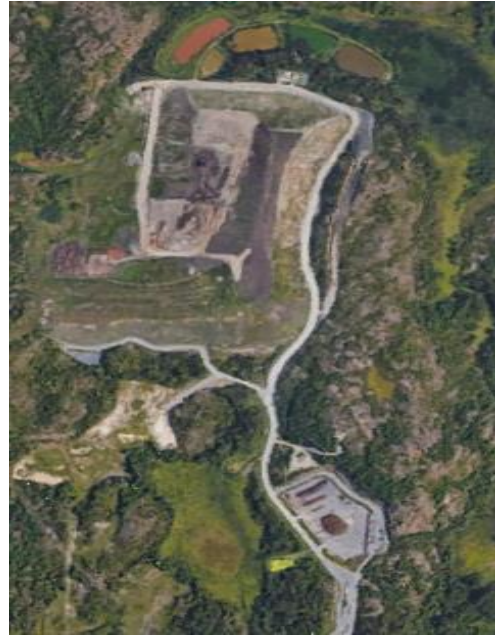


# SOLID WASTE ASSET MANAGEMENT PLAN



Version No. 1

2023

1

# **1. Executive Summary**

## **1.1. Purpose**

Asset management is the systematic and coordinated activities and practices of an organization to deliver on its service objectives optimally and sustainably through cost-effective lifecycle management of assets.

This solid waste asset management plan details information about solid waste infrastructure assets including the actions required to provide the existing level of service in a cost-effective manner while outlining the associated risks of asset ownership. The plan defines the existing services provided, how services are provided and what funds are required to maintain the services over a 20-year planning period.

## **1.2. Asset Management Strategy**

The lifecycle intervention strategies for solid waste operations discussed within this report include best practice activities. Best practices for the management of solid waste assets are applied with intervention decisions to strive for the lowest lifecycle cost and are as follows:

- The solid waste inspection program protocols.
- Document issues identified from asset users.
- Adhere to the legislation, guidelines and acts set out by the Ministry of the Environment.
- Retain trained and/or certified asset staff when applicable and provide additional training to address proper use and maintenance for each asset;
- Monitor the condition of assets on a regular basis, monthly and annually depending on the asset.
- Meet or exceed minimum waste compaction rates
- Maximize diversion efforts to conserve landfill space

## **1.3. Failure Prediction and Risk Management**

A risk framework was developed, and each individual asset is assigned a risk score based on a calculated probability and consequence of failure.

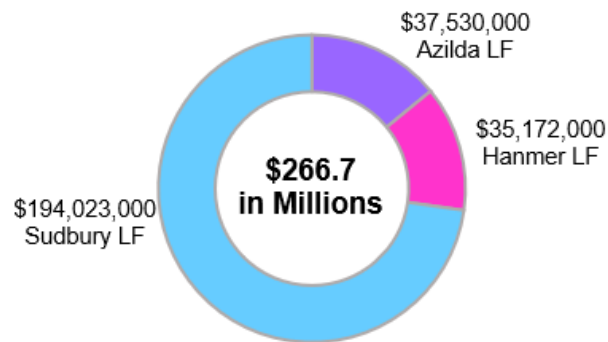
The probability of failure is an estimate of the likelihood of an asset is to not meet its service expectations. The consequence of failure is an estimate of the effect or outcomes if an asset fails. Under the solid waste portfolio infrastructure assets are prioritized for renewal or replacement with the output of the risk assessment. The parameters of the risk assessment are discussed in further detail within the plan.

### 1.4. State of the Infrastructure

The scope of the plan encompasses the assets of solid waste operations owned and operated by the City of Greater Sudbury. The value distribution and replacement costs of solid waste assets are summarized in Figures 1 and 2.

