




COMMUNICATION UPDATE

TO:	Mayor and Members City Council
DATE:	July 23, 2021
SUBJECT:	Chedoke Creek Order - Cootes Paradise Workplan - HW.21.03
WARD(S) AFFECTED:	City Wide
SUBMITTED BY:	Andrew Grice Director, Hamilton Water Public Works Department
SIGNATURE:	

The City of Hamilton (City) was served Director's Order No.1-PE3L3 (Order) by the Ministry of the Environment, Conservation and Parks (MECP) on December 4, 2020, as a result of the Main/King Combined Sewer Overflow (CSO) discharge that occurred between January 2014 and July 2018. The second part of the Order required the City to develop the Cootes Paradise Report, which was submitted to the Director on March 22, 2021 and was approved on June 11, 2021. It proposed the remediation and mitigation works to offset the impacts associated with the added nutrient loading to Cootes Paradise and the Western Hamilton Harbour Area.

Within six (6) weeks of the approval of the Cootes Paradise Report by the MECP, the City is required to submit a Cootes Paradise Workplan (Workplan) which outlines the detailed actions and timelines for the approved remediation and mitigation options for Cootes Paradise and the Western Harbour. The Workplan, as prepared by Wood Environment and Infrastructure Solutions (Wood), is attached to Report HW.21.03 as Appendix "A". The structure of the Workplan is, for the most part, outlined by the MECP in the Order, and is subject to MECP Director approval. As with the Cootes Paradise Report, the Workplan utilized priority projects identified in the Chedoke Creek Water Quality Improvement Study along with addressing additional Order requirements and any Ministry comments based on the approval of the Cootes Paradise Report.

The nutrient loading that occurred during the 2014 to 2018 discharge of sewage into Chedoke Creek was estimated to have released 312 tonnes of total Kjeldahl nitrogen

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(TKN) and 47 tonnes of total phosphorus (TP). The Workplan addresses the deficit between the discharge event and what the targeted dredge is estimated to remediate.

The offsetting works being considered largely fall into two (2) forms, those that reduce the nutrients from the inflowing water, and those in-water works that treat the nutrients and other contaminants, either in a one-time reduction (such as removal) or continuously through uptake (such as specific plantings). Based on additional assessment and feedback from MECP and Royal Botanical Gardens (RBG) the proposed updated offsetting works for Cootes Paradise and the Western Harbour is shown below.

Remediation/Mitigation Offsetting Works

#	Annual Removal Projects
A1	Large Scale Floating Vegetative Mats
A2	Outcomes from Lower Chedoke Master Environmental Assessment Study
#	One-Time Removal Projects
B1	Exploratory Study to Dredge beyond Princess Point Embayment in Cootes Paradise
B2	Sediment Nutrient Inactivation
#	Watershed Projects (Point/Non-Point Annual Removals)
C1	Outcomes from Chedoke Watershed Stormwater Retrofit Master EA Study
C2	Outcomes from Application of Redevelopment Sites – Stormwater Management Policy
C3	Outcomes from Application of Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy
#	Other
	Ainsley Woods Class EA (Sewer Separation)

There are four additional projects/initiatives that are pending further review from City, MECP and area stakeholders. These include Golf Course Runoff Management, potential Desjardins Canal works, accelerating the Sewer Cross Connection Program to address the removals of partial cross connections involving private homeowners and a project that will review, the City's existing policy and procedures related to Street Management programs focused on roads in the Chedoke Watershed.

Careful consideration on the benefits and potential impacts of all the projects/initiatives will be completed in order to demonstrate an overall remediation/mitigation benefit, versus completing the work to meet an offset goal.

The Workplan also includes calculations that identify the proposed offset goal of each proposed offsetting work along with guidance on monitoring plans that will need to be developed to collect information on the efficacy of the proposed works. The monitoring data will offer insights into the need for any adaptive management to ensure the recovery and effectiveness of the mitigative works are realized to offset the added nutrient loading to Cootes Paradise and the Western Hamilton Harbour Area.

The estimated timelines to implement the proposed initiatives and priority settings have also been included in the Workplan. As stated in the Workplan, the City is bound by the *Environmental Assessment Act* in its decision making related to municipal infrastructure, therefore the large-scale initiatives will be evaluated through the Municipal Class EA process in 2022 and then advanced into the design of preferred solutions in 2023 with construction in 2024.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” to Report HW.21.03 – Chedoke Creek Order – Cootes Paradise Workplan, Wood Environment and Infrastructure Solutions



Cootes Paradise Work Plan

City of Hamilton
Project #WW20101062

Prepared for:

City of Hamilton

7/23/2021



Cootes Paradise Work Plan

City of Hamilton

Project #WW20101062

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7/23/2021

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Revision History

Version	Document Date	Submitted	Description of Revisions
1	July 23, 2021	July 23, 2021	None – Original Document.

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Appendix A – Director’s Order 1-PE3L3

1.0 Introduction

This Workplan, **Remediation Mitigation Workplan – Cootes Paradise and Western Harbour** referred to as the "**Cootes Paradise Workplan**", has been prepared by Wood Environment & Infrastructure Solutions (Wood) on behalf of the City of Hamilton (City) to address the requirements outlined in the Ministry of the Environment, Conservation and Parks (MECP) Director's Order: 1- PE3L3 (the "Order", issued December 4, 2020). The content in this workplan is specific to the remediation and mitigation proposed for Cootes Paradise and the Western Harbour area, to off-set the impacts associated with the Chedoke Creek Spill, as detailed in the Order. The City, in accordance with the Order, submitted reporting "**Remediation Mitigation Report – Cootes Paradise and Western Harbour** referred to as the "**Cootes Paradise Report**" on March 26, 2021, April 23, 2021 and May 21, 2021, the last of which was approved by MECP on June 11, 2021. The Cootes Paradise Report provided the basis for the current workplan, along with feedback and input from the City, MECP and Royal Botanical Gardens (RBG). Given the limited time to prepare the fulsome scope of this workplan, additional consultation was not feasible, however future consultation is proposed as part of all subsequent activities, the extent of which will be defined through the individual scope of those projects.

The Order has numerous components (ref. Appendix A) which are addressed in the earlier Cootes Paradise Report, and the Workplan sections which follow. Furthermore, as detailed in the Cootes Paradise Report, the City initiated a study into the water quality issues in the Chedoke Creek watershed (ref. "Chedoke Creek Water Quality Improvement Framework", GM Blue Plan and Wood, April, 2021, ("Framework Study"), prior to the issuance of the Order and several aspects of that study have contributed to the understanding of issues and available opportunities for remediation to address the impacts of the spill.

The Cootes Paradise Workplan is fundamentally intended to outline the works considered necessary to address the impacts of the 2014-2018 discharge event to Chedoke Creek and the broader Cootes Paradise/Western Harbour systems. The first part of the Order specific to the Targeted Dredging of Chedoke Creek is currently in the field data collection, design and permitting stage, with the emphasis to remove nutrients from the Chedoke Creek waterway currently resident in the bed of the creek. In its review of earlier studies (as detailed in the Chedoke Creek Workplan, May 21, 2021), MECP has indicated that the impacts of the 2014-2018 discharge event extended to Cootes Paradise and the Western Harbour hence there is a requirement for the City to advance additional ("unplanned" or "added value") works to explicitly offset the impacts to these systems. The Cootes Paradise Workplan has considered the information gathered from the field investigations for the Chedoke Creek Targeted Dredge and has used this as a basis (in part) to develop the workplan for a set of offsetting projects to meet this goal. It is also notable that the works considered herein are larger scale and longer-term undertakings, which fundamentally differs from the smaller scale near term offset works currently being planned by the City and Wood as part of the Targeted dredge scope for implementation in 2021.

The specific aspects of the Order being addressed herein include:

- 10. Within six (6) weeks of approval of Item 8 above or such other date approved by the Director in writing, submit to the Director for approval, a proposed workplan for the approved remediation/mitigation measures for Cootes Paradise/Western Hamilton Harbour Area ("Cootes Paradise Workplan"). The workplan shall consider and address, as necessary, Work Ordered in Item 8 and 9 above and any ministry comments upon approval of Item 8, and shall include, but not be limited to, the following:**
 - i. A detailed workplan and timeline for carrying out the approved remediation/mitigation options within the Cootes Paradise/Western Hamilton Harbour Area; (ref. Section 3)**

- ii. **Calculations referred to in Item 9 iv) and v) or as otherwise approved; and; (ref. Section 4)**
 - iii. **Proposed follow-up monitoring required to ensure the recovery and effectiveness of the remediation plan. (ref. Section 5)**
11. **Within two (2) weeks of the approval obtained pursuant to item 10 above, commence implementation of the approved Cootes Paradise Workplan within the timelines set out in the approval. Follows approval from MECP and Council support for budget allocation and related implementation considerations**
12. **Submit a report prepared by the Qualified Person within one (1) month of the completion of the work undertaken pursuant to the approved Cootes Paradise Workplan to the Director confirming that the natural environment has been restored and outlining the completed items and the work undertaken to restore the natural environment, including, but not limited to, the following:**
- i. **Any monitoring results completed before, during and after the work undertaken in accordance with Cootes Paradise Workplan; expected to be a multi-year effort as outlined herein**
 - ii. **Analysis of the results in Item 12 (i) above for the purpose of the intended monitoring; expected to be a multi-year effort as outlined herein**
- and**
- iii. **Determination if any requirement for on-going monitoring is needed to verify the effectiveness or maintenance of the remedial actions undertaken as necessary. expected to be a multi-year effort as outlined herein**
13. **Provide notice to any impacted landowner(s) of the following items:**
- i. **within 7 days of submission of any proposed workplan(s) submitted to the Director for approval; and**
 - ii. **within 7 days of the approval of any workplan(s) by the Director. RBG is considered the primary landowner, consultation with RBG remains ongoing**

2.0 Overview of Outcomes/Recommendations from Chedoke Creek

The introduction of excess nutrients from the 2014-2018 discharge of sewage into Chedoke Creek is the primary water quality concern for Cootes Paradise and the Western Harbour. The offsetting mitigative works being considered for Cootes Paradise and the Western Harbour, largely fall into two forms, those that reduce the nutrients from the inflowing water, and those in-water works that treat the resident nutrients and other contaminants, either in a one-time reduction (such as removal) or continuously through uptake (such as specific plantings).

The concept of the mitigative offsetting works considers both forms of work in establishing the proposed overall scope to remediate the impacts of the discharge event. The ongoing execution of the Workplan for the Chedoke Creek Targeted Dredging has provided current field data on existing conditions in the creek, as well as the extent to which the targeted dredge and small-scale local remediation within the Chedoke Creek, will be able to offset the impacts of the discharge event. It is the quantifiable deficit between the spill event discharge and the targeted dredge remediation which has guided the scope of this workplan, developed for the remediation of Cootes Paradise and the Western Harbour.

In its review of the works documented in the Cootes Paradise Report, MECP indicated that works which were currently being planned through other programs and initiatives ("planned works") would not be considered towards the offset quantum for Cootes Paradise and the Western Harbour. It was however acknowledged that these works would continue to be supported and will provide benefits accordingly. Rather MECP promoted the consideration of unplanned or added-value works ("unplanned"), which currently are not part of any City program or initiative and hence would be considered supplemental and additive to the benefits in Cootes Paradise and the Western Harbour.

2.1 Summary of Findings from Targeted Dredge Work Plan

The Chedoke Creek Targeted Dredge Work Plan included preliminary dredge elevations and nutrient mass removal estimates targeted at the nutrient mass transport that occurred during the 2014 to 2018 discharge of sewage into Chedoke Creek. The sewage discharge was estimated to have released 312 tonnes of total Kjeldahl nitrogen (TKN) and 47 tonnes of total phosphorus (TP) into Chedoke Creek. The proposed dredge elevations and nutrient mass removal estimates were based on the bathymetric survey and sediment core sampling conducted in Chedoke Creek and Princess Point Embayment in April 2021.

Sediment cores were collected using a manual piston tube device. In Chedoke Creek, cores were collected across 25 transects spaced 100 meters apart; additional cores were collected in the Princess Point embayment (from 11 locations). At each sample location, core collection was attempted at 15 cm intervals until the piston tube coring device reached refusal. Core samples were analyzed for TKN, nitrite, nitrate, nitrate + nitrite, and acid extractable phosphorous (representing TP) of each 15 cm interval. Nitrite, nitrate, nitrate + nitrite concentrations were reported consistently less than their respective detection limits, so TKN was assumed to represent total nitrogen (TN).

Sediment data were evaluated to identify soft sediment target areas within Chedoke Creek, consistent with the Order, and additional area within the Princess Point embayment was included to provide an indication of the extent to which the increased nutrient offset, not otherwise available within the Chedoke Creek limits, could be remediated. Chedoke Creek was divided into three zones (Zones 1 through 3) and the Princess Point embayment was divided into two zones (Zones 4 and 5).

Based on this zoned approach four of the five zones were recommended for removal. Zone 1 contained limited soft sediments (15 cm or less) with relatively low nutrient concentrations which would limit the practicability of sediment removal effort in this area. Dredging in the central and downstream portions of Chedoke Creek and in the Princess Point embayment, target deeper soft sediments and higher nutrient concentrations. The average targeted sediment thickness in these areas ranges from 0.30 to 0.60 m; the average TKN concentration ranges from 1,180 to 1,641 ug/g and average TP concentration ranges from 987 to 1,251 ug/g. Based on the zoned approach and adjusted target dredge elevations within Chedoke Creek and Princess Point, an estimated 68 tonnes of TP and 93 tonnes of TKN could be removed by dredging. This is 19 tonnes above the TP target mass of 47 tonnes but is still short of the 312-tonne TKN target by 219 tonnes. Approximately 23 tonnes of TP and 29 tonnes of TKN have been identified for removal from Chedoke Creek with the remaining 47 tonnes of TP and 66 tonnes of TKN located within the Princess Point embayment.

As part of the 60% design phase (not included in the Targeted Dredge Work Plan), Wood is currently refining the dredge footprints and elevations, including additional refinements to allow for setbacks from the shore and bridge structures. As designs progress and additional data are collected, the nutrient removal estimates may need to be refined. However, both the initial dredge footprint and the zoned approach nutrient mass removal estimates indicate that dredging in Chedoke Creek and Princess Point Embayment will provide a notable reduction in the 47 tonnes of TP estimated from the CSO spill event. Reduction of the 219 tonne TKN deficit will require additional effort. While Cootes Paradise will benefit from the sediment dredging described in the Targeted Dredge Work Plan, additional mitigation efforts described in the following sections are also recommended for consideration.

2.2 Planned Works

For context, the following works which are currently part of a potential, existing or planned City program or initiative, are considered to be "planned works" for the Chedoke Creek Watershed and are expected to provide a benefit to Cootes Paradise and the Western Harbour. Notwithstanding as noted above, these works are not being considered for the formal offset calculation required through the December 4, 2020 MECP Director's Order. They have only been highlighted here to provide background when considering future "unplanned works" (ref. Section 2.3).

Table 2.2.1. Planned Works per Framework Study

Type	#	Project	Lead/Process
Near-Term Capital	1	Highway 403 Trunk Sewer Twinning	City
	2	Chedoke Creek Targeted Removal (First Part of Order)	
Long-Term Capital	3	Inlet Controls in Combined Sewer Areas	City - via Flooding and Drainage Master Servicing Study
		Sewer Separation	
	4	Expand Storage Elsewhere in System	City - via Water/Wastewater/ Stormwater Master Plan
		Increase Capacity Downstream of Main-King CSO Tank	
Near-Term O&M	5	CSO Monitoring Improvements and Active Management	City
	6	Inspection and Repair – Facilities	
		Inspection and Repair – Trunk Sewers	
	7	Cross Connection Program	
	8	Wet Weather Flow in Separated Sewers –Targeted in Chedoke Watershed and broader Main-King Catchment	City - Initiate Inflow & Infiltration Monitoring

Type	#	Project	Lead/Process
Long-Term O&M	9	Water Quality Program Management and Monitoring	City
Policy and Engagement	10	Stormwater User Rate/ Low Impact Development Best Management Practices Policy	City

2.3 Unplanned/"Added Value" Works

Per the summary in the Cootes Paradise Report, the following works have been considered as "unplanned" or "added value" based largely on the assessment and consultation conducted as part of the Framework Study.

Table 2.3.1. Unplanned Works per Framework Study

Type	#	Project	Lead	
Near-Term Capital	1	Rehabilitate existing Highway 403 Culvert (Landfill)	MTO	
	2	Highway 403 Water Quality Improvements		
	3	Leachate Collection System Monitoring & Data Collection	City - Additional data required before any capital works	
	4	Aeration System (Major)	Based on RBG's 25yr Master Plan	City - via Lower Chedoke Master EA Study
		Constructed Wetland		
		Stream Naturalization		
Restore Delta at Mouth of Chedoke Creek				
4	Other Remediation and Mitigation Works			
5	Retrofits Throughout Watershed	City via Chedoke Watershed Stormwater Retrofit Master EA Study		
Long-Term Capital	6	Golf Course – Stream Naturalization	City	
	7	Expand/Fix Leachate Collection System (dependant of findings of item 3)		
	8	Lower Chedoke Master EA Capital Works	City – Scope conditional on the outcomes of each EA	
	9	Chedoke Watershed Stormwater Retrofit Master EA Capital Works		
Near-Term O&M	10	Golf Course – Runoff Management	City	
Long-Term O&M	11	Enhanced Salt Management – Highway 403	MTO	
	12	City Street Management – Enhanced Street Sweeping and Snow/Salt Management	City - Develop and Initiate Program	
Policy and Engagement	13	Engage Residents, Stakeholders, and City	City	
	14	Redevelopment Sites - Stormwater Management Policy	City - Develop Policy & Implement through Future Projects	
	15	Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy		
	16	Wet Weather Flow in Separated Sewers – Policy / Future Infrastructure Projects		

2.4 Other Works

Over the course of the preparation of the Cootes Paradise Report and subsequent to its approval by MECP on June 11, 2021, the City has engaged in dialogue with other internal City departments, as well as the RBG and MECP. The outcomes of this dialogue have contributed to some additional projects for consideration as part of a long list of unplanned works as follows:

Table 2.4.1. Other Unplanned Works for Consideration

• Desjardins Canal Works
• Accelerate Sewer Cross Connection investigation program
• Ainsley Woods Class EA (Sewer Separation)
• "Daylighting" of Chedoke Creek Tributaries

2.5 Assessment

Based on feedback to-date from the City, MECP and RBG, the following assessment of the updated set of unplanned/ "added value" works has been conducted. The projects have been identified by type (i.e., A, B, or C), and the pros and cons of each has been summarized along with a recommendation for consideration going-forward by the City and MECP. The objective has been to establish a work plan which explicitly addresses the impacts of the spill, in combination with the predicted improvements associated with the targeted dredge works.

