subsidiary of Waste Management Inc., which operates across Canada, 48 USA states, the District of Columbia, and Puerto Rico. Waste Management of Canada Corporation currently operates 249 landfills and 305 of its own transfer stations. They currently operate the Glanbrook Landfill and previously operated the City's Transfer Stations and the City's former energy-from-waste Solid Waste Reduction Unit (SWARU).

ALTERNATIVES FOR CONSIDERATION

Staff recommends that the service delivery option for the waste transfer and disposal facilities and preferred proponents be approved by Council prior to the municipal election in October 2018.

As a best practice for transfer station and landfill operations of this size and complexity, contractors require one year or greater to procure equipment and resources necessary

to provide the services. In most cases, a one year lead time is necessary to manufacture specialized heavy equipment such as loaders and landfill compactors which are an essential component for the operations. In the event that Council does not wish to approve the Report recommendations, the timeframe remaining is insufficient for staff to prepare an alternative RFP and for the successful proponents to prepare for the new contract. In this situation, the City would need to consider extending the current contracts for up to six months assuming that the current service providers are agreeable and reasonable. Extending the current contracts would require additional work in order to negotiate the contract extension with the current service providers.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Clean and Green

Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure

Hamilton is supported by state of the art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

APPENDICES AND SCHEDULES ATTACHED

N/A

EVALUATION SUMMARY

Table 1 – Technical Evaluation Summary

Proponent	Project A	Project B	Project C
Aim Waste Management Inc.	Pass	N/A	N/A
Budget Environmental Disposal Inc.	Pass	N/A	N/A
Future Waste Systems Inc.	N/A	Did not pass	N/A
Halton Recycling Ltd. dba Emterra Environmental	Pass	N/A	N/A
Suez Canada Waste Services	N/A	Did not pass	N/A
Waste Connections of Canada Inc.	Pass	Pass	Pass
Waste Management of Canada Corporation	Pass	Pass	Pass

Table 2 – Financial Evaluation Summary
(Estimated Annual Contract Value in $Millions, stated in 2018 dollars)

Proponent	Project A	Project B
Waste Connections of Canada Inc.	$4.479	
Waste Management of Canada Corporation		$3.689 + 0.450[1] = $4.139[2]

Notes

1. The landfill compaction incentive cost of $0.45 Million has been added to the RFP Project B costs to be comparable with the existing budget.
2. The RFP included prices submitted for provisional items as an opportunity to provide future operational efficiencies, cost savings, and economies of scale by having the site contractor complete additional capital work. The Project B costs identified in Table 2 excludes the prices for provisional items. Provisional items include work that may be performed on an as needed basis during the contract at the City’s discretion, such as installing gas collection pipe at the Landfill. Provisional items are typically funded from the capital budget and should therefore not be included in the operating contract comparison. It is anticipated that this type of work would be performed infrequently, e.g. once or twice during the ten-year contract period.

CITY OF HAMILTON

PLANNING AND ECONOMIC DEVELOPMENT DEPARTMENT
Licensing and By-law Services Division

and

PUBLIC WORKS DEPARTMENT
Environmental Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Mandatory Waste Receptacles at Drive-Through Food Premises (PED18171/PW18067) (City Wide) (Outstanding Business List)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Luis Ferreira (905) 546-2424 Ext. 3087 Raffaella Morello (905) 546-2424 Ext. 3926
SUBMITTED BY: **SIGNATURE:**	Ken Leendertse Director, Licensing and By-law Services Planning and Economic Development Department Craig Murdoch Director, Environmental Services Division Public Works Department

RECOMMENDATION

(a) That Schedule 21 of the Business Licensing By-law 07-170 relating to Food Premises be amended to require the installation and maintenance of waste and recycling receptacles at drive-through food premises as described in Report PED18171/PW18067;

(b) That subject to approval of Recommendation (a) of Report PED18171/PW18067, the appropriate By-law be enacted by Council, with content acceptable to the General Manager of the Planning and Economic Development Department and in a form satisfactory to the City Solicitor;

(c) That the item respecting Mandatory Drive-Thru Garbage Containers be identified as complete and removed from the Public Works Committee Outstanding Business List.

EXECUTIVE SUMMARY

Concerns were raised regarding the increased amount of litter in neighbourhoods where food premises with drive-throughs exist. Observations were made that many of these drive-through food premises do not have waste receptacles located at the exterior of the premises to allow their customers to deposit waste while using the drive-through. This matter was brought to Council's attention in order to improve neighbourhood cleanliness in and around these locations.

Staff reviewed various City By-laws including the Waste Management By-law 09-067, Property Standards By-law 10-221 and the Licensing By-law 07-170 and identified several regulations which require premises to be maintained free and clear of waste, however no existing by-law provision requires drive-throughs to provide exterior waste receptacles for customers. Amendments to Schedule 21 of the Licensing By-law 07-170, relating to Food Premises, would achieve the desired legislative requirement to satisfy Council direction.