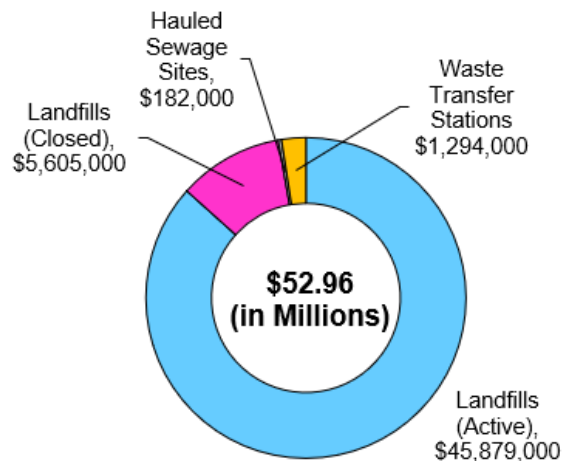
The value distribution of solid waste infrastructure in Figure 1 is representative of the financial value associated with the remaining capacity of the three active landfills. This value takes into consideration the tipping fees that are collected and the remaining disposal capacity at the active landfills.

**Figure 1: Value Distribution of Solid Waste Infrastructure (inclusive of Disposal Capacity)**



The replacement costs of solid waste assets are detailed in figure 2. The replacement costs are inclusive of property valuation, ministry approvals, fencing, roads, leachate, and gas monitoring systems etc.

**Figure 2: Replacement Cost Distribution of Solid Waste Infrastructure (exclusive of Disposal Capacity)**

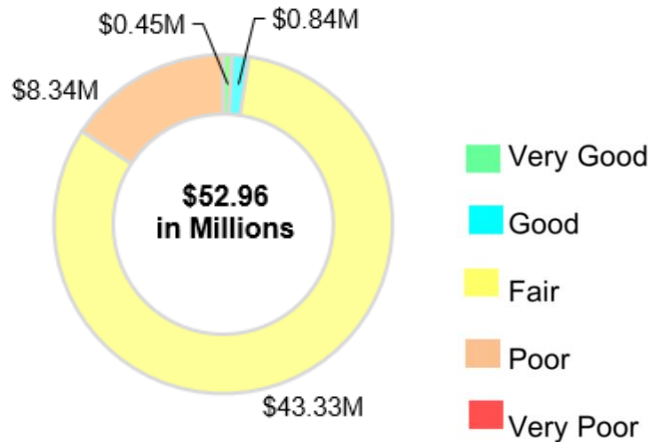


This plan does not take into consideration financial requirements to replace the existing disposal capacity of the landfill asset once it reaches end of life.

For the purposes of this asset management plan the City will look at the replacement values for solid waste assets to be **\$52,960,000**.

The data analyzed to develop the plan is integrated from a work order management system, the City's Tangible Capital Asset Database, and data spreadsheets. The details behind the development of condition and inspection frameworks are attached in Appendix A. Figure 3 below outlines condition ratings of the solid waste Inventory as they relate to their replacement costs.

**Figure 3: Condition and Valuation of the Solid Waste Operations Inventory in Millions**



### 1.5. Level of Service

Levels of Service (LoS) are used to define the extent that the City is currently delivering services and the extent that the City will aim to deliver services to the community. They provide a direction for a particular service area against which performance can be measured. Levels of service are imperative to establish reasonable expectations while taking into consideration the risks associated with service delivery and the affordability of delivering a service. Following the approval by Council of the solid waste asset management plan, staff will work towards defining level of service targets for Council review, consideration, and approval.

### 1.6. Long-Term Need

The 60-year average annual reinvestment requirement (AAR<sub>60</sub>) by asset class is detailed in section 7. The AAR<sub>60</sub> represents the estimated annual amount of capital the City requires to reinvest in the solid waste inventory. Investment was analyzed on a 60-year period to capture the theoretical useful life of solid waste assets. The 60-year average annual reinvestment requirement for all solid waste assets is **\$1,135,000** and does not include financial need for future active landfill disposal and/or landfill acquisition.

### 1.7 Future Demand

The City's solid waste operation is monitored for future demand requirements. The most significant future demand driver for solid waste operations is population growth. The City has

implemented preventative measures in anticipation of the demand drivers and are outlined in section 8 of this plan.

## 1.8 Climate Change

In September 2020, Council approved the Community Energy Emissions Plan (CEEP) that is the long-term plan to reduce carbon emissions and pollution in Greater Sudbury. The City is beginning to monitor the effects of climate change on its infrastructure assets and the effects of climate change are discussed in further detail in section 9 of this plan.