Table 2.5.1. Screening of Unplanned Works – Cootes Paradise Work Plan

Unplanned Project	Pros	Cons	Recommendations
Resident Projects (annual removal) – Type A			
<ul style="list-style-type: none"> Large Scale Floating Vegetative mats 	Visible; effective for TP and TN; reasonable cost; proven technology; modular	Potential for extensive maintenance; locations need to consider other uses and hydraulics	Advance as part of work plan – build on knowledge gained from 2021 deployment of pilot project
<ul style="list-style-type: none"> Outcomes from Lower Chedoke Master EA Study 	Comprehensive study of all potential opportunities for lower Chedoke Creek under the Municipal Class EA process; allows for stakeholder and Indigenous engagement	Study will require 1 year (+/-); outcomes will require time beyond the study of design and construction – benefits are 2 to 3 years out; Numerical offset benefit difficult to predict	Advance as part of work plan
Resident Projects (one-time removal) – Type B			
<ul style="list-style-type: none"> Dredging beyond Princess Point Embayment in Cootes Paradise 	Considerable resident material to meet overall dredge quantity targets; area's restoration provides a good opportunity to benefit the local ecosystem	Princess Point embayment already included as part of preliminary targeted dredge plan hence will not provide a further benefit to Cootes Paradise – focus will be on areas beyond Princess Point	Advance as part of work plan – for open water beyond Princess Point; the first step will be to conduct a field data collection program to determine the location and potential severity of any contaminant deposits
<ul style="list-style-type: none"> Sediment Nutrient Inactivation 	Chemical additives such as alum or Phoslock have a high binding affinity for phosphate that prevents it from being released from the sediments into the water column where it becomes a food source for suspended algae. Addressing internal loading is often one of the most cost-effective means of nutrient control.	Depending on the hydraulic retention time of the treatment area, the benefits may be short-lived. The addition of solid material or precipitants can temporarily impact benthic invertebrates. Some products, such as alum, can have a significant impact on pH and application must be carefully monitored.	Advance as part of work plan – note that careful consideration on the benefits and potential impacts on benthic invertebrates will be required

Unplanned Project	Pros	Cons	Recommendations
Watershed Projects (point/non-point annual removals) – Type C			
<ul style="list-style-type: none"> Rehabilitate existing Highway 403 Culvert (Landfill) 	Direct removal of landfill leachate from Chedoke Creek; low-moderate cost	Not within the control of the City; moderate effectiveness	Exclude from Work Plan; engage MTO separately
<ul style="list-style-type: none"> Highway 403 Water Quality Improvements 	Direct removal of urban contaminants from roadway runoff; low cost	Not within the control of the City; moderate effectiveness; high O&M	Exclude from Work Plan; engage MTO separately
<ul style="list-style-type: none"> Outcomes from Chedoke Watershed Stormwater Retrofit Master EA Study 	Comprehensive study of all potential opportunities for retrofitting stormwater systems in Chedoke Creek watershed under the Municipal Class EA process; allows for stakeholder and Indigenous engagement	Study will require 1 year (+/-); outcomes will require time beyond the study of design and construction – benefits are 2 to 3 years out; Numerical offset benefit difficult to predict	Advance as part of work plan
<ul style="list-style-type: none"> Outcomes from Leachate Collection System Monitoring & Data Collection 	Monitoring data will guide the need for additional supplemental leachate management works	Scope of work unclear; may take several years of monitoring to determine the need and scope of additional mitigation	Exclude from Work Plan; advance monitoring under a parallel scope with other City departments
<ul style="list-style-type: none"> Golf Course – Runoff Management 	Relatively low cost; complements current golf operations	Involves another City group; will need to determine what is being done now and how an improved program can benefit the runoff water quality	To be determined – pending further dialogue with City group responsible
<ul style="list-style-type: none"> Enhanced Salt Management – Highway 403 	Direct removal of chloride from roadway runoff;	Not within the control of the City; moderate effectiveness; potential safety concerns and high O&M	Exclude from Work Plan; engage MTO separately
<ul style="list-style-type: none"> City Street Management – Enhanced Street 	Relatively low cost; complements current roadway operations	Involves another City group; will need to determine what is being done now and how an improved	To be determined – pending further dialogue with City group responsible

Unplanned Project	Pros	Cons	Recommendations
Sweeping and Snow/Salt Management		program can benefit the runoff water quality	
<ul style="list-style-type: none"> Outcomes from application of Redevelopment Sites - Stormwater Management Policy 	Policy in place – will require further review to formalize/strengthen; no cost to City;	Benefits are accrued over time; estimate of offset benefit is speculative based on rate of development	Advance as part of work plan
<ul style="list-style-type: none"> Outcomes from application of Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy 	Policy in place – will require further review to formalize/strengthen	Benefits are accrued over time; estimate of offset benefit is related to rate of roadway reconstruction in Chedoke Creek watershed	Advance as part of work plan
<ul style="list-style-type: none"> Outcomes from application of Wet Weather Flow in Separated Sewers – Policy / Future Infrastructure Projects 	Reduction in frequency of CSOs; potential for added clean water discharge to Chedoke Creek	Potential High cost of infrastructure; difficult to estimate off-set benefit as it requires complex multi-year modelling of CSO	Exclude from Work Plan; advance separately under a parallel scope with other City departments
Others			
<ul style="list-style-type: none"> Desjardins Canal Works 	Noted as a historically contaminated waterway; connected to Cootes Paradise ecosystem; supports stakeholder objective (RBG)	Limited available data; will require fieldwork, assessment, design and approvals; unlikely to be able to be bundled with Chedoke Targeted Dredge works	To be determined pending further dialogue with others (RBG, MECP, City groups, and area stakeholders etc.)

Unplanned Project	Pros	Cons	Recommendations
<ul style="list-style-type: none"> Accelerate Sewer Cross Connection investigation program 	Current City program; direct benefit from reduction of sanitary discharge to creek	Not a new program but "new" accelerated funding possible; low hanging fruit is gone – now into more difficult removals of partial cross connections involving private homeowners	To be determined pending further dialogue with others (MECP, City groups and area stakeholders etc.)
<ul style="list-style-type: none"> Ainsley Woods Class EA (Sewer Separation) 	Comprehensive study of sewer separation opportunities for Ainsley Woods under the Municipal Class EA process; allows for stakeholder and Indigenous engagement	Study will require 1 year (+/-); outcomes will require time beyond the study of design and construction – benefits are 2 to 3 years out; Numerical offset benefit difficult to predict	Advance as part of work plan
<ul style="list-style-type: none"> "Daylighting" of Chedoke Creek Tributaries 	Restores previous sections of Chedoke Creek which were enclosed and of limited habitat value; potential to provide water quality benefit to runoff; visible	Amount of benefit is difficult to determine however may be comparatively small compared to cost (empirical methodology exists); costly; need to consider functional implications	Exclude from Work Plan; advance separately under a parallel scope with other City departments


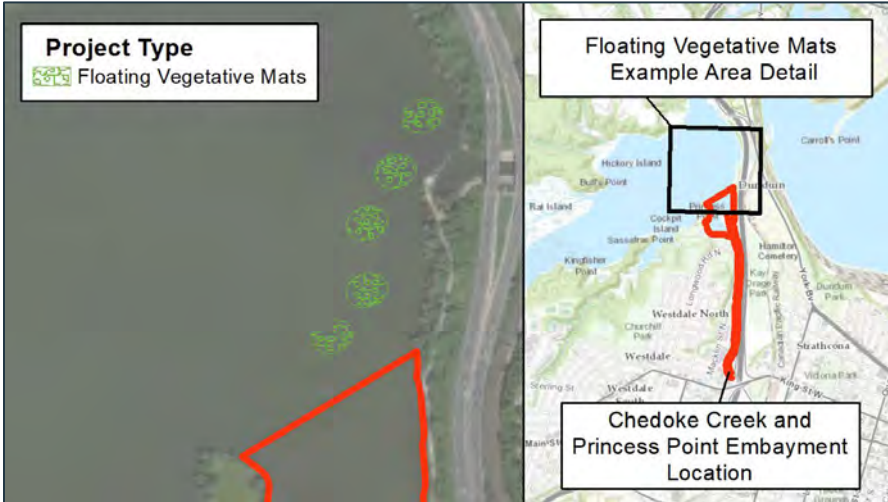
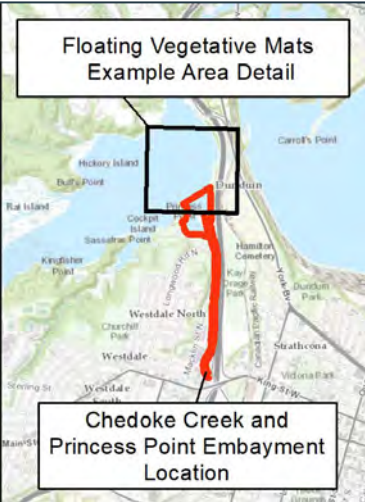
3.0 Work Plan

The Cootes Paradise Work Plan includes a wide range of water quality restoration projects which aim to address and offset the impacts of the Chedoke Creek CSO spill event. Projects have been grouped by the type of load reduction as follows:


- Resident projects resulting in the elimination of a recurring pollutant load (Type A)
- Resident projects resulting in a one-time load reduction (Type B)
- Projects within the watershed that provide recurring load reductions (Type C)

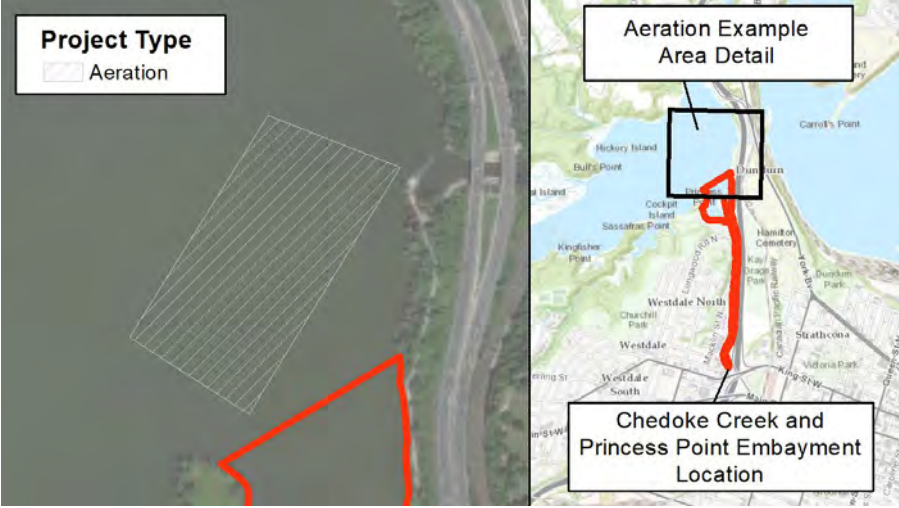
Type A projects include reduction of nutrients from internal sources, also known as legacy loads, and from external watershed sources that occur as a result of stormwater runoff or other similar processes. Load reductions resulting from Type A projects have been estimated using the sum of annual load reductions over the life of the project. Type B projects provide direct removal or inactivation of internal pollutant sources and load reductions have been estimated based on the direct in-situ pollutant mass removal or inactivation. Type C projects are outside the immediate vicinity of Chedoke Creek and provide supplemental load reduction benefits to Cootes Paradise by reduction of additional recurring pollutant loads similar to Type A projects.

Table 3.1. Resident Projects (Annual Removal) – Type A

Project Name:	A1: Large Scale Floating Vegetative Mats
Description:	Floating vegetative mats, also known as floating treatment wetlands (FTW's), provide a buoyant matrix fabricated from a variety of materials designed to support the growth of emergent vegetation within open water. The mats facilitate aquatic root growth below the bottom of the matrix and into the underlying water column which provides direct removal of nutrients to support plant growth and has the added benefit of providing surface area within the root zone which in turn provides habitat for a wide range of micro and macro- organisms.
Location:	Example map of 1-hectare (total) floating vegetative mats is included below. <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Project Type</p>  Floating Vegetative Mats </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Floating Vegetative Mats Example Area Detail</p>  </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Chedoke Creek and Princess Point Embayment Location</p>  </div> </div>
Scope:	Planning and implementation of large-scale floating vegetative mats will include stakeholder participation along with evaluation and assessment of the functionality of small-scale floating vegetative mats yet to be deployed downstream of Chedoke Creek, as part of a pending demonstration project to be implemented by the City. Several suppliers manufacture and provide design support for floating treatment wetlands.

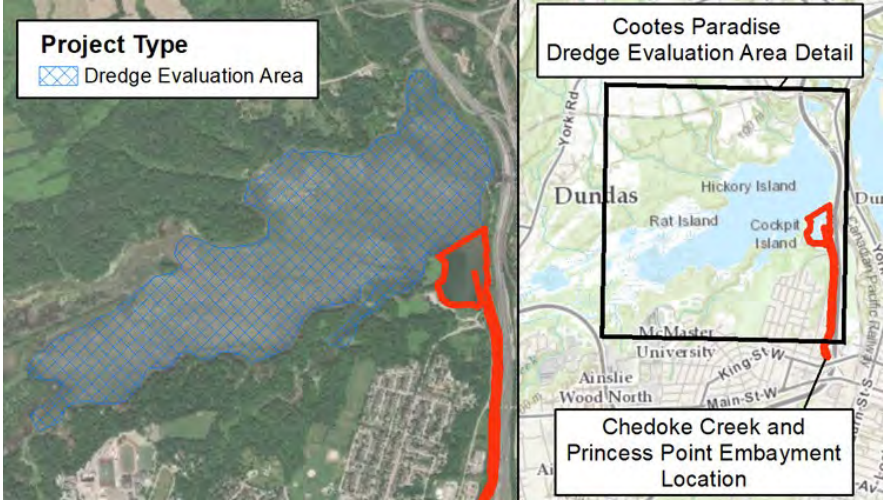
	<p>A series of stakeholder meetings regarding a scope for the anticipated use of large-scale floating vegetative mats will be led by the City and will need to include discussions of the following:</p> <ul style="list-style-type: none"> • Possible deployment areas, • Potential impacts to navigation, • Potential aesthetic impacts • Maintenance requirements, • Harvesting plans and potential beneficial reuse, • Initial planting effort and opportunities for public volunteer participation, • Identify a donor source for plantings, • Preferred vendors / design specifications, • Development of bid package specifications and criteria, • Permitting requirements, • Determine an estimated project lifecycle <p>Once the project scope has been established, the City will complete the design and permitting elements of the project and, once the requisite permits are obtained, subsequently develop a Tender for supply and implementation.</p> <p>The successful contractor will be responsible for supplying the specified materials and labour to complete installation of the floating vegetative mats. Effort to complete the plantings during/after installation of the mats will be provided either by the contractor or by the stakeholders as determined during the stakeholder scoping and planning discussions.</p> <p>It is assumed that a stakeholder group such as RBG will provide follow-on monitoring and management of the floating vegetative mats. Any required harvesting will occur as determined by the stakeholder group until the project lifecycle is complete.</p>
<p>Benefits to Cootes Paradise and Western Harbour:</p>	<p>For the purposes of the offset calculation, it has been assumed that the combined area of the proposed floating vegetative mats will be one hectare (+/-). Based on research conducted at the University of Manitoba's International Institute for Sustainable Development, cattails can remove an average of 45 kg of total phosphorus per year. Assuming a ten-year project lifecycle, this would result in approximately 0.45 tonnes of TP removal. Assuming nitrogen is present at a ratio of 10:1, TKN removal over the project lifecycle would be approximately 4.5 tonnes.</p> <p>Other benefits include vegetative diversity and habitat for wildlife.</p>
<p>Timing:</p>	<p>Stakeholder involvement can begin immediately with evaluation of the demonstration floating treatment wetlands beginning as soon as installation occurs in 2021. Design and permitting can take place concurrently with stakeholder involvement with a target project start occurring mid- 2022 following the major dredging anticipated in 2022.</p>
<p>Other Considerations</p>	<p>Floating vegetative mats will provide significant benefits beyond the ability to remove nitrogen and phosphorus. Additional benefits include:</p> <ul style="list-style-type: none"> • Ability to sequester carbon • Uptake of additional pollutants • Promotion of ecological diversity • Public awareness and education

Project Name:	A2: Outcomes from Lower Chedoke Master EA Study
Description:	<p>This proposed study will involve a comprehensive review of the Lower Chedoke Creek environs to evaluate various alternatives in terms of their benefits, impacts, and life cycle costs to improve the ecology of the area including the inputs to Cootes Paradise and the Western Harbour. As part of the Framework Study, several projects were identified through stakeholder engagement and previous studies which constituted large scale undertakings. The City is bound by the EA Act in its decision making related to municipal infrastructure hence is advocating for a systematic and comprehensive review of these large scale undertakings (plus others) through the Municipal Class EA process. Some of these initial projects included recommendations from RBG's Long-term strategy outlined in its 25 Year Master plan which considered large scale aeration, constructed wetlands and others. As noted, other projects will also be reviewed including creek and riparian area restoration, strategic plantings and others.</p>
Location:	
Scope:	<p>The scope of the study will include the following:</p> <ul style="list-style-type: none"> • Adopt Class EA process for assessment and selection of preferred solutions; provide overview of process and list of Canadian and Ontario EA requirements • Develop a problem statement • Review opportunities • Conduct a baseline inventory and study area characterization for the following: land use, surface water runoff (hydrology, hydraulics), surface water quality, sediment quantity and quality, groundwater, geology, natural heritage system (terrestrial and aquatic), watercourse morphology, cultural heritage resources, archaeology • Establish a communications and engagement framework for all notices, public consultation, webpage, virtual meetings, • Document all communications in an EA project register • Develop a long-list of proposed projects including: Constructed Wetland, Aeration System, Stream Naturalization, others • Investigate and confirm other possible projects for the Lower Chedoke Creek • Develop evaluation criteria • Evaluate long list of alternatives; screen out lowest ranking alternatives and create short-list of feasible alternatives • Confirm feasibility and effectiveness of proposed projects

	<ul style="list-style-type: none"> • Conduct impact assessment of preferred alternative on the study environment • Provide final recommendation for Lower Chedoke Creek projects • Develop preliminary cost estimates for projects • Develop an implementation plan and schedule • Develop a monitoring plan • Confirm preliminary design details of preferred recommendation • Meet all consultation and engagement requirements of MEA Class EA process
<p>Benefits to Cootes Paradise and Western Harbour:</p>	<p>Example of Aeration deployment:</p>  <p>A benthic aeration/oxygenation system may be a recommended outcome from the Lower Chedoke Creek Master Plan. For the purpose of assessing the potential benefit to Cootes Paradise a 7-hectare area shown above has been used for calculation purposes. Sediment nutrient data from Cootes Paradise samples collected in April 2021 have been used to develop potential reductions that could be achieved by introducing oxygen and preventing dissociation of iron-bound phosphorus that is assumed to be 20% of the bioavailable TP. Assuming bioavailable TP represents 50% of the TP, potential mass reductions from aeration/oxygenation could inactivate 0.6 tonnes of TP (or 90 kg per hectare). In addition to providing more suitable oxygen conditions for benthic invertebrates, aeration/oxygenation projects can also facilitate the conversion of ammonia within the sediment to nitrate which could significantly reduce the potential for ammonia toxicity and provide even more favorable conditions for benthic invertebrates. However, although nitrate is significantly less toxic than ammonia, it is still a food source for suspended algae and additional measures outside the scope of aeration would need to be implemented to promote denitrification removal of TN.</p>
<p>Timing:</p>	<p>It is anticipated that if the City can get immediate funding that it will initiate this project (study portion) in 2021 Q4/2022 Q1. The project will involve field work over the spring of 2022, with assessment and analyses taking place over the summer, followed by stakeholder engagement in the fall. The project study duration will be approximately 1 year, being completed late 2022/early 2023. The set of Lower Chedoke Creek projects (preferred) will then move to the next stages of planning and design which are expected to require another 1 year including permitting followed by approvals and tendering and construction of the first or highest priority project in early 2024.</p>

Other Considerations	As part of the Class EA Master plan other issues such as long-term ownership and operations and maintenance of any significant infrastructure will need to be considered. Further, depending on the preferred solutions some of the capital projects may have complementary social co-benefits which will at a high-level need to be considered in the Class EA and formalized through implementation.
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Table 3.2. Resident Projects (One-Time Removal) – Type B

