City of Kitchener

Storm Water
Asset Management Plan

2020

Phase 1 – 2013
Phase 2 – 2020
Contents
1. Acknowledgements .................................................................................................................... 6
2. Executive Summary ................................................................................................................... 7
3. Introduction ................................................................................................................................ 9
  3.1 Content ............................................................................................................................... 10
    Figure 3.1.1 Storm System Assets Groups ........................................................................ 11
  3.2 Purpose of this Asset Management Plan ............................................................................ 11
  3.3 Assumptions and declarations, systems, terminology, and quality of data ....................... 12
    3.3.1 Assumptions and declarations..................................................................................... 12
    3.3.2 Systems ....................................................................................................................... 13
    3.3.3 Quality of data............................................................................................................. 13
4. State of Local Infrastructure .................................................................................................... 14
  Figure 4.0.1 Estimated replacement cost (valuation) of storm infrastructure ...................... 15
4.1 Asset Inventory .................................................................................................................. 15
  4.1.1 Storm Mains................................................................................................................ 16
    Figure 4.1.1.1 Diameter classification of storm mains .................................................... 16
    Figure 4.1.1.2 Material classification of storm mains ....................................................... 16
  4.1.2 Storm Manholes .......................................................................................................... 17
  4.1.3 Storm Catchbasins ...................................................................................................... 17
  4.1.4 Oil and Grit Separators (as a Storm Quality Control device) ..................................... 17
  4.1.5 Storm Ditches and Culverts ........................................................................................ 17
  4.1.6 Stream Reaches ........................................................................................................... 18
  4.1.7 Storm Facilities / Ponds .............................................................................................. 18
  4.1.8 Storm Low-impact development (LID) components .................................................. 18
  4.1.9 Storm leads, inlets, outlets, weirs ................................................................................ 19
4.2 Installation Profiles ............................................................................................................ 19
  Figure 4.2.1 Asset Installation Profile – Storm Mains......................................................... 20
  Figure 4.2.2 Asset Installation Counts per Era – all storm assets ........................................ 20
4.3 Asset Condition .................................................................................................................. 21
  4.3.1 Asset condition – storm mains .................................................................................... 21
  Figure 4.3.1.1 Kitchener storm pipe condition data rating ranges ...................................... 22
Figure 4.3.1.2 Overview of structural condition of Kitchener storm mains ......................... 22
Figure 4.3.1.3 Storm main structural condition status from storm sewer camera inspection, with associated lengths .................................................................................................................. 23
Figure 4.3.1.4 Operations & Maintenance condition of Kitchener storm mains ......................... 24
Figure 4.3.1.5 Storm main operations and maintenance condition status with associated lengths ....................................................................................................................................... 24
4.3.2 Asset condition – storm manholes .................................................................................. 25
Figure 4.3.2.1 Storm manhole condition status ........................................................................ 25
4.3.3 Asset condition – storm catchbasins ............................................................................. 25
Figure 4.3.3.1 Storm catchbasin condition status ..................................................................... 25
4.3.4 Asset condition – storm ditches, ditch-culverts (less than 3-meter span) ....................... 26
4.3.5 Asset condition – storm quality control oil-grit separators ............................................ 26
4.3.6 Asset condition – storm stream reaches, ponds/facilities ............................................. 26
Figure 4.3.6.1 Storm Ponds/Facilities condition priorities ....................................................... 27
4.3.7 Asset condition – storm low-impact development ......................................................... 27
4.3.8 Asset condition – storm leads, inlets, outlets, weirs ........................................................ 27
4.4 Asset Consumption by Asset Type .................................................................................... 28
4.4.1 Asset consumption – storm mains .................................................................................. 28
Figure 4.4.1.1 Percentage breakdown by 10-year intervals of storm mains compared to expected useful life of 80 years. .................................................................................................................. 28
4.4.2 Asset consumption – storm manholes ........................................................................... 29
4.4.3 Asset consumption – storm catchbasins ........................................................................ 29
4.4.4 Asset consumption – storm ditches, ditch-culverts (less than 3-meter span) ................. 29
4.4.5 Asset consumption – storm quality control devices ....................................................... 29
4.4.6 Asset consumption – storm stream reaches, ponds/facilities ........................................ 29
4.4.7 Asset consumption – storm low-impact development ................................................... 30
4.4.8 Asset consumption – storm leads, inlets, outlets, weirs ................................................ 30
5. Levels of Service ................................................................................................................ 31
Table 5.0.1 Levels of Service Statements .............................................................................. 31
5.0.2 Value of Service – Efficiency ........................................................................................ 32
5.0.3 Value of Service – Quality ........................................................................................... 32
5.0.4 Value of Service – Reliability ....................................................................................... 32
5.0.5 Value of Service – Sustainability................................................................. 32
5.1 Customer Levels of Service.............................................................................. 33
  Table 5.1.1 Customer Levels of Service Performance Measures ....................... 33
  5.1.2 Customer Levels of Service Trends.............................................................. 34
5.2 Technical Levels of Service.............................................................................. 34
  Table 5.2.1 Technical Levels of Service Performance Measures and Work Activities .... 35
  5.2.2 Technical Levels of Service Trends.............................................................. 35
5.3 Legislation and Policies .................................................................................... 36
5.4 Risk Management & Growth ............................................................................ 36
5.5 Public expectations - local ............................................................................... 36
5.6 Regional maintenance agreement ..................................................................... 36
6. Asset Management Strategy ............................................................................. 37
  6.0.1 Condition-based analysis ............................................................................ 37
6.1 Service-Oriented Activities.............................................................................. 37
  Figure 6.1.1 Cityworks maintenance management system, service-oriented activity listing ................................................................. 38
  6.1.2 Storm network modelling ........................................................................... 38
6.2 Betterment Activities ...................................................................................... 38
  Figure 6.2.1 Storm main lining program ............................................................... 39
6.3 Routine Maintenance Activities........................................................................ 39
  Figure 6.3.1 Routine maintenance – SSU Maintenance & Operations..................... 40
6.4 Replacement and Disposal Activities ............................................................... 40
  Figure 6.4.1 Storm main replacement via Full Reconstructions............................... 41
  Figure 6.4.2 Storm replacement works - SSU Operations & Maintenance .......... 42
6.5 Growth and New Assets.................................................................................. 42
  6.5.1 Development charges background study ..................................................... 43
  Figure 6.5.2 Storm new works - SSU Operations & Maintenance ....................... 44
6.6 Inspection Activities ....................................................................................... 44
  Figure 6.6.1 Storm inspections - SSU Operations & Maintenance ......................... 45
  6.6.2 Asset inspection regimen – storm mains ....................................................... 45
  Figure 6.6.2.2 Storm sewer main inspection program ......................................... 46
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2. Executive Summary

Kitchener’s **Asset Management Division** has a documented purpose which is *to develop a Corporate Asset Management program that will ensure the availability and sustainability of Kitchener’s existing and future assets.*

In 2011, the Ministry of Infrastructure released its 10-year infrastructure plan “Building Together: Guide for Municipal Asset Management Plans”.

> *Building Together responds to the far-reaching trends that will affect Ontario’s infrastructure needs, including a more global and service-oriented economy; a larger, older and more urbanized population; and the effects of a changing climate. A key element of this framework is ensuring good stewardship through proper asset management.*

The regulation “Asset Management Planning for Municipal Infrastructure”, or O. Reg. 588/17, requires all Ontario municipalities to have a strategic asset management policy in place by July 1, 2019, an asset management plan for core infrastructure assets by July 1, 2022.

In response to the Ministry’s document, the City’s active FCM participation, and an objective to remain progressive and responsible asset owners, The City of Kitchener has produced this asset management plan for the City’s storm system assets, one of thirteen of the City’s asset categories completed or in-queue for this undertaking.

This asset management plan provides a detailed analysis of the current status of the City’s storm assets, what investigative and monitoring efforts are performed, and how current business processes align with the City’s corporate asset management strategy’s two guiding principles.

1. Balancing asset condition and level of service.
2. Allocating financial resources among priorities.

The Sanitary and Storm Utility (SSU) is responsible for the planning, installation, maintenance and disposal of all City-owned storm water infrastructure. The City’s *Sanitary and Stormwater Maintenance and Operations Section*, within the SSU, provides overall stewardship for the day-to-day operation and maintenance of the storm assets outlined in the utility. For the purposes of this plan, the following asset types will be address:

- Storm Gravity Mains
- Storm Catchbasins
- Storm Manholes
- Storm Leads
• Storm Inlets
• Storm Outlets
• Weirs
• Storm Culverts
• Storm Ponds/Facilities
• Watercourses
• Ditches
• Low-impact Development
• Oil/Grit Separator (quality devices)

An analysis of current and historic expenditures and costs for routine, betterment, service-oriented activities and capital replacements was undertaken. The analysis outlined within this document, includes some descriptive charts, illustrating the current state of affairs and identifies that the Utility has a very detailed dataset.

