

**REPORT TO:** Community and Infrastructure Services Committee

**DATE OF MEETING:** May 30, 2016

**SUBMITTED BY:** Hans Gross, P.Eng., Director of Engineering  
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**PREPARED BY:** Nick Gollan, C.E.T., Manager, Stormwater Utility  
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**WARD(S) INVOLVED:** All

**DATE OF REPORT:** May 19, 2016

**REPORT NO.:** INS-16-047

**SUBJECT:** Stormwater Management Master Plan Final Report

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**RECOMMENDATION:**

**THAT Council approve the City of Kitchener Integrated Stormwater Management Master Plan (ISWM-MP) Schedule 'B' Municipal Class Environmental Assessment Report prepared by Aquafor Beech Ltd. and dated May 19, 2016 together with the recommended approaches; and**

**THAT staff be directed to file the report for the 30 day public review period as required by the Environmental Assessment Act; and further**

**THAT staff be directed to develop an Implementation Plan, with an operations and maintenance strategy, resource requirements, and supporting policies and by-laws as set-out in staff report INS-16-047.**

**EXECUTIVE SUMMARY:**

The City of Kitchener's Integrated Stormwater Management Master Plan (ISWM-MP) continues the 'state-of-the-art' approach to managing stormwater first established in 2001 as part of the City's previous Master Plan and continued in 2010 and 2012 with the formation of the City's Stormwater Utility and Credit Program. The ISWM-MP updates the 2001 Study and serves as a decision support tool, providing direction for the prioritization of projects. The ISWM-MP, was completed as a Master Plan, an approved process under the *Ontario Environmental Assessment Act*. The various alternatives, evaluation criteria and recommended approaches for the six stormwater management program elements in the ISWM-MP as laid out in report INS-16-046 were endorsed by Environmental Committee on May 19, 2016.

\*\*\* This information is available in accessible formats upon request. \*\*\*  
Please call 519-741-2345 or TTY 1-866-969-9994 for assistance.

A consultation plan developed early in the study process focused on innovative approaches to obtain enhanced public input and improve citizen participation. It was the intent of the ISWM-MP to move citizen engagement beyond a process of simply presentation and feedback - to a community visioning opportunity and a chance to create excitement, secure valuable insights and ideas as well as encourage public support and critique of the plan as it progressed.

Public Open Houses featured “Interactive Zones” and “Ideas Zones” which offered an opportunity for the community to share their “vision and ideas” as to how stormwater could be improved in their neighbourhood, on their property and in their community. Comments received as part of the second open house relating to the study direction described the approach as “thorough and sensible”, the problems as “clearly identified and well described” and the solutions seeming “sensible and creative”. Local stakeholders, agencies and the broader development community were also invited to participate as part of Public Advisory Committee and thorough the City’s Environmental Advisory Committee.

Overall, the six elements of the ISWM-MP have been developed with an emphasis on integration. The identified projects are planned to be completed as part of existing and planned City initiatives to better serve the residents of Kitchener and reduce overall costs. In this way, the City goals to increase urban tree canopy, construct new trails and cycle lanes, improve transit, rehabilitate parks and reconstruct City roads can also serve to improve stormwater management leveraging economies of scale. At its core the ISWM-MP is a strategy for the City to better allocate existing funding to projects and areas most in need and which stand to show the greatest improvement.

#### **1. What are the main reasons for undertaking the study?**

- **Develop an inventory of the existing conditions of the subwatersheds and better understanding City’s stormwater infrastructure and assets;**
- **Being able to prioritize improvements to the infrastructure without the need for separate environmental assessments; and**
- **Developing new practices to manage climate change as it affects infrastructure and urban areas.**

To understand the existing conditions of the subwatersheds and infrastructure baseline data needed to be collected to inform the approach going forward. Every subwatershed was ranked for stream health, water quality, aquatic ecology, terrestrial ecology and stormwater management. Overall approximately 25% of the urban area is treated by stormwater infrastructure such as ponds or oil grit separators to control flooding and water quality leaving 75% of the area flowing uncontrolled into local creeks and the Grand River.

Completing this study as a Schedule ‘B’ Environmental Assessment allows the City to proceed with the detailed design and construction of individual elements of the works subject to completion of the 30 day review. Further citizen engagement will be conducted for individual elements of the work to help shape and refine the detailed design phase.

The City's new approach to stormwater management focuses on runoff prevention, preserves and acknowledges the benefits provided by natural systems, recognizes rainwater as a resource to be managed rather than a waste and uses 'green' infrastructure approaches in combination with conventional SWM approaches to better and more efficiently manage stormwater and improve the environment.

Through the use of rain gardens, permeable pavements, rainwater cisterns, bioswales, perforated pipes and tree clusters among others, the City will integrate stormwater features into everyday urban forms and into the very fabric of the community. In this way, a complete and healthy community is formed whereby the very features which support the human inhabitants (roads, parks, grassed areas, sidewalks) become the very elements that protect local creeks, maintain our groundwater supplies, create habitat and make a community more livable.

In this approach conventional sidewalk becomes a permeable sidewalk, a ditch becomes a bioswale, a road becomes a stormwater filter, a parking lot becomes an invisible stormwater ponds and a front yard becomes an oasis.

## **2. What environmental concerns are addressed by the study?**

- **Degraded surface water and groundwater quality;**
- **Warming of local creeks which can affect fish;**
- **Increased sediment being delivered to local creeks;**
- **Negative effects on human and animal health;**
- **Loss of fish and wildlife habitat, and natural features;**
- **Increased flooding and creek erosion;**
- **Reduced groundwater recharge (our drinking water source); and**
- **Overwhelming of the municipal storm sewer system resulting in flooding.**

The study was started with the basic recognition that urban areas degrade the environment in many ways, as a result of both new development and existing development. Pollutants from all land uses within the City can impact the natural environment, as well as the animal and human life which depends upon it. When we build cities, we change the land and the way in which that land reacts to rainfall. Rainfall that previously contributed little or no runoff to streams now causes flow to occur and consequently, the amount of water draining to local streams significantly increases.

At its core, the City's new ISWM-MP looks to address these concerns. This plan reflects the change in the way in which the public and policy makers regard the natural environment. This change, embodied within the principles of Low Impact Development (LID), has led to considerable changes in the planning, design and construction of Ontario communities and the infrastructure necessary to sustain them.