Project Name:	B1: Dredging beyond Princess Point Embayment in Cootes Paradise
Description:	Project consists of the assessment, design and implementation of additional dredging to remove contaminated sediments in Cootes Paradise beyond the work currently underway in response to Provincial Officer’s Order. Prior to initiating any dredging, a field program will be required to locate and quantify potential adverse contaminated sediment. This work will also inherently involve a review of the cost-benefits with a focus on environmental and biological enhancements to the system.
Location:	<p>Within Cootes Paradise as determined by future evaluation.</p> 
Scope:	<p>Additional opportunities for dredging may be available within Cootes Paradise. However, limited information is currently available regarding the bathymetric and chemical characteristics of sediments within this area.</p> <p>The scope of the project will need to consider the extent of benefits expected to be realized from the additional targeted dredge operation and is expected to include the following:</p> <ul style="list-style-type: none"> • Complete fieldwork required to determine existing site conditions and additional potential removal areas (bathymetry, sediment, SAR) • Conduct cost-benefit review with focus on environmental outcomes • Complete design work including dredging process including transportation of dredged material, dewatering and location for final placement of dredged material • Confirm timing, capital budget, and design details of the project • Coordinate with the RBG, City of Hamilton, MECP and other stakeholders through permitting to complete dredging • Coordinate with appropriate approval agencies before initiating work

Benefits to Cootes Paradise and Western Harbour:	There are limited data available to develop any current dredge targets or estimate the nutrient mass removals that may result from any further dredging within Cootes Paradise. The potential benefits though for the purpose of this assessment can be estimated by using data collected from Cootes Paradise as part of the Chedoke Creek Targeted Dredge Work Plan. Using an approximate theoretical dredge footprint of 2.4 hectares and the sediment nutrient mass estimation technique described in the Chedoke Creek Targeted Dredge Work Plan, a dredge depth of 1-meter could provide removal of an additional 23 tonnes of TP and 69 tonnes of TKN. Clearly this represents a high-level estimate only at this stage and will require further field study to isolate areas of contamination and validate the benefits to the ecosystem.
Timing:	Additional data collection and evaluation are required before determining potential dredge locations. An initial field program including sediment sampling and a bathymetric survey would be needed first which could be initiated in 2022. Stakeholder involvement should be initiated early in the process. Other required elements affecting timing include design and permitting. If dredging is recommended, a target project start could occur in 2023.
Other Considerations	Additional data are necessary to evaluate whether dredging of additional areas within Cootes Paradise is recommended, feasible or supported. Other considerations include input from stakeholders.
Project Name:	B2: Sediment Nutrient Inactivation
Description:	Sediment nutrient inactivation is generally achieved by direct surface water application of a chemical with a high binding affinity for the target nutrient which is generally orthophosphate. Non-proprietary products such as aluminum sulfate or proprietary products including Phoslock® could be effective if applied within an open-water system such as Cootes Paradise, where potential sediment transport is minimal, and dredging may not be practicable. One advantage of chemical sediment nutrient inactivation over other indirect remediation measures is that a directly quantifiable mass reduction can be obtained, based on the mass of bioavailable phosphorus determined using a sequential phosphorus fractionation method (ref. Psenner et.al. 1988 ¹). Generally, the upper 5 -10 cm of sediments are sampled to provide an assessment of the phosphorus species most susceptible to release into the overlying water column. No data are currently available for Cootes Paradise regarding bioavailable phosphorus, so it has been assumed to be 50% bioavailable.

¹ "Psenner, R., Boström, B., Dinka, M., Petterson, K., Pucsko, R., Sager, M., 1988. Fractionation of phosphorus in suspended matter and sediment. Archive für Hydrobiologie: Ergebnisse der Limnologie 30, 98e103.

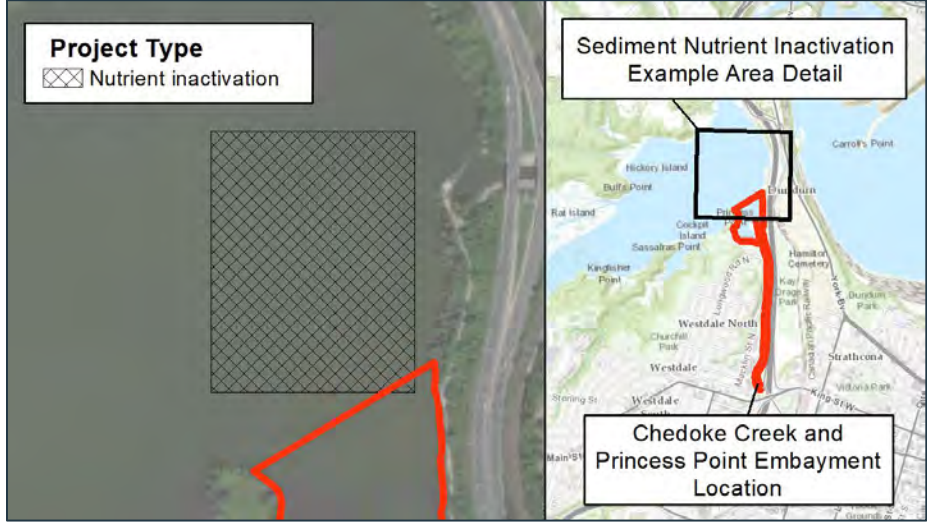
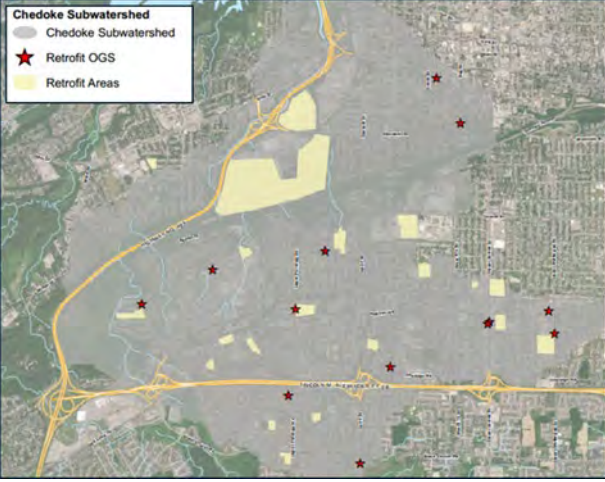

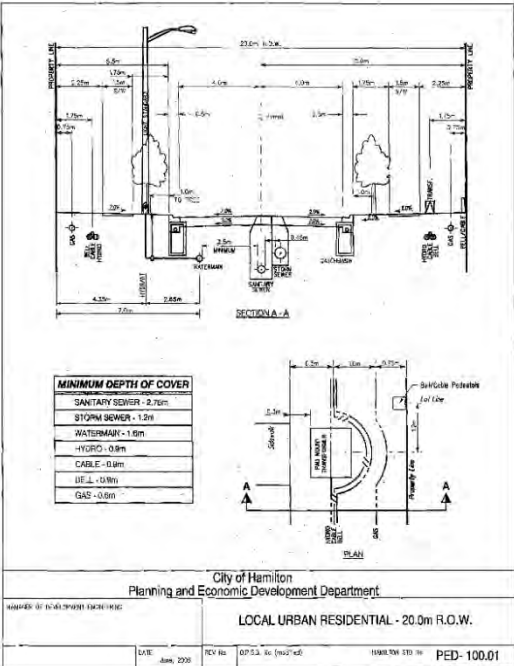
<p>Location:</p>	<p>Various areas within Cootes Paradise that may be hotspots for bioavailable phosphorus. An example area is shown below; this area encompasses approximately 9 hectares north of the Princess Point Embayment and downstream of Chedoke Creek.</p> 
<p>Scope:</p>	<p>The City will need to work with Royal Botanical Gardens and other stakeholders to identify target areas for sediment nutrient inactivation. Once identified, sediment samples will be collected and characterized for phosphorus speciation to determine the proportion of bioavailable phosphorus. Then, additional samples will be collected to determine flux rates and to perform bench tests with the potential chemical treatment. Depending on the selected product, the City will issue an RFP for application at the rate prescribed by the manufacturer, or in the case of alum, at a rate that is sufficient to provide the required inactivation of bioavailable phosphorus without causing an excessive change to pH.</p>
<p>Benefits to Cootes Paradise and Western Harbour:</p>	<p>The potential benefit from sediment nutrient activation can be demonstrated using the 9-hectare area shown, sediment nutrient data from Cootes Paradise samples collected in April 2021, assumptions described above about the bioavailability of TP, and an additional assumption that sediment nutrient inactivation can bind 80% of the bioavailable TP. Using these assumptions and sediment mass calculations demonstrated in the Chedoke Creek Targeted Dredge Work Plan, sediment nutrient activation could result in removal of approximately 3.4 tonnes of TP from a 9-hectare area (0.37 tonnes per hectare). Sediment nutrient inactivation projects are generally implemented to control phosphorus which is usually the nutrient which limits algal growth. However, new products are available which also target release of ammonia and can also have a benefit to TKN reduction. The potential mass reduction benefits would need to be evaluated in a future study.</p>
<p>Timing:</p>	<p>The design and implementation process for Sediment nutrient inactivation could be initiated in 2022, with the various field tests with application in the latter part of the year or early in 2023.</p>
<p>Other Considerations</p>	<p>Development of accurate load reduction estimates will require a laboratory determination of bioavailable phosphorus within the sediments as well as an analysis of sediment nutrient flux. Further, careful consideration on the benefits and potential impacts to benthic invertebrates will need to be considered.</p>

Table 3.3. Watershed Projects (Point/Non-Point Annual Removals) – Type C

Project Name:	C1: Outcomes from Chedoke Watershed Stormwater Retrofit Master EA Study
Description:	This municipal (MEA) Master Planning study will involve an assessment of potential locations across the Chedoke Watershed for stormwater retrofit projects to improve the runoff water quality and reduce the deposition of urban contaminants into Chedoke Creek and ultimately Cootes Paradise and the Western Harbour. The watershed generally lacks stormwater management (SWM) hence opportunities will be sought to use public spaces (parks, roads and other lands) to build new SWM infrastructure to treat previously untreated storm runoff.
Location:	 <p>The map displays the Chedoke Subwatershed boundary in grey. Yellow shaded regions indicate designated retrofit areas, while red stars mark the locations of Retrofit Oil/Grit Separator (OGS) units. The map shows a network of roads and waterways within the watershed.</p>
Scope:	<p>The Master Plan EA study specific to the separated portion of Chedoke Creek will develop a long-list of potential retrofits and through the Class EA process evaluate the benefits in the context of social, physical and economic environments leading to a set of preferred solutions.</p> <p>The scope of the study will include the following:</p> <ul style="list-style-type: none"> • Adopt Class EA process for assessment and selection of preferred solutions; provide overview of process and list of Canadian and Ontario EA requirements • Develop a problem statement • Review opportunities • Conduct a baseline inventory and study area characterization for the following: land use, surface water runoff (hydrology, hydraulics), surface water quality, sediment quantity and quality, groundwater, geology, natural heritage system (terrestrial and aquatic), watercourse morphology, cultural heritage resources, archaeology • Establish a communications and engagement framework for all notices, public consultation, webpage, virtual meetings, • Document all communications in an EA project register • Develop a long-list of potential retrofits throughout the watershed, including oil/grit separator (OGS) units, SWM facilities, and Golf Course works • Investigate and confirm other possible stormwater management projects • Develop evaluation criteria • Evaluate long list of alternatives; screen out lowest ranking alternatives and create short-list of feasible alternatives

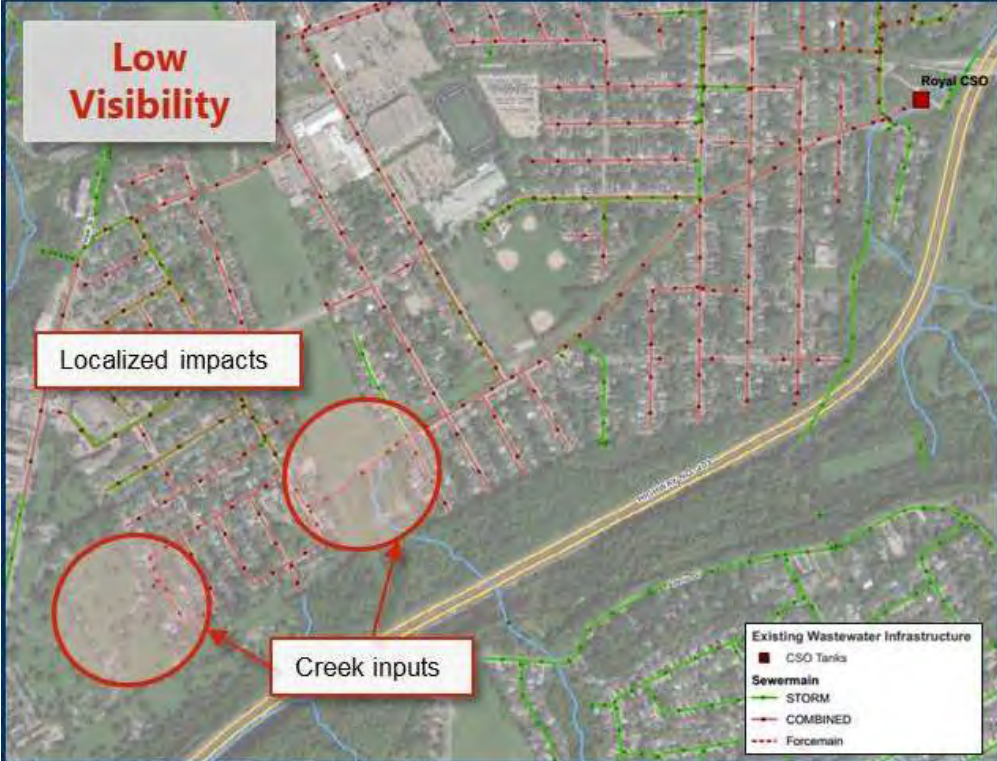
	<ul style="list-style-type: none"> • Confirm feasibility and effectiveness of proposed projects in Chedoke Creek Watershed by evaluating benefits, impacts, and life cycle costs • Conduct impact assessment of preferred alternative on the study environment • Provide final recommendation and prioritization for stormwater retrofits • Develop preliminary cost estimates for retrofits • Develop an implementation plan and schedule • Develop a monitoring plan • Confirm preliminary design details of preferred recommendation • Meet all consultation requirements of the Master Plan EA project
Benefits to Cootes Paradise and Western Harbour:	For the purpose of providing input to the offset calculation per the requirements of the Order, the potential TP and TN load reductions associated with a 20-ha retrofit project have been estimated using a spreadsheet model which considers numerous variables including rainfall, land use, soil type, impervious surface, and BMP treatment coverage. Assuming a 20-ha drainage area is retrofitted with 80% BMP treatment, annual downstream TP load reduction could range between 13 and 22 kg. Downstream annual TN load reduction could range between 76 and 111 kg. These load reductions are based on broad assumptions and may change significantly during project design.
Timing:	It is anticipated that if the City can get immediate funding that it will initiate this project 2021 Q4/2022 Q1. The project will involve field work over the spring of 2022, with assessment and analyses taking place over the summer, followed by stakeholder engagement in the fall. The project study duration will be approximately 1 year, being completed late 2022/early 2023. The set of SWM retrofits will then move to the next stages of planning and design which are expected to require another 1 year including permitting followed by approvals and tendering and construction of the first or highest priority retrofit project in early 2024.
Other Considerations	The forms of projects are expected to be of two primary types – Oil and Grit separators and new SWM facilities on public lands in locations where discharge to an open watercourse or trunk sewer is proximate. Land availability will be a significant factor in the extent to which future projects can improve water quality. The ultimate quantification of benefits will be a function of the amount of existing built-up drainage area which can be reasonably treated over the period of the program. Notably, retrofits are rarely as effective as new builds however based on cost-benefits most retrofits are deemed positive for their watersheds.
Project Name:	C2: Outcomes from Application of Redevelopment Sites – Stormwater Management Policy
Description:	Project consists of updating the SWM Policy for Redevelopment Sites in the Chedoke Watershed. The policy will contain prescription of BMPs including Low Impact Development measures for redevelopment sites within the City. The Policy will also provide specific targets for removal which at a minimum will be required to reach Provincial Guidance (Enhanced – 80% TSS removal).

Location:	<p>Figure shows current development and redevelopment applications (e.g., site plan, subdivision, zoning, and OP amendments).</p> 
Scope:	<p>Based on recommendations from the Chedoke Creek Water Quality Improvement Framework and communication with stakeholders, an updated Stormwater Management Policy for Redevelopment Sites in the City, focused on the Chedoke Creek Watershed should be implemented. The City currently has policies in place across its jurisdiction requiring SWM for re-development lands. The intent of this policy is to strengthen and potentially improve the rate of water quality treatment with a specific emphasis on contaminants of concern (COC) in Cootes Paradise. The policy will need to be consistent with Conservation Authority and Provincial guidance while acknowledging the need to address specific contaminants of concern.</p> <p>The scope of the policy update will include:</p> <ol style="list-style-type: none"> 1. Research other jurisdictions for similar policies for enhanced water quality treatment (e.g., Bay of Quinte) 2. Research technologies to specifically target contaminants of concern in Cootes Paradise 3. Consult with stakeholders - include Development industry on practical methodologies to be applied in re-development sites 4. Review Conservation Authority, Provincial and City stormwater management policies 5. Develop "white paper" on policy guidance and circulate to stakeholders 6. Finalize Policy based on stakeholder feedback.
Benefits to Cootes Paradise and Western Harbour:	<p>The potential TP and TN load reductions associated with a notional 20-ha redevelopment project have been estimated using a spreadsheet model which considers numerous variables including rainfall, land use, soil type, impervious surface, and BMP treatment coverage. Assuming a 20-ha area is redeveloped with 80% BMP treatment, annual downstream TP load reduction could range between 13 and 22 kg. Downstream annual TN load reduction could range between 76 and 111 kg. These load reductions are based on broad assumptions and may change significantly during project design. The rate of redevelopment is based on industry and market forces which are difficult to predict however for the purpose of the estimation the assumption is that 20 ha +/- are redeveloped annually.</p>
Timing:	<p>It is expected that the City will be able to develop an enhanced policy to target COC in Cootes Paradise within 6 months – estimated mid-2022. The uptake of this policy will be conditional on the rate of development and it is expected that the earliest</p>

	<p>benefits will move through the planning and design of redevelopment sites over 2022/2023 with tangible runoff improvements anticipated in 2024.</p>
<p>Other Considerations</p>	<p>The benefits to this action are governed by third parties (development industry) hence predicting the timing and benefits is speculative at best. An important advantage of this action/policy is that it will come at essentially no cost to the public and will represent a direct improvement by providing treatment of runoff for lands currently receiving no treatment.</p>
<p>Project Name:</p>	<p>C3: Outcomes from Application of Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy</p>
<p>Description:</p>	<p>The City currently has a practice to examine opportunities to provide SWM (quality/quantity) for rehabilitated/reconstructed roads. The intent of this project (Similar to Project C2) is to enhance the policy/practice (with a focus on the Chedoke Creek watershed and its COC), to strengthen the City's process and practices to maximize runoff treatment for rehabilitated roads. The emphasis will not only be on new pavement but also existing pavement so that net runoff treatment benefits are realized. The Project will involve updating the City's stormwater management policy and practices for rehabilitated road projects.</p>
<p>Location:</p>	 <p>City of Hamilton Planning and Economic Development Department</p> <p>LOCAL URBAN RESIDENTIAL - 20.0m R.O.W.</p> <p>DATE: June 2020 REV: 02/23 by [redacted] HAMILTON STD BY: PED-100.01</p>
<p>Scope:</p>	<p>Based on recommendations from the Chedoke Creek Water Quality Improvement Framework and communication with stakeholders, an updated Stormwater Management Policy for Rehabilitated and reconstructed public roadways in the City, focused on the Chedoke Creek Watershed should be implemented. The City currently has policies and practices in place across its jurisdiction requiring SWM for its roadway reconstruction projects. The intent of this policy is to strengthen and potentially improve the form and quantum of water quality treatment for these roadways with a specific emphasis on contaminants of concern (COC) in Cootes Paradise. The policy will need to be consistent with the City's current practices and procedures.</p>