Kitchener has a storm mains network with over 94% of the inspected mains in excellent structural health and fewer than 6% of inspected mains in average or poor condition. Section 7 describes how those which are in need or anticipated to be in need in short order have a long-term capital funding strategy in place.

Kitchener has 10% of the inspected mains of the network with identified operations and maintenance issues. Section 7 describes an operations and maintenance strategy which only requires the rate of inflation to maintain these assets to the defined levels of service, though the Council report INS-17-070 states that “the stormwater program is relatively new and has a larger maintenance gap [than water and sanitary].”

By documenting all current information sets including asset inventories; defined service levels; service-oriented activities; betterment expenditures; projected capital revenues and costs, the Sanitary and Storm Utility has the information it requires to make future decisions that will incorporate asset management strategies in providing services to Kitchener’s residents.
3. Introduction

The City of Kitchener is subject to the Municipal Act, Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure, Ontario Water Resources Act, and Environmental Protection Act. The upper-tier municipality, the Regional Municipality of Waterloo, also has by-laws (e.g. 1-90 and 50-92) with respect to the stormwater sewer network by which the City of Kitchener must abide.

Discussion of legal/statutory protections and requirements fall outside the scope of this AMP. But for clarity, the City by virtue of this plan considers the ownership, stewardship, optimal physical and cost-effective operation of the Stormwater Utility of high importance. Within the geographic inclusion area for the Province’s Places to Grow Act, 2005 and 2017 update, Kitchener continues to recognize and prepare for the economic, ecological, and social growth within that framework.

In 2020, the former Sanitary Utility – a multi-departmental entity, was re-organized into the Sanitary and Stormwater Division. The Director of the SSU is asset lead with responsibility for ensuring the capacity and integrity of the system for the City’s current and future needs. The SSU is comprised of two distinct service groups, SSU Planning and Programs and SSU Maintenance and Operations, each with its own manager.

SSU Planning and Programs facilitates the planning of capital replacement, rehabilitation, disposal, decommissioning and/or removal of existing stormwater infrastructure. Additionally, the Planning and Programs team establishes and manages City-wide stormwater focused programming. SSU Maintenance and Operations act as asset stewards whose primary responsibility is to inspect, operate and maintain all City owned stormwater assets.

Engineering: The responsibility of the City’s Engineering Division is to provide design and approval, and construction project management services in support of new and renewal stormwater planning. Further, the Engineering Development team is responsible for the planning and design of new stormwater network infrastructure in residential, commercial, and industrial developments.

Finance: Provides financial information for tracking, evaluating and projecting revenues, expenses and user rates. Additional services include accounting and reporting on the historical costs and service life of assets; prepares, summarizes, and reviews capital budgets.

Asset Management: Obtains and maintains condition and performance information on infrastructure assets. Provides analysis including theoretical and risk-based modeling. Creates capital plans for these and other assets. The team provides both SSU and Engineering Division consolidated results and recommendations from the various sources, including inspection results.
Asset management maintains and develops the City’s work management software which plays a vital role in tracking operating costs for the various work activities for stormwater assets.

Geospatial Data & Analytics: As part of the Technology Innovation and Services Division enters and maintains the City’s geographic and base attribute data for City assets.

There are great benefits found in having a defined and documented asset management plan for any large grouping of infrastructure assets as is managed by the Sanitary and Stormwater Utility. These include effectively managing the total cost of owning and operating the assets, while delivering the desired levels of service, minimizing risk, and planning for future growth expectations.

There are direct links among this Asset Management Plan 2020 (AMP), The City of Kitchener Official Plan 2014 (OP), and the Kitchener Growth Management Plan 2019 (KGMP). The OP and KGMP provide the framework of goals, objectives, and policies with respect to the cultural, social, economic and natural environment of the City. This AMP document provides a state of the union and ongoing strategic and financial picture of the sanitary asset portfolio within that framework.

Similarly, there is value in perusing both the 2013 Phase 1 AMP entitled Stormwater Report Final Oct 1513 (AMP) and 2016 Integrated Stormwater Management Master Plan, Final report (MP) for useful primers and evaluation of progress with respect to stormwater asset work at the City of Kitchener.

The assets described by this plan are scrutinized within the framework of an existing, and always forward-rolling 10-year capital program. The interval between the first stormwater asset management plan and this has been approximately seven years. It is anticipated that the next iteration will be five years hence. This will coincide with a similar 5-year re-evaluation of the capital program described in Section 6.7.1 Non-Infrastructure Solutions / Integrated Infrastructure Planning.

### 3.1 Content

This Asset Management Plan (AMP) is the second to be developed for Kitchener’s stormwater assets. The phase 1 AMP focused heavily on the City’s capital responsibilities and thus there is opportunity in this second iteration to delve into the cause and effect of maintenance activities related to the condition of the asset; the long term lifecycle management plan associated with optimizing the level of service; and the financial management plan necessary to sustain the expectation of services provided by this asset category. The asset entities covered by this updated plan are shown in figure 3.1.1.
3.2 Purpose of this Asset Management Plan

This plan update has been completed to help the City of Kitchener meet the requirements laid out in Ontario Regulation 588/17, to meet corporate goals, levels of service, and aid in the development of long term sustainable funding strategies that will address the needs of the City’s aging infrastructure.

This plan documents the list of the core services provided by the City with respect to the stormwater asset category, along with associated costs, both historical and projected. By understanding the costs associated with providing existing levels of service and forecasting the renewal, replacement and future development of stormwater infrastructure, the City of Kitchener can remain an efficient and effective service provider / asset owner.

Kitchener recognizes the collaborative ambitions of the Province in:

*Asset management will be the foundation of the [Building Together] strategy. Asset management planning will allow needs to be prioritized over wants. It will help ensure that investments are made at the right time to minimize future repair and rehabilitation costs and maintain municipal assets.*

*[The Ministry is] moving toward standardization and consistency in municipal asset management. The first step is requiring any municipality seeking provincial capital funding to prepare a detailed asset management plan and show how its proposed project fits within it. As part of this process, municipalities will need to demonstrate how they themselves are assisting financially with the proposed project, including engaging with Infrastructure Ontario.*

--- Ministry of Infrastructure, Ontario

This Phase 2 AMP validates the commitment from Kitchener council and takes into account the Ministry of Infrastructure’s goal of public involvement, capitalizes on experienced in-house professionals, and utilizes data-driven engineering best practices.
3.3 Assumptions and declarations, systems, terminology, and quality of data

With the City of Kitchener having robust datasets dating back in some cases on the order of decades, and contemporary software packages having replaced legacy information systems, there are a few points of clarity to be made.

3.3.1 Assumptions and declarations

Consistent with previous Asset Management Plans, the replacement cost method is used to determine valuation. This method also aligns with the *Waterloo Regional Municipalities Insurance Pool (WRMIP) Summary of Municipal Assets*.

Replacement costs are based on per-unit or per meter as appropriate to the specific asset. The largest value asset type – storm mains – is represented herein by three cost categories (small-to-medium; large; very large). Across-the-board averaging aligns with Kitchener’s Financial Operations accounting processes, while Kitchener’s project-level analysis and decision-making include replacement costs by diameter for better accuracy in project costs.

Some representative capital replacement projects from 2019 and other recent years were analyzed to provide cost actuals for stormwater components, the unit costs from which were used in this plan for replacement cost estimation. The City’s 2019 submission to the National Water and Wastewater Benchmarking Initiative (NWWBI) was sourced for additional cost data.

Replacement costs in the introductory 2013 AMP combined storm pipes, manholes, catchbasin, leads together as a singular asset entity, whereas this Phase 2 AMP attempts to analyze the costs related to each asset category independently.

Capital and Operating forecasts provided herein are subject to annual vetting and review by the Financial Planning Division, with final analysis and decision-making by City Council.

Drainage complaints, a component of Levels of Service, requires analysis of two disconnected datasets: a historic GIS layer and a spreadsheet containing current and historical information.

A variety of City-owned storm infrastructure, not typically along rights-of-way or easements is not under the purview of the Sanitary & Storm Utility (SSU) but of other functional areas. Assets such as catchbasins and their leads, OGSs, inlets and outlets that service City-owned *park lands* or *parking lots* are under the stewardship of those respective City divisions. This includes the likes of *Parks & Cemeteries*, *Facilities Management*, and *Parking Enterprise*. As such, these assets are not accounted for within this Asset Management Plan and shall be captured in the AMPs for those business units.
The Green Information Exchange project, with respect to lifecycle costing and asset consumption in section 4.4, is an external, multi-agency initiative called Sustainable Technologies Evaluation Program and is not run by the City of Kitchener.