Recognizing this evolution in stormwater management, the ISWM-MP takes a holistic approach to reducing runoff by managing rainwater where it falls – at its source, along with capturing and filtering runoff as it flows over the land surface and treating runoff at the end of the system before it reaches the local watercourse.

**3. What are the six main elements of the study that will be integrated into the everyday urban form?**

- **Municipal Pollution Prevention, Operations & Maintenance Practices;**
- **Market Based Strategies for Private Property (source controls);**
- **Stormwater for the Capital Roads Program (conveyance controls);**
- **Stormwater Management Facilities;**
- **Watercourse and Erosion Restoration; and**
- **Urban Flood Management & Stormwater Infrastructure.**

The ISWM-MP has six elements which are detailed in a series of technical documents which make up the core of the plan. The first element focuses on pollution prevention and municipal practices that can help to prevent impacts before they occur. The second focuses on supporting and encouraging private property to ‘take-action’ to beautify their neighbourhoods, homes and businesses while managing stormwater at the same time. This includes selected methods being tested on a pilot project basis in collaboration with REEP Green Solutions as part of the recently approved 3-year (\$439,500) Trillium ‘Grow’ funding which is to target two neighbourhoods in need within the City.

Other elements include improving the way local roads and laneways treat runoff by constructing Low Impact Development controls like bioswales or perforated pipes as part of routine road works; maintaining and improving existing as well as constructing new stormwater management facilities as part of park rehabilitations; restoring local creeks and better managing urban flooding particularly with the threat of Climate Change.

**4. How does the City’s current stormwater infrastructure measure up to accommodate future climate change?**

As part of the ISWM-MP, a storm trunk sewer network model was developed for all pipes 600mm and larger (approximately 6,000 pipe segments which represents 33% of the total storm sewer network) in order to assess and identify the capacity of the existing storm sewer network and associated stormwater management ponds. The impact of climate change increases the number of pipes that flood from 6.2% to 8.8%

Following the development of the storm trunk sewer network model, and identification and assessment of the capacity of the existing stormwater management ponds, the Recommended Approach includes expansion of the existing sewer network model into areas to be identified for future study as part of the Implementation Plan.

## **5. What information will the Implementation Plan provide?**

- **Prioritized list of works based on priority subwatersheds;**
- **The market based approaches designed to increase participation in the Stormwater Credit Policy; and**
- **Final staffing recommendations in order to implement the recommended approach.**

The Implementation Plan (under separate cover, anticipated Fall 2016) will prioritize all the works based on priority subwatersheds as well as recommend funding allocation and policy development. Prioritization will be based on the subwatersheds in the most need and where there are opportunities to improve conditions through the elements of the recommended approach. Projects within subwatersheds will be prioritized based on the areas of greatest need.

### **BACKGROUND:**

In 2001, the City of Kitchener completed the Stormwater Management Policy Development Study to develop a Stormwater Management Master Plan that was intended to guide the future location, design and implementation of stormwater management measures throughout the City. The resulting City of Kitchener Stormwater Management Policy (#I-1135) was developed, which when written in 2001 can generally be considered 'State-of-the-Art' for its time. However, since that time, the approach to stormwater management has evolved.

As a component of the 2013 City of Kitchener Stormwater Management Audit, a SWM policy background and industry practices review was completed which concluded that the 2001 SWM Policy did not adequately capture or represent key Federal, Provincial, Regional and local policies, guidelines, and regulations, as well as the City of Kitchener Storm Water Charges By-law and Credit Policy (2010-113, as amended by 2011-153, as amended by 2012-036). The report recommended that the City complete an Integrated Stormwater Master Plan (ISWM-MP) following a Master Planning approach in accordance with the Environmental Assessment Act as outlined by the Municipal Engineer's Association Municipal Class Environmental Assessment (MEA), October 2000, as amended in 2007 and 2011.

### **Problem Statement, Opportunity and Constraints:**

Urban areas may degrade the environment in many ways, as a result of both new development and existing development. Pollutants from a variety of residential, commercial and industrial sources impact the environment, as well as terrestrial and aquatic life when conveyed to the receiving bodies of water. Urban development can also result in undesired changes to the hydrologic characteristics within subwatersheds, where rainfall events that previously contributed little or no runoff to streams now cause flow to occur and consequently, the amount of water draining to streams significantly increases in volume. As a result of existing land uses, together with proposed land use changes, a number of potential environmental problems have been identified. These include:

- Degraded surface water and groundwater quality;
- Thermal enrichment of surface water;

- Increased sediment loads to surface water;
- Adverse effects on human and animal health;
- Loss and degradation of fish and wildlife habitat, natural features and processes
- Increased flooding and erosion;
- Disruption of the pre-development hydrologic process (reduction in groundwater recharge and stream baseflow); and
- Urban flooding (overwhelming of the municipal storm sewer system)

**Study Purpose:**

The purpose of the ISWM-MP study is to update the City of Kitchener 2001 SWM Policy Study (#I-1135) and serve as a decision support tool as well as a methodology for the prioritization of works. The ISWM-MP also serves as a transparent citizen engagement process by which the City can establish stormwater management guidelines and policies for the next 15 years. When approved, the ISWM-MP will provide direction for resource requirements and identified works relating to the following six (6) stormwater management program elements:

- 1) Pollution Prevention, Municipal Management & Operational Practices,
- 2) Market Based Strategies for Private Property (source controls),
- 3) Stormwater for the Capital Roads Program (conveyance controls),
- 4) Stormwater Management Facilities,
- 5) Watercourse and Erosion Restoration, and
- 6) Urban Flood Management & Stormwater Infrastructure.

**Study Goals and Objectives:**

The City of Kitchener ISWM-MP considers flood and erosion control, groundwater and surface water quality management, natural heritage, environmental management and infrastructure, all in an integrated manner as part of an overall plan. In addition, the ISWM-MP integrates existing policies, regulations, acts and guidelines. The objectives of the City of Kitchener ISWM-MP include twenty (20) objectives for: water quality (4), water quantity (3), erosion control (2), natural environment (3), water resource sustainability (2), infrastructure (3) and policy and implementation (3).