	<p>The scope of the policy update will be similar to the redevelopment policy enhancement (C2) and could potentially be included in that project's scope to improve efficiencies:</p> <ol style="list-style-type: none"> 1. Research other jurisdictions for similar policies and practices for enhanced water quality treatment (e.g., Bay of Quinte) 2. Research technologies to specifically target contaminants of concern in Cootes Paradise 3. Consult with stakeholders on practical methodologies to be applied in re-development sites 4. Review Conservation Authority, Provincial and City stormwater management policies 5. Develop "white paper" on policy guidance and circulate to stakeholders 6. Finalize Policy and practices based on stakeholder feedback
<p>Benefits to Cootes Paradise and Western Harbour:</p>	<p>Incorporation of stormwater BMPs during roadway rehabilitation projects could provide significant nutrient reductions to Cootes Paradise. Similar to the BMP retrofit projects, nutrient load reductions have been estimated using a spreadsheet model which considers numerous variables including rainfall, land use, soil type, impervious surface, and BMP treatment coverage. Assuming 8 km of 2-lane roadway area is rehabilitated with 80% BMP treatment, annual downstream TP load reduction could range between 9 and 12 kg. Downstream annual TN load reduction could range between 44 and 71 kg.</p>
<p>Timing:</p>	<p>It is expected that the City will be able to develop an enhanced policy to target COC in Cootes Paradise within 6 months – as noted opportunities to combine this with the redevelopment policy (B2) may improve efficiencies – estimated mid-2022. The City will be able to apply this policy immediately to the design of any works slated for 2023. The realized benefits of this policy will be conditional on the rate of roadway reconstruction. As noted, the earliest project in design in 2022/2023 will then realize tangible runoff improvements in 2024.</p>
<p>Other Considerations</p>	<p>The City is in direct control of the outcomes of this action since it will apply to its roadways. The extent of benefits and associated costs of implementation will need to be assessed for each setting as there can be various utility and physical restrictions which can limit the ability to effectively implement focused BMPs. These will need to be assessed on a case-by-case basis.</p>

Table 3.4. Others

<p>Project Name:</p>	<p>Ainsley Woods Class EA (Sewer Separation)</p>
<p>Description:</p>	<p>The City, through the Framework Study identified the potential for a new Class Environmental Assessment to evaluate the existing surface water inputs into the combined sewer system within the Ainsley Woods neighbourhood in the Mid Chedoke Creek. The purpose of this Class EA is to comprehensively review the surface water inputs into the combined sewers that run through Ainsley Woods, specifically at the points just upstream of Blackwood Crescent and at the western extent of Iona Avenue. The objective would be to identify potential outlets for this separated flow, including evaluating the benefits, impacts, and life cycle costs of the various feasible solutions.</p>
<p>Location:</p>	
<p>Scope:</p>	<p>This project consists of the separation of the creek inputs into the combined sewers that run through Ainsley Woods, specifically at the points just upstream of Blackwood Crescent and at the western extent of Iona Avenue in Mid Chedoke Creek. The project also requires a review of the existing combined sewer system in the study area, to potentially identify high-priority areas for sewer separation projects. A Class Environmental Assessment is required to identify an appropriate outlet for the separated flow, and areas for sewer separation, including evaluating the benefits, impacts, and life cycle costs of the various feasible solutions.</p> <p>The scope of the project will include the following:</p> <ul style="list-style-type: none"> • Adopt Class EA process for assessment and selection of preferred solutions; provide overview of process and list of Canadian and Ontario EA requirements • Develop a problem statement • Review opportunities • Conduct a baseline inventory and study area characterization for the following: land use, surface water runoff (hydrology, hydraulics), surface water quality,

	<p>combined sewer and storm sewer hydraulics, sediment quality, groundwater, geology, natural heritage system (terrestrial and aquatic), watercourse morphology, cultural heritage resources, archaeology</p> <ul style="list-style-type: none"> • Establish a communications and engagement framework for all notices, public consultation, webpage, virtual meetings, • Document all communications in an EA project register • Develop a long-list of potential design alternatives, outlets for the separated creek flows, dedicated storm sewers, and potential retrofits to the existing sewer system • Develop evaluation criteria • Evaluate long list of alternatives; screen out lowest ranking alternatives and create short-list of feasible alternatives • Confirm feasibility and effectiveness of proposed creek and sewer separation projects by evaluating benefits, impacts, and life cycle costs • Conduct impact assessment of preferred alternative on the study environment • Provide final recommendation and prioritization for creek and sewer retrofits • Develop preliminary cost estimates for retrofits • Develop an implementation plan and schedule • Develop a monitoring plan • Confirm preliminary design details of preferred recommendation • Meet all consultation requirements of the Master Plan EA project
<p>Benefits to Cootes Paradise and Western Harbour:</p>	<p>By reducing the creek inputs into the combined sewer system, the frequency and volume of combined sewer overflows into the creek will be reduced and increased baseflow will reach the creek. Assuming the additional capacity would prevent annual wastewater discharge to Chedoke Creek of approximately 10 million liters, the potential load reductions over a 20-year lifecycle could be 412 kg TP and 2,380 kg TKN using the average wet weather discharge concentrations of 1.61 mg/L TP and 10 mg/L TKN from the Main/King CSO reported by Hatch, 2019. Increased natural flow contribution will also enhance ecological environment within the localized receiver and riparian habitat.</p>
<p>Timing:</p>	<p>It is anticipated that if the City can secure immediate funding that it will initiate this project 2021 Q4/2022 Q1. The project will involve field work over the spring of 2022, with assessment and analyses taking place over the summer, followed by stakeholder engagement in the fall. The project study duration will be approximately 1 year, being completed late 2022/early 2023. The set of sewer separation projects will then move to the next stages of planning and design which are expected to require another 1 year including permitting followed by approvals and tendering and construction of the first or highest priority project in early 2024.</p>
<p>Other Considerations</p>	<p>Local stakeholder/landowner input will be critical as will the potential constraints imposed by existing utilities and infrastructure.</p>

4.0 Spill Offset Quantification

The Cootes Paradise Work Plan is intended to provide supplemental total phosphorus and total nitrogen load reduction to offset the downstream pollutant transport that occurred during the Chedoke Creek CSO spill event. The sewage discharge was estimated to have released 312 tonnes of total Kjeldahl nitrogen (TKN) and 47 tonnes of total phosphorus (TP) into Chedoke Creek. Based on the zoned targeted dredge approach within Chedoke Creek and Princess Point, an estimated 68 tonnes of TP and 93 tonnes of TKN could be removed by dredging. Approximately 23 tonnes of TP and 29 tonnes of TKN have been identified for removal from Chedoke Creek with the remaining 47 tonnes of TP and 66 tonnes of TKN located within the Princess Point embayment. As discussed in Section 2.1, the Chedoke Creek Targeted Dredge project if the Princess Point embayment is included in the dredge footprint is expected to remove 45% more TP mass than was discharged but will address only 30% of the TKN mass that was discharged. The majority of the nitrogen has likely been transported downstream into Cootes Paradise and Hamilton Harbor as ammonia. Therefore, the City has through the Cootes Paradise Report identified the projects along with others based on stakeholder consultation. Table 4.1 summarizes current estimates as detailed in Section 3, associated with the additional offsetting nutrient load reduction provided by each project.

Table 4.1. Loading Offset Summary by Project Type

Advanced to Workplan Projects	Type of Project	Lifecycle (Years)	Potential Offset (tonnes)	
			TP	TKN
Resident Projects (lifecycle removal) – Type A				
Large Scale Floating Vegetative mats	A	10	0.45	4.5
Outcomes from Lower Chedoke Master EA Study (aeration)	A	10	0.6	TBD
Resident Projects (one-time removal) – Type B				
Dredging in Cootes Paradise	B	1	47.0	66.0
Sediment Nutrient Inactivation	B	1	3.4	TBD
Watershed Projects (point/non-point lifecycle removals) – Type C				
Outcomes from Chedoke Watershed Stormwater Retrofit Master EA Study	C	20	0.35	1.87
Outcomes from application of Redevelopment Sites - Stormwater Management Policy	C	20	0.35	1.87
Outcomes from application of Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy	C	20	0.21	1.15
Others				
Ainsley Woods Class EA (Sewer Separation)	C	20	0.322	2.0

5.0 Monitoring

Project-specific conceptual monitoring components will be expanded into formal monitoring plans to collect information on the efficacy of the proposed works to benefit Cootes Paradise; these are described in the following sections. Implementation and effectiveness of the remediation activities specifically for Cootes Paradise will be determined by confirming that the remediation measures have been constructed as per the approved plans and are functioning as intended, using the criteria and guidance developed in association with the MECP, through the response to the Order.

In general, the monitoring and evaluation of conditions compared to these criteria will demonstrate overall habitat quality improvement based on improved water quality, reduced sediment contamination concentrations and an improved benthic fauna community. These components will realize improvement at different temporal scales, with the sediment contamination expected to be nearly immediate, concurrent with the dredging and potential chemical inactivation activities. Changes to the sediment quality will support changes to the benthic invertebrate community that will require several years to establish. As such, a series of post-remediation monitoring studies are likely to be required for measurement and confirmation of the remediation activities' effectiveness. The following describes a conceptual monitoring framework for some of the candidate off-set works proposed within Cootes Paradise which are ultimately intended to improve water quality flowing downstream to Cootes Paradise and the Western Harbour. A more fulsome and comprehensive monitoring strategy for broader scale system-wide parameters will be developed once the scope of remediation and mitigation is better defined. Further it should be noted that selection of the off-setting projects will be conditional on several factors including field work and detailed review of the benefits of each in delivering on the project objectives, hence the scope of monitoring work will be defined in the future as more information becomes available.

5.1 A1: Large Scale Floating Vegetative Mats

Floating vegetative mats, also known as floating treatment wetlands (FTWs), have been historically used to manage and remove excess nutrients and metals from surface waters under a variety of conditions. The plants used for FTWs accumulate and store nutrients within their tissues, which can be mechanically removed from the area thereby improving surface water quality. The amount of uptake and storage of nutrients and metals is dependent on the plant species, and species selection for the Cootes Paradise application can be determined during detailed design. Studies show the shoots accumulate more nutrients and metals than the roots, as such, the target harvest material may be the shoots growing 5 centimeters (cm) above the surface of water.

These monitoring events can be used as an opportunity to promote public outreach and education. Partnering with environmental organizations such as the Royal Botanical Gardens and Hamilton Conservation Authority can provide additional support and have existing platforms for public involvement. Monitoring implementation and effectiveness of the FTWs can be completed on a thrice annual basis using the periodicity and success criteria as provided in Table 5.1.

Table 5.1. Vegetative Mats Monitoring, Success Criteria and Contingency Summary

Monitoring Period	Success Criteria	Action / Contingency
Immediately post-construction (assume Spring installation)	Vegetative mats have been constructed and placed as per the approved design drawings: <ul style="list-style-type: none"> • Appropriate size • Correct plant species • Anchors and placement within specified location and total water depth(s). 	As-constructed survey results provided in a report to document existing conditions and identify non-conformance relative to approved design. Corrective actions to be completed as per discussion with MECP.
Summer post-construction	Inspection of vegetative mats to confirm performance: <ul style="list-style-type: none"> • 80% or greater of planted species are showing new growth and increased biomass • Constructed mats are remaining in-place, anchors are performing as expected and structural maintenance is not required. 	Assessment report to document existing conditions and non-conformance with success criteria including photos of each mat from consistent vantage points taken during the as-constructed surveys. Corrective actions to be completed as per discussion with MECP.
Fall post-construction (end of growing season)	Inspection of vegetative mats and removal of plant tissue for analysis: <ul style="list-style-type: none"> • Constructed mats are remaining in-place, anchors are performing as expected and structural maintenance is not required. • Removal of shoots for laboratory analysis of nutrients and metals to help quantify total removal quantities. 	Assessment report to document existing conditions and non-conformance with success criteria including photos of each mat from consistent vantage points taken during the as-constructed surveys. The report will also document total vegetation mass removed and laboratory analysis results. Corrective actions to be completed as per discussion with MECP.

5.2 A2: Outcomes from Lower Chedoke Master EA Study

The comprehensive review of large-scale undertakings to improve the ecology of Cootes Paradise and Western Harbour such as large-scale aeration, constructed wetlands and other undertakings will require project-specific monitoring. The Municipal Class EA process including stakeholder and agency consultation will help to determine the selected large-scale undertakings, which will require development of component-specific monitoring plans.

5.3 B1: Dredging in Princess Point Embayment and Beyond (Note: this is now proposed to be included as part of Targeted Dredge scope)

Targeted dredging will remove contaminated sediment from the Princess Point embayment and areas potentially beyond (within selected portions of Cootes Paradise). These removals will improve sediment quality and are likely to improve the benthic invertebrate community. Benthic invertebrate community surveys can facilitate assessment of the biological response to dredging, with colonization of the dredged areas to occur during several years post-remediation. The following conceptual monitoring and success criteria may be used to assess implementation and effectiveness of this off-set measure (ref. Table 5.2).

Table 5.2. Targeted Dredging Monitoring, Success Criteria and Contingency Summary

Monitoring Period	Success Criteria	Action / Contingency
Immediately post-construction (sediment removal)	Bathymetric and/or topographic surveys conducted to demonstrate physical remediation was completed appropriately and total removal volume align with the approved design drawings: <ul style="list-style-type: none"> • Correct locations dredged. • Expected total water depth(s) achieved. 	As-constructed survey results provided in a report to document existing conditions and identify non-conformance relative to approved design. Corrective actions to be completed as per discussion with MECP.
Years 1, 3 and 5 post-construction	Inspection of dredge areas: <ul style="list-style-type: none"> • Bathymetric and/or topographic surveys conducted for comparison to as-constructed and previous monitoring event(s) measurements. • Sediment quality sampling of the bioactive layer (top 10 cm) for chemical laboratory analysis confirming contaminants of concern are less than pre-construction values. • Benthic invertebrate community surveys within the targeted dredge areas show increased taxa richness, density and diversity relative to pre-construction values. 	Assessment report to document existing conditions and non-conformance with success criteria. Corrective actions to be completed as per discussion with MECP.

5.4 B2: Sediment Nutrient Inactivation

Sediment nutrient inactivation may be used to remove contaminated sediment from within the Princess Point embayment of Cootes Paradise and areas potentially beyond (within Cootes Paradise). The nutrient inactivation would improve sediment quality and is likely to improve the benthic invertebrate community. Benthic invertebrate community surveys can facilitate assessment of the biological response to nutrient inactivation, with colonization of the treatment areas to occur during several years post-remediation. The following conceptual monitoring and success criteria may be used to assess implementation and effectiveness of this offset measure (ref. Table 5.3).

Table 5.3. Sediment Nutrient Inactivation Monitoring, Success Criteria and Contingency Summary

Monitoring Period	Success Criteria	Action / Contingency
Years 1, 3 and 5 post-construction	Inspection of nutrient inactivation treatment areas: <ul style="list-style-type: none"> • Sediment quality sampling of the bioactive layer (top 10 cm) for chemical laboratory analysis confirming nutrient concentrations are less than pre-construction values. • Benthic invertebrate community surveys within the treatment areas show increased taxa richness, density and diversity relative to pre-construction values. 	Assessment report to document existing conditions and non-conformance with success criteria. Corrective actions to be completed as per discussion with MECP.

5.5 C1: Outcomes from Chedoke Watershed Stormwater Retrofit Master EA Study

This Municipal (MEA) Master Planning study will involve an assessment of potential locations across the Chedoke Watershed for stormwater retrofit projects to improve the runoff water quality and reduce the deposition of urban contaminants into Chedoke Creek and ultimately Cootes Paradise and the Western Harbour. Performance monitoring to measure success of this project may be shown in the periodic surface water quality monitoring already undertaken by the City, Royal Botanical Gardens and Hamilton Conservation Authority. As such, success thresholds for this project's contribution to improved surface water quality would be difficult to quantify on a retrofit-by-retrofit basis given the inherent variability in background runoff conditions. A site-specific water quality monitoring program at the location of the retrofit to measure before and after water quality parameter concentrations may provide suitable evidence of program success; and ultimately, an overall improvement of Cootes Paradise water quality would show these measures are contributing to the overall goal of improved ecosystem health.

5.6 C2: Outcomes from Application of Redevelopment Sites – Stormwater Management Policy

Updating the Stormwater Management Policy for Redevelopment Sites in the Chedoke Watershed is meant to strengthen and potentially improve the rate of water quality treatment with a specific emphasis on contaminants of concern (COC) in Cootes Paradise. This program would provide a direct improvement by providing treatment of runoff for lands currently receiving no treatment.

As such, a before-after monitoring program at or near the location of the redevelopment may be required to quantitatively measure the success and efficacy of policy changes. The monitoring program would be developed on a site-specific basis and realistically would be an evolving program as the number of redevelopment sites increases. Similar to other programs listed herein, an overall improvement of Cootes Paradise water quality would show these measures are contributing to the overall goal of improved ecosystem health and routine surface water quality monitoring results can be used as the success criteria.

5.7 C3: Outcomes from Application of Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy

Opportunities of retrofits for road rehabilitation will enhance the policy/practice (with a focus on the Chedoke Creek watershed and its COC), to strengthen the City's process and practices to maximize runoff treatment for rehabilitated roads. As noted earlier, the emphasis will not only be on new pavement but also existing pavement so that net runoff treatment benefits are realized.

These retrofits would improve water quality treatment which aligns with the overall goal of improved surface water quality contributions to the Cootes Paradise receiver. Sites-specific monitoring of the roadway sections proposed for reconstruction will be required to measure differences in pre- and post-retrofit project sites. These retrofits are expected to improve the overall quality of surface water within Cootes Paradise and similar to other projects, routine surface water quality monitoring results will demonstrate success. However, it will be difficult to identify discrete, proportionate water quality improvements attributable to this project relative to other initiatives presented herein.

5.8 Other Projects – Ainsley Woods Class EA (Sewer Separation)

Separation of the creek inputs into the combined sewers that run through Ainsley Woods, specifically at the points just upstream of Blackwood Crescent and at the western extent of Iona Avenue in Mid Chedoke Creek would improve surface water quality and increase natural flow contribution that will enhance the ecological environment within the localized receiver and riparian habitat.

Monitoring the frequency of CSO and the associated discharge volumes over time will demonstrate the separation is functioning as intended. Additionally, ecological metrics including habitat quality, riparian vegetation assessment and possibly sediment quality assessment may provide further lines of evidence to demonstrate success. A site-specific monitoring plan is required to define the study design and success criteria once this program is better understood.

5.9 Cootes Paradise Overall Monitoring

A number of periodic and routine monitoring programs are currently conducted to measure surface water and biological health of Cootes Paradise. The RBG and HCA collect surface water quality samples at locations across the basin including within the Princess Point embayment and Chedoke Creek, as well as fish community sampling within these areas to measure fish community composition. These long-term programs have a database of legacy metrics that can be used to support an overall multi-faceted monitoring program that will build on these data to measure the success of enhancement projects noted herein. Components for continued monitoring can be determined once these projects are better understood and the scope of projects are developed. Examples of these overall monitoring initiatives include:

- Citizen science initiatives for water quality monitoring and habitat assessment (e.g., aquatic vegetation surveys)
- Increased sample frequency or increased number of sample locations to improve data resolution may provide quantitative evidence to show program success
- Site-specific long term monitoring study designs following adaptive management principles that will measure other ecological metrics and overall ecological health of Cootes Paradise.