## 1.9 Next Steps

Table 1 identifies the next steps that emerged during the development of the asset management plan.

| <b>Table 1: Next Steps</b>         |                              |   |
|------------------------------------|------------------------------|---|
| <b>Section</b>                     | <b>Category</b>              | <b>Action Item</b>  |
| State of the Infrastructure        | Inventory                    | <ul style="list-style-type: none"> <li>• Monitor and refine the solid waste operations asset inventory to reduce the quantity of data assumptions</li> <li>• Implement a digital solution to track, monitor and analyze solid waste data</li> <li>• Expand the use of the current asset identification standard that will encompass all solid waste operations</li> </ul> |
| Level of Service                   | Asset Level of Service       | <ul style="list-style-type: none"> <li>• Develop target service levels for Council review</li> </ul>  |
| Asset Management Strategy          | Lifecycle Management Plan    | <ul style="list-style-type: none"> <li>• Review and refine strategies as necessary</li> </ul>   |
| Failure Prediction Risk Management | Risk Assessment and Exposure | <ul style="list-style-type: none"> <li>• Monitor and refine the deterioration model for solid waste operations assets as necessary</li> </ul>   |
| Long-Term Needs                    | Funding Sources              | <ul style="list-style-type: none"> <li>• Develop a sustainability strategy to achieve target levels of service for Council review, discussion, and approval.</li> <li>• Determine funding source for infrastructure need.</li> </ul>  |

## 2. Introduction

The City of Greater Sudbury's primary goal for solid waste management is reducing and eliminating adverse impacts of waste materials on human health and the environment to support economic development and superior quality of life. This is being done in the most efficient manner possible, to keep costs low and prevent waste buildup. The City's mission is to ensure the delivery of an integrated, cost-effective, and environmentally sound and solid waste management system while promoting waste reduction, reuse, and recycling.

The Environmental Services Division is committed to implementing projects, programs, and processes that promotes the 3R's and that extends the lifespan of our assets, meeting the current needs and challenges while anticipating the needs and challenges of the future.

Solid waste is responsible for three areas: solid waste and litter collection, waste handling and processing and, garbage disposal. The City of Greater Sudbury owns and operates three active landfill sites, three closed landfill sites, 3 hauled sewage sites and 14 waste transfer stations.

The Environmental Services Division of the City of Greater Sudbury must comply with all legislation, acts and guidelines as set out by the Ministry of Environment.

In Ontario, landfill sites and other waste management activities are subject to Part V of the *Environmental Protection Act* and the regulations made under the Act. The basic legislative framework for waste management is defined in Part V and the regulatory requirements for the design and operation of waste disposal sites are included in *Regulation 347*. For new or expanding landfill sites, these regulatory requirements are superseded by *Regulation 232/98*.

*Ontario Regulation 232/98* made under Part V of the *Environmental Protection Act* takes effect on August 1, 1998, and contains detailed requirements for the design, operation, closure, and post-closure care of municipal (i.e., non-hazardous) waste landfilling sites.

The scope of this plan encompasses the assets of solid waste operations owned and operated by the City of Greater Sudbury. All building and building elements, such as the Recycling Center, equipment, furnishings, and appliances as well as fleet vehicles required to operate the buildings are not included in this AMP, however, are captured under the Building and Facilities AMP and the Fleet and Equipment AMP.

## 3. Asset Management Strategy

Best practices for the management of solid waste assets are applied with intervention decisions to strive for the lowest lifecycle cost. In addition, condition data is collected and involved in maintaining level of service contemplations and in the asset lifecycle intervention strategies for solid waste.

### 3.1. Maintain or Adjust Level of Service

Environmental Services manages the portfolio assets to maintain the existing levels of service.

Best practices include but are not limited to:

- The solid waste inspection program protocols.

- Document issues identified from asset users.
- Adhere to the legislation, guidelines and acts set out by the Ministry of the Environment.
- Retain trained and/or certified asset staff when applicable and provide additional training to address proper use and maintenance for each asset;
- Monitor the condition of assets on a regular basis, monthly and annually depending on the asset.
- Meet or exceed minimum waste compaction rates
- Maximize diversion efforts to conserve landfill space
- Continue to collect and report on performance measures currently tracked, while developing collection and reporting strategies for newly identified performance measures
- Perform annual inspection and certification as per legislation.