3.3.2 Systems

The City’s ESRI Geographic Information Systems (GIS) databases contain the authoritative digital source of asset inventories (with Engineering as-builts being the legal authoritative source) for analysis. The data is queried and analyzed by experts across the Corporation for data-driven decisions. ArcGIS is the application front-end.

The City’s computerized maintenance management system Cityworks is the definitive source of work history and operating expenditures for labour, equipment and material costs.

The City’s financial management system SAP is the definitive repository of capital expenditures.

The custom, in-house created Microsoft- and ESRI-software-based Condition Analysis Tool is the primary capital project selector for stormwater asset renewal. Analysis derives from GIS layers and MS Access databases into an ArcGIS map document file.

3.3.3 Quality of data

With a comprehensive asset-specific dataset dating back to 2008, for the purposes of analysis and reporting from Cityworks, this Phase 2 AMP will reference storm maintenance data from 2015 onwards to get a more contemporary and relevant data view.

Some datasets are quite robust in source data, including the likes of storm mains, manholes, catchbasins, facilities, infiltration galleries, oil-grit separators, stream reaches, with some other datasets being less populated including the likes of ditches and newer low-impact development technologies.

Installation date data of the early twentieth century is less than reliable. All asset types referenced herein, particularly with installation of “- 1904” and other early eras should be considered best-available knowledge.
4. State of Local Infrastructure

The City of Kitchener’s population is predicted to grow from the 2016 census count of 241,800 to 315,100 residents, an approximately 30% increase, over the next 25 years. The City must continue to champion asset management principles to grow and maintain its wastewater infrastructure responsibly, while providing levels of service that are agreed upon by council and accepted by the public.

This AMP presents the estimated asset replacement costs in 2020 dollars, *figure 4.0.1*. As noted with the introductory Stormwater Asset Management Plan of 2013, to understand the City’s investment in public works infrastructure and to focus on the need for renewal, it is helpful to understand the value of the assets in question. The main methodology by which underground assets are replaced at Kitchener – gauged by both dollars spent and kilometers replaced – is by **full reconstruction**. The process which derives this program is described in *Section 6.7.1 Non-Infrastructure Solutions / Integrated Infrastructure Planning*.

The cost to replace storm assets (excluding restoration, etc.) within a full reconstruction – determined to be 12.8% of total cost – is the basis for calculations for replacement cost. Notably, these reconstruction costs include paying for portions of an entire project cost, including the likes of excavation, structure disposals, new structures, traffic control, road and site restoration. Thus, the Storm Utility (of the Sanitary and Storm Utility) cost-shares all reconstructions at 23% of each project. Project engineering and administration at 20% is a component of all these capital projects, and is included in the values in *figure 4.0.1*.

The estimated replacement value of the City’s storm infrastructure is **$1,034,719,798**. This most current valuation is a substantial **44%** increase over that determined for the 2013 plan. Figure 4.0.1 shows the breakdown of the overall replacement value by asset type.
4.1 Asset Inventory

The physical assets owned by the City are represented in the Corporate database (i.e. GIS). This makes visualization, statistical analysis, reporting, and other information queries quite easy, while reliant on quality data.

The asset inventory as shown in Figure 3.1 is exhaustive in support of analytical and operational purposes for the Storm Utility, and for high level State of the Infrastructure and Gap Analysis purposes, the City reports on Storm mains, facilities, infiltration galleries, oil-grit separators, catchbasins, and stream reaches.

As will be shown below, stormwater asset categorization is more detailed than the 2013 Phase 1 AMP.
4.1.1 Storm Mains

There are 16,275 active storm main segments totaling 643 kilometers, representing about 5.2% network length growth since the Phase 1 AMP in 2013. This inventory of storm mains has an approximate replacement value of $542,163,181, at 45% of the overall asset category value.

Diameter classification of storm sewers in Kitchener, summed by length is as follows:

Figure 4.1.1.1 Diameter classification of storm mains

<table>
<thead>
<tr>
<th>LENGTH (KM)</th>
<th>MATERIAL</th>
<th>SYSTEM%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4</td>
<td>AC - ASBESTOS CEMENT</td>
<td>0.4</td>
</tr>
<tr>
<td>373.6</td>
<td>CP - CONCRETE</td>
<td>50.0</td>
</tr>
<tr>
<td>6.2</td>
<td>CSB - CONCRETE SEGMENT BOLTED</td>
<td>1.4</td>
</tr>
<tr>
<td>8.7</td>
<td>CSP - CORRUGATED STEEL PIPE</td>
<td>2.0</td>
</tr>
<tr>
<td>0.1</td>
<td>CSU - CONCRETE SEGMENT UNBOLTED</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>6.1</td>
<td>HDPE - HIGH DENSITY POLYETHYLENE</td>
<td>0.8</td>
</tr>
<tr>
<td>0.7</td>
<td>PE - POLYETHYLENE</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>
4.1.2 Storm Manholes

Storm manholes provide access to the network of storm mains. There are **14,599** active storm manholes. This inventory has an approximate replacement value of **$64,752,993**, at **5%** of the overall asset category value.

4.1.3 Storm Catchbasins

Storm catchbasins provide for surface ingress of storm water to the network of storm mains, and for some quality control by way of a sump. There are **11,032** active storm catchbasins at time of writing. This inventory has an approximate replacement value of **$40,591,492**, at **3%** of the overall asset category value.

4.1.4 Oil and Grit Separators (as a Storm Quality Control device)

Storm quality control devices provide for basic, primary storm water treatment prior to entry to the network of storm mains. There are **93** Kitchener-owned and **1** shared ownership with the Region of Waterloo OGSs at time of writing. This inventory has an approximate replacement value of **$6,821,124**, at **1%** of the overall asset category value.

4.1.5 Storm Ditches and Culverts

Ditches and culverts provide a surface level conveyance of storm water alongside, and as crossings of municipal roadways. There are **8,900** meters of ditches and **283** meters of storm
culvert under Kitchener ownership. This inventory has an approximate replacement value of $1,680,062, at less than 1% of the overall asset category value.

4.1.6 Stream Reaches

Stream reaches provide for natural surface water flow following the lie of the land. There are 1,165 discrete segments of stream reaches of Kitchener ownership. This inventory has an approximate replacement value of $163,131,750, at 27% of the overall asset category value.

4.1.7 Storm Facilities / Ponds

Storm ponds are a key component of Kitchener’s stormwater management program. There are 163 designated storm ponds of Kitchener ownership. This inventory has an approximate replacement value of $66,996,532, at 6% of the overall asset category value.

4.1.8 Storm Low-impact development (LID) components

Low-impact development components provide for more natural storm water capture and mitigation as close to the source as practical, with a goal of mimicking a natural hydrological cycle. These efforts are part of new build-outs or retrofits and in right-of-way reconstructions. Examples can include bioretention, permeable pavers, infiltration galleries, enhanced swales, cooling trenches, rainwater capture.

Using these components provides a distinct and purposeful effort on the City’s part to address climate adaptation, and mitigate potential intense weather events, as discussed in section 6.8.

There are 605 identified LID components of Kitchener ownership. This inventory has an approximate replacement value of $489,385, at less than 1% of the overall asset category value.
4.1.9 Storm leads, inlets, outlets, weirs

Ingress to the stormwater network is facilitated by leads and inlets, and egress and attenuation from the storm network is facilitated by outlets and weirs. Identified Kitchener-owned components include 13,794 storm leads, 601 inlets, 914 outlets, 95 weirs. This inventory has an approximate replacement value of $15,697,279, at 1% of the overall asset category value.

4.2 Installation Profiles

In order to assist the City with analysis, it is helpful to understand the installation profiles of the stormwater assets. This provides for extrapolation of rehabilitation project timing and consideration of long-term replacement of assets.

As is common for municipalities in Canada, post-war city-building activity boomed, and the installation profiles of storm assets, particularly mains, clearly shows this at Kitchener. Critically, for interpretation of the following charts, new installations were the sole storm network changes until reconstructions of existing rights-of-way began in earnest in the 1970s. Thus, these charts show new installations and both new and replacement activities thereafter.
Figure 4.2.1 Asset Installation Profile – Storm Mains

![Installation Profile for Storm Mains](image)

Figure 4.2.2 Asset Installation Counts per Era – all storm assets

<table>
<thead>
<tr>
<th>ERA</th>
<th>Mains</th>
<th>Manholes</th>
<th>Catchbasins</th>
<th>OGS</th>
<th>Ponds</th>
<th>LID</th>
<th>Leads</th>
<th>Inlets</th>
<th>Outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1940</td>
<td>306</td>
<td>1206</td>
<td>952</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1325</td>
<td>59</td>
<td>103</td>
</tr>
<tr>
<td>1940-1949</td>
<td>222</td>
<td>455</td>
<td>336</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>372</td>
<td>15</td>
<td>33</td>
</tr>
<tr>
<td>1950-1959</td>
<td>1,121</td>
<td>973</td>
<td>717</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>797</td>
<td>23</td>
<td>44</td>
</tr>
<tr>
<td>1960-1969</td>
<td>1,518</td>
<td>1557</td>
<td>1182</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>1299</td>
<td>27</td>
<td>53</td>
</tr>
<tr>
<td>1970-1979</td>
<td>2,240</td>
<td>2199</td>
<td>1963</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1796</td>
<td>40</td>
<td>52</td>
</tr>
<tr>
<td>1980-1989</td>
<td>1,676</td>
<td>1711</td>
<td>1421</td>
<td>0</td>
<td>21</td>
<td>0</td>
<td>1237</td>
<td>85</td>
<td>139</td>
</tr>
<tr>
<td>1990-1999</td>
<td>2,190</td>
<td>2471</td>
<td>1759</td>
<td>10</td>
<td>34</td>
<td>0</td>
<td>1412</td>
<td>84</td>
<td>152</td>
</tr>
</tbody>
</table>

Installation profiles of ditches and ditch culvert, stream reach, and weir assets are not documented.
Rapid City growth and a focus on stormwater management methodologies means that storm pond installation began in earnest in the 1980s. Storm quality considerations have come to the fore only in recent decades, as demonstrated by the recency of quality control device installations.