6.0 Priority Setting and Scheduling

The unplanned projects have been evaluated using ecological, social and economic considerations to establish relative/qualitative priorities for implementation, expressed as high, moderate and low. Further, the potential timing of projects has also been summarized in Table 6.1. Since these projects have already been screened from the long-list documented in the Cootes Paradise Report, it is recognized that all of these projects have a relatively high priority for implementation. Clearly some are conditional on significant planning studies and others will be a function of further field work, however over the fulness of time each project will to varying degrees contribute to the health of Cootes Paradise and the Western Harbour through reductions in TP and TN, as well as associated habitat and ecological enhancements.

Table 6.1. Priorities of Proposed Offset Works – Cootes Paradise Work Plan

Unplanned Project	Prioritization Considerations			Priority/Schedule
	Ecological	Social	Economic	
Resident Projects (annual removal) – Type A				
<ul style="list-style-type: none"> Large Scale Floating Vegetative mats 	Direct benefits to Cootes Paradise and Western Harbour ecology; enhanced wildlife and flora	Provides high visibility and also complementary to educational/public awareness goals of City and RBG	Moderate cost effectiveness; some trialing planned for 2021 pilot	High – implement in 2022 following 2021 pilot study
<ul style="list-style-type: none"> Outcomes from Lower Chedoke Master EA Study 	Will involve a fulsome environmental review as part of MEA Class EA principles and process; focus will be on the direct ecology of Cootes Paradise	Potential for broad stakeholder engagement through Class EA	Requirement for systematic economic evaluation using full life cycle costing of all preferred solutions	High – conduct study in 2022 and then advance design of preferred solutions in 2023 with construction in 2024
Resident Projects (one-time removal) – Type B				
<ul style="list-style-type: none"> Dredging in Cootes Paradise 	Intent is to locate and remove worst contaminants which may impact long-term environmental function	Limited benefit to public except for potentially removing areas of risk through direct water contact (boating)	Given uncertainty of locations and form of contaminants the costs and associated benefits of broader scale dredging of Cootes Paradise are unknown	Moderate – given the uncertainty of the location, amount or type of contaminant as well as the type of ecological benefit this project would be of lesser priority; a field scoping program though could/should be undertaken in 2022 to determine next steps

Unplanned Project	Prioritization Considerations			Priority/Schedule
	Ecological	Social	Economic	
<ul style="list-style-type: none"> Sediment Nutrient Inactivation 	Binds sediment phosphorus and potentially ammonia and reduces internal nutrient flux which would otherwise provide a food source for algae	Reduces the intensity and duration of algal blooms which directly translates to improved water quality and enhanced public recreation opportunities	One of the most economical means of improving water quality since there is no structural component. However, multiple treatments will likely be required	High – once the rate of internal flux has been determined (2021), bench tests can be performed to determine effectiveness and a treatment plan can be developed for implementation in 2022
Watershed Projects (point/non-point annual removals) – Type C				
<ul style="list-style-type: none"> Outcomes from Chedoke Watershed Stormwater Retrofit Master EA Study 	Will involve a fulsome environmental review as part of MEA Class EA principles and process; focus will be on the environmental conditions at the retrofit sites	Potential for broad stakeholder engagement through Class EA	Requirement for systematic economic evaluation using full life cycle costing of all preferred solutions	High – conduct study in 2022 and then advance design of preferred solutions in 2023 with construction in 2024
<ul style="list-style-type: none"> Outcomes from application of Redevelopment Sites - Stormwater Management Policy 	Benefits will be indirect due to improved stormwater runoff quality including a reduction in TP and TKN	Redevelopment sites will be required to implement on-site/source controls which may influence site designs	Costs for retroactive stormwater management for redevelopment sites will be wholly the responsibility of development proponents with no costs to the public	High – while benefits are limited to indirect water quality improvements costs are borne by development community hence opportunity to advance should be pursued immediately (2022)
<ul style="list-style-type: none"> Outcomes from application of Retrofits for Road Rehabilitation Projects / Low Impact Development Best Management Practices Policy 	Benefits will be indirect due to improved stormwater runoff quality including a reduction in TP and TKN	Most stormwater management infrastructure is anticipated to subsurface with limited visibility; may be opportunity for some rain gardens and other surface based BMPs which would provide aesthetic and educational benefits	Premium (5% +/-) for treatment of runoff from roadways which currently do not receive treatment; not all roadway BMPs will be cost effective and likely not feasible to treat 100 per cent of roadways due to other constraints such as utilities	Moderate – benefits are indirect and costs in some settings may be prohibitive; incumbent on City to develop a consistent screening tool to evaluate each roadway segment for optimum water quality treatment; advance screening in 2022 and implement BMPs strategically as part of roadway reconstruction program

Unplanned Project	Prioritization Considerations			Priority/Schedule
	Ecological	Social	Economic	
Others				
<ul style="list-style-type: none"> Ainsley Woods Class EA (Sewer Separation) 	Will involve a fulsome environmental review as part of MEA Class EA principles and process; focus will be on the direct ecology of the Chedoke tributaries as well as possible benefits of reduced CSOs to Cootes Paradise, as well as improved ecology with clean water inputs	Potential for broad stakeholder engagement through Class EA; potential for major capital works to redirect drainage systems which may impact transportation and private properties	Requirement for systematic economic evaluation using full life cycle costing of all preferred solutions; due to the nature of sewer separation, particularly in the upper/mid portions of the watershed, potential exists for costly infrastructure to facilitate the separation	Moderate - High – conduct study in 2022 and then advance design of preferred solutions in 2023 with construction in 2024; depending on economic assessment potential exists for outcomes to have low cost benefits (to be determined)



**Appendix A:
Director's Order 1-PE3L3**

Ministry of the Environment,
Conservation and Parks

Ministère de l'Environnement,
de la Protection de la nature et des Parcs



Director's Order

Section 157.3 Environmental Protection Act, R.S.O. 1990
Section 16.4 Ontario Water Resources Act, R.S.O. 1990
Section 26.3 Pesticides Act, R.S.O. 1990
Section 107 Safe Drinking Water Act, S.O. 2002, c.32 (SDWA)
Section 32 Nutrient Management Act, 2002, S.O. 2002

Order Number
1-PE3L3

To:

HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

HAMILTON, CITY OF
71 MAIN STREET WEST, 1st Floor
HAMILTON, ONTARIO L8P 4Y5
Canada

Site: Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour, and as further described in the Provincial Officer Report # 1-OW6SS under section entitled "Description of the Site and the Orderees".

Response to Request

Attention: City Clerk

I have reviewed Provincial Officer Order 1-OW6SS ("Order") dated 20/11/2020 (dd/mm/yyyy) in response to your request for the review dated November 27, 2020, submitted by your lawyer, Ms. Rosalind Cooper on behalf of the City of Hamilton. I have considered your submissions and met with the issuing Provincial Officer, Shelley Yeudall and technical support staff in the Ministry of the Environment Conservation and Parks (Ministry) to discuss the Order and the above noted request. I have also considered the submissions made at a meeting held on December 3, 2020 between City officials Andrew Grice, Cari Vanderperk and Mark Bainbridge and Ministry officials including myself, Shelley Yeudall, Lindsey Burzese, Zafar Bhatti and Sarah Day.

Pursuant to my authority under s. 157.3 of the Environmental Protection Act, R.S.O. 1990, c. E.19 (EPA) and s. 16.4 of the Ontario Water Resources Act, R.S.O. 1990, c. O.40 (OWRA) I hereby confirm and alter portions of the Order as set out below.

Item No. 1 of the Order was altered to extend the compliance date as specified below.

Item No. 2, No. 3, No. 8 and No. 10 of the Order were altered to extend the compliance dates as specified below, and to refer to the Director as opposed to Provincial Officer for the submission of required documents.

Item No. 6, No. 7, No. 12, No. 13, No. 15, No. 17, No. 18, No. 19 and No. 20 of the Order were altered to refer to the Director as opposed to the Provincial Officer.

Item No. 16 of the Order was revoked.

Item No. 4, No. 5, No. 9, No. 11 and No. 14 of the Order are confirmed.

For ease of reference this order uses the definitions used in the Provincial Officer's Report.

Also, for ease of reference, the Director's Order now reads as follows:

1. By January 15, 2021, retain the services of a Qualified Person that has the experience and qualifications to carry out the work specified in this order.
2. By January 15, 2021, submit to the Director written confirmation that the Qualified Person has been retained to carry out the work specified in this order, that a copy of the order has been given to the Qualified Person; and that the Qualified Person has the experience and qualifications to carry out the work.

Chedoke Creek Downstream of the Main/King CSO Discharge Pipe

3. By February 22, 2021, submit to the Director, for approval, a remediation workplan for Chedoke Creek that is developed by the Qualified person to undertake the targeted dredging of Chedoke Creek based on the recommendation identified in section 5.2.5 of the Wood report entitled "MECP Order # 1-J25YB Item 1b – Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated January 24, 2019 ("Chedoke Creek Workplan"). The Chedoke Creek Workplan shall be prepared in accordance with the requirements set out in Items 4 and 5 below.
4. The Chedoke Creek Workplan shall, at a minimum:
 - i. Consider technical reports, Ministry comments and affected stakeholders' comments, to determine an acceptable plan to implement the recommendation in the Wood report to restore the Chedoke Creek, while mitigating impacts of implementing the plan on the natural environment, including water;
 - ii. Contain a detailed timeline setting out critical milestones and checkpoints with the Ministry for carrying out the Chedoke Creek Workplan;
 - iii. Contain a Species at Risk assessment plan and associated timelines for Chedoke Creek downstream of the spill and including potential impacted areas downstream of Chedoke Creek that may be impacted by targeted dredging;
 - iv. Undertake consultation with the Species at Risk Branch within the Ministry in respect of any identified items pursuant to 4 iii) and incorporate this feedback and outcome into the workplan for any species at risk;
 - v. Provide a description of any anticipated approvals needed to implement the Chedoke Creek Workplan, initial consultation and proposed timelines to obtain such approvals, if required, for the Workplan to be implemented;
 - vi. The consultation in iv) and v) shall include the Regional Technical Support Section of the Ministry;
 - vii. Contain a description of the identified areas and the extent (depth, location) of the targeted dredging with a description of how the items outlined in Item 5 below were addressed and a description of any methods for refining identified areas in Item 5 including the impacted areas identified in the Wood reports and SLR reports and timing as needed, in the Chedoke Creek Workplan;
 - viii. Contain a description of the approximate volume of material to be removed;
 - ix. Identify and contain a description of proposed mitigation measures for any short-term impact(s) that may arise from implementing the Chedoke Creek Workplan for Chedoke Creek, its shoreline and connected waterways/natural environment, on any species at risk and other potentially impacted uses. Mitigation measures may include, but are not limited to: exclusion measures for local aquatic uses; limit recreational uses in the area; total suspended solids control as required for carrying out the targeted dredging; and proposed monitoring during any remediation to monitor effectiveness of mitigation measures during dredging identified in iv); and
 - x. Contain a proposed monitoring plan to monitor the recovery of the natural environment and effectiveness of the Chedoke Creek Workplan once dredging is complete.

5. With respect to the area from the Main/King CSO outfall to the mouth of Chedoke Creek, the Chedoke Creek Workplan shall take into consideration the scope of targeted dredging work necessary to restore the natural environment to pre-spill conditions, as to be agreed upon by the Ministry, and to mitigate any impairments or potential impairments from the spill, in relation to the following, but not limited to:

- i. Sediment areas identified as impacted, in consultation with the Ministry, by the sewage spill;
- ii. Sediment areas identified as containing elevated organic material consistent with sewage sludge;
- iii. Sediment areas identified as elevated nutrients (particularly TP, TAN, and TKN);
- iv. Sediment areas identified as had, may have, or continuing to have reduced dissolved oxygen levels in the water column from historical levels;
- v. Sediment areas identified as having elevated parameters as identified by the ERA carried out by SLR ("Ecological Risk Assessment (ERA), Chedoke Creek, Hamilton, Ontario" dated February 12, 2020) to have moderate or high risk for impacts, or otherwise identified by the reports or in comments by the Ministry; and
- vi. Addressing any ecological flow path requirements and connectivity within the creek in any remedial action plan that may impact low flow path and connectivity.

6. By October 31, 2021 or such other date approved by the Director in writing, complete the approved Chedoke Creek Workplan.

7. Within one (1) month of the completion of the of the work undertaken pursuant to the approved Chedoke Creek Workplan, submit to the Director, a report prepared by the Qualified Person confirming that the natural environment has been restored to pre-spill conditions and that further impairment to the natural environment will not occur as a result of the spill to the Chedoke Creek as detailed in the attached Provincial Officer's report, and at a minimum contain the following:

- i. The details of the work undertaken to complete the Chedoke Creek Workplan;
- ii. Any monitoring results completed before, during and after the work undertaken in accordance with the Chedoke Creek Workplan;
- iii. Analysis of the results in Item 7(ii) above for the purposes of the intended monitoring; and
- iv. Determination if any requirement for on-going monitoring is required to verify the effectiveness or maintenance of the remedial actions undertaken is necessary.

Cootes Paradise/Western Hamilton Harbour Area

8. By March 22, 2021, submit to the Director for approval, a proposed remediation/mitigation report that is prepared by a Qualified Person(s) for the Cootes Paradise/Western Hamilton Harbor Area to offset the added nutrient loading, principally TP, identified in the Wood reports, the SLR reports and particularly the Hatch reports, and address any other potential on- going impacts (dissolved oxygen, algal blooms) as a result from the sewage spill to this area ("Cootes Paradise Report").

9. The report in Item 8 shall, at a minimum:

- i. Identify and review all potential remediation or mitigation measures, whether direct, indirect, or a combination of measures with consideration for short and long-term measures to address the remediation goal to offset added nutrient loading particularly for TP and any potential on-going impacts (dissolved oxygen, algal blooms) from the sewage spill to the Cootes Paradise/Western Hamilton Harbor Area as identified in the Wood reports, the SLR reports and the Hatch reports;
- ii. Undertake consultation with and provide a summary of comments received from the Royal Botanical Gardens, Hamilton Conservation Authority, the Ministry, and any other relevant affected stakeholders for potential remediation and mitigation options as per item i. above;
- iii. Contain a cost/benefit analysis of all options to assess efficiency and effectiveness of any remediation or mitigation options;
- iv. Identify the recommended options for remediation and mitigation;

v. Identify the proposed offset goal to achieve remediation and/or mitigation with respect to the approximate equivalent loadings from the sewage spill;

vi. Propose a methodology for quantification with respect to the offset of the loadings for any remediation and/or mitigation measures to meet the intended goal for overall remediation and/or mitigation to address the added TP loading from the spill; and

vii. Identify and propose timelines to implement the recommended remediation or mitigation measures to offset loadings from TP, impacts to dissolved oxygen from nutrients or other measures that may improve existing or potential impairments with identification of options that can be implemented as soon as possible to start to reduce the on-going or potential impacts.

10. Within six (6) weeks of approval of Item 8 above or such other date approved by the Director in writing, submit to the Director for approval, a proposed workplan for the approved remediation/mitigation measures for Cootes Paradise/Western Hamilton Harbour Area ("Cootes Paradise Workplan"). The workplan shall consider and address, as necessary, Work Ordered in Item 8 and 9 above and any ministry comments upon approval of Item 8, and shall include, but not be limited to, the following:

i. A detailed workplan and timeline for carrying out the approved remediation/mitigation options within the Cootes Paradise/Western Hamilton Harbour Area;

ii. Calculations referred to in Item 9 iv) and v) or as otherwise approved; and

iii. Proposed follow-up monitoring required to ensure the recovery and effectiveness of the remediation plan.

11. Within two (2) weeks of the approval obtained pursuant to item 10 above, commence implementation of the approved Cootes Paradise Workplan within the timelines set out in the approval.

12. Submit a report prepared by the Qualified Person within one (1) month of the completion of the work undertaken pursuant to the approved Cootes Paradise Workplan to the Director confirming that the natural environment has been restored and outlining the completed items and the work undertaken to restore the natural environment, including, but not limited to, the following:

i. Any monitoring results completed before, during and after the work undertaken in accordance with Cootes Paradise Workplan;

ii. Analysis of the results in Item 12 (i) above for the purpose of the intended monitoring; and

iii. Determination if any requirement for on-going monitoring is needed to verify the effectiveness or maintenance of the remedial actions undertaken as necessary.

13. Provide notice to any impacted landowner(s) of the following items:

i. within 7 days of submission of any proposed workplan(s) submitted to the Director for approval; and

ii. within 7 days of the approval of any workplan(s) by the Director.

14. Provide notice to any impacted landowner(s) at least seven (7) days before the implementation of any work on the approved Chedoke Creek Workplan or the approved Cootes Paradise Workplan;

15. Within seven (7) days of any work on the Chedoke Creek Workplan and the Cootes Paradise Workplan, provide written confirmation to Director, that implementation of the approved workplan(s) has commenced.

16. Within (2) days of any limitations or changes being identified to the approved workplans, notify the Director and within two (2) weeks, submit, in writing for review and acceptance, any proposed changes to an approved workplan with the relevant information to support any proposed changes. Written acceptance by the Director of the proposed changes is required prior to implementation of any proposed changes.

17. Prior to the first of each month, provide to the Director written, monthly progress updates on the progress made to comply with this order.

18. In conjunction with the written monthly progress updates, the City shall meet with the Director within 7 days of the submission of the monthly report to discuss the progress reports.

19. Post this order on the web site of the City for public viewing within 24 hours of it being served and it shall remain posted unless otherwise directed by the Director.

A. While this order is in effect, a copy or copies of this order shall be posted in a conspicuous place.

B. While the order is in effect, report in writing, to the District or Area Office, any significant changes of operation, emission, ownership, tenancy or other legal status of the facility or operation.

Request for Hearing

You may require a hearing before the Environmental Review Tribunal if, within 15 days of service of this order, you serve written notice of your appeal on the Environmental Review Tribunal and the Director. Your notice must state the portions of the order for which a hearing is required and the grounds on which you intend to rely at the hearing. Except by leave of the Environmental Review Tribunal, you are not entitled to appeal a portion of the order or to rely on grounds of appeal that are not stated in the notice requiring the hearing. Unless stayed by the Environmental Review Tribunal, the order is effective from the date of service.

Written notice requiring a hearing must be served personally or by mail upon:

The Secretary Environmental Review Tribunal 655 Bay Street, 15th Floor Toronto, ON M5G 1E5	and	Director Ministry of the Environment, Conservation and Parks 119 King St. W., 9th floor Hamilton, ON, L8P 4Y7 Fax: (905) 521-7806
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Where service is made by mail, the service shall be deemed to be made on the fifth day after the date of mailing and the time for requiring a hearing is not extended by choosing service by mail.

For your Information

The procedures to request a hearing and other information provided above are intended as a guide. The legislation should be consulted for additional details and accurate references.

Reasons for Response

I altered work ordered item Items No. 1, No. 2, No. 3 and No.8 of the Order allow the City of Hamilton more time to follow their internal procurement and funding process to retain the Qualified Person within a reasonable period of time. Additional time was granted, at the City's request, to allow the City more time to work with the Qualified Person to complete the Chedoke Creek Workplan and the Cootes Paradise Report.