The proposed changes to the Licensing By-law would include the addition of a definition of "Drive-Through Facility" in section 1 of Schedule 21, the addition of the words "exterior waste and recycling receptacles" for inclusion on the premises plan required under section 3, and a new requirement for Food Premises with a Drive-Through Facility to install and maintain waste and recycling receptacles located so as to be accessible to customers remaining in their vehicles. Upon approval, an amending by-law in a form satisfactory to the City Solicitor will be enacted and incorporated in the corresponding by-law.

Alternatives for Consideration – Not Applicable

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial / Staffing: N/A

Legal: Pursuant to section 10(2) of the *Municipal Act, 2001* (the "Act") the City has the legal authority to pass by-laws respecting business licensing and pursuant to section 151(1)(c) of the Act the City may impose conditions as a requirement of obtaining, continuing to hold or renewing a business licence.

HISTORICAL BACKGROUND

At its meeting of February 14, 2018, Council approved Item 9.1 of the Public Works Committee Report 18-002 directing staff to study the feasibility of enacting a by-law obligating all drive-through restaurants to have the proper number of waste disposal

containers available to drive-through customers and report back to the appropriate Standing Committee.

On April 9, 2018, staff from the Environmental Services Division and Licensing and By-Law Services Division met with Councillor Merulla to explore various options to address the motion. As part of a comprehensive enforcement strategy discussed at this meeting, revisions to Schedule 21 (Food Premises) of the Licensing By-law to require the provision of waste receptacles at food premises with drive-through facilities was the preferred approach.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

In accordance with the requirements to give notice of the enactment of a Business Licensing By-law pursuant to the City of Hamilton's By-law to Adopt and Maintain a Policy with Respect to the Provision of Public Notice, notice of this proposed amendment has been published in The Hamilton Spectator.

RELEVANT CONSULTATION

Staff from the Legal Services Division, Environmental Services Division, Municipal Law Enforcement Section, and Business Licensing Section was consulted in the preparation of this Report.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

Food premises with a drive-through facility provide a quick and convenient method for customers to pick up food products. Food products from drive-through and fast food restaurants are generally packaged in non-recyclable and non-compostable packaging. Oftentimes this packaging ends up as litter in the neighbourhood surrounding these establishments if the customers fail to dispose of the packaging properly.

There is no empirical data to support whether having waste receptacles at drive-through facilities reduces the amount of litter found on and around these types of establishments. However, anecdotally it can be easily surmised that having waste receptacles in a convenient location would have positive benefits by encouraging customers to use them, thereby reducing the amount of litter on the property and the same litter being blown onto surrounding neighbourhood properties or the roadway. Staff's recommendation to require operators of food premises with a drive-through facility to install and maintain waste and recycling receptacles that are accessible from the customer's vehicle would provide an opportunity for waste to be disposed of in the receptacles, thereby providing an alternative for customers who may otherwise allow their waste to be disposed of on the establishment's property, adjoining properties or roadways.

Staff contacted over 100 fast food restaurants with drive-throughs and several corporate head offices of major fast food chains and found that most of them do not have waste receptacles at their drive-throughs. Our research identified that in some cases, fast food restaurants did not have waste receptacles near their drive-through due to lack of space on their property or concerns that these waste receptacles would attract individuals to discard all garbage from their vehicles unrelated to the food premises.

Conversations with the Managers of the locations that have waste receptacles at the drive-through believe that the area is cleaner, which also supports staff's field observations of customers using the waste receptacles as they were utilizing the drive-through. The fact that most waste receptacles had waste in them supports the idea that customers use them to discard their waste which may be a contributing factor for why less litter was found in and around these properties.

Staff completed a scan of by-laws from other municipalities and found no examples of licensing or other by-laws mandating restaurants with drive-throughs to provide waste receptacles for their customers. Hamilton would be the first to include this requirement in the Licensing By-law for this type of establishment.

The anecdotal evidence collected through field observations of these facilities supports the fact that the lack of waste receptacles at drive-throughs contributes to the amount of litter found at these establishments and the surrounding neighbourhoods. It is also clear that these establishments need to do more to keep their property clean and free of litter. They need to be good corporate citizens and contain litter related to their products while contributing to a safe and clean environment for their customers and the community.

If this recommendation is approved, staff will develop a detailed marketing and educational plan for drive-through operators to ensure compliance with the new requirements.

ALTERNATIVES FOR CONSIDERATION

N/A

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Healthy and Safe Communities

Hamilton is a safe and supportive city where people are active, healthy, and have a high quality of life.