The low-impact development (LID) methodology is quite new, and with a variety of options including bioswales and permeable pavers, the most robust dataset available is for infiltration galleries.

The City has 22 current or recent historical right-of-way full reconstruction projects wherein Low-Impact Development implementations were a major stormwater component. Examples included porous concrete laybys, exfiltration systems, bioretention, silva cells.

4.3 Asset Condition

The City inspects storm sewers and other storm assets for the following purposes:

- Annual condition inspection of sewers – proactive inspection to identify potential failures and for planning routine Operations and Maintenance (O&M) programs, capital replacement, and rehabilitation projects.
- Troubleshooting – investigation of problem incidents to identify issues and select the appropriate remedial action.
- End of warranty and post-repair inspections – inspection of new or renewed sewers to ensure that construction meets specifications and to document as-recorded conditions.

The assessment of an asset’s condition is a valuable source of information to asset leads. The timely and cyclical capturing of condition data provides important insight into the condition and performance of assets and what impact betterment and routine maintenance activities are having on extending the serviceable life of infrastructure (i.e. improving or sustaining the overall health of the asset).

4.3.1 Asset condition – storm mains

Kitchener’s robust asset inspection program provides a very objective source of information for storm main asset condition. Further, as described above, Kitchener performs detailed analysis of the defects which are showing as poorer in condition in order to verify the actual field functions of the asset(s).

As both types of defect – structural and operations & maintenance (O&M) – are collected simultaneously.
Condition status in all the following related figures derive from the standardized PACP rating codes, described above, using the following scale in figure 4.3.2.1.

Figure 4.3.1.1 Kitchener storm pipe condition data rating ranges.

<table>
<thead>
<tr>
<th>PACP RATING</th>
<th>PACP GRADE</th>
<th>PACP RATING NUMERIC RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Immediate Attention</td>
<td>4.5 - 5</td>
</tr>
<tr>
<td>4</td>
<td>Poor</td>
<td>3.5 - 4.4</td>
</tr>
<tr>
<td>3</td>
<td>Fair</td>
<td>2.5 - 3.4</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>1.5 - 2.4</td>
</tr>
<tr>
<td>1</td>
<td>Excellent</td>
<td>0.1 - 1.4</td>
</tr>
<tr>
<td>0</td>
<td>No Observed Defects</td>
<td>0</td>
</tr>
</tbody>
</table>

*Structural Index*

Structural condition – collected along with Operations & Maintenance (O&M) condition – represents pipe issues which are related to the physical aspect of the pipe, such as with cracks, fractures, breaks, holes, surface damage.

Figure 4.3.1.2 Overview of structural condition of Kitchener storm mains
Figure 4.3.1.3  Storm main structural condition status from storm sewer camera inspection, with associated lengths

Structural Condition Profile of All Storm Mains Currently in Service

Operations & Maintenance Index

Apart from structural condition, Kitchener also tracks operations and maintenance type defects through the same defect coding system via the same inspection regimen. The following figures show current state condition for operations and maintenance defects.

Operations & Maintenance (O&M) condition describes various types of foreign objects that may interfere with the operations of the conveyance system.
Figure 4.3.1.4  Operations & Maintenance condition of Kitchener storm mains

Figure 4.3.1.5  Storm main operations and maintenance condition status with associated lengths
4.3.2 Asset condition – storm manholes
Figure 4.3.2.1 Storm manhole condition status

![Counts of Condition Scores Assigned to Manholes](image)

4.3.3 Asset condition – storm catchbasins
Figure 4.3.3.1 Storm catchbasin condition status

![Counts of Condition Scores Assigned to Catchbasins](image)
4.3.4 Asset condition – storm ditches, ditch-culverts (less than 3-meter span)

The SSU Maintenance & Operations group performs inspections of ditches. There is no available condition data currently for these assets.

4.3.5 Asset condition – storm quality control oil-grit separators

OGS inspection currently collect metrics for operational factors, silt level, and hydrocarbon level. No condition data is currently collected for these assets.

4.3.6 Asset condition – storm stream reaches, ponds/facilities

The SSU – Utility Planning & Programs section maintains a data source with various attributes, condition, and performance information, which includes a condition priority ranking. The present ranking is shown in figure 4.3.6.1.
Figure 4.3.6.1 Storm Ponds/Facilities condition priorities

Counts of Condition Priorities Assigned to Storm Facilities

The stream reaches inspection component was performed by an external consultant last in 2016. There is no current condition data for this asset.

4.3.7 Asset condition – storm low-impact development

With the vast majority of LID components having been installed only in the past decade or so, condition information for LID components has yet to be compiled.

4.3.8 Asset condition – storm leads, inlets, outlets, weirs

Storm leads, inlets, outlets, weirs do not have condition data.
4.4 Asset Consumption by Asset Type

4.4.1 Asset consumption – storm mains

With age being a common predictor of condition, the storm mains network has an average age of about 30 years – a 38% proportion of 80-year expected useful life consumed.

Figure 4.4.1.1 Percentage breakdown by 10-year intervals of storm mains compared to expected useful life of 80 years.

An important distinction should be made between asset condition indicators and asset consumption. While the City has robust condition data from camera inspections of the sewers and associated defect observation coding, this does not provide a correlation to consumption (of estimated lifespan) of storm pipes. For example, a CCTV coding of 3 out of 5 does not necessarily correlate to 48 years of an expected 80-year asset lifespan expended.

Though this method is not yet employed at Kitchener, the installation profiles of storm main assets in relation to the material type used at the era of installation may be compared and analyzed. There is an expectation of differing longevities of asset materials which may provide for more refined asset lifecycle planning.
4.4.2 Asset consumption – storm manholes

As there is little industry standardization for lifecycle timing of stormwater manholes, replacements are aligned with stormwater main replacement.

4.4.3 Asset consumption – storm catchbasins

As there is little industry standardization for lifecycle timing of stormwater catchbasins, replacements are aligned with stormwater main replacement.

4.4.4 Asset consumption – storm ditches, ditch-culverts (less than 3-meter span)

Storm ditches and ditch culverts are newly-considered assets in this Stormwater AMP Phase 2. However, neither have attribute data in GIS or other City systems, and only ditch-culverts have some basic attribute data as was needed for the 2018 condition inspection. There is no asset consumption metric for these assets.

4.4.5 Asset consumption – storm quality control devices

There is no asset consumption metric for these assets.

4.4.6 Asset consumption – storm stream reaches, ponds/facilities

There is no asset consumption metric for these assets.
4.4.7 Asset consumption – storm low-impact development

There is no asset consumption metric for these assets.

4.4.8 Asset consumption – storm leads, inlets, outlets, weirs

As there is little industry standardization for lifecycle timing of stormwater lead, inlets, outlets, and weirs, replacements are aligned with stormwater main replacement.
5. Levels of Service

Levels of Service (LoS) define and describe the output and value that is delivered by the organization to its end users and the practices that are followed to achieve it. These Levels of Service are driven by the following factors:

- Mandatory requirements such as legislation obligations to meet certain goals and standards
- Limitations on current infrastructure and technical requirements to meet standards such as response times and engineering standards
- Community expectations on the acceptable output and value provided

The City of Kitchener and the Stormwater Utility have been working on creating a refined and comprehensive list of Levels of Service and performance measures. The Levels of Service that have been chosen for Storm Water follow O. Reg. 588/17 legislated requirements, as well as additional metrics that encompass the value and work provided by the Stormwater Utility. The following are agreed upon Levels of Service for Stormwater assets. Levels of Service are currently being monitored and reviewed by a working group.