I altered work ordered Item No. 10 of the Order to allow at least six (6) weeks, or such other date approved by the Director, for the submission of the Cootes Paradise Workplan in relation to the approved remediation/mitigation measures for Cootes Paradise/Western Hamilton Harbour Area. The additional time will allow the City more time to develop the Cootes Paradise Workplan in consultation with the Qualified person and accommodate their internal approval processes.

Item No. 16 of the order was revoked as I agree with the City that the requirements were duplicative, and that the monthly update meetings required by Item No. 17 (formerly No. 18 of the Order) will provide the necessary updates to me and the Ministry on the City's progress in complying with the order. Item No. 17, No. 18, No. 19 and No. 20 of the Order were renumbered accordingly.

I am confirming work ordered Items No. 4, No. 5, No. 6, No. 7, No. 9, No. 11, No. 12, No. 13, No. 14, No. 15, No. 17, No. 18, No. 19 and No. 20 of the Order.

A meeting was held on December 3, 2020 between City officials Andrew Grice, Cari Vanderperk and Mark Bainbridge, and me along with Ministry staff, in response to the request for review of the Order. I discussed the requirements of the Order in detail, including in relation to the clarifications sought by the City in its request for review, with support from Ministry officials in attendance. The City was given opportunity to ask questions of me and Ministry officials regarding the work ordered, and I discussed expectations of the Order moving forward. I am of the view that given the nature of the discussions, and the City's understanding of the work that is required of them, I did not see a need to alter any other terms of the order.

I note that Item No. 2, No. 3, No. 6, No. 7, No.8, No. 10, No. 12, No. 13, No. 15, No. 17, No. 18, No. 19 and No. 20 were altered to refer to the Director, as opposed to the Provincial Officer, for the purposes of administering the requirements of the order, and so I am apprised of progress made to comply with the Order.

Issued at City of Hamilton this 04/12/2020 (dd/mm/yyyy).



Stephen Burt

Badge # 1504

Hamilton District

Provincial Officer's Report

Order Number
1-OW6SS

To:

HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

HAMILTON, CITY OF
71 MAIN STREET WEST, 1st Floor
HAMILTON, ONTARIO L8P 4Y5
Canada

Site:

Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour, and as further described in the Provincial Officer Report under section entitled "Description of the Site and the Orderes".

Observations

1. Authority to Issue Order

This Order is being issued pursuant to my authority under sections 157, 157.1 and 196 of the Environmental Protection Act and under sections 16, 16.1, and 104 of the Ontario Water Resources Act.

2. Definitions

For the purpose of this Order, the following terms shall have the meanings described below:

"adverse effect" means one or more of:

- (a) impairment of the quality of the natural environment for any use that can be made of it,
- (b) injury or damage to property or to plant or animal life,
- (c) harm or material discomfort to any person,
- (d) an adverse effect on the health of any person,
- (e) impairment of the safety of any person,
- (f) rendering any property or plant or animal life unfit for human use,
- (g) loss of enjoyment of normal use of property, and
- (h) interference with the normal conduct of business.

"cBOD" means Carbonaceous Biochemical Oxygen Demand

"City" means the City of Hamilton.

"Combined Sewers" means pipes that collect and convey both wastewater from residential, commercial, institutional and industrial buildings and facilities (including infiltration and inflow) and stormwater runoff through a single-pipe system;

"Combined Sewer Overflow (CSO)" means a discharge to the environment from a Combined Sewer system that usually occurs as a result of precipitation when the capacity of the combined sewer is exceeded.

"combined sewer system" is a wastewater collection system which conveys sanitary wastewaters (domestic, commercial and industrial wastewaters) and stormwater runoff through a single pipe system to a Sewage Treatment Plant (STP) or treatment works. Combined sewer systems which have been partially separated and in which roof leaders or foundation drains contribute stormwater inflow to the sewer system conveying sanitary flows are still defined as combined sewer systems in Procedure F-5-5.

"discharge", when used as a verb, includes add, deposit, emit or leak and, when used as a noun, includes addition, deposit, emission or leak; ("rejet", "rejeter")

"DO" means Dissolved Oxygen

"Dry weather flow" is sewage flow resulting from both: 1) Sanitary wastewater (combined input of industrial, domestic and commercial flows); and 2) Infiltration and inflows from foundation drains or other drains occurring during periods with an absence of rainfall or snowmelt.

"EPA" means the Environmental Protection Act, R.S.O. 1990, c. E.19.

"ERA" means Ecological Risk Assessment.

"HATCH" means HATCH Limited.

"HATCH reports" means the following reports:

- Report entitled "Quantification of Volume and Contaminant Loadings" dated September 28, 2018 by HATCH Limited;
- Report entitled "Main-King CSO Tank Overflow Volume Estimates" by HATCH Limited dated April 14th, 2020.

Ministry" or "MECP" means the Ontario Ministry of Environment, Conservation and Parks.

"municipality" means the City of Hamilton

"operator" means a person who adjusts, inspects or evaluates a process that controls the effectiveness or efficiency of a facility, and includes a person who adjusts or directs the flow, pressure or quality of the wastewater within a wastewater collection facility;

"Order" means this Provincial Officer's Order 1-OW6SS, as it may be amended.

"overflow event" occurs when there is one or more CSOs from a combined sewer system, resulting from a precipitation event. An intervening time of twelve hours or greater separating a CSO from the last prior CSO at the same location is considered to separate one overflow event from another.

"owner" means a municipality or person having authority to construct, maintain, operate, repair, improve or extend water works or sewage works; ("propriétaire")

"owner of the pollutant" means the owner of the pollutant immediately before the first discharge of the pollutant, whether into the natural environment or not, in a quantity or with a quality abnormal at the location where the discharge occurs, and "owner of a pollutant" has a corresponding meaning; ("propriétaire du polluant", "propriétaire d'un polluant")

"OWRA" means the Ontario Water Resources Act, R.S.O. 1990, c. O.40.

"Partially Separated Sewer Systems" means wastewater collection systems that originally had Combined Sewers and where either only a portion of a system was retrofitted to separate sewers, or in which roof leaders or foundation drains still contribute stormwater inflow to the separated sewer conveying sanitary sewage, and/or a new development area served by separate sewers was added to an area served by Combined Sewers;

"person having control of a pollutant" means the person and the person's employee or agent, if any, having the charge, management or control of a pollutant immediately before the first discharge of the pollutant, whether into the natural environment or not, in a quantity or with a quality abnormal at the location where the discharge occurs, and "person having control of the pollutant" has a corresponding meaning;

"pollutant" means a contaminant other than heat, sound, vibration or radiation, and includes any substance from which a pollutant is derived;

"practicable" means capable of being effected or accomplished;

"Provincial Officer" means the undersigned provincial officer or, in the event that the undersigned is unable to act, any other provincial officer authorized to act pursuant to the EPA and OWRA.

"Provincial Officer's Report" means this 18-page report which comprises part of the Order.

"restore the natural environment", when used with reference to a spill of a pollutant, means restore all forms of life, physical conditions, the natural environment and things existing immediately before the spill of the pollutant that are affected or that may reasonably be expected to be affected by the pollutant, and "restoration of the natural environment", when used with reference to a spill of a pollutant, has a corresponding meaning;

"Sanitary Sewers" means pipes that collect and convey wastewater from residential, commercial, institutional and industrial buildings, and some infiltration and inflow from extraneous sources such as groundwater and surface runoff through means other than stormwater catch basins;

"Separate Sewer Systems" means wastewater collection systems that comprised of Sanitary Sewers while runoff from precipitation and snowmelt are separately collected in Storm Sewers;

"sewage" includes drainage, storm water, commercial wastes and industrial wastes and such other matter or substance as is specified by the regulations; ("eaux d'égout")

"sewage works" means any works for the collection, transmission, treatment and disposal of sewage or any part of such works, but does not include plumbing to which the Building Code Act, 1992 applies; ("station d'épuration des eaux d'égout")

"Site" means the site described as: Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour and as further described in the Provincial Officer Report under section entitled

"Description of the Site and the Orderees".

"SLR" means SLR Consulting (Canada) Ltd.

"SLR reports" means the following reports:

- Letter report entitled "Peer Review Report - Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated May 15, 2019 by SLR Consulting (Canada) Ltd.;
- Report entitled "Ecological Risk Assessment (ERA), Chedoke Creek, Hamilton, Ontario" by SLR Consulting (Canada) Ltd. dated February 12, 2020 (including "APPENDIX A Previous Environmental Investigations Sampling Locations");
- Report entitled "Cootes Paradise: Environmental Cootes Evaluation Hamilton, Ontario" by SLR Consulting (Canada) Ltd. dated April 22, 2020; and
- Letter report entitled "Response to Ministry of Environment, Conservation and Parks May 28, 2020 letter entitled Chedoke Creek Spill Response – District Comments" by SLR Consulting (Canada) Ltd. dated June 12, 2020.

"spill", when used with reference to a pollutant, means a discharge,
(a) into the natural environment,
(b) from or out of a structure, vehicle or other container, and
(c) that is abnormal in quality or quantity in light of all the circumstances of the discharge,
and when used as a verb has a corresponding meaning; ("déversement", "déverser")

"Storm Sewers" means pipes that collect and convey runoff resulting from precipitation and snowmelt (including infiltration and inflow);

"substance" means any solid, liquid or gas, or any combination of any of them.

"TAN" means Total Ammonia Nitrogen

"TKN" means Total Kjeldahl Nitrogen

"TP" means Total Phosphorous

"Tribunal" means the Environmental Review Tribunal

"TSS" means Total Suspended Solids

"Wet weather flow" is the combined sewage flow resulting from:

1. Sanitary wastewater; and
2. Infiltration and inflows from foundation drains or other drains resulting from rainfall or snowmelt; and
3. Stormwater runoff generated by either rainfall or snowmelt that enters the combined sewer system.

"Wood" means Wood Environmental & Infrastructure Solutions a division of Wood Canada Limited.

"Wood reports" means the following reports:

- Report entitled "MECP Order # 1-J25YB Item 1b – Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated January 24, 2019 by Wood Environmental & Infrastructure Solutions;
- Report entitled "MECP Order # 1-J25YB Item 1c – Implementation and Costing Report" dated January 24, 2019 by Wood Environmental & Infrastructure Solutions; and
- Memo entitled "Chedoke Creek Project, Wood Commentary on SLR Peer Review Comments, City of Hamilton" dated May 23, 2019 by Wood Environmental & Infrastructure Solutions.

3. Description of the Site and the Orderees

The City of Hamilton is the owner and operator of two (2) wastewater treatment plants (WWTP) called Dundas WWTP and Woodward WWTP located at 135 King Street West and 700 Woodward Avenue, respectively. Sewage is collected via the wastewater collection system made up of both Separate Sewer Systems and Combined Sewer Systems and Partially Separated Sewer Systems serving the former towns of Stoney Creek, Hamilton, Dundas, Ancaster and Waterdown and other hamlets surrounding the City.

The City of Hamilton is also the owner and operator of the wastewater collection system which includes approximately nine (9) Combined Sewer Overflow (CSO) tanks. CSO tanks are engineered structures designed to hold a portion of combined sewage (sewage and stormwater) during rain events that is in excess of the WWTP capacity. The purpose of providing storage capacity at the CSO tanks is to prevent untreated sewage from discharging to the natural environment. When the rain stops, the sewage is gradually pumped to the WWTP for treatment. Under heavy rain conditions, a CSO tank storage capacity may be exceeded, which may result in combined sewer overflow into the receiving water although at a more diluted concentration than raw sewage. The Main/King CSO Tank and Pumping Station (HCS04) located at 707 King Street West, Hamilton has a combined sewage storage capacity of 75,000 m³.

As detailed later in this Provincial Officer's Report, from January 28, 2014 until July 18, 2018, sewage from the Main/King CSO pumping station was discharged to Chedoke Creek on multiple occasions in the absence of rain and when the capacity of the CSO tank was not exceeded. The sewage flowed from the pumping station into the overflow chamber and out via a 2400 mm discharge pipe traveling west/northwest discharging into Chedoke Creek just north of Glen Road, Hamilton. The spill flowed north in Chedoke Creek discharging into the south-eastern portion of Cootes Paradise with the usual currents going out the Desjardins Canal into the western end of Hamilton Harbour.

The Site is described as: Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour, and as detailed in Appendix A.

Appendix A shows a map of the Site entitled "Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour".

The following are property uses of land surrounding Chedoke Creek:

Neighbouring land uses to the east include Hwy 403 with park land further east (Kay Drage Park/former Landfill); To the south and west is a mix of residential homes and apartments, institutional properties (long term care facility and former school), and Royal Botanical Garden's park land extending north to Princess Point; and To the north of Chedoke Creek is Cootes Paradise and additional Royal Botanical Garden (RBG) park land.

4. Events Leading to the Provincial Officer's Order

An estimated volume of 24 billion litres of sewage spilled from the Main/King CSO Tank and associated Pumping Station into Chedoke Creek during the period of January 28, 2014 until July 18, 2018 as a result of the incorrect operation of a valve, and the malfunction of a second gate valve without detection. The purpose of a CSO tank is to collect and retain sewage and storm flows during rain events that would otherwise overwhelm a waste water collection system and thereby prevent untreated sewage from discharging to the natural environment. The associated pumping station then pumps the sewage to the pant when the rain stops, and capacities allow for more flow. Discharges from a CSO tank should not occur during dry weather conditions or during rain events for which the tank capacity has been designed. Because the discharge was abnormal in quality and quantity and unapproved under the OWRA it was determined a spill.

The following chronology is a description of this Provincial Officer's dealings with this spill event since first being assigned to it on July 6, 2018:

Prior to July 6, 2018 the District Office received Annual Reports from the City about the Main/King CSO tank which reported no recent combined sewer overflows. The City also did not report any operating problems encountered and corrective actions taken with respect to the CSO tank as required under condition 4 (c) of the Certificate of Approval (CofA)/Environmental Compliance Approval (ECA) # 3-1455-94-956.

On July 6, 2018, the Spills Action Centre received a public complaint regarding the City discharging sewage into Chedoke Creek and Cootes Paradise. The complaint was forwarded to the Hamilton District Office. The caller reported the presence of sewage odours, worse than he had ever experienced, and raw sewage related plastic debris within Chedoke Creek. Caller reported that the problem had been ongoing since the City installed the CSO tank. The caller indicated that they had also reported the same observations to the City.

On July 9, 2018, Hamilton District Manager, Paul Widmeyer received an email from the Hamilton Health Unit, regarding the health hazard of extremely high E. coli results meeting the criteria of "suspected sewage contamination" in Chedoke Creek with results reported of 3.4 million CFU/100 mL and a trend of historical high results from approximately the end of May 2018.

On July 10, 2018 the Hamilton Health Unit required the City of Hamilton to post warning signs for the public at potential water access points along Chedoke Creek, Princess Point Park, Cootes Paradise Waterfront Trail, Desjardin Canal (which allows flow between Cootes Paradise and Hamilton Harbour) and to remove the canoe/kayak dock at Princess Point Park.

On July 11, 2018 the Hamilton Conservation Authority took samples in the Chedoke Creek watershed at several locations for E. coli and human/bovine bacteria markers in order to isolate the section of Chedoke Creek where the discharge was occurring and determine the source of contamination. Sample results showed high concentrations of E. coli and bacteria readings consistent with human source. Resampling was conducted on July 18, 2018 by the Hamilton Conservation Authority with results also showing high concentrations of E. coli and bacteria readings consistent with human source.

On July 13, 2018, I received a presentation from the Hamilton Harbour Remedial Action Program (HHRAP) committee where the Royal Botanical Gardens (RBG) presented photos of the Chedoke Creek on July 4, 2018 showing a significant amount of sewage solids floating on the surface.

On July 16, 2018, I visited the site at Kay Drage Park bridge with Water Compliance Supervisor, Zafar Bhatti and detected sewage odours and observed sewage debris in Chedoke Creek.

On July 17, 2018, the undersigned Provincial Officer met with City staff at Chedoke Creek outfall and detected strong sewage odours downwind of the outfall and observed significant sewage debris in the creek. City staff identified the sewage as algae. At the Kay Drage Park bridge a slight increase in sewage debris was observed in the creek.

The City had been checking their system and providing update reports from staff suggesting natural organics, algae or sediment reflux all-natural sources and not sewage coming from the sewage system up to July 18th, 2018 but my inspections were on-going to determine the source.

On the morning of July 18, 2018, I visited the upstream portion of the Chedoke Creek outfall at the MTO work site on the east side of the 403 and observed that the water was running clear with no odour.

On July 18, 2018, Calder Engineering Ltd conducted a confined space inspection and sampling of the twin box culvert and connecting and storm sewer pipe from overflow chamber of Main/King CSO tank and Pumping Station located at 707 King Street West. The twin box culvert channels Chedoke Creek under Main Street West to where Chedoke Creek emerges north of Glen Road and receives flow from several different areas. It was this inspection that found sewage flowing into the box sewer from King/Main

CSO tank at an estimated rate of 150 L/sec, while clear water was coming from Chedoke Creek. Further investigation at the Main /King Pump Station found sewage in the CSO tank overflow chamber discharging to a 2400 mm storm discharge culvert. Sewage was entering the overflow chamber through a reported 4.7% open 3000 mm x 3000 mm maintenance gate valve between the overflow chamber and the influent 1950 mm combined sewer entering the pumping station wet well. Once identified the City closed the gate and reported the spill to the Spills Action Centre due to the discharge being of abnormal quality and quantity.

Water Compliance Supervisor Zafar Bhatti and I attended the King/Main CSO tank location on July 18, 2018 to confirm that the discharge had stopped and to conduct a visual inspection of the Chedoke Creek outfall which showed no flow from the east side of the box culvert which had been observed the previous day by the undersigned Provincial Officer. Sewage debris was still observed with sewage odours. Preliminary reports from the City indicated that the gate valve had been open since January 29, 2014. The initial estimated volume of sewage discharged to the creek from January 29, 2014 until the gate valve was fully closed was initially reported as 15.9 billion litres (and more accurately determined to be 24 billion litres later).

The undersigned Provincial Officer also conducted a site visit on July 20, 2018 and found strong sewage odours on Glen Road, downwind of the creek and observed a boom installed by City contractors between Kay Drage Park bridge and the Chedoke Creek Outfall to collect floating materials.

On July 27, 2018, the City confirmed that a gate valve between the sewage pumping station wet well and overflow chamber had been open since January 28, 2014 allowing dry weather flow out of the station. In January 2018 a second gate valve malfunctioned which directed added (wet and dry weather) flow from a large combined sewer into the wet well where the first gate valve was open which allowed the added flow to spill into the overflow chamber and discharging to Chedoke Creek.

A Provincial Officer Order (POO) Number 1-J25YB was issued on August 2, 2018 requiring the City, among other things, to evaluate impacts of the sewage spill to Chedoke Creek from the Main/King CSO tank facility between January 28, 2014 and July 18, 2018. This evaluation required evaluation of impacts to Chedoke Creek from the spill and anticipation/risk of on-going impacts, recommendations for remediation and/or mitigation, if necessary, and regarding the most effective way to complete the remediation and/or mitigation; and associated implementation timeline for any necessary remedial and/or mitigation work by November 30, 2018.

In October 2018, the City submitted a report entitled "Quantification of Volume and Contaminate Loadings" by HATCH dated September 28, 2018 which stated that an estimated 24 billion litres (24 million cubic metres) of raw sanitary sewage and combined sewage was discharged to Chedoke Creek from January 28, 2014 to July 18, 2018. The Total Contaminant Loadings (in Tonnes) for the period from January 28, 2014 to July 18, 2018 were estimated to be 2375 Tonnes of TSS, 47 Tonnes of TP, 159 Tonnes of TAN, 312 Tonnes of TKN and 1373 Tonnes of cBOD.