Following the approval by Council of the Solid Waste Asset Management Plan, staff will work towards defining level of service target for Council review, consideration, and approval. The process of reviewing and setting target levels of service will involve Council and department leads to introduce the appropriate targets that can be sustained financially through capital infrastructure spending. To set targets, Council will be provided with the risks associated with the target options.

Future versions of the Solid Waste Asset Management plan will include the target levels of service as defined by Council at the appropriate time. The targets will include an explanation of why the targets are suitable for Greater Sudbury by explaining the associated risks and funding strategies to achieve the targets over time.

### **3.2. Lifecycle Management Plan**

Life Cycle Asset Management (LCAM) is an integrated approach to optimizing the life cycle of the City's assets beginning at conceptual design, continuing through shut down and decommissioning.

Best practices for the management of solid waste assets are applied with intervention decisions to strive for the lowest lifecycle cost. These best practices include:

- The solid waste annual inspection program protocols discussed in Section 4.3 Asset Useful Life;
- Document issues that are identified by asset users;
- Adhere to manufacturers maintenance routines and schedules;
- Monitor the condition of assets annually.

- Regular maintenance activities are standard procedure across the solid waste portfolio. They are required to meet legislated requirements, approved service levels, and to optimize asset lifecycles. Non infrastructure solutions are considered in all stages of the planning process to identify opportunities to optimize asset lifecycles and reduce asset related service delivery costs through optimizing asset use, monitoring asset condition, and assessing asset specific risk to service.

Most solid waste assets are inspected regularly for deficiencies by the operating contractor and are required to rectify deficiencies as part of the contracted scope. Other solid waste assets such as the waste transfer stations are maintained in-house by trained staff, using professional experience and judgement. The inspection program performed by staff is designed to enable assets to perform to their service potential. The City also obtains licensed consultant professionals to perform major maintenance work as determined by the City staff and capital projects. Annual monitoring and sampling reports are done by a consultant and review by City staff and then sent to the Ministry of Environment (MOE) for reviews. MOE conducts periodic site visits to ensure compliance. Once an asset has reached the end of useful life, a needs assessment is conducted prior to replacement.

## **4. State of the Infrastructure**

Waste management is a major issue for modern cities. The City of Sudbury accomplishes this task internally using a combination of City employees and contracted services to collect the waste which is delivered to City managed waste management facilities. Garbage is disposed at the City's landfill sites while Blue Box recyclables, Green Cart organics, Leaf & yard trimmings as well as, appliances and electronics are segregated for diversion. Household hazardous waste can be diverted from landfill by dropping it off at the City's permanent hazardous waste depot or by having it collected by the Toxic Taxi. The AMP does not present specific deficiencies or project needs but presents a high-level review of the state of the solid waste services assets and general needs that have been identified for the future.

### **4.1. Asset Data Inventory**

A detailed asset inventory is a key component in understanding what assets the City owns to develop and implement an asset management plan that provides a vision, strategy, and disciplined approach to achieve sustainable, efficient, and resilient assets.

Achieving a complete inventory can be a time-sensitive and costly effort, but one that can provide invaluable to future operational needs. An inventory that is up to date can feed many other initiatives. With a complete data set, it is easier to frame the structure of future asset conditions and define capital replacement needs. Concise asset inventories are also used to establish preventative maintenance programs.

Solid waste operations asset inventories are stored within an excel spreadsheet management system and the tangible capital asset database. The City's solid waste operations inventory is summarized in Table 2.

| <b>Service Area</b> | <b>Asset Type</b>       | <b>Quantity</b> |
|---------------------|-------------------------|-----------------|
| <b>Solid Waste</b>  | Landfills (Active)      | 3               |
|                     | Landfills (closed)      | 3               |
|                     | Waste Transfer Stations | 14              |
|                     | Hauled Sewage Site      | 3               |
| <b>Grand Total:</b> |                         | <b>23</b>       |