### Table 5.0.1 Levels of Service Statements

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Levels of Service</th>
<th>LoS Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Water Utility</td>
<td>Value of Service</td>
<td>Efficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storm Services are provided in the most cost effective and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Efficient manner and in-line with other Municipalities</td>
</tr>
<tr>
<td>Storm Water Utility</td>
<td>Quality</td>
<td>Proactive Inspection Program to ensure Quality Infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and Services</td>
</tr>
<tr>
<td>Storm Water Utility</td>
<td>Reliability</td>
<td>Continuous Storm Water Services are provided without</td>
</tr>
<tr>
<td></td>
<td></td>
<td>interruption</td>
</tr>
<tr>
<td>Storm Water Utility</td>
<td>Sustainability</td>
<td>Environment is protected through designed safeguards</td>
</tr>
</tbody>
</table>

The Level of Service Statements represent high overarching corporate values that are trying to be achieved through specific work. The high-level values are Efficiency, Quality, Sustainability and Reliability and they are impacted by both Customer and Technical work and performance. Each statement has several performance measures that can track its achievement as well as numerous work activities that staff do to ensure the infrastructure is running smoothly.
5.0.2 Value of Service – Efficiency

The City of Kitchener Storm Water Utilities is comprised of 8 asset groups with a replacement value of $1,197,851,548. The SSU group works to keep these assets running as smoothly and as efficiently as possible. The aim is to keep the costs as low as possible for users while maintaining the highest quality services possible.

5.0.3 Value of Service – Quality

With a network of infrastructure that spans the entire City and delivers services to over 240,000 citizens a focal point of the SSU is to ensure the quality of those services and infrastructure stays at a high level. A proactive inspection program is utilized that focuses on keeping the infrastructure condition as high as possible and ensuring any potential issues in the network are caught on time.

Examples of the work done to maintain quality can be seen in Tables 5.1.1 and 5.2.1 and is identified through work such as CCTV inspections of pipes and cleaning of the various asset groups and sediment removal.

5.0.4 Value of Service – Reliability

The City of Kitchener works to ensure that all asset groups of the Stormwater system are operating as designed and that services are provided without interruption. As of 2019, Stormwater complaints and flooding due to public system issue were at an all-time low as referenced in Table 5.1.1.

Work done to keep the infrastructure reliable and running is centered around repairing and replacing assets such as Storm mains and catchbasins. In 2019, the number of repairs/replacements has decreased from the prior year and has fallen in-line with the 5-year averages. The trends are being monitored and work activities will be adjusted as needed.

5.0.5 Value of Service – Sustainability

Ensuring the environment is protected is a large part of Stormwater planning. Climate change continues to become more prevalent, so continuing work is done to ensure that the City of Kitchener Stormwater infrastructure is prepared for all possibilities. There is currently a review
of City of Kitchener properties that are resilient to 5- and 100-year storms, and as data is obtained it will be used to impact future planning.

5.1 Customer Levels of Service

Customer Levels of Service can be identified as community expectations on certain services as well as how the more technical work activities are impacting customer experiences. The Customer Levels of Service performance measures highlight data that has direct impact on a citizen. Currently only trends are being monitored, but in the near future specific targets and goals for the performance measures will be set as more data is obtained and considered.

Table 5.1.1 Customer Levels of Service Performance Measures

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>Average Annual Residential Stormwater Fee/ Lot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$176.64 $164.76 $150.00 $137.00 $125.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Maintenance Budget Spent</td>
<td></td>
<td>1.01</td>
<td>1.12</td>
<td>1.16</td>
<td>1.21</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>% Capital Budget Spent</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.02</td>
<td>N/A</td>
</tr>
<tr>
<td>Quality</td>
<td>SWM Facility Sediment Removal (m3)</td>
<td></td>
<td>365.6</td>
<td>2785</td>
<td>2636</td>
<td>6112</td>
<td>2735</td>
</tr>
<tr>
<td>Reliability</td>
<td># of Stormwater Related Customer Complaints/ 1000 People Served</td>
<td></td>
<td>0.20</td>
<td>6.19</td>
<td>3.72</td>
<td>1.9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Cost of Stormwater Education Program / 1,000 People Served</td>
<td></td>
<td>$44.02</td>
<td>$443.00</td>
<td>$561</td>
<td>$239.90</td>
<td>$725.29</td>
</tr>
<tr>
<td></td>
<td># calls regarding Flooding due to public system issue/ 1000 people served</td>
<td></td>
<td>0.03</td>
<td>0.19</td>
<td>0.11</td>
<td>0.16</td>
<td>0.2</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Area of permeable Pavement</td>
<td></td>
<td>916</td>
<td>916</td>
<td>916</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Total # of Spills that Reach the Receiving Environment</td>
<td></td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>% of Properties resilient to a 100-year storm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data Collection in Progress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% of Properties resilient to a 5-year storm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data Collection in Progress</td>
<td></td>
</tr>
</tbody>
</table>

Consistent Trend  Upward Trend  Downward Trend

*Data obtained from National Water & Wastewater Benchmarking Initiative as well as City of Kitchener Corporate Business Plan
5.1.2 Customer Levels of Service Trends
The City of Kitchener is always aiming to provide the best Level of Service given the resources available. Looking at the figures in Table 5.1.1 it shows that the trend for Customer Levels of Service seems to be that the performance is consistent or in some cases has increased. While there is consistency in areas such as the budget planning process, spending only what is planned, and in the number of Low Impact Development (LID) implementations, there are also areas that have improved. There has been a decrease in the number of customer complaints and calls regarding flooding in the City, as they are at all time low in the year 2019.

The trends highlighted could be due to numerous factors including city population growth, an outlier year, resource constraints, as well as increase in costs to provide services. This is a topic that is being investigated more thoroughly through a working group and is currently lacking concrete data. As more research is done, a more in-depth look into these trends will be able to be identified.

5.2 Technical Levels of Service
The Technical Levels of Service performance measures are a combination of actual work activities done by SSU staff, inspections and benchmarking data. They highlight the technical work that is done by staff on Stormwater assets that help keep all infrastructure healthy and running smoothly.

Currently only trends are being monitored, but in the near future specific targets and goals for the performance measures will be set as more data is obtained and considered. Table 5.2.1 shows total assets worked upon or inspected, irrespective of the number of work orders.
Table 5.2.1 Technical Levels of Service Performance Measures and Work Activities

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>Manhole Inspection</td>
<td>Consistent</td>
<td>66</td>
<td>68</td>
<td>57</td>
<td>37</td>
<td>68</td>
</tr>
<tr>
<td>Quality</td>
<td>Pipes Inspected using CCTV</td>
<td>Downward</td>
<td>5%</td>
<td>11%</td>
<td>15%</td>
<td>8%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Catch Basin Cleaning</td>
<td>Upward</td>
<td>810</td>
<td>610</td>
<td>466</td>
<td>677</td>
<td>631</td>
</tr>
<tr>
<td></td>
<td>Storm Main Cleaning</td>
<td>Downward</td>
<td>16</td>
<td>19</td>
<td>169</td>
<td>49</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Debris Clean-up – Storm Reaches</td>
<td>Consistent</td>
<td>53</td>
<td>50</td>
<td>58</td>
<td>55</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>% of Catch Basins Inspected</td>
<td>Consistent</td>
<td>24%</td>
<td>28%</td>
<td>23%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Outlet Cleaning</td>
<td>Downward</td>
<td>4</td>
<td>11</td>
<td>24</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Oil/Grit Separator Units Cleaned Out</td>
<td>N/A</td>
<td>0%</td>
<td>48%</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>Catch Basin Casting Repair/Replace</td>
<td>Consistent</td>
<td>76</td>
<td>105</td>
<td>81</td>
<td>64</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Storm Main Repairs</td>
<td>Downward</td>
<td>28</td>
<td>38</td>
<td>35</td>
<td>43</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Storm Casting - Repair/Replace</td>
<td>Downward</td>
<td>51</td>
<td>123</td>
<td>98</td>
<td>88</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Storm Lead Repair/Replace</td>
<td>Downward</td>
<td>2</td>
<td>21</td>
<td>11</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Storm Lateral Repair</td>
<td>Consistent</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Pond Debris Clean-up</td>
<td>Downward</td>
<td>92</td>
<td>144</td>
<td>128</td>
<td>142</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Brush Cutting</td>
<td>Downward</td>
<td>41</td>
<td>63</td>
<td>47</td>
<td>77</td>
<td>85</td>
</tr>
</tbody>
</table>

*Data obtained from National Water & Wastewater Benchmarking Initiative as well as City of Kitchener Corporate Business Plan and Work Management System

5.2.2 Technical Levels of Service Trends
The City of Kitchener is always aiming to provide the best Level of Service given the resources available. The current trends in the Technical Levels of Service can be seen in Table 5.2.1. The trend from 2018 to 2019 seems to be for the performance measures to trend downward or stay consistent. The year 2018 seemed to be an outlier as there were spikes in many performance measures that seem to have been normalized again in 2019.