**Class EA Process:**

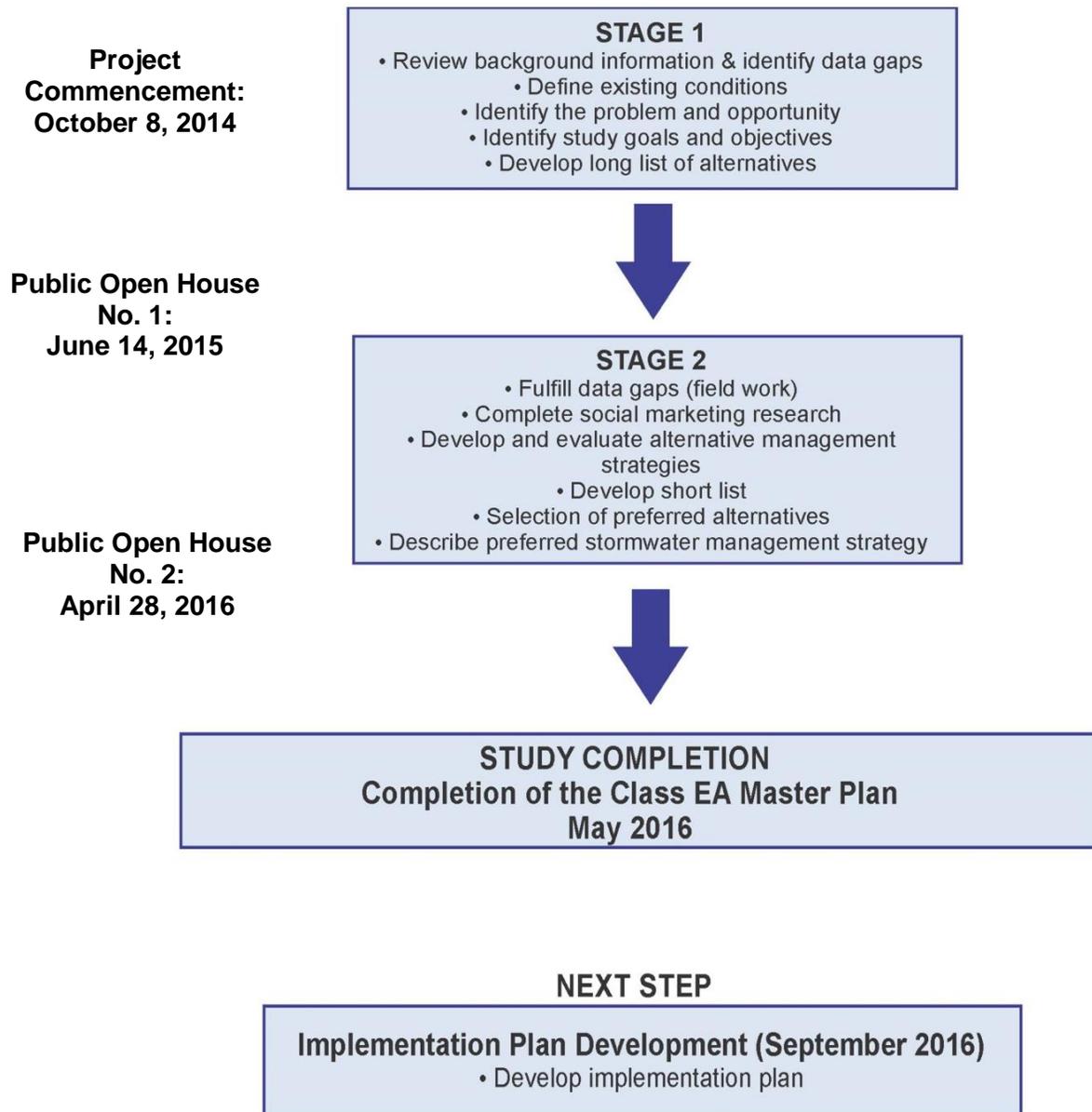
The ISWM-MP was conducted in accordance with the requirements for Master Plans under **Section 4, Approach #2** of the Municipal Engineers Association Municipal Class Environmental Assessment Act (October 2000, as amended in 2007 & 2011), which is an approved process under the *Ontario Environmental Assessment Act*. As part of the Class EA process evaluation of alternatives, assessment of the potential environmental effects and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations.

The ISWM-MP fulfills all of the Class EA requirements for Schedule A, A+, and B projects which can then proceed directly to detailed design subject to completion of the 30 day review and

resolution of any Part II orders, if received. It further identifies any Schedule C projects for future studies.

**Study Process:**

The Master Plan itself has been completed in two (2) stages as detailed in the **Figure 1** below. A separate Implementation Plan (anticipated in Fall 2016) will be prepared following the mandatory 30-day public review of the Class EA document. The Implementation Plan will allocate funding, prioritize works and inform the development of the necessary supporting policies and by-laws to permit the implementation of the recommended approaches.



**Figure 1- Integrated Stormwater Master Plan Study Process**

## **MASTER PLAN REPORT:**

A report titled “**Integrated Stormwater Management Master Plan (ISWM-MP) Municipal Class Environmental Assessment (May 2016)**” has been prepared and details the existing conditions of stormwater and environmental resources within the City of Kitchener, the Class EA process including the various alternatives, evaluation criteria and the recommended approaches for the six (6) stormwater management program elements of:

- 1) Municipal Pollution Prevention, Operations & Maintenance Practices;
- 2) Market Based Strategies for Private Property (source controls);
- 3) Stormwater for the Capital Roads Program (conveyance controls);
- 4) Stormwater Management (SWM) Facilities;
- 5) Watercourse and Erosion Restoration; and
- 6) Urban Flood Management & Stormwater Infrastructure.

Separate detailed reports were also prepared for each of the program elements detailed above and are included as technical appendices to the ISWM-MP Class EA document. A summary of the six (6) stormwater management program elements which make up the Recommended Approaches are provided below.

## **RECOMMENDED APPROACHES:**

### **1) Municipal Pollution Prevention, Operations & Maintenance Practices**

Pollution Prevention, Municipal Management and Operational Practices are important to ensure pollutants are prevented from impacting the environment and to ensure existing stormwater infrastructure maintain their effectiveness. The ISWM-MP explored approaches to manage pollutants and sediment within the City’s stormwater management infrastructure in the most cost effective manner. The study and resulting recommended approaches have been completed following Schedule A/A+ of the Municipal Class EA process, and therefore, are pre-approved.