#### **4.2. Estimated Asset Value**

The information provided to describe asset condition reflects best available data and professional judgement. The value of the solid waste infrastructure is determined through a combination of site reviews and assessments, appraisals, and estimating. A summary of the City's solid waste operations value is provided in Table 3.

| <b>Service Area</b>            | <b>Asset Type</b>     | <b>Valuation</b> |
|--------------------------------|-----------------------|------------------|
| <b>Landfills (active)</b>      | Azilda                | \$5,856,000      |
|                                | Hanmer                | \$8,337,000      |
|                                | Sudbury               | \$31,686,000     |
| <b>Landfills (closed)</b>      | Nickel Centre         | \$397,000        |
|                                | Onaping               | \$276,000        |
|                                | Walden                | \$4,932,000      |
| <b>Hauled Sewage Sites</b>     | Valley Hauled Sewage  | \$77,000         |
|                                | Dowling Hauled Sewage | \$44,000         |
|                                | Dryden Hauled Sewage  | \$61,000         |
| <b>Waste Transfer Stations</b> | Burma                 | \$59,000         |
|                                | Elk Lake              | \$8,000          |
|                                | Ella Lake             | \$12,000         |
|                                | Fire Route S          | \$6,000          |
|                                | Kukagami              | \$143,000        |
|                                | Michaels South Shore  | \$10,000         |
|                                | Silver Lake           | \$17,000         |
|                                | Railway               | \$15,000         |

|                                  |              |                     |
|----------------------------------|--------------|---------------------|
|                                  | Frenchman    | \$34,000            |
|                                  | Perreault    | \$31,000            |
|                                  | Marina       | \$3,000             |
|                                  | Panache      | \$89,000            |
|                                  | Fire Route R | \$46,000            |
|                                  | Walden       | \$821,000           |
| Subtotal Landfills (Active)      |              | \$45,879,000        |
| Subtotal Landfills (Closed)      |              | \$5,605,000         |
| Subtotal Hauled Sewage Sites     |              | \$182,000           |
| Subtotal Waste Transfer Stations |              | \$1,294,000         |
| <b>Grand Total:</b>              |              | <b>\$52,960,000</b> |

The estimated replacement value of the City's Solid assets is **\$52,960,000**. This value represents 0.49% of the replacement value of the City's total asset inventory.

**4.3. Asset Useful Life and Asset Condition**

For the development of this asset management plan, the theoretical useful life of an active landfill is based on the total capacity of the site reduced by the capacity that has already been used at the site. For example, at the Hanmer Landfill Site the total capacity that site can hold is 1,653,915m<sup>2</sup> of waste. From waste measuring and weighing it has been estimated that 1,078,617m<sup>2</sup> of the total capacity has already been used waste. Therefore, the remaining capacity of the site is 575,298m<sup>2</sup> or approximately 35%. Should one of the three active landfills reach capacity the waste from that site would be diverted to the remaining two sites reducing the useful life at an accelerated rate. For this reason, it is estimated that overall, City of Greater Sudbury landfills have a useful remaining life of approximately 25 years.

The theoretical useful life of a closed landfill site is indefinite for the evolution of the plan.

The theoretical useful life of the assets that make up the transfer depots are based on the condition of the asset. This is determined by professional judgment of staff as well as industry standards across the City of Greater Sudbury as well as various comparable cities within Northern Ontario.

An asset condition assessment (ACA) outlines how an organization can improve its asset management operations by efficiently managing its assets. The City uses asset condition assessments to decide upon preventative maintenance or remedial work to preserve an assets value and extend its useful life. Staff perform annual inspections on assets throughout the solid waste portfolio that are important in determining the extent to which an asset can meet the intended purpose. The condition of an asset is a measure of its physical state and provided indication as to whether service levels are being attained. The outcomes of an ACA can be multifaceted; they can inform on the conditions, prioritize needed repairs, and predict timing of capital renewal needs.

Elements of a comprehensive ACA include:

- Date of installation
- Condition rating
- Remaining useful life (RUL) as determined by current condition and lifecycle expectation
- Immediate issues including poor maintenance conditions or effects to operability or access
- Pictures, visual inspections, and documentation of conditions.
- Replacement value
- Repair strategies and associated costs
- Performance characteristics, legislated safety inspections and certifications.
- Discussions with the asset users, operators, and stakeholders regarding the performance of an asset.
- 
- Annual monitoring reporting of landfills using fly over techniques (drones) that indicate volume levels of the landfills.