A downward trend is not necessarily a negative. In some cases, such as the downward trend in Repairs/Replacements under Reliability, it could be seen as positive as fewer breaks and problems occurred in those asset groups. Since there are numerous reasons for these potential changes, this is a topic that is being investigated more thoroughly through a working group and is currently...
lacking concrete data. As more research is done, a more in-depth look into these trends will be able to be identified.

5.3 Legislation and Policies
The City of Kitchener follows all Federal, Provincial and Regional legislation and policies while providing all services to the users.

5.4 Risk Management & Growth
The City of Kitchener has seen large growth in terms of population as well as housing subdivisions, roads, and natural areas that all need to be addressed equally and have a proper Level of Service. This rapid growth has put pressure on providing a consistent Level of Service due to financial constraints and workforce capacity. With this rise in population, this increases the risk of assets failing sooner than expected, or a decrease in asset condition due to the increase in use. This is an area that will need further investigation as there is insufficient data for clear conclusions.

5.5 Public expectations - local
As part of Kitchener’s Water Infrastructure Program evaluation, 2017, a randomly selected and representative sample of adult Kitchener residents were polled for their considerations on Kitchener utility services, including stormwater. While subjective, the responses do help inform service level expectations from the users of the services and can also help demonstrate attitudes on tolerance for user rates which affect maintenance and rehabilitation efforts.

Residents expressed that they were very satisfied or somewhat satisfied with reliability of stormwater service.

5.6 Regional maintenance agreement
The City, a lower-tier municipality within the Region of Waterloo, is contracted to maintain certain storm assets owned by the Region. There is a great deal of interconnectivity of storm infrastructure within the Region and catchments are in no way related to municipal boundaries.

The Region of Waterloo as asset owner has its own Levels of Service which are communicated to the municipalities within via by-law and by maintenance agreement. These are not discussed within this Asset Management Plan, but it bears noting that works performed by Kitchener on these assets are fully cost-recovered from the Region of Waterloo, though there is an effect on availability of City staff since they are part of the same staff complement.
6. Asset Management Strategy

6.0.1 Condition-based analysis

For well over the past decade, various condition and performance datasets have been combined – from road needs, storm condition, sanitary condition, water age and break history – into a multiple-structure prioritization tool. Having an existing infrastructure replacement program (WIP, described in Section 6.7.1 Non-Infrastructure Solutions / Integrated Infrastructure Planning) well underway from which projects were selected primarily based on age, a shift towards a combined principle and practice of condition-based and age-based strategy was adopted.

Condition-based needs, local degradation observations, targeted rehabilitation timing, and the need for maintaining the robust reactive, operational regimen are currently in place. Asset condition and performance along an anticipated lifespan are continually analyzed.

The following sections will convey the City’s current processes including usage of a capital planning tool and a work management system and how this addresses service-oriented activities, renewal / betterment activities, replacement, disposal activities, and lifecycle management.

6.1 Service-Oriented Activities

For the purposes of this asset management plan, service-oriented activities are those operational or maintenance activities that are performed on an asset during the course of its lifecycle in an effort to maintain its level of service. These activities do not have a direct impact on the overall condition of the asset, but simply maintain it at a defined service level.

A full listing of current service-oriented activities as performed by SSU Maintenance & Operations is found in figure 6.1.1.
6.1.2 Storm network modelling

The trunk pipes of the storm network have been modelled in a specialist application InfoWorks CS. An all-encompassing description of this is not duplicated here, but can be found in the 2016 Final Report: *Integrated Stormwater Master Plan Final Report*

The SSU – Utility Planning & Programs section is the curator of the stormwater model.

6.2 Betterment Activities

A betterment activity can be defined as a work task that has the potential to extend the life of the asset through increasing the asset’s condition.

A recently-used technology for interim remediation of storm mains is **cured-in-place pipe (CIPP) lining**. Of great benefit is the fact that this treatment typically requires no excavation whatsoever. It provides a barrier protecting the internal wall of the existing pipe, guards against improper infiltration/exfiltration, and enhances the flow characteristics of the original deteriorated pipe.

With a cost of $202 a meter as at 2018, this treatment is inexpensive in comparison to other available storm pipe rehabilitation strategies. In comparison, the costs for a storm main replacement via full reconstruction were averaging around $572 a meter and have since increased to around $659 a meter. There are considerable benefits of the non-destructive nature of the
activity on the surface engineered structures or natural environment, and relatively unintrusive nature to residents.

Figure 6.2.1 Storm main lining program

An array of additional betterment plans via creek improvements are outlined in Appendix H. These are intended to improve aquatic habitats, along with reduction of maintenance needs.

6.3 Routine Maintenance Activities
Routine maintenance activities are another large grouping of work performed by SSU – Operations & Maintenance staff. Routine maintenance is defined as a work activity that sustains the physical condition of the asset at its current good / excellent level, or an activity that returns the physical condition of an asset to a functional threshold, and thus sustains the intended function of the asset.

From an operational standpoint, examples of this type of work may include sediment removal, erosion repairs, spill clean-up.
6.4 Replacement and Disposal Activities

*Replacement of any individual asset or group of assets should be driven by a detailed analysis of that asset or group. It should not be automatically dictated by financial plan assumptions.*

-- Ministry of Infrastructure, Ontario

Replacement and disposal activities of Kitchener’s stormwater assets are well planned and documented. On the capital side, funding for asset replacement primarily comes from capital budgets (with some for emergencies in maintenance budgets) – planned up to a decade in advance – with most assets being replaced as a function of all-structure right-of-way reconstruction. The driving factors for replacement are by way of detailed analysis of asset condition and performance. The resulting analysis is then aligned with the capital budget forecasts.

*Figure 6.4.1 shows storm main replacement length through these capital works.*
Context for some notably higher budget expenditures is by way of Infrastructure Stimulus Funding and Light Rapid Transit funding from senior levels of government, with more recent increases due to increased City focus on replacement of infrastructure in need.

SSU – Maintenance and Operations, performs some moderate replacement activities in order to maintain levels of service outside the scope of larger capital works, shown in figure 6.4.2.
6.5 Growth and New Assets

Storm asset expansion is determined through the City’s Planning Division in conjunction with Engineering Development Section of Engineering Division. The planning documents which describe the requirements for future growth include the Development Charges (DC) Background Study, 2019, and the Kitchener Growth Management Plan (KGMP), 2019.

Although Planning Division co-ordinates the preparation of what amounts to expansion activities, it is appropriate to state that multiple City areas and City Council act as a shared determiner.
6.5.1 Development charges background study

Storm servicing, under the STORM WATER MANAGEMENT section and STORM/WATERCOURSE appendix, along with associated budget implications, has been calculated from 2019 through 2036.

The development-related capital program for Storm/Watercourse includes $13.18 million of capital works.

The 2019-2036 development-related net capital cost of $4.76 million relating to all projects except for the Schneider Creek project is allocated 73 per cent against residential development and 27 per cent against non-residential development. The development-related net capital cost of the Schneider Creek project has been allocated 60 per cent residential and 40 per cent non-residential development in accordance with the above noted Ontario Municipal Board ruling.

The resulting unadjusted development charge rates are $58.45 per capita for residential development and $1.79 per m2 for non-residential development.

A $4.73 million surplus in the Storm/Watercourse development charges reserve fund is available to partially fund the development-related capital program. After cash flow analysis, this contributes to reducing the Storm/Watercourse charge to zero for both residential and non-residential development.

The full DC study can be found at Kitchener Development Charges Background Study.


Additionally, the SSU – Maintenance and Operations section performs some moderate additions to storm assets through work order activities tracked in Cityworks, outside the scope of larger capital works, as demonstrated in figure 6.5.2.
6.6 Inspection Activities

Inspection activities are surveys of condition, performance, and safety in order to maintain best available objective knowledge of the assets. *Figure 6.6.1* outlines the entirety of in-house SSU inspections.
The Asset Management Strategy, already underway, is to align funding made available for Operations & Maintenance activities through the WIP program (section, 6.7). This includes providing staff resourcing which has not kept pace with inspection needs as the same staff complement provides sanitary and storm services.

6.6.2 Asset inspection regimen – storm mains

The methodology for storm main inspection and condition assessment at the City of Kitchener has been and continues to be via a tendered annual closed-circuit television (CCTV) program, averaging about 53,731 meters a year since the program inception of storm data capture in 2012.

Each year, the City of Kitchener inspects an average of approximately 8% of the linear stormwater network fluctuating between about 4% and 10% based on annual contractor unit rates and budget allowances. From calculations of network length and percent inspected per year since program inception, it is determined that the City is on an approximate 14-year cycle to inspect the entire network of storm pipes.