Clean and Green
Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

APPENDICES AND SCHEDULES ATTACHED

N/A

LF:RM:st

INFORMATION REPORT

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 17, 2018
SUBJECT/REPORT NO:	Approval of Water Servicing for Development (PW18084) (City Wide) (Outstanding Business List Item)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Dave Arsenault (905) 546-2424, Extension 6413
SUBMITTED BY: **SIGNATURE:**	Bert Posedowski (Acting) Director, Water & Wastewater Planning and Capital Public Works Department

Council Direction:

Public Works Committee, at its meeting of June 18, 2018, passed a motion:

> **"**Staff were directed to report back to the Public Works Committee with a response to the concerns raised by the Hamilton-Halton Homebuilders' Association (HHHBA), an outline of how long it takes for water main approvals to be processed and what issues affect how long it takes for the applications to be processed and approved".

Information:

This report provides:

- A brief overview of Hamilton Water's role in the approval of development applications, with respect to municipal water servicing;
- Summary data for Hamilton Water review and comment timelines; and
- Information regarding review of the City of Hamilton's (City) fire flow policy for water infrastructure.

With respect to municipal water servicing, Hamilton Water has different roles and responsibilities in the City's approval process for two categories of land development projects that are regulated under *Ontario's Planning Act*:

1. Development without new municipal infrastructure, and

2. Development with new municipal infrastructure.

In both cases, the development approval process is managed and co-ordinated by Planning & Economic Development Department (P&ED). Hamilton Water receives circulations for review from P&ED staff, and provides comments and/or recommendations for approval to P&ED staff.

Although the HHHBA's concerns are focused on the second category of approvals, where "Form 1" approval of new water infrastructure is required, we have summarized timelines for both categories of approvals. The City's policies for available fire flow apply to both categories of approvals. It should be noted that the review durations presented in this report reflect only the periods between Hamilton Water's receipt of the documents from P&ED staff, and the submission of Hamilton Water's comments back to P&ED staff. Processes and factors before and after Hamilton Water's review periods, or the total time from the applicant's first submission to receipt of final approval, are not addressed in this report.

❖ Development Without New Municipal Infrastructure

- P&ED is the approval authority for the development and manages the overall process. Hamilton Water and other City entities have supporting roles in the process.
- Hamilton Water is responsible for reviewing and confirming that the City's existing infrastructure is capable of providing adequate domestic and fire-fighting water supply needs for the proposed land use and building systems.
- The City's "Comprehensive Development Guidelines and Financial Policy Manual" outlines in detail the analysis and reporting that must be completed and submitted by the proponent to demonstrate that the proposed development can be adequately serviced without new municipal water infrastructure.

Table 1 summarizes Hamilton Water's review statistics for development applications where new municipal water infrastructure is not required. This includes Formal Consultation, Zoning & Official Plan Amendment Applications and Site Plan Applications.

Table 1: Development Reviews – No New Municipal Water Infrastructure

	January 2017 to May 2018 (17 months)
No. of Submissions Received (including resubmissions)	720
No. of Technical Reviews Completed (including resubmissions)*	360
Average Review Time	14 working days
Typical Range of Review Times	8 to 17 working days

Note:*Typically, upon screening, about 50% of development circulations received by HW are found to not require water servicing technical review.

The data in Table 1 demonstrates that the typical time taken by Hamilton Water to review a development submission and return comments is approximately three weeks.

For development applications (no new municipal infrastructure) reviewed over the period January 2017 to May 2018, it has been observed that two review iterations per file is typical, but about 25% of development files require 3 or more review iterations.

❖ Development with New Municipal Water Infrastructure

- Where a project requires new municipal water infrastructure, there is a greater role and responsibility in the process for Hamilton Water, and the approval bears greater compliance and liability risk for the City.
- Changes to the City's water infrastructure are regulated under Ontario's *Safe Drinking Water Act*. Hamilton Water's engineers are responsible for certifying the approval amendment documents ("Form 1") on behalf of the City as owner of the water system. Hamilton Water has a responsibility to ensure that the new water infrastructure design is compliant with regulations, and that the alterations to the system will not create undue risk of water quality compliance violations and consequent health risks.
- Approval of the site plan for the proposed development is contingent on approval of the new municipal water infrastructure design.
- Typically, the design of the infrastructure is carried out by the development proponent. However, as the assets will become property of the City, the design must meet the requirements of the Hamilton Water's engineers. City staff must consider operational, maintenance, and performance needs, in addition to regulatory compliance. The proponent may need to revise and resubmit the design and supporting documents multiple times if information is missing, incomplete or inaccurate.

- Approval of developments that require new municipal water infrastructure are typically more complex and involve applications that often require more time and effort on the part of both the proponent and Hamilton Water staff, in comparison to those that do not. A higher level of technical scrutiny is applied to submissions of this type.