### ***Catch Basin Clean-out, Street Sweeping and Leaf Pick-up Program***

The ISWM-MP reviewed existing street sweeping and leaf collection programs, as well as completed a detailed assessment of catch-basin sediment quality and loading rates within four (4) representative areas of the City corresponding to a new subdivision, mature and old subdivision (minimum of 10 years and 30 years since development respectively) and an industrial/ commercial area. Recommendations included:

- That the existing street sweeping and leaf collecting programs be further investigated to assess the potential to integrate catch-basin cleaning to increase efficiency and reduce cost.
- Sediment removal from catch-basins within uncontrolled areas (areas without existing stormwater ponds or OGS units) be completed within priority subwatersheds to be detailed in the Implementation Plan.

### ***Oil and Grit Separator (OGS) Cleanouts***

OGS units are designed to capture sediment and oils from the storm sewer network prior to stormwater being discharged. The City of Kitchener is currently responsible for the operation and maintenance of sixty-five (65) OGS units in the City, with new ones often added as part of road reconstruction projects where technically feasible. Maintenance has been completed for fourteen (14) of the most critical units and the remainder have been prioritized based on operational status or recommended for additional study within the ISWM-MP. The ISWM-MP evaluated thirty-two (32) units with available information and quantified their overall maintenance requirements and concluded that sixteen (16) OGS units required immediate maintenance, six (6) OGS units were classified as high priority and ten (10) OGS units were classified as moderate and low priority. Ultimately, all of the units will require maintenance service at some point as a condition of the Environmental Compliance Approval for their installation.

### **2) Market Based Strategies for Private Property (source controls)**

In 2011, the City established a stormwater utility fee and credit program in 2012 for up to 45% of the fee to encourage private landowners to implement on-site stormwater mitigation and pollution prevention measures. To support landowners implementing SWM mitigation measures such as rain gardens, bioswales, redirecting downspouts, etc., the City of Kitchener in partnership with Residential Energy Efficiency Project (REEP Green Solutions) provides information, resources and direct expert guidance to residential and industrial, commercial and institutional (ICI) property owners.

However, the number of applications by residents and businesses received for participating in the Stormwater Utility Credit Policy has decreased in volume recently relative to when the program was introduced in 2012. Overall uptake sits at approximately 6% of all residential and non-residential properties. To increase uptake of SWM and pollution prevention practices, market-based research was undertaken to develop enhancements to current SWM programming. The City of Kitchener undertook an extensive market-based research study to explore and understand the "wants and needs" of residents and businesses in order to support and service those interested in improving stormwater management on their properties. This research included a comprehensive review of leading jurisdictions in Canada and the USA, development of a demographic profile of the residents of the City and Kitchener as well as:

- Interviews with business property owners/managers, builders/developers and service providers (in the fields of landscape design and installation, roofing and building sciences, and porous/permeable surfacing).
- A research session (March 11, 2015) with a demographically representative sample of single-family homeowners in the City.

Based on the results of the market-based research, the recommended approach puts forward that in addition to the existing residential credit program, the City intends to evaluate the opportunity to determine the appropriateness of a variety of incentives and programs to support and service those interested in improving stormwater management on their non-residential properties. Approaches such as various financing options, 'bonusing' strategies,

review enhancements, and service charge reductions will be evaluated and appropriate methods will be detailed as part of the implementation plan to be developed in the coming months. It is proposed that the City try a few selected methods on a pilot project basis and focus on priority watersheds in collaboration with REEP Green Solutions as part of the recently approved 3-year (\$439,500) Trillium 'Grow' funding which is to target 2 neighbourhoods in Kitchener.

The goal of this element of the Recommended Approach for source controls will be to achieve a twenty percent (20%) uptake over a five year period, allowing the City to secure source-level SWM measures at just over 25% of non-residential properties by 2021.

### **3) Stormwater for the Capital Roads Program (conveyance controls)**

As an element of the Recommended Approach, the City has identified stormwater management treatment options (conveyance controls) that can be incorporated into the 10-year Capital Forecast for road right-of-way (ROW) reconstruction (resurfacing) and full reconstruction projects until 2024 for local, minor and major roads as well as laneways. Conveyance controls are linear stormwater transport systems that are generally located adjacent to or within roadways. They encourage infiltration of water into the ground, improve water quality and reduce runoff. They can include traditional curb and gutter systems and techniques such as bioswales, grassed channels and subsurface perforated pipe systems.

The incorporation of a cost-effective ROW retrofit approach using a combination of traditional SWM controls (i.e. Oil and Grit Separator (OGS) and other treatment devices) and Low Impact Development (LID) approaches as part of planned road reconstruction and resurfacing projects presents a significant opportunity to improve SWM control (water quality, water quantity, erosion mitigation and water balance) in a cost effective manner within existing urban areas of the City built prior to the implementation of modern stormwater management practices. In addition, ROW retrofits have the added benefit of providing an opportunity to enhance street aesthetics, mitigate and adapt to climate change conditions and reduce urban heat island effects.

The ISWM-MP evaluated through desktop and field investigations, 203 roadway projects and 22 laneways identified within the 10-year Capital Forecast and developed preferred stormwater alternatives for one-hundred seven (107) roadway projects and twenty-two (22) laneway projects.

To direct the implementation of the Recommended Approach, a decision making framework to select the appropriate SWM treatment options for all Capital ROW projects has been developed and in consultation with the Region of Waterloo Hydrogeology and Sourcewater Protection staff, a document has been developed which defines where and how infiltration of roadway runoff can safely occur in the context of the approved source protection planning policy.

The above has been completed following Schedule A/A+ of the Municipal Class EA process, and therefore, all recommended works are considered pre-approved.

#### **4) Stormwater Management (SWM) Facilities**

The Recommended Approach for Stormwater Management Facilities is comprised of three (3) individual elements of:

1. Sediment Removals from Existing SWM Facilities
2. Planned SWM Retrofits
3. Park Rehabilitation and SWM Enhancements

##### ***Sediment Removals from Existing SWM Facilities***

The City of Kitchener inventory includes one hundred and thirty-two (132) SWM facilities that require regular maintenance (not including natural ponds). The ISWM-MP determined the effect of sediment accumulation on existing SWM facilities and developed a prioritized list of those requiring maintenance based on the amount of sediment within each facility and the effect of this accumulation in terms of loss in storage or decrease in performance. The SWM facilities were grouped according to the facility type (i.e Dry versus Wet Facilities).