For well over the past decade, and continuing today, pipe condition at Kitchener is determined as per the National Association of Sewer Service Companies’ (NASSCO) Pipeline Assessment
Certification Program (PACP), using the assessment codes and data standards they have developed and refined. PACP allows operators in the field to document the inspection observations from a defined list of defect codes into a computer as they pilot a remote camera apparatus. These codes provide standardized scoring for all observation found during the inspection of a storm main.

Defect codes are assigned 1 through 5 inclusive (with 0 indicating no defects), for both structural defects and operational defects. PACP coding uses the methodology found in Figure 4.3.1.1.

These observations can then be calculated into an overall score for a sewer segment, from manhole to manhole, known as the Structural Pipe Rating Index (SPRI). This information is routinely used for assessment of individual pipes, whole street segments, neighbourhoods, catchments, city-wide consideration – and to consistently apply these values as a primary criterion for all-structure right-of-way infrastructure replacement via the Water Infrastructure Program (WIP) capital program.

The following chart figure 6.6.2.2 outlines each year since the sewer inspection program included the stormwater network, and the estimated time it would take to reinspect the entire city. This is a function of the storm pipe network asset length of that year, how much budget was available, and how much per meter the inspections cost.

Figure 6.6.2.2 Storm sewer main inspection program
6.6.3 Asset inspection regimen – storm manholes

The SSU Maintenance & Operations group performs manhole inspections. The Cityworks inspection template is completed by internal field inspection staff. Manhole inspections provide a comparative-condition score which can trigger work orders based upon findings.

Figure 6.6.3.1 Storm manhole inspection rate.

6.6.4 Asset inspection regimen – storm catchbasins

The SSU Maintenance & Operations group performs catchbasin inspections. Noting a recent change in the inspection template and what conditions are captured, Kitchener continues of late to inspect more catchbasins per year each year.
The Cityworks inspection template is completed by internal field inspection staff. A sub-asset, *catchbasin insert*, is identified with a [yes/no] answer at time of inspection. The CB insert, commercially known as "CB Shield", directs sediment into the catchbasin sump, preventing or slowing sediment accumulation in the catchbasin lead and stormwater main.

Catchbasin inspections provide a comparative-condition score which can trigger work orders based upon findings.
6.6.5 Asset inspection regimen – storm quality control oil-grit separators

Figure 6.6.5.1 Storm OGS inspection rate.

6.6.6 Asset inspection regimen – storm stream reaches, ponds/facilities

Storm facility inspection is routinely performed. Kitchener has run an annual inspection program for a couple of years to generate Cityworks service requests on the assets, and also determine the overall condition. These condition priority scores however are not used for decision making, as the driving factor for maintenance for storm facilities is currently sediment removal. Sediment accumulation rates were provided from the Stormwater master plan of 2016, and Kitchener has hired contractors to do sediment surveys to confirm the amount of volume of sediment.

The SSU Maintenance & Operations group performs inspections of both main ponds and stream reaches. There are a series of standard questions, although there is no weighting or conventional condition rating system.

In addition to storm pond clean-outs, SSU Maintenance & Operations is also looking at the defects and fixing those while crews are on site. However, some issues (e.g. fence repair) require additional or different staff.
6.7 Non-Infrastructure Solutions

6.7.1 Integrated Infrastructure Planning

The Ontario Ministry of Infrastructure in “Building Together: Guide for Municipal Asset Management Plans”, suggests there is value in integrated planning to optimize lifecycle costs.

A common strategy is to coordinate capital spending across multiple assets. A good example is coordinating water and wastewater repair/replacement with municipal road replacement. Municipal roads periodically need to be rebuilt, and the associated schedules are part of the municipal planning cycle. If there is a good possibility that a watermain or sewermain will fail or start to provide degraded service — during the life of the road that is being rebuilt, significant cost savings can be achieved by replacing the watermain or sewermain at the same time.


While this type of all-structure-replacement capital works has been in place for decades at Kitchener, in 2002 the city embarked on an acceleration of this work with the aptly termed, Accelerated Infrastructure Replacement Program (AIRP). What originated as an age-based criterion for structure replacement identification, was later refined to a condition-based assessment via an in-house-designed Database Management System and Geographical Information System linked tool. This was termed the Condition Analysis Tool and is described briefly above in sections 3.3.2 and 6.0.1.

The other asset types whose conditions drive a full reconstruction – road, sanitary sewer, potable water – are described in their respective Asset Management Plans. With respect to the storm sewer network and other storm assets, full reconstructions under the renamed Water Infrastructure Program (WIP) has led to the replacement, as of the completion of the 2019 construction season, of approximately 2,035 storm manholes, 1,704 catchbasins, and 82 kilometers of storm main.

6.7.2 Storm network risk model

Since the Stormwater AMP phase 1, the City of Kitchener has undertaken an initiative to create a risk model for linear stormwater assets. The value in risk modelling is to aid in prioritizing and planning asset rehabilitation and replacement, both in the near-term and long-term. There is further value in the ability to provide an objective answer to media, residents, senior management, council, other levels of government regarding the risk of failure of assets in question.
Ultimately, a total risk score is derived by running a series of mathematical calculations from a variety of pertinent data sources. Factors include pipe condition score, downstream and other land parcel disruption effects, pipes under high traffic roads, connectivity to impervious areas, distance to buildings and other utilities, such as natural gas, water mains, railways. A **probability of failure** and **consequence of failure** score informs the final score.

*Figure 6.7.2.1* shows the results of the risk scoring at Kitchener by segment length. With a maximum risk score of 100, very little of the storm network is in a state of any monumental risk. This speaks to good design and stewardship of the storm network such that there are not a lot of compounding factors of concern: e.g. large diameter mains, with inferior upstream surcharge storage capacity, nearby institutional properties; or inspected poor storm sewer condition pipes in close proximity to railway lines.

*Figure 6.7.2.1  Storm risk scoring by kilometers of storm main segments*
To determine a **probability of failure**, Kitchener uses stormwater main condition structural rating – from the CCTV camera defect inspections described elsewhere in this plan. This is the objective, standardized description of condition by rating of all defects found.

To determine a **consequence of failure**, Kitchener uses a comprehensive array of attribute, locational, connectivity elements. Sewer main diameter, land use, traffic counts are used to create **potential disruption** factors. Storm sewer proximity to critical life and health, and institutions of importance, and large employers feeds an **effect of service disruption** factor. Similarly, distances to watercourses, buildings, other high value utilities feeds the **effect of service disruption** factor.

The model has been created in the City’s GIS environment in-house which allows for easy modification, adjustment, changing of model parameters. The model is functional as of 2017 and now informs capital planning via the in-house condition analysis tool.
Valuable condition, maintenance, risk and other data can be classified to show heat mapping of potential problem areas within the city. Any available metric can be heat mapped, with the instance of Figure 6.7.2.3 showing a natural breaks classification of storm mains risk scoring.

Figure 6.7.2.3 Stormwater mains risk score heat map visual sample

The City of Kitchener has a 10-year capital outlook which plans for replacement of the infrastructure assets which have been objectively determined to be most at risk of failure, both from a condition and performance perspective, and from a risk-assessment perspective. As such, failure of assets that might fail to meet expected service levels in the interim will fall to the purview of the Maintenance & Operations Section of the Sanitary and Stormwater Utilities Division. Those
protocols are outlined in *Section 5 Levels of Service*, including a strict adherence to environmental and other regulatory requirements.

### 6.7.3 Inter-municipality pooled projects

The City of Kitchener partners with other government entities for purposes of efficiency and in the spirit of collaboration for the better public good, including a longstanding protocol of partnering with the Region of Waterloo on City infrastructure replacement within Regional rights-of-way.

### 6.7.4 Options analysis

In order to facilitate the levels of service outlined in *Section 5 Levels of Service*, Kitchener maintains an experienced Asset Planning Section in the Financial Services Department.

The Ministry of Infrastructure proposes:

*For example, planned maintenance projects could use a standard inflation measure, while large capital project may require a more specific measure that better reflects changes in construction costs.*

Asset Planning is responsible for the project initiation and budget estimation for full reconstruction capital projects, with annual scrutiny on changes in construction costs, and indeed all relevant project costs. In addition, Kitchener has undertaken an investigative process in 2017 to evaluate and update the accelerated capital infrastructure asset replacement program. From this it was determined that the current scenario of 2% annual inflation for maintenance activities, and project-level analysis for large projects remains the preferred methodology for the Infrastructure Services Department – Sanitary & Stormwater Utilities Division.

### 6.7.5 Cross-Canada peer and industry partnerships

The City of Kitchener is a participant in a national committee, the *National Water and Wastewater Benchmarking Initiative* (NWWBI), an endeavour led by the Victoria, BC Capital Regional District, and project managed by a large Canadian consulting firm. As such, the City, along with a variety of other municipalities, Regional municipalities, Water Commissions, provide on an annual basis a vast array of detailed productivity and financial information to a consultant agency. The consultant compiles these data and acts as a liaison amongst the partner organizations to
inform each on comparisons in stormwater (and other asset) performance, and remediation challenges and opportunities.