On January 31, 2019, the City submitted a consultant's (Wood) report (report entitled "MECP Order # 1-J25YB Item 1b – Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated January 24, 2019 by Wood Environmental & Infrastructure Solutions) as a fulfilment of the above Order #1-J25YB, which recommended Direct Removal (section 5.2.5) of settled material by hydraulic dredging. The report stated, "Physical removal of the organic sediment will directly address the three primary sources of potential impairment including nutrient contamination, bacteriological contamination and habitat loss". Options considered in the order of most to least effective were: Direct Removal, Chemical Inactivation, Physical Capping and No Action.

On March 20, 2019, the City reported that a peer review of the original reports was being conducted. On May 30, 2019 I received both: a Peer Review Report by SLR, dated May 15th, 2019; and a memo from Wood, dated May 23, 2019.

On September 19, 2019 as part of the review of the above reports, the Surface Water Specialist of the Technical Support Section and I requested clarification from the City on the identification of a clear conclusion or recommendation for remediation and/or mitigation option the City was proposing. The City had submitted both the Wood report with one recommendation for dredging and the peer review, which recommended no action. No clear indication was provided by the City on which recommendation it was proposing. With no response from the City by September 30th, 2019 I requested a response by October 4th. The City reported on October 1, 2019 that additional sampling work was completed at the site during the last week of September 2019 as a result of the peer review to identify the need for any remedial work.

On October 10, 2019 in a meeting the City informed the Director, me and other Ministry staff that an ERA had been started. I requested a final report and recommendations by November 15th, 2019. The City then informed us that an ERA final report could not be provided until the end of January 2020 as lab analysis and data interpretation/report would take additional time. The Surface Water Specialist of the Technical Support Section in consultation with the Director and I, informed the City that the contaminated sites environmental risk assessment process cannot be used for the determination of spill clean-up requirements as this process does not have the same requirements as a spill to undertake practicable clean-up to restore the natural environment under Section 93 of the EPA. The legal duty to restore the natural environment in section 93 of the EPA helps to prevent a spill site from becoming a

contaminated site and to ensure the owner deals with the spill and its impacts. Some of the analyses undertaken in an ERA can be used to identify areas and extent of impact of a spill, which may be incorporated into the full evaluation of impact and remediation/mitigation options for the spill, but it does not identify level of clean-up required for spills or the practicable measures available to address the impacts of the spill.

In order to ensure appropriate timelines were followed, a Provincial Officer Order (POO) was issued and the City submitted a Request for Review resulting in the Directors decision to issue Director's Order #1-MRRCX on November 28th, 2019 clarifying the work to be conducted with revised time lines of submission of the ERA in Chedoke Creek by February 14, 2020 and Cootes Paradise Environmental Impact Evaluation (EIE) report by May 1, 2020. Work required was:

1. A Chedoke Creek ERA and evaluation of the environmental impact, an identification and evaluation of sewage remaining in the creek, identification of any anticipated on-going environmental impacts to the creek, and a review of options designed to remediate the creek and monitor the environmental condition of the creek, written proposed actions with justification in respect to the remediation and the monitoring of the creek including selected option(s) for environmental remediation and monitoring with supporting documentation/justification and an implementation timeline including significant milestones and any approvals required; and
2. An environmental impact evaluation to Cootes Paradise from the sewage discharged including a written assessment of any anticipated on-going environmental impacts with identification of contaminants related to the sewage spill, any known environmental impacts and an assessment of anticipated on-going environmental impacts from the identified contaminants including a spatial and environmental evaluation of the contaminants remaining (floatables and non floatables) in Cootes Paradise, and any proposed remedial actions and recommendations with justification including timelines with surface water monitoring program.

On February 14, 2020 the City submitted its Chedoke Creek ERA report and letter of position recommending that no further actions or additional remedial work was required to address the effects from the sewage spill or previous effects from the sewage discharge because of the alleged likelihood of recontamination, presence of historical contamination, and potential presence of a species at risk.

On May 28, 2020, the Director provided preliminary comments from the Ministry technical experts to the City and asked the City to provide additional information and clarification in order to complete its review of the Chedoke Creek ERA and better understand the City's methodology used to conclude that no further action or remediation was needed in Chedoke Creek. The request included, but was not limited to:

- o Clarification on the assessment of the creek sediment;
- o Additional work to verify the presence of a species at risk (Lilliput mussel);
- o Additional evidence to support the no-dredging conclusion to address organic material related to the spill; and
- o an assessment of any other remedial options considered.

The City and its consultant provided additional information to the Director, me and Ministry staff on June 15, 2020 and maintained that no further action was required.

In a letter dated February 13th, 2020 and in a meeting on March 13, 2020 the Royal Botanical Gardens (RBG), expressed concerns regarding ecological damage, potential extent of contamination to the bed of the marsh, which is owned by RBG, and requested a robust analysis of the spill impact and future remediation efforts. RBG plays a critical role in administering marsh restoration programs, ecological remediation plans and are responsible for the health and safety of visitors, program participants and staff of Cootes Paradise.

On April 30, 2020, the City submitted the required Cootes Paradise EIE and letter of position. It did not recommend any action or additional remedial work to address the effects from the sewage spill because the City believed either impact was short-lived or no adverse impact was sustained on water quality, sediment, aquatic vegetation or fish in Cootes Paradise.

I provided the materials for technical review by Technical Support Section, and as a result of their review comments they advised me that more work is needed to address the impacts of the spill on Chedoke Creek and Cootes Paradise as outlined in section entitled 4.2 Workplan below.

4.1 Environmental Site Investigations and Related Information

To date, the following reports detailing environmental site investigations and related information regarding the Site have been received, reviewed by Ministry Staff, provided for technical review and are listed below:

Documents submitted under Order No. 1-J25YB, dated August 2, 2018

- Report entitled "Quantification of Volume and Contaminant Loadings" dated September 28, 2018 by HATCH Limited;

- Report entitled "MECP Order # 1-J25YB Item 1b – Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated January 24, 2019 by Wood Environmental & Infrastructure Solutions;
- Report entitled "MECP Order # 1-J25YB Item 1c – Implementation and Costing Report" dated January 24, 2019 by Wood Environmental & Infrastructure Solutions;

Additional Letter Reports/Peer Review submitted

- Letter report entitled "Peer Review Report - Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated May 15, 2019 by SLR Consulting (Canada) Ltd.;
- Memo entitled "Chedoke Creek Project, Wood Commentary on SLR Peer Review Comments, City of Hamilton" dated May 23, 2019 by Wood Environmental & Infrastructure Solutions.

Documents submitted under Directors Order No. 1-MRRCX dated November 28, 2019

- Letter from the City entitled "Response to Director's Order 1-MRRCX" Items 1 & 2 submitted on February 14th, 2020 with the following report attachment:
 - "Ecological Risk Assessment (ERA), Chedoke Creek, Hamilton, Ontario" by SLR Consulting (Canada) Ltd. dated February 12, 2020 (including "APPENDIX A Previous Environmental Investigations Sampling Locations").
- Report entitled "Main-King CSO Tank Overflow Volume Estimates" by HATCH Limited dated April 14th, 2020.
- Letter from the City entitled "Response to Order No.1-MRRCX, Items 3 and 4" submitted on April 30, 2020 with the following attachments:
 - Letter from the City of Hamilton entitled "Director Order Number; Item No. 4, Surface Water Monitoring Program" dated April 30, 2020; and
 - Report entitled "Cootes Paradise: Environmental Cootes Evaluation Hamilton, Ontario" by SLR Consulting (Canada) Ltd. dated April 22, 2020.

Confirmation of Position and Methodology Clarification

- Letter from the Ministry to the City entitled "Chedoke Creek Spill Response – District Comments" dated May 28, 2020
- Letter of response from the City entitled "Response to District Comments – Chedoke Creek Spill Response" dated June 15, 2020 with the following attachment:
 - Letter entitled "Response to Ministry of Environment, Conservation and Parks May 28, 2020 letter entitled Chedoke Creek Spill Response – District Comments" by SLR Consulting (Canada) Ltd. dated June 12, 2020.

4.2 Work Plan

As previously discussed, I provided the materials for technical review by Technical Support Section, and as a result of their review comments they advised me that more work is needed to address the impacts of the spill on Chedoke Creek and Cootes Paradise as outlined in this section.

Chedoke Creek

The City and its consultants (Wood and SLR) have identified dredging in Chedoke Creek as the only effective option, of the options assessed, to address the increased sewage parameter concentrations in the sediment from the spill. SLR reported that hydraulic dredging could improve sediment quality but identified several items potentially limiting the effectiveness or feasibility of hydraulic dredging and therefore did not recommend dredging, namely: 1) a potential species at risk presence in Chedoke Creek due to its identification in nearby Cootes Paradise; 2) an inability to differentiate sediment contaminated by the spill versus historical contamination; and 3) the likelihood of recontamination from other on-going sources of contamination to the creek.

I asked Ministry technical experts to assess the above potential limitations and was advised that the limitations noted can be addressed with the refinement of targeted dredging locations and mitigation measures or limitations and were not supported as outlined below and based on the information provided. They advised further work is required to assess and address the potential presence of any species at risk in Chedoke Creek that may be subject to dredging. This could include the development of mitigatable measures to protect any species at risk during dredging or avoidance of specific areas for dredging. Consideration on the impact of dredging on species at risk is also given for: if the potential impact from dredging is deemed to be a long-term negative impact; if current conditions are degraded due to historical or spill impacts and already potentially negatively impacting the species; and if there would be a long-term impact improvement despite a short-term negative impact from dredging, in order to determine what and where it is appropriate to dredge. The City is required to address the impacts of the spill and restore the natural environment even if historical contamination (even similar contamination) is present and does not absolve the owner of cleaning up a spill. It is also felt that any recontamination from on-going sources, such as: the closed landfill, combined sewer overflows; potential sanitary sewer cross-connections; and stormwater, are within the City's range of scope and responsibility. Significant improvements have been made to most of these sources (in quantity and quality) in the last 10-15 years, as shown by the improved conditions in the creek and sediment

before the spill. Any on-going sources of contamination are not anticipated to re-contaminate any remediated area to the same level historically seen or to the level seen from the 24 billion litres of sewage seen in this spill and is generally minor in comparison to the loadings seen from the spill.

Some of the key items from the Ministry's technical staff review of the Chedoke Creek ERA and impact assessment are as follows:

- The data interpretation and aggregate data analysis used in assessing pre spill conditions, spill period conditions and post spill conditions did not look at specific year differences (2018 vs 2014-2017) but used mean data analysis over the spill period potentially masking the extent of the impact of the spill seen, particularly in 2018, for some parameters and didn't determine if the pre-spill period used was representative of conditions at the time of the spill.
- Information supported the sediment being impacted by the sewage spill by some of the nutrients;
- Impacted sediment was found to be a moderate to high risk with bacteria, PAH's and copper;
- The contaminant loading of nutrients, cBOD and other sewage related parameters showed ongoing impact on DO levels;
- Elevated TAN levels in Chedoke Creek above pre-spill conditions were on-going.

Cootes Paradise

The consultant's report (SLR) concluded that no further action was required based on some limited monitoring data indicating that Cootes Paradise had returned to pre-spill conditions. Despite a request from the Director, myself and ministry technical staff the report did not consider, a loadings assessment from the spill to understand the magnitude of the loadings added to the system and to have a long-term impact on the system e.g. algal blooms. The additional loadings will undo and delay the improvements from several projects that are being/have been undertaken to improve the conditions in Cootes Paradise to meet HHRAP goals, such as improvements to TP treatment at the Dundas sewage treatment plant. The added loadings may also increase the likelihood and extent of algal blooms for several years. Based on advice received from ministry technical experts, it is not as feasible, for a number of reasons, to undertake a direct restoration of the added loadings to Cootes Paradise and the western Hamilton Harbour area both from the extent and type of the dispersion of TP, and the cost, effectiveness and potential to cause more harm than good in these areas using a direct removal method like dredging. In order to address the impacts of the increased loadings caused by the spill, based on advice received from Ministry experts, other remedial options must be considered and utilized to offset and/or improve the conditions in these systems in an effort to mitigate the added loading and associated impact as a result of the spill, and thus restore the natural environment.

I have considered some of the key items from the Ministry's technical staff review of the Cootes Paradise EIE and are as follows:

- As previously discussed, the data interpretation and aggregate data analysis used in assessing pre spill conditions, spill period conditions and post spill conditions did not look at specific year differences (2018 vs 2014-2017) but used mean data analysis over the spill period potentially masking the extent of the impact of the spill seen.
- Total Phosphorous (TP) and E. coli also showed similar patterns during the spill with TP double the concentration seen during pre and post spill periods for the east end of Cootes Paradise (CP11, CP11.2 and CP1).
- Rough loadings analysis for Total Phosphorous to Cootes Paradise from the spill in the:
 - o The last 6 months of the spill (January-July 2018) added about 94 kg/d of TP which is approximately double the average annual daily TP loadings (39 kg/day) on top of the normal TP loadings to the system during that time, which may be retained in various forms and recirculated within providing an additional source of nutrients.
 - o The previous four years of the spill (2014-2017) added approximately half, at about 21 kg/d, of the annual average daily TP loading of 39 kg/d on top of the normal TP loadings to the system during that time; and
 - o The total spill loading of 47,750 kg, compared to the annual average modelled loading of 14,100 kg/yr, indicated that the loadings from the spill over 4.5 years were equivalent to approximately three (3) years of additional loadings to Cootes Paradise from the point sources (e.g. Dundas sewage treatment plant, combined sewer overflows and the non-point sources (urban and rural stormwater runoff in the tributaries) combined.
- The report did not assess total ammonia nitrogen (TAN) as a contaminant of potential concern for Cootes Paradise. TAN can have other impacts including eutrophication, elevated nutrients supporting greater algal blooms, and can also cause a nitrogenous oxygen demand impacting dissolved oxygen. Data showed levels at CP11 much higher during the spill, e.g. 13.1 mg/L TAN compared to 1.95 mg/L of TAN during pre and post spill with similar trends at CP11.2 and CP1, although to a lesser extent.
- TKN, Ammonia and cBOD would show high input levels to the systems compared to average annual loadings
- The report did not assess the potential for added loadings to the system to impact algal blooms.
- Although diluted throughout a larger area (Chedoke Creek, the eastern portion of Cootes and into Hamilton Harbour to some extent), potential long-term impacts from the additional loadings, particularly for Total Phosphorous were not evaluated.
- The assessment on Chedoke Creek identified that the bulk of the loadings of some parameters, particularly TP, moved beyond Chedoke Creek into Cootes Paradise. Understanding of the currents and water exchange between Cootes Paradise and Hamilton

Harbour indicates that some of the loading also would have moved into Hamilton Harbour.

Considering the above, I am of the view that more work is needed. The work ordered under section 157, in respect of section 93 and section 14 of the EPA, is needed to restore the natural environment as a result of the spill, and to prevent further impairment to the natural environment, and to prevent adverse effects.

The EPA imposes a duty to mitigate and restore the natural environment on the owner of a pollutant and the person having control of a pollutant that is spilled as per section 93 of the EPA which states:

93 (1) The owner of a pollutant and the person having control of a pollutant that is spilled and that causes or is likely to cause an adverse effect shall forthwith do everything practicable to prevent, eliminate and ameliorate the adverse effect and to restore the natural environment.

When duty effective

(2) The duty imposed by subsection (1) comes into force in respect of each of the owner of the pollutant and the person having control of the pollutant immediately when the owner or person, as the case may be, knows or ought to know that the pollutant is spilled and is causing or is likely to cause an adverse effect.

The City is owner of the pollutant and the City's employees and operators were the person(s) having control of the pollutants, namely raw sewage contaminants (including TSS, TP, TAN, TKN and cBOD), that were discharged into the natural environment over approximately 4.5 years (January 28, 2014 and July 18, 2018) from its sewage works. The discharge of 24 billion litres of sewage was not authorized under the OWRA. As previously discussed, the discharges were occurring at all times, during both dry weather and wet weather conditions regardless of the CSO tank's operating level. The discharged volume of the dry weather flow alone, raw sanitary sewage, was 2.9 billion litres which is abnormal to be discharged to the natural environment considering this volume under normal operating conditions would have received full treatment at the wastewater treatment plant. The estimated normal CSO operation volume during the spill period (2014-2018), for the Main-King CSO if it was operating properly, was modelled by HATCH to be about 0.321 billion litres in total for those five years. Sanitary sewage flow of approximately 2.9 billion litres alone added approximately a loading of 771 tonnes of TSS, 502 tonnes of cBOD, 13 tonnes of TP, and 101 tonnes of TKN into Chedoke Creek. This discharge was further augmented by wet weather flow making a total volume of the spill 24 billion litres with total loadings of 2375 tonnes of TSS, 1373 tonnes of cBOD, 47 tonnes of TP, and 312 tonnes of TKN with no treatment by the WWTP or CSO tank. I consider these volumes and loadings excessive and abnormal in quality and quantity. As a result of the discharge, sewage was spilled into the Chedoke Creek causing adverse effects, including impairment to the quality of the natural environment, including waters (e.g. Chedoke Creek and Cootes Paradise), for any use that can be made of it, impairment to the safety of any person, and loss of enjoyment of normal use of property. Examples include odour complaints from RBG and the public due to raw sewage debris floating in the water and on the shore. As a result of the discharge, technical review by ministry experts have determined an adverse effect was observed as a result of the spill and if the natural environment is not restored the remaining spilled contaminants may cause further adverse effect.

As previously discussed, in July 2018, the City began remediation efforts along the surface of Chedoke Creek which included the installation of booms and removal of floating sewage by boat and hydrovac trucks. A seasonal boom was put in place to capture any further associated sewage floatables discharged. The operator station inspection program has been revised and assessments on critical valves have been completed in the system and maintenance prioritized. I am advised by the Ministry's technical experts that these efforts have not restored the natural environment to the pre-spill conditions as required under Section 93 of the EPA due to ongoing evidence of sewage parameter concentrations present above pre-spill conditions for some parameters and on-going low DO conditions.

Accordingly, the City was requested on several occasions, in writing and during meetings to assess and make recommendations to remediate the impacts of the spill (Order No. 1-J25YB dated August 2, 2018, Order No. 1-J3XAY dated November 21, 2019, Directors Order No. 1-MRRCX dated November 28, 2019 and letter dated May 28, 2020 entitled "Chedoke Creek Spill Response – District Comments".)

In addition, the City was in contravention of s.14 of the EPA in relation to the spill, which has caused and may cause an adverse effect as discussed above.

Pursuant to section 30(1) of the OWRA every person that discharges or causes or permits the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters is guilty of an offence.

The discharge of sewage from the Main/King CSO described above constituted a contravention of section 30 of the OWRA. The City as the owner and operator discharged or caused or permitted the discharge of a material/sewage into or in any waters, Chedoke

Creek and Cootes Paradise/Hamilton Harbour, has impaired and may continue to impair the quality of the water further if work is not done.

For the purposes of the OWRA, the quality of water is deemed impaired by the discharge of material, where certain conditions are met as set out in section 1(3) of the OWRA. In the circumstances of this spill, the quality of water is deemed impaired for Chedoke Creek and its connected waterways/natural environment for the following: there was a degradation in the appearance and odour of the water; and the quality of the water was impaired by the discharge of 24 billion litres of sewage that entered the water directly and caused or may cause injury to or interference with any living organism that lives in or comes in contact with or as a result of it using or consuming the water or sediment that is in contact with the water.