Dry facilities (only have water in them during certain storm events) focus on quantity control and were assessed based on the loss in storage capacity. Wet Facilities are designed to provide quality control via a permanent water pool to allow the accumulation of sediment from stormwater. Wet facility sizing is based on the level of protection to be provided in terms of Total Suspended Solid Removal (TSS). A decrease in performance was represented as a loss in efficiency/level of protection due to sediment accumulation. Maintenance requirements (i.e. clean-outs) were prioritized accordingly. The ISWM-MP recommendations included:

- Of the thirty-one (31) Dry facilities identified:
  - Seven (7) were assessed as High Priority (>20% Loss)
  - Two (2) were assessed as Moderate Priority (11-20% Loss)
  - Seven (7) were assessed as Low Priority (6 -10% Loss)
  
- Of the sixty-two (62) Wet facilities that were analyzed:
  - Twenty-Two (22) were assessed as High Priority
  - Three (3) were assessed as Moderate Priority
  - Two (4) were assessed as Low Priority

The above has been completed following Schedule A/A+ of the Municipal Class EA process, and therefore all the recommended works as detailed above are considered pre-approved. Further, the maintenance of SWM facilities is a legislated requirement as a condition of the Environmental Compliance Approval issued for their construction. The City has maintained SWM facilities on a planned basis since 2014.

##### ***Planned SWM Retrofits***

As part of previous Class Environmental Assessments (EAs) completed in 2001 and 2010 eighteen (18) existing ponds were identified as feasible retrofit locations. Retrofits improve or enhance the water quality, quantity and erosion control performance of existing stormwater management facilities and bring them in-line with current standards.

The City has already completed retrofits at eight (8) facilities from 2005 to 2013. The ten (10) remaining planned retrofits awaiting implementation include Ponds 6 (currently underway as part of Kolb Creek project), 66, 10, 16, 65, 61, 21, 7, 62, and 111.

### ***Park Rehabilitation and SWM Enhancements***

To identify locations where new stormwater management facilities could be implemented in combination with park rehabilitations to increase the proportion of SWM controlled drainage areas in the City to improve: water quality and quantity control as well as erosion control, a four (4) phase assessment was conducted.

**Phase 1 - GIS/Land Assessment:** identified potential locations within the study area. Six (6) screening level assessment criteria were utilized to determine feasible locations.

**Phase 2 - Field Reconnaissance/ Impact Assessment:** consisted of a much more detailed and thorough assessment of each potential location. This phase used a combination of a field reconnaissance and as well as the assessment of each feasible location for impacts and/or opportunities related to the technical, environmental, and social considerations.

**Phase 3- Performance Assessment:** evaluated the performance capabilities of each site carried forward using primary and secondary criteria per the Stormwater Management Planning and Design Manual, MOE (2003). This step also identified conceptual SWM facility alternatives for each location (surface or subsurface storage facility) and developed Class 'C' cost estimates

**Phase 4 – Consultation with City Staff:** Each potential location was reviewed and (5) sites were eliminated based on identified issues such as high groundwater, soil conditions and future development (i.e. future school site and highway expansions by MTO).

A total of thirty (30) potential sites were screened, of which twelve (12) were deemed feasible as either a surface facility (SWM Pond, wetland etc.) or subsurface facility (underground storage facility) following the four (4) phase process. Preferred alternatives for each location were evaluated in fulfillment of Schedule B Class EA requirements using criteria under the primary categories of:

**Physical & Natural Environment Criteria** - Water Quality, Stream Geomorphology, Aquatic Habitat, Fisheries, Wildlife and Groundwater Resources

**Social & Cultural Criteria** - Visual Aesthetics, Recreational Opportunities, Cultural/Heritage Resources and Health & Safety

**Technical & Engineering Criteria** - Flood Control, Erosion Control, Ease of Implementation and Operations & Maintenance

**Economic Criteria** - Capital Costs, Operations & Maintenance Cost, Lifecycle Costs and Ability to coordinate with other projects

Alternatives, with higher scores represented the greater fulfilment of the evaluation criteria. The preferred solutions for each of the twelve (12) opportunities were then selected based on highest total score from all of the evaluation criteria across each of the alternative solutions. The twelve (12) sites included within the Recommended Approach for Park Rehabilitation and SWM Enhancements are listed in **Table 1 below**.

**Table 1 – Twelve (12) Sites Included in the Recommended Approach for Park Rehabilitation and SWM Enhancements**

Map & Site ID	Location Name	Preferred Alternative
2-1	Victoria Park	Subsurface Storage Facility
2-2	Cameron Heights Pool & Kaufman Park	Subsurface Storage Facility
2-3	Cherry Park	Subsurface Storage Facility with Wet Pond
3-4	Roseburg Park	Subsurface Storage Facility
4-2	Idlewood Greenway	Subsurface Storage Facility
4-5	Prospect Park	Wet Pond
5-2	Sandrock Hydro-Corridor	Wet Pond
5-5A	Country Side Park	Wet Pond
5-5B	Country Side Park	Wet Pond
6-1	Country Hill Park	Subsurface Storage Facility
6-3B	Millwood Park	Wet Pond
7-2	Biehn Park	Subsurface Storage Facility

The above has been completed following Schedule B of the Municipal Class EA process, and therefore, may proceed directly to detailed design subject to the completion of the 30 day review. As this work would be done in collaboration with park improvements, the timing of these projects will be somewhat budget dependent and will be looked at in greater detail during the development of the Implementation Plan anticipated in the Fall of 2016.

**5) Watercourse and Erosion Restoration**

The purpose of the stream erosion assessment component of the ISWM-MP was to document the physical health of Kitchener’s watercourses and to create an inventory of erosion sites that could potentially be addressed through creek-based restoration works. A technical field scoring methodology was used to assess the levels of risk and environmental opportunity, and to classify the erosion sites (primary and secondary). Stream restoration opportunities, including the identified erosion site and restoration reach opportunities, were also evaluated within the context of the Ecological Restoration Areas identified within the City of Kitchener’s Official Plan and the recently Council approved Fish Habitat Banking Arrangement with the Department of Fisheries and Oceans Canada. The primary sites are listed in **Table 2**.