6.7.6 City-internal co-ordination on strategic initiatives

The SSU looks to partner at every opportunity with other functional areas to co-ordinate storm works at strategic and project levels. This includes the likes of Parks & Cemeteries upgrades and enhancements, the Trails Master Plan and sustainable transportation with Transportation Planning, and Engineering Development for the likes of Environment Compliance Approvals.

The City's Roads & Traffic section performs street sweeping services, a service-oriented activity for the SSU, with a certain assumed level of service which means the activity is performed continually. The cost of this activity is attributable to the SSU.

6.7.7 Rain gauges and watercourse quality monitoring

The City has long maintained two rain gauges at large City-owned facilities to the benefit of both the sanitary and stormwater aspects of the SSU. Related, the City has recently engaged in a pilot project with local consultant experts to investigate tying work to observed conditions through data analysis. Next steps include investigation of a full implementation through Kitchener’s monitoring program. An existing dataset provides a foundation for chemical sampling results.
6.8 Climate Adaptation

In 2019 The City of Kitchener developed and rolled out a *Corporate Climate Action Plan* to address the impacts of Climate Change and how to reduce the City’s *greenhouse gas emissions* and its overall impact to the environment.

The SSU group is working to prepare the Stormwater network and infrastructure for all possible changes to the climate and the adverse effects it will have on the types of weather the City of Kitchener sees in the future. A proactive approach has been taken by Stormwater Utility as a number of initiatives have already been started between 2016-2018 that will help prepare the city for climate related weather events. They are:

- improved modeling of all watercourse and surface elevations to determine high risk flooding locations
- Low Impact Development (LID) has been developed and incorporated to road reconstruction programs
- construction work on watercourses to improve aquatic habitat and slow surface water

6.9 Procurement

The City of Kitchener has a purchasing policy (by-law chapter 170) to ensure that a fair, open and transparent procurement process is followed.
7. Financial Strategy

In 2017, as part of a City Council-driven Water Infrastructure Program (WIP), described earlier, a thorough investigation of operating and capital programs was undertaken. This evaluation included “the relationship between capital and maintenance investments and looked to balance affordability with these infrastructure investments”. Some guiding principles of the endeavor outlined the correlation between capital and maintenance programs in:

[Recognition] that preventative maintenance activities and inspections are important activities to provide lowest lifecycle cost for infrastructure.

Failure to renew and replace infrastructure has an impact on reactive/emergency maintenance activities and increases lifecycle costs

Growth of [an] asset base should recognize total costs of ownership including maintenance and operating cost impacts.

There is a necessary connection between Financial Reporting and Asset Management at Kitchener. Financial Reporting tracks only one asset type in the storm category – storm infrastructure – which includes all storm assets as a pool. Amortization, for the purposes of Accounting Division, is by straight line amortization – a linear degradation of value over time. Accounting applies an assumed 50-year lifespan to all storm assets, whereas Asset Management considers estimated lifespans to be based on asset type and specific characteristics thereof.

Assets added as new acquisitions via capital works, project managed through Engineering Division, are added to the pool via the SAP software system. This aligns with the terminology of Engineering contracts wherein contractors price out disposals and new assets, though notably, disposals are not tracked by Accounting Division except at end of expected life.

7.1 Operating Expenditures

The following figures express the operating expenditure data extracted from Cityworks for the years 2015 through 2019. The data is grouped by asset type where appropriate and represents full-city totals.

Kitchener can demonstrate operating costs which are reactive type activities and non-reactive type activities. Reactive activities are those which are ad hoc or unplanned, whereas non-reactive activities are those which result from planned work to remedy known issues or to keep assets functioning at a defined level of service.
Further, Kitchener can view operating costs by categorization of **inspection** activity, **routine** activity, **service-oriented** activity. Inspection activities are surveys of condition, performance, and safety in order to maintain best available objective knowledge of the assets. Routine activities are those activities that help support the condition of that asset throughout its expected lifecycle. Service-oriented activities are those activities that don’t affect health of assets but provide for maintenance of level of service.

A trend is showing of significant expenditure decreases, which is due to the split resourcing of sanitary and storm Operations staff, of late being tasked with prioritizing storm network maintenance work. It will require additional cycles of CCTV inspection to determine how this affects asset condition.

As would be expected, sanitary and storm Operations staff work management data shows most of the effort is towards **reactive** work.

**Figure 7.1.1 Storm total operating expenditures – reactive versus non-reactive activities**

Kitchener has the ability to show stormwater operating expenditures over time by activity categorizations of inspection, new, routine maintenance, service-oriented.
With respect to maintenance programs, it was determined through the aforementioned Water Infrastructure Program (WIP) evaluation that the stormwater maintenance gap would be resolved by 2022. However, as per internal business process which aligns with Ministry of Infrastructure expectations, 2% inflation on all expenses is applied to the storm maintenance budget each year in the City’s budget.

Kitchener’s Financial Planning area maintains Operating Budget Projections, and provides City Council with this financial picture.

Revenue is almost solely from stormwater charges to customer utility bills. Expenses include the likes of the Engineering internal costs, and various grants and credits. Transfers to capital include WIP capital funding and sundry other capital needs including Cityworks and SAP.

The Stabilization Reserve Fund is designed to dampen dramatic rate increases, with this strategy following Government Finance Officers Association (GFOA) recommendations. Kitchener has a reserve over the course of the 5-year projection, yet with an increasing balance each year, it is
currently below minimum target, with an expectation of slightly exceeding minimum target in year five.

The Capital Reserve Fund is via budget close-outs from projects which are not from WIP.

Anticipated growth and water usage trends round out the values for increases or decreases in rates and water consumption.

7.2  Capital Revenue and Cost Projections

In 2017, a thorough review of operating and capital programs was undertaken. This exercise determined the future funding requirements for the multi-utility-funded capital program, which performs the bulk of storm asset replacement at Kitchener, from data outlined in Section 4 State of Local Infrastructure.

No change was recommended to the selection or estimating methodology of this integrated infrastructure replacement scenario, which serves to provide the majority of storm asset replacement. The target planning horizon of the program was updated from 2032 to 2044, and the near-term rate increase – notably for the entire integrated program, which includes sanitary, stormwater, and potable water components – was modified to a 6.5% total increase. With this long-term program being funded by three City utilities, the percent increase to the Storm Utility specifically was pegged at 9.9% for 2018 and onward.

Funding gap analysis was performed in the 2017 WIP program update, with the gap to be closed by 2044. For full detail, including cost projections versus the projected budgets, reference document INS-17-070 - Water Infrastructure Program Summary and Rate Options.

The following Figure 7.2.1 represents the historical budget for storm replacement in the capital and operating programs.
It is clear in comparison to planned capital works that the City of Kitchener will increase expenditures in the stormwater asset area. Top priorities – particularly the downtown – were derived from the Kitchener Growth Management Plan and planning is now based on watershed priorities.

Funding is well-considered with stormwater utility charges based on class of property within the municipality, with each property slotted into a class for which a flat fee is paid per month.

7.3 Long Term Capital Funding Requirements

By virtue of detailed planning via the Water Infrastructure Program (WIP) in mid-2017, rate increases and timelines mean costs are planned and smoothed over the upcoming 25 years, and beyond. As earlier described, the WIP accounts for three asset categories – storm water, potable water, wastewater, and as such, this detailed long-term capital plan uses useful life characteristics of the potable water asset type to determine an overall replacement scenario.
The Council-approved scenario most closely aligns to replacement needs post 2044 and represents the most stable, “smoothed” capital program increase option. It was determined that this long-term funding scenario means essentially closing the capital needs gap by 2044.

*Figure 7.3.1* outlines the City build eras correlated to anticipated replacement needs, along with the extended-term capital outlay projected to close the identified infrastructure gap.

*Figure 7.3.1* Long-term capital replacement needs and timeline.

*note that watermain asset data was used as the logical driver of replacement needs for each of the three Water Infrastructure Program (WIP) utilities, including stormwater

All-structure **full reconstructions** of the right-of-way is the primary methodology for asset replacement, and as such, many of the stormwater asset types covered by this asset management plan – mains, manholes, catchbasins, leads, OGSs – are accounted for within this long-term capital replacement plan.

Assets that are not covered by the WIP program, such as ponds/facilities and watercourses, have a robust 10-year capital plan via SSU – Funding sources include Development Charges, Stormwater Reserve Fund, Disaster Mitigation and Adaptation Fund grant, and Stormwater Enterprise funding.
The City’s SSU – Programs section considers the Stormwater Master Plan shall be conducted in 10 year cycles, which provides for an update to the long-term capital plan. With the Stormwater Master Plan coming into effect in 2017, a refreshed master plan should be in place for 2027.