When working on the collection of condition data of assets it is crucial to remember that asset conditions do not remain stagnant and that it is only a timestamp of condition. It is best practice to complete a comprehensive assessment on an annual basis, while revisiting aging assets and critical equipment intermittently. Current asset conditions are best observed over time and require more than a one-time report.

#### **4.4. Current Asset Condition**

The data analyzed to develop conditions are annual inspection reports performed from assigned solid waste staff using professional judgments, comparable assets, and industry standards. The data is also collected from the City's Tangible Capital Asset Database and Excel spreadsheets. Solid waste assets are assessed based on a one to five scale rating that follows an internationally accepted rating system based on condition, where 1 is very good and 5 is very poor and can be described as follows:

Very Good – sound; new or like new; no evidence of deterioration; does not require repair(s) only planned maintenance required

Good - minor defects; minor wear and tear, or minor deterioration; intervention is not required  
minor maintenance required plus planned maintenance

Fair – component/system in adequate condition; defects are evident; components require minor maintenance or minor intervention

Poor – components or systems not functioning as intended; severe component deterioration; components are damaged but repairable; materials finishes are damaged; minor structural defects, major system defects, imminent service interruptions leading to moderate intervention and/or moderate maintenance

Very Poor – structural defect and/or failure; component and system failures requiring replacement; environmental contamination, or spills exist; major intervention, replacement or renewal required

The average condition of the City’s solid waste operations assets is provided in Table 4.

| <b>Table 4 - Solid Waste Asset Condition</b> |                       |                       |
|--|-----------------------|-----------------------|
| <b>Service Area</b>                          | <b>Asset Location</b> | <b>Mean Condition</b> |
| <b>Landfills (active)</b>                    | Azilda                | 50% Fair              |
|  | Hanmer                | 65% Poor              |
|  | Sudbury               | 58% Fair              |
| <b>Landfills (closed)</b>                    | Nickel Centre         | 90% Very Good         |
|  | Onaping               | 80% Good              |
|  | Walden                | 80% Good              |
| <b>Hauled Sewage Sites</b>                   | Valley Hauled Sewage  | 80% Good              |
|  | Dowling Hauled Sewage | 90% Very Good         |
|  | Dryden Hauled Sewage  | 80% Good              |
| <b>Waste Transfer Stations</b>               | Burma                 | 80% Good              |
|  | Elk Lake              | 80% Good              |
|  | Ella Lake             | 90% Very Good         |
|  | Fire Route S          | 80% Good              |
|  | Kukagami              | 80% Good              |
|  | Michaels South Shore  | 80% Good              |
|  | Silver Lake           | 80% Good              |
|  | Railway               | 80% Good              |
|  | Frenchman             | 80% Good              |
|  | Perreault             | 80% Good              |
|  | Marina                | 80% Good              |
|  | Panache               | 80% Good              |
|  | Fire Route R          | 80% Good              |
|  | Walden                | 80% Good              |

## 5. Levels of Service

The levels of service discussed in this plan look at the City's current levels of service as they are currently funded. Further development of the Solid Waste Asset Management Plan will provide opportunities for Council to review alternatives to the current levels of service. These future alternatives will be evaluated considering various levels of acceptable condition, risk, and financial alternatives.

The review of target levels of service will provide insight to establishing the criticality of assets and the long-term financial stability of the diverse options and impacts of proceeding with or deferring capital expenditures.

Consultation with staff, review of current activities and review of financial data have all been used in the preparation of the level of service framework. The current levels of service are described below.