**Table 2: Primary Stream Restoration Opportunities in Alphabetical Order**

Watercourse, Location	Reach ID	Risk	Preferred Solution
Borden Creek at Concordia Park	BD-1A	Sanitary Sewer	Local Works
Borden Creek at Concordia Park	BD-1A	Water Main	Removal of Risk
Borden Creek downstream of Conestoga Pkwy	BD-1B	Sanitary Sewer	Removal of Risk
Lower Laurel Creek	LC-1A-B, 2A	Sanitary Sewer, Building	Reach Based Works <sup>1</sup>
Montgomery Creek at Vanier	MG-1E-F	Water Main, Culvert	Removal of Risk <sup>2</sup>
Sandrock Creek at Westheights	SR-2B	Trail, Storm Sewer Outfalls	Local Works
Schneider Creek at Manitou	SC-4L-5A	Water Main (Abandoned)	Removal of Risk <sup>2</sup>
Schneider Creek at Old Carriage	SC-2B-3A	Trails, Private Property	Local Works <sup>1</sup>
Shoemaker Creek	SM-2B-E	Sanitary and Storm Sewers	Reach Based Works
Stonegate (Hofstetter) Creek	ES-GRT6-1	Storm Sewer	Removal of Risk
Strasburg Creek Downstream of Old Huron	SB-13A	Culvert, Sanitary Sewer	Local Works <sup>1</sup>
Voisin Creek at Greenbrook	VS-1A	Road, Sidewalk, Utilities	Reach Based Works

1 – Requires land rights (i.e., acquisition and/or easements) and associated costs have not been included in the EA

2 – Optional works to expand the scope and length of stream restoration have also been identified in the EA

Alternative solutions were assessed for each of the primary stream restoration opportunities to recommend a preferred solution. Four preliminary alternative solutions were evaluated in each case, including:

- **Do Nothing** – No creek-based works to address existing erosion or to mitigate existing risks
- **Local Works** – Selective creek-based works to address local erosion issues and risks, and to improve stream habitat
- **Reach Based Works** – Extensive creek-based works to address erosion issues and risks, and to improve or fully rehabilitate stream habitat
- **Removal of Risk** – Elimination or reduction of the erosion risk within the creek channel by removing, realigning, or redesigning the associated infrastructure, and/or by addressing land rights for properties within the stream corridor and the erosion hazard zone.

Preliminary alternatives for each of the primary stream restoration opportunities were evaluated in fulfillment of Schedule B Class EA requirements based on the evaluation criteria as summarized below:

- **Physical/Natural Environment** - Potential Aquatic Habitat Benefit (Water Temperature), Potential Aquatic Habitat Benefit (Fish Passage), Potential to Reduce Erosion of Public Lands, Potential to Reduce Erosion of Private Lands, Potential to Reduce Stream bank and Stream bed Erosion, Potential to Enhance Groundwater Regime, Potential to Reduce Flooding, Potential to Improve Terrestrial Habitat, Integration with Existing Infrastructure and Integration with Existing Environment.

- **Social/Cultural** - Aesthetic / Recreation, Compatibility with Adjacent Land Use, Community Disruption and Public Health and Safety
- **Economic** - Construction Costs, Operation Maintenance and Infrastructure Protection
- **Technical/Engineering** - Ease of Implementation, Agency Acceptance, Policy/Bylaw Requirements, Technical Feasibility

Alternatives, with higher scores represented the greater fulfilment of the evaluation criteria. The preferred solutions for each of the primary stream restoration opportunities were then selected based on highest total score from all of the evaluation criteria across each of the four alternative solutions.

The prioritization of the stream restoration opportunities (**Table 2**) will be integrated within a system-wide evaluation of stormwater management priorities and subwatershed health, and in the context of other City projects as part of the Implementation Plan.

## **6) Urban Flood Management & Stormwater Infrastructure**

As part of the ISWM-MP, a storm trunk sewer network model was developed for all pipes 600mm and larger (approximately 6,000 pipe segments which represents 33% of the total storm sewer network) in order to assess and identify the capacity of the existing storm sewer network and associated stormwater management ponds under five (5) scenarios:

- **Scenario 1 - Existing Conditions:** Calibrated trunk sewer model based on one-year of monitoring data completed as part of the ISWM-MP. Known flooding locations as reported by the City of Kitchener staff demonstrate good agreement with the calibrated model.
- **Scenario 2 - Climate Change on Existing Conditions:** The 5 year storm was increased by 20% to reflect climate change impacts per the recommendations of the Localized Climate Projections for Waterloo Region (September 2015).
- **Scenario 3 - LID Volume Control on Existing Conditions:** Reflects the application of a 12.5mm volume control target (city wide) to reflect the benefits of LID controls on the existing conditions.
- **Scenario 4 - Climate Change & LID Volume Control:** is a combination of Scenarios 2 and 3, and reflects the benefits of the 12.5mm volume control target (city wide) and the impacts of the predicted climate change conditions.
- **Scenario 5 – Intensification on Existing Conditions:** Reflects the impact of intensification within Priority A and B areas per the City of Kitchener Growth Management Plan on the existing trunk sewer system.

The completed Climate Change assessments of the stormwater trunk sewer system is in keeping with Strategic Priority of Sustainable Environment and Infrastructure, and Strategy #4.5 - strengthen the capability and capacity within the organization to manage all of the City's assets so that they are affordable, dependable and sustainable in the long-term. The Climate Change scenario was developed based on the Localized Climate Projections for Waterloo Region (September 2015) developed by the Interdisciplinary Center on Climate Change (IC3) and the University of Waterloo.

**Table 3** summarizes the modelling results of the five (5) scenarios and lists the total length of pipe at capacity and the total length of pipe which is surcharged (flow exceeding the pipe capacity which can result in flooded roads and property).