Files approved from January 2017 to June 2018 averaged four detailed review iterations, plus an average of two screening iterations before the application was deemed complete.

Table 2 summarizes Hamilton Water's review statistics for development application where new municipal water infrastructure is required. The summary includes only technical reviews of applications deemed complete.

Table 2: Development Reviews – New Municipal Water Infrastructure Required

	Received January 2016 to June 2018 (30 months)	Received July 2017 to June 2018 (12 months)
No. of Development Sites	19	10
No. of Technical Reviews	56	27
Average Review Time	23 working days	14 working days
Typical Range of Review Times	2 to 53 working days	2 to 28 working days

Table 2 shows that the time taken by Hamilton Water for review and comment on submissions currently averages less than 15 working days.

❖ Review Time Summary

In summary, Hamilton Water's application reviews typically take between 14 and 23 working days, depending on whether they are associated with new municipal infrastructure or not. Problems arise when applications are submitted incomplete or with errors, this leads to re-submissions and additional review iterations.

In most cases, the iterations represent a progression of the file, and each review becomes more focussed. In some cases, re-submissions have not addressed any of the review comments provided by Hamilton Water in the previous submission, causing needless delay to the review and approval process.

❖ Staff Resource Shortages January to March 2017

At the end of 2016, and extending through the first few months of 2017, Hamilton Water experienced a temporary shortage of staff with the appropriate specialized training to fulfil the development review role in a timely manner. Senior staff departures and

difficulty in quickly recruiting qualified staff to fill vacancies were key factors in this problem. During this period, Hamilton Water's review and response times increased well beyond our performance targets. Hamilton Water implemented a number of corrective actions to address this problem, and by mid-2017, the team's turnaround performance improved considerably, as evidenced by Table 2.

- Fire Flow Policy

Hamilton Water, with the assistance of our consultant for the on-going Water Master Plan update project (commenced in 2017), is conducting a comprehensive review of the City's existing water servicing and planning policies, including the fire flow policy.

Our consultant has reviewed Ontario municipalities fire flow policies, consulted with staff (PW as well as P&ED) and stakeholders (including HHHBA) and developed a process for identifying fire flow constraints within the water distribution system. The consultant has developed preliminary recommendations for the policy based on the City's key considerations and objectives of: fire safety / building protection, water quality, community/built form quality, implementation, fairness/transparency and overall cost effectiveness.

Further consultation is planned with staff and stakeholders in the Fall of 2018 prior to presenting the final recommendations for a Master Plan Fire Flow Policy to Council.

Appendices and Schedules Attached

N/A

CITY OF HAMILTON
MOTION

Public Works Committee: September 17, 2018

MOVED BY COUNCILLOR A. VANDERBEEK……

SECONDED BY COUNCILLOR……..

Accessible Entrance Improvements to the Dundas Lawn Bowling Club

WHEREAS, the Dundas Lawn Bowling Club is located in a City facility in the Dundas Driving Park, which is used extensively from April to October by the club patrons and guests, including clubs from other municipalities for practices, games and tournaments;

WHEREAS, the Dundas Lawn Bowling Club has approached the City requesting structural capital improvements, for the first time in at least 25 years, to accommodate an aging population who increasingly experience accessibility challenges in this building and is requesting inclusive use of this recreational amenity;

WHEREAS, the current entrance is not accessible or barrier-free, offers no entrance way protection from the sun or rain, has a single entrance door with a reduced and non-standard height, and is limited by the existing structure and roofline, requiring structural modification to the roof;

WHEREAS, a proposed renovation would provide needed repairs to the front of the building and more inclusive access to the facility for patrons participating in recreational programs, allowing the club to sustain its membership and operation;

WHEREAS, the Club will, at their expense, contribute a concrete path and entrance pad (an added value of approximately $15,000), which will further improve accessibility at this City facility, once the new entranceway is in place; and,

WHEREAS, the work needs to be undertaken during the Club's winter closure, starting in the fall of 2018, so it can be completed early in 2019.

THEREFORE, BE IT RESOLVED:

(a) That the accessible entrance improvements to be completed at the City's facility in the Dundas Driving Park, which accommodates the Dundas Lawn Bowling Club, in the amount of $175,000, to be funded as follows, be approved:

    (i) $25,000 from the Ward 13 Cell Tower Account Number 3301609613; and,

(ii) $150,000 from the Unallocated Capital Reserve Account Number 108020; and,

(b) That the General Manager, Public Works Department, be authorized and directed to negotiate, enter into and execute a Contract and any ancillary documents with acceptable lowest bidder, for the accessible entrance improvements to be completed at the City's facility in the Dundas Driving Park, in a form satisfactory to the City Solicitor.