**5.1 Community:** Community Levels of Service are high level qualitative descriptions which indicate what the City currently strives to achieve through community, stakeholder, and individual expectations. Community levels of service for solid waste assets can be described as follows:

- maintain an acceptable level of cleanliness and in a state of good repair to avoid service interruptions
- are accessible and equipped to meet the needs of users
- user concerns are promptly addressed
- meet legislative, regulatory, and code standards and are available to meet service programming needs
- efficient and cost effective
- have appropriate security provisions in place that provide a safe and secure environment
- site access is provided to emergency services
- appropriate parking is provided
- ensure all regulatory requirements are met

As the City develops the Solid Waste Master Plan, it realizes the need to provide a variety of coordination, management, and community development services that result in a dynamic and sustainable solid waste delivery system. The Environmental Services Division is committed to service excellence and strives to provide services that are delivered effectively with a commitment to continuously improve the level of service. Through its partners and direct engagement, staff strive to be innovative, creative, and in touch with community needs and expectations. The use of cross-divisional work teams, inter-department communication, and

collaboration with agencies on specific initiatives are the norm and are a best practice for other municipalities to emulate.

Through the Solid Waste Master Plan, the City of Greater Sudbury recognizes the expectations from the community that are critical for identifying issues, trends, and future priorities. These can be described as follows:

- Recycling:
  - o Blue box recycling collection completed weekly as scheduled
- Household Garbage:
  - o Garbage collection is completed every other week as scheduled
  - o Large furniture, appliances and electronics are collected within 3 business days of making a collection request
- Leaf & Yard Trimmings:
  - o Leaf & yard trimmings are collected every other week as scheduled
- Green Cart organics:
  - o Green Cart organic waste is collected weekly as scheduled
- Landfill and Remediation:
  - o Landfill operations have limited impact on surrounding neighborhoods
  - o Landfill operations meet legislative requirements
  - o Landfills are safe, accessible, and open for public to dispose of waste

**5.2 Strategic:** Qualitative and Quantitative measures that describe what is being provided to the community. Examples of how this can be defined can include reliability, legislative compliance, quantity, quality, and safety.

The strategic levels of service indicated below support the community levels of service. For specific assets, the City of Greater Sudbury has recognized that certain provisions are necessary to measure what is recommended for the municipality and what is currently being offered.

- Waste Collection Services:
  - o Provide waste collection services to approximately 60,000 households, 400 apartment buildings, 88 multi-type properties, and 153 IC&I properties.
- Recycling:

- Capacity to process 42,000 tonnes of recyclable materials 6 days per week (actual is 17,491 tonnes)
- Garbage Collection:
  - Capacity to collect approximately 40,000 to 42,000 tonnes of waste annually (Actual is 34,417 tonnes per year)
  - Collection of household hazardous waste with approximate capacity for 4,000 collection trips annually (Actual is 3674 pick-ups)
  - Capacity to process 25 hazardous waste classes without limit 26 Saturdays per year (Handled 320 tonnes)
- Landfills and Remediation:
  - Initiative-taking reduction of greenhouse gas emissions at the Sudbury Landfill through landfill gas collection and monitoring
  - Ensure legislative compliance with all governing legislation (EPS, O. Reg. 347, Resource Recovery and Circular Economy Act, the Environmental Assessment Act, etc.)
  - Maintain and operate processing and handling facilities with approved total capacities for approximately 100,000 tonnes of waste annually (Actual waste disposed 38,049 tonnes)
  - 13 residential waste transfer stations with approved capacity of 11,906 tonnes per year
  - Maintain and operate landfill sites for garbage disposal with reserve capacity of approximately six million tonnes and an estimated service life of 60 to 84 years with a combination of internal and external resources
  - Disposal of waste at 3 landfill sites, 6 days per week.

### **5.3 Asset Level of Service – Key Performance Indicators (KPI)**

An asset level of service is a quantitative measure that defines the performance expectations for a given asset to produce the desired levels of service. These services are measures and can include asset conditions, responsiveness, expenditure, and asset value.

Levels of Service can be evaluated by measures such as customer complaints per capita, customer surveys, community outreach, collected data, or discussions with municipal staff familiar with service operations.

The key performance indicators currently included in the asset levels of service are indicated below.

- Asset Data Collection and Inspections completed on an annual basis
- Asset Condition Index Ratings
  - o % of assets in poor or very poor condition = 16%
  - o % of assets in fair condition = 81%
  - o % of assets in good or very good condition = 3%

The Levels of Service (LOS) performance measures are related to Corporate Values of Customer Service, Cost Efficiency, Accessibility, Reliability/Availability, Legislative, Quality, Safety and Environment/Sustainability.