**Table 3 - Summary of Trunk Sewer Model Results: Scenarios 1-5**

Scenarios ID	Scenarios Name	Total Length of Pipe at Full Capacity (m)	% Length of Pipe at Full Capacity (%)	Total Length of Surcharged Pipes (m)	% Total Length of Surcharged Pipes (%)
1	Existing Conditions	10,723	4.8%	13,763	6.2%
2	Climate Change on Existing Conditions	13,934	6.3%	19,566	8.8%
3	LID Volume Control on Existing Conditions:	4,585	2.1%	5,842	2.6%
4	Climate Change & LID Volume Control	10,685	4.8%	14,691	6.6%
5	Intensification on Existing Conditions	12,427	5.6%	14,671	6.6%

Following the development of the storm trunk sewer network model, and identification and assessment of the capacity of the existing stormwater management ponds, the Recommended Approach includes expansion of the existing sewer network model into areas to be identified for future study as part of the Implementation Plan. The model expansion will permit the City to evaluate and select the preferred remedial approaches to improve the level of service.

### THE IMPLEMENTATION PLAN

The Implementation Plan (under separate cover, anticipated Fall 2016) will prioritize all the works based on priority subwatershed as well as recommend funding allocation and policy development. Prioritization will be based on the watersheds in the most need and where there are opportunities to improve conditions through the elements of the recommended approach. The implementation plan will detail:

- The market based approaches designed to increase participation in the Stormwater Credit Policy taking into consideration all costs and resource requirements, including staffing, overhead expenses, consulting services, advertising and promotion, and miscellaneous program related expenses;
- How identified works can add to the 'credits' of the Habitat Bank created with the Department of Fisheries and Oceans (DFO) through the additional fish habitat enhancement projects as completed through City projects and the recommended approach. Furthermore, the plan will explore the development of a market for the sale of accumulated 'credits' as a potential future stormwater funding source;
- Various incentives for property owners who implement private stormwater controls as part of the Stormwater Utility Credit Program within prioritized subwatersheds as part

of a 'pilot program' with a focus on the Industrial, Commercial, Institutional (ICI) and multi-residential land uses within the City;

- Strategic alignments in regards to the operation and maintenance of City owned stormwater management facilities, specifically, the development of a cost reconciliation mechanism and service level agreement between the Stormwater Utility and Operations to better track allocated O&M funds and direct the allocation of future O&M funding. It will consider the creation of an operations unit funded by the Stormwater Utility with a priority focus on the completion of stormwater related operation and maintenance tasks and associated projects as identified through the recommended approach; and
- Final staffing recommendations in order to implement the recommended approach for Market-based approach implementation, conveyance and SWM facility opportunities, InfoSWMM model expansion, monitoring and operations and maintenance.

Two (2) supporting documents which have been prepared in draft as part of the ISWM-MP process in collaboration with City staff, the Region of Waterloo, the GRCA and the Ministry of Environment and Climate Change, will be finalized as part of the Implementation Plan and will form the basis for the development of the future stormwater policy. "Infiltration in the Context of Source Protection Planning Policy" defines where and how infiltration of runoff can safely occur in the context of the approved source protection planning policy and "Stormwater Volume Criteria and Targets", outlines the proposed minimum stormwater volume criteria and targets for 'new' development, redevelopment, reurbanization and residential intensification as well as linear projects.

In order to ensure the goals and objectives of the Master Plan are accomplished over time, a monitoring program will also be established as part of the Implementation Plan which will address the need for resources required to:

- Stay current in the review of monitoring reports and data as required by subwatershed plans and other policies;
- The creation of a shared water quality data base (currently underway in partnership with the GRCA);
- Analyze and complete Phase 4 of the adaptive environmental management (AEM) feedback loop of subwatershed plans, environmental studies and other policies. The four (4) phase AEM approach requires Characterization (Phase 1), Impact Assessment (Phase 2), Implementation (Phase 3) as well as Monitoring and Refinement of the management strategy (Phase 4). The analyzed data from the follow-up monitoring is used to test the assumptions made during earlier study phases to evaluate the performance of the selected management strategies and make necessary adjustments. When all four (4) phases of the AEM process are not completed the process cannot ensure project goals and objectives are being met.

## **ALIGNMENT WITH CITY OF KITCHENER STRATEGIC PLAN:**

Strategic Priority: Sustainable Environment and Infrastructure

Strategy: SE2 Stormwater Master Plan

Strategic Action: 4.2 Develop measures to manage stormwater and improve water quality in the city's watersheds.

## **FINANCIAL IMPLICATIONS:**

The Implementation Plan that will be developed for the Fall of 2016 will be based on the existing 9.2% projected annual stormwater rate increase over the next 10 years and potential infrastructure funding from other levels of government. Costs identified below are in 2016 dollars.

### **1) Municipal Pollution Prevention, Operations & Maintenance Practices**

Sixteen (16) OGS units require maintenance, six (6) OGS units were classified as high priority (Estimated Cost: \$130,000) and ten (10) OGS units were classified as moderate and low priority (Estimate Cost: \$65,000)

### **2) Market Based Strategies for Private Property (source controls)**

The 5-year program costs including all resource requirements, including staffing, overhead expenses, consulting services, advertising and promotion, and miscellaneous program related expenses (Estimated 5-year cost: \$3.5 million).

### **3) Stormwater for the Capital Roads Program (conveyance controls)**

Implementation of the preferred approach would utilize the existing stormwater contribution to the AIRP projects, and require an additional \$1.9 to \$11.1 million in funding up to 2024 for turf versus highly vegetated aesthetically pleasing streetscaping options, respectively. Laneway implementation would require an additional \$1.7 million in funding or result in a savings of \$330,000 for permeable pavements versus perforated pipe, respectively.

### **4) Stormwater Management (SWM) Facilities**

#### Sediment Removals from Existing SWM Facilities (See Table 4)

Of the Thirty-one (31) Dry facilities that were analyzed:

- a. Seven (7) High Priority
- b. Two (2) Moderate Priority
- c. Seven (7) Low Priority

Of the Sixty-two (62) wet facilities that were analyzed:

- d. Twenty-Two (22) High Priority
- e. Three (3) Moderate Priority
- f. Four (4) Low Priority

The completion of sediment removal from existing facilities is estimated at \$3.2 million.

Planned SWM Retrofits

The ten (10) remaining planned retrofits awaiting implementation include Ponds 6 (currently underway), 66, 10, 16, 65, 61, 21, 7, 62, and 111. Cost estimates developed as part of the previous Class EAs, estimate the implementation costs at \$ 6.0 million.