For the purposes of section 30 of the OWRA, I am of the view, after having consulted with ministry experts, that the spill caused or may cause impairment to the system and therefore the items identified in the Order are required and more work is needed. Some of the identified impairments or potential impairments also include: 1) The sediment has been identified as having moderate to high risk for effects to some organisms from PAHs. Elevated levels of bacteria have or may have impacted uses or continue to do so; 2) Elevated TAN and nitrite levels in the water and added TKN levels in the sediment will continue to have an added nutrient source, impact DO levels, and add to the eutrophication of the system, all of which may continue to impact organisms in the water and sediment; and 3) the added nutrient loadings, particularly TP, at the significance of the loading to the entire system, will continue to increase the risk in the frequency and size of algal blooms which may impair the water for its use or cause injury as a result of algal blooms.

Considering the above noted on-going impacts and continuing potential impairment, I am of the opinion, after consultation with Ministry staff and technical experts, that a "no action" recommendation by the City does not discharge its obligation to restore the natural environment nor does it address or prevent potential adverse effects, or may impair or continued impairment of the natural environment, including waters.

Thus, further action is necessary to restore the natural environment in relation to Chedoke Creek and that further action is needed to offset the impacts of the spill to Cootes Paradise. Accordingly, I require the City to undertake remedial measures outlined in the accompanied Provincial Officer's Order to restore the natural environment in Chedoke Creek as a result of the spill and take steps to determine what is required in relation to Cootes Paradise and implement those steps once an appropriate course of action is determined.

Based on previous significant public interest, and the need to keep the public informed, the Order also requires posting on the City's website with progress reports, as needed. Progress reports and meetings with the Ministry are outlined to improve collaborative communication and information sharing during spill response workplan development, remediation and ensure timely progress towards restoring the natural environment. Landowner notifications are also required to improve communications with stakeholders.

5. Legal Basis for the Order and Provincial Officer's Opinion

I reasonably believe that the City of Hamilton has contravened or is contravening those provisions of the EPA as outlined in the Offences, Suspected Violation(s)/Offences section of this report.

And

I further reasonably believe that the City of Hamilton has contravened or is contravening those provisions of the OWRA as outlined in the Offences, Suspected Violation(s)/Offences section of this report.

And

I further reasonably believe that the requirements in this Order are in the public interest in order to prevent any further discharge of material into Chedoke Creek, Cootes Paradise and Hamilton Harbour, that may impair the quality of any water;

And

I further reasonably believe the requirements specified in this Order are necessary:

- i) to prevent, or reduce the risk of any adverse effect on the natural environment from contaminated sediment which sediment was the direct result of the spill or spills to the Chedoke Creek from the Main/King CSO and which will continue to discharge compounds into the natural environment from the Site; and/or
- ii) to prevent, decrease or eliminate an adverse effect that may result from the presence of such contaminants in, on or under the Site.

6.0 Attachments

The attachments listed below form part of the Order:

Appendix A – Site Map "Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour"

Offence(s)

Suspected Violation(s)/Offence(s)

Act – Regulation – Section


Description

Environmental Protection Act, 93 (1) The owner of a pollutant and the person having control of a pollutant that is spilled and that causes or is likely to cause an adverse effect shall forthwith do everything practicable to prevent, eliminate and ameliorate the adverse effect and to restore the natural environment.

(2) The duty imposed by subsection (1) comes into force in respect of each of the owner of the pollutant and the person having control of the pollutant immediately when the owner or person, as the case may be, knows or ought to know that the pollutant is spilled and is causing or is likely to cause an adverse effect. R.S.O. 1990, c. E.19, s. 93.

Environmental Protection Act, Section 14 (1) Subject to subsection (2) but despite any other provision of this Act or the regulations, a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect. 2005, c. 12, s. 1 (5).

Ontario Water Resources Act, Section 30 (1) Every person that discharges or causes or permits the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters is guilty of an offence. R.S.O. 1990, c. O.40, s. 30 (1).



Shelley Yeudall
Provincial Officer
Badge Number: 881

Provincial Officer's Order

Order Number
1-OW6SS

Environmental Protection Act, R.S.O. 1990, c.E 19 (EPA)
Nutrient Management Act, R.S.O. 2002, c.4 (NMA)
Ontario Water Resources Act, R.S.O. 1990, c.O. 40 (OWRA)
Pesticides Act, R.S.O. 1990, c. P11 (PA)
Safe Drinking Water Act, S.O. 2002, c.32 (SDWA)

To: HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

HAMILTON, CITY OF
71 MAIN STREET WEST, 1st Floor HAMILTON, ONTARIO L8P 4Y5
Canada

Site: Chedoke Creek, downstream of the Main/King Combined Sewer Overflow discharge pipe, the eastern end of Cootes Paradise and western end of Hamilton Harbour, and as further described in the Provincial Officer Report under section entitled "Description of the Site and the Ordeees".

Work Ordered

Pursuant to my authority under sections 157, 157.1, 196 of the Environmental Protection Act and under sections 16, 16.1, and 104 of the Ontario Water Resources Act I hereby order you, the City of Hamilton, to do the following:

1. By December 11, 2020, retain the services of a Qualified Person that has the experience and qualifications to carry out the work specified in this Order.
2. By December 11, 2020, submit to the undersigned Provincial Officer written confirmation that the Qualified Person has been retained to carry out the work specified in this Order, that a copy of the Order has been given to the Qualified Person; and that the Qualified Person has the experience and qualifications to carry out the work.

Chedoke Creek Downstream of the Main/King CSO Discharge Pipe

3. By January 22, 2021, submit to the undersigned Provincial Officer, for approval, a remediation workplan for Chedoke Creek that is developed by the Qualified person to undertake the targeted dredging of Chedoke Creek based on the recommendation identified in section 5.2.5 of the Wood report entitled "MECP Order # 1-J25YB Item 1b – Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report" dated January 24, 2019 ("Chedoke Creek Workplan"). The Chedoke Creek Workplan shall be prepared in accordance with the requirements set out in Items 4 and 5 below.
4. The Chedoke Creek Workplan shall, at a minimum:
 - i) Consider technical reports, Ministry comments and affected stakeholders' comments, to determine an acceptable plan to implement the recommendation in the Wood report to restore the Chedoke Creek, while mitigating impacts of implementing the plan on the natural environment, including water;
 - ii) Contain a detailed timeline setting out critical milestones and checkpoints with the Ministry for carrying out the Chedoke Creek Workplan;
 - iii) Contain a Species at Risk assessment plan and associated timelines for Chedoke Creek downstream of the spill and including potential impacted areas downstream of Chedoke Creek that may be impacted by targeted dredging;

- iv) Undertake consultation with the Species at Risk Branch within the Ministry in respect of any identified items pursuant to 4 iii) and incorporate this feedback and outcome into the workplan for any species at risk;
- v) Provide a description of any anticipated approvals needed to implement the Chedoke Creek Workplan, initial consultation and proposed timelines to obtain such approvals, if required, for the Workplan to be implemented;
- vi) The consultation in iv) and v) shall include the Regional Technical Support Section of the Ministry;
- vii) Contain a description of the identified areas and the extent (depth, location) of the targeted dredging with a description of how the items outlined in Item 5 below were addressed and a description of any methods for refining identified areas in Item 5 including the impacted areas identified in the Wood reports and SLR reports and timing as needed, in the Chedoke Creek Workplan;
- viii) Contain a description of the approximate volume of material to be removed;
- ix) Identify and contain a description of proposed mitigation measures for any short-term impact(s) that may arise from implementing the Chedoke Creek Workplan for Chedoke Creek, its shoreline and connected waterways/natural environment, on any species at risk and other potentially impacted uses. Mitigation measures may include, but are not limited to: exclusion measures for local aquatic uses; limit recreational uses in the area; total suspended solids control as required for carrying out the targeted dredging; and proposed monitoring during any remediation to monitor effectiveness of mitigation measures during dredging identified in iv); and
- x) Contain a proposed monitoring plan to monitor the recovery of the natural environment and effectiveness of the Chedoke Creek Workplan once dredging is complete.

5. With respect to the area from the Main/King CSO outfall to the mouth of Chedoke Creek, the Chedoke Creek Workplan shall take into consideration the scope of targeted dredging work necessary to restore the natural environment to pre-spill conditions, as to be agreed upon by the Ministry, and to mitigate any impairments or potential impairments from the spill, in relation to the following, but not limited to:

- i) Sediment areas identified as impacted, in consultation with the Ministry, by the sewage spill;
- ii) Sediment areas identified as containing elevated organic material consistent with sewage sludge;
- iii) Sediment areas identified as elevated nutrients (particularly TP, TAN, and TKN);
- iv) Sediment areas identified as had, may have, or continuing to have reduced dissolved oxygen levels in the water column from historical levels;
- v) Sediment areas identified as having elevated parameters as identified by the ERA carried out by SLR ("Ecological Risk Assessment (ERA), Chedoke Creek, Hamilton, Ontario" dated February 12, 2020) to have moderate or high risk for impacts, or otherwise identified by the reports or in comments by the Ministry; and
- vi) Addressing any ecological flow path requirements and connectivity within the creek in any remedial action plan that may impact low flow path and connectivity.

6. By October 31, 2021, or such other date approved by the Provincial Officer in writing, complete the approved Chedoke Creek Workplan.

7. Within one (1) month of the completion of the of the work undertaken pursuant to the approved Chedoke Creek Workplan, submit to the undersigned Provincial Officer, a report prepared by the Qualified Person confirming that the natural environment has been restored to pre-spill conditions and that further impairment to the natural environment will not occur as a result of the spill to the Chedoke Creek as detailed in the attached provincial officer's report, and at a minimum contain the following:

- i) The details of the work undertaken to complete the Chedoke Creek Workplan;
- ii) Any monitoring results completed before, during and after the work undertaken in accordance with the Chedoke Creek Workplan;
- iii) Analysis of the results in Item 7(ii) above for the purposes of the intended monitoring; and
- iv) Determination if any requirement for on-going monitoring is required to verify the effectiveness or maintenance of the remedial actions undertaken is necessary.

Cootes Paradise/Western Hamilton Harbour Area

8. By January 22, 2021, submit to the undersigned Provincial Officer for approval, a proposed remediation/mitigation report that is prepared by a Qualified Person(s) for the Cootes Paradise/Western Hamilton Harbor Area to offset the added nutrient loading, principally TP, identified in the Wood reports, the SLR reports and particularly the Hatch reports, and address any other potential on-going impacts (dissolved oxygen, algal blooms) as a result from the sewage spill to this area ("Cootes Paradise Report").

9. The report in Item 8 shall, at a minimum:

- i. Identify and review all potential remediation or mitigation measures, whether direct, indirect, or a combination of measures with consideration for short and long-term measures to address the remediation goal to offset added nutrient loading particularly for TP and any potential on-going impacts (dissolved oxygen, algal blooms) from the sewage spill to the Cootes Paradise/Western Hamilton Harbor Area as identified in the Wood reports, the SLR reports and the Hatch reports;
- ii. Undertake consultation with and provide a summary of comments received from the Royal Botanical Gardens, Hamilton Conservation Authority, the Ministry, and any other relevant affected stakeholders for potential remediation and mitigation options as per item i. above;
- iii. Contain a cost/benefit analysis of all options to assess efficiency and effectiveness of any remediation or mitigation options;
- iv. Identify the recommended options for remediation and mitigation;
- v. Identify the proposed offset goal to achieve remediation and/or mitigation with respect to the approximate equivalent loadings from the sewage spill;
- vi. Propose a methodology for quantification with respect to the offset of the loadings for any remediation and/or mitigation measures to meet the intended goal for overall remediation and/or mitigation to address the added TP loading from the spill; and
- vii. Identify and propose timelines to implement the recommended remediation or mitigation measures to offset loadings from TP, impacts to dissolved oxygen from nutrients or other measures that may improve existing or potential impairments with identification of options that can be implemented as soon as possible to start to reduce the on-going or potential impacts.

10. Within three (3) weeks of approval of Item 8 above, submit to the undersigned Provincial Officer for approval, a proposed workplan for the approved remediation/mitigation measures for Cootes Paradise/Western Hamilton Harbour Area ("Cootes Paradise Workplan"). The workplan shall consider and address, as necessary, Work Ordered in Item 8 and 9 above and any ministry comments upon approval of Item 8, and shall include, but not be limited to, the following:

- i) A detailed workplan and timeline for carrying out the approved remediation/mitigation options within the Cootes Paradise/Western Hamilton Harbour Area;
- ii) Calculations referred to in Item 9 iv) and v) or as otherwise approved; and
- iii) Proposed follow-up monitoring required to ensure the recovery and effectiveness of the remediation plan.

11. Within two (2) weeks of the approval obtained pursuant to item 10 above, commence implementation of the approved Cootes Paradise Workplan within the timelines set out in the approval.

12. Submit a report prepared by the Qualified Person within one (1) month of the completion of the work undertaken pursuant to the approved Cootes Paradise Workplan to the undersigned Provincial Officer confirming that the natural environment has been restored and outlining the completed items and the work undertaken to restore the natural environment, including, but not limited to, the following:

- i) Any monitoring results completed before, during and after the work undertaken in accordance with Cootes Paradise Workplan;
- ii) Analysis of the results in Item 12 (i) above for the purpose of the intended monitoring; and
- iii) Determination if any requirement for on-going monitoring is needed to verify the effectiveness or maintenance of the remedial actions undertaken as necessary.

Communication

13. Provide notice to any impacted landowner(s) of the following items:

- i) within 7 days of submission of any proposed workplan(s) submitted to the undersigned Provincial Officer for approval; and
- ii) within 7 days of the approval of any workplan(s) by the undersigned Provincial Officer.

14. Provide notice to any impacted landowner(s) at least seven (7) days before the implementation of any work on the approved Chedoke Creek Workplan or the approved Cootes Paradise Workplan;

15. Within seven (7) days of any work on the Chedoke Creek Workplan and the Cootes Paradise Workplan, provide written confirmation to undersigned Provincial Officer, that implementation of the approved workplan(s) has commenced.

16. Commencing March 1, 2021 and on the first day of the month, until the completion report for each workplan is submitted, submit a three (3) month summary report, prepared by the Qualified Person(s), to the undersigned Provincial Officer, detailing all of the actions taken in implementing the approved workplan in the preceding three months.

17. Within (2) days of any limitations or changes being identified to the approved workplans, notify the undersigned Provincial Officer and within two (2) weeks, submit, in writing for review and acceptance, any proposed changes to an approved workplan with the relevant information to support any proposed changes. Written acceptance by the undersigned Provincial Officer of the proposed changes is required prior to implementation of any proposed changes.

18. Prior to the first of each month, provide to the undersigned Provincial Officer written, monthly progress updates on the progress made to comply with this Order.

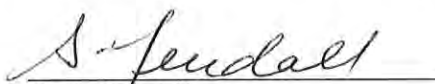
19. In conjunction with the written monthly progress updates, the City shall meet with the undersigned Provincial Officer within 7 days of the submission of the monthly report to discuss the progress reports.

20. Post this Order on the web site of the City for public viewing within 24 hours of it being served and it shall remain posted unless otherwise directed by the undersigned Provincial Officer.

- A. While this Order is in effect, a copy or copies of this order shall be posted in a conspicuous place.
- B. While the Order is in effect, report in writing, to the District or Area Office, any significant changes of operation, emission, ownership, tenancy or other legal status of the facility or operation.

This Order is being issued for the reasons set out in the annexed Provincial Officer's Report which forms part of the Order.

Issued at City of Hamilton this 20/11/2020 (dd/mm/yyyy)



Shelley Yeudall
Badge Number: 881
Hamilton District

APPEAL/REVIEW INFORMATION

REQUEST FOR REVIEW

You may request that this order be reviewed by the Director. Your request must be made in writing (or orally with written confirmation) within seven days of service of this order and sent by mail or fax to the Director at the address below. In the written request or written confirmation you must,

- specify the portions of this order that you wish to be reviewed;
- include any submissions to be considered by the Director with respect to issuance of the order to you or any other person and within respect to the contents of the order;
- apply for a stay of this order, if necessary; and provide an address for service by one of the following means:
 1. Mail
 2. Fax

The Director may confirm, alter or revoke this order. If this order is revoked by the Director, you will be notified in writing. If this order is confirmed or amended by order of the Director, the Director's order will be served upon you. The Director's order will include instructions for requiring a hearing before the Environmental Review Tribunal.

DEEMED CONFIRMATION OF THIS ORDER

If you do not receive oral or written notice of the Director's decision within seven days of receipt of your request, this order is deemed to be confirmed by order of the Director and deemed to be served upon you.

You may require a hearing before the Environmental Review Tribunal if, within 15 days of service of the confirming order deemed to have been made by the Director, you serve written notice of your appeal on the Environmental Review Tribunal and the Director. Your notice must state the portions of the order for which a hearing is required and the grounds on which you intend to rely at the hearing. Except by leave of the Environmental Review Tribunal, you are not entitled to appeal a portion of the order or to rely on grounds of appeal that are not stated in the notice requiring the hearing. Unless stayed by the Environmental Review Tribunal, the order is effective from the date of service.

Written notice requiring a hearing must be served personally or by mail upon:

The Secretary
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, ON M5G 1E5

and

Director (Provincial Officer Orders)
Ministry of the Environment, Conservation and Parks
119 King St. W., 9th floor Hamilton, ON, L8P 4Y7
Fax: (905) 521-7806

Where service is made by mail, it is deemed to be made on the fifth day after the date of mailing and the time for requiring a hearing is not extended by choosing service by mail.

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal by

Tel: (416) 212-6349

Fax: (416) 326-5370

www.ert.gov.on.ca



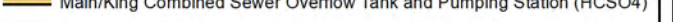
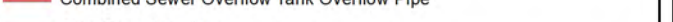

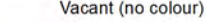
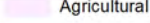
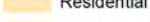
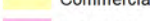
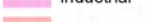

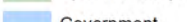

FOR YOUR INFORMATION

- Unless stayed by the Director of the Environmental Review Tribunal, this order is effective from the date of service. Non-compliance with the requirements of this order constitutes an offence.
- The requirements of this order are minimum requirements only and do not relieve you from complying with the following:
 - Any applicable federal legislation;
 - Any applicable provincial requirements that are not addressed in the order; and
 - Any applicable municipal law.
- The requirements of this order are severable. If any requirement of this order or the application of any requirement to any circumstances is held invalid, the application of such requirement to other circumstances and the remainder of the order are not affected.
- Further orders may be issued in accordance with the legislation as circumstances require.
- The procedures to request a review by the Director and other information provided above are intended as a guide. The legislation should be consulted for additional details and accurate reference.

Appendix A -Site Map
Chedoke Creek, downstream of the Main/King Combined Sewer
Overflow discharge pipe, the eastern end of Cootes Paradise
and western end of Hamilton

Drinking Water and Environmental Compliance Division
Central Region Technical Support Section

Legend

-  Chedoke Creek Outfall
 -  Point of Interest
 -  Main/King Combined Sewer Overflow Tank and Pumping Station (HCSO4)
 -  Combined Sewer Overflow Tank Overflow Pipe
 -  Glen Road, Hamilton
- Land Use**
-  Vacant (no colour)
 -  Agricultural
 -  Residential
 -  Commercial
 -  Industrial
 -  Institutional
 -  Special/Exempt
 -  Government



Data Sources, Uses and Constraints

1. Parcel boundary and basemap provided by the Ministry of Natural Resources and Forestry
2. Land Use information provided by the Municipal Property Assessment Corporation

Disclaimer

The map shown here is for illustration purposes only. Ministry of the Environment, Conservation and Parks provides this information with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort has been made to use data believed to be accurate, a degree of error is inherent in all maps. Map products are intended for reference purposes only, and the Ministry of the Environment, Conservation and Parks will accept no liability for consequential and indirect damages arising from the use of this map. This map is distributed 'as-is' without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose or use.