Park Rehabilitation and SWM Enhancements

The implementation of the proposed SWM facility opportunities is estimated to cost \$32.1– \$41.2 million with an additional \$4.3 – \$8.1 million required for park rehabilitation.

**5) Watercourse and Erosion Restoration**

Based on the primary list of erosion sites and restoration reach opportunities, \$10.0 – \$15.0 million in stream restoration projects have been considered within the Integrated Stormwater Master Plan. An additional \$4.0 – \$5.0 million in secondary projects have been identified that the City may consider when opportunities arise within other City projects, not including any associated costs for addressing land rights on private property. Stream restoration projects already within existing studies have also been excluded from these cost estimates.

**6) Urban Flood Management & Stormwater Infrastructure**

The replacement of the 14,961m of surcharging pipe identified as part of Scenario 4 has an estimated cost of \$17 million. To address pipe capacity issues outside the modelled trunk sewer system (i.e. <600mm) modelled as part of the ISWM-MP, it is recommended that the City allocate an additional \$23.0 million.

Estimated capital costs estimates for each element of the Recommended Approach are detailed in **Table 4** below.

**Table 4 - Recommended Approach - Capital Cost Estimate†**

Recommended Approach Element	Capital Cost Estimate (\$ millions)*
1) Municipal Pollution Prevention, Operations & Maintenance Practices a. OGS Maintenance (High, Moderate & Low Priority)	\$0.2
2) Market Based Strategies for Private Property (source controls): 5 year program costs	\$3.5
3) Stormwater for the Capital Roads Program (conveyance controls) a. Roadways b. Laneways	\$1.9 to \$11.1 \$-0.3 to \$1.7
4) Stormwater Management (SWM) Facilities a. Sediment Removals (High, Moderate & Low Priority) b. Planned Retrofits	\$3.2 \$6.0 \$32.1 to \$41.2

c. Park Rehabilitation and SWM Enhancements (new SWM Facilities including park rehabilitation)	
5) Watercourse and Erosion Restoration	\$14.0 to \$20.0
6) Urban Flood Management & Stormwater Infrastructure (includes estimated costs for pipes smaller than 600mm which were not modelled)	\$40.0
<b>TOTAL</b>	<b>\$100.6M to \$126.9M</b>
†Class 'C' cost estimate. Note: all values in 2016 CDN dollars * Rounded to the nearest \$100,000	

### COMMUNITY ENGAGEMENT:

A Consultation Plan was developed in co-operation with City and REEP staff. Recognizing the mandatory requirements for Public Consultation under the Municipal Class EA process, the Consultation Plan ensured all mandatory requirements were met while providing a more innovative approach that provides for enhanced public input and ultimately lays the foundation for improved participation of residents to secure feedback. It was the intent of the ISWM-MP to move public consultation beyond a process of presentation and feedback to a community visioning opportunity and a chance to create excitement, secure valuable insights and ideas and encourage public support.

CONSULT - The public consultation completed for the ISWM-MP included:

- Notice of Study Commencement (The Record, October 3, 2014)
- Public Open House No. 1 (June 14, 2015)
- Wonders of Nature Stormwater Display at Huron Natural Area (August 29, 2015) which included a survey for participants to fill out.
- Public Open House No. 2 (April 28, 2016) which included the distribution of more than 3,000 letters to residents who lived in neighbourhoods where a stormwater opportunity was identified as part of the Recommended Approach.
- Public Advisory Committee Cyber Newsletters with response forms circulated to all local stakeholder, municipalities, agencies, Provincial and Federal Ministries and First Nations.
  - Newsletter No. 1 – January 16, 2015
  - Newsletter No. 2 – June 9, 2015
  - Newsletter No. 3 – October 9, 2015
  - Newsletter No. 4 & Comment Response to date – April 1, 2016
- Waterloo Region Homebuilder Association (WRHBA)
  - November 20, 2015
  - March 18, 2016
- Public Advisory Committee Workshop – April 21, 2015
- Environmental Committee (EC)
  - November 19, 2015
  - March 17, 2016
  - May 19, 2016
  - EC endorsed the six ISWM-MP program elements as outlined in INS-16-046.

COLLABORATE - As part of the Public Open House No. 1 and 2, an “Interactive Zone” and “Ideas Zone” respectively were offered which provided an opportunity for participants to share their “vision and ideas” as to how stormwater could be improved in their neighbourhood, on their property and in their community. Comments received as part of Open House No. 2 relating to the direction of ISWM-MP described the approach as “thorough and sensible”, the problems as “clearly identified and well described” and the solutions seeming “sensible and creative”

The residents who participated in the “Ideas Zone” in as part of Open House No. 2 were excited and supportive of the concept and appreciative to be able to participate in a fun and meaningful way.

Thirteen (13) questionnaires (from the total of 55 registered in attendance) were returned following Open House No. 2. In summary:

- 85% of respondents agreed with the evaluation criteria presented
  - 69% of respondents agreed with the recommended approach for Market Based Strategies for Private Property (source controls)
  - 92% of respondents agreed with the recommended approach for Pollution Prevention, Municipal Management and Operation Practices & Stormwater for the Capital Roads Program (conveyance controls)
  - 69% of respondents agreed with the recommended approach for Park Rehabilitation and SWM Enhancements
  - 86% of respondents agreed with the recommended approach for Watercourse and Erosion Restoration
  - 77% of respondents agreed with the recommended approach for Urban Flood Management & Stormwater Infrastructure
- Note: The vast majority of respondents, who did not agree with the above, entered a response of No-opinion.
- 92% of respondents found that the project team was helpful in answering questions, keeping them informed and that the information provided was helpful.
  - 85% of respondents heard about the Public Open House by letter

INFORM - This report has been posted to the City’s website with the agenda in advance of the council / committee meeting.

**PREVIOUS CONSIDERATION OF THIS MATTER:**

- INS-14-037 Stormwater Policy Review and Proposed Master Plan
  - Staff were directed to proceed with the development of an Integrated Stormwater Management Master Plan to replace Stormwater Management Policy #I-1135.
- INS-15-076 Stormwater Management Master Plan Status Update
  - Staff provided a progress update to Council on the development of the Plan.

**ACKNOWLEDGED BY:** Justin Readman, Interim Executive Director of Infrastructure Services