The existing asset levels of service are provided in the following table 5, which are based on the current condition of an asset that is providing the existing service levels to users.

| <b>Table 5 - Solid Waste Existing Level of Service</b> |                       |                     |
|--|-----------------------|---------------------|
| <b>Service Area</b>                                    | <b>Asset Location</b> | <b>Existing LoS</b> |
| <b>Landfills (active)</b>                              | Azilda                | 50%                 |
|  | Hanmer                | 65%                 |
|  | Sudbury               | 58%                 |
| <b>Landfills (closed)</b>                              | Nickel Centre         | 90%                 |
|  | Onaping               | 80%                 |
|  | Walden                | 80%                 |
| <b>Hauled Sewage Sites</b>                             | Valley Hauled Sewage  | 80%                 |
|  | Dowling Hauled Sewage | 90%                 |
|  | Dryden Hauled Sewage  | 80%                 |
| <b>Waste Transfer Stations</b>                         | Burma                 | 80%                 |
|  | Elk Lake              | 80%                 |
|  | Ella Lake             | 90%                 |
|  | Fire Route S          | 80%                 |
|  | Kukagami              | 80%                 |
|  | Michaels South Shore  | 80%                 |
|  | Silver Lake           | 80%                 |
|  | Railway               | 80%                 |
|  | Frenchman             | 80%                 |
|  | Perreault             | 80%                 |
|  | Marina                | 80%                 |
|  | Panache               | 80%                 |
|  | Fire Route R          | 80%                 |
|  | Walden                | 80%                 |

## 6. Failure Prediction and Risk Management

Risk management is a major component of asset lifecycle management. The City's risk management goals involve identifying, understanding, and managing the potential for infrastructure assets to meet planned service objectives.

Risk assessment is applied to prioritize and optimize capital spending and decision making. The City evaluates both the Probability of Failure (PoF) and the Consequence of Failure (CoF) when prioritizing for the capital budget. This helps clarify and build a shared understanding about the risk associated with a decision to not engage in a project.

### 6.1. Probability of Failure (PoF)

The probability of failure is an estimate of the likelihood of an asset is to not be meeting its service expectations. The PoF for solid waste has been derived from asset condition. Table 6 demonstrates the rationale to determine the PoF of solid waste assets.

| <b>Table 6: Probability of Failure (PoF) Solid Waste</b>  |              |                                |            |
|---|--------------|--------------------------------|------------|
| <b>Asset Condition translates to → Likelihood and PoF</b> |              |                                |            |
| <b>Condition</b>  |              | <b>Likelihood</b>              | <b>PoF</b> |
| <b>F (Very Poor)</b>                                      | Less than 20 | Almost Certain: 80% of Greater | <b>P5</b>  |
| <b>D (Poor)</b>   | 20 - 39      | Likely: 60 – 79%               | <b>P4</b>  |
| <b>C (Fair)</b>   | 40 - 59      | Possible: 40 – 59%             | <b>P3</b>  |
| <b>B (Good)</b>   | 60 - 79      | Unlikely: 20 – 39%             | <b>P2</b>  |
| <b>A (Very Good)</b>                                      | 80 - 100     | Rare: Less than 20%            | <b>P1</b>  |

### 6.2. Consequence of Failure (CoF)

The consequence of failure is an estimate of the effect on outcomes if an asset fails. The consequences of failure could range from a service interruption to a catastrophic result depending on the asset criticality. The CoF has been developed to adhere to the Corporate Impact and Likelihood Criteria for Enterprise Risk Management recommended by the City's Auditor General. The City also has planned mitigation already in place to maintain service objectives should an asset fail. The availability and quantity of mitigation or redundancy was considered with the development of the CoF.

Solid waste operational assets are assessed for risk annually when they are prioritized as part of the capital budget. Items that are reviewed can be described as and weighted as follows:

- Service Delivery 20%
- Strategic, Legislation, and Environmental 20%
- Social repercussions 20%
- Economic and Financial Losses 20%

- Redundancy and Mitigation 20%

Each of the categories and parameters described above are weighted within a consequence of failure framework to calculate situation specific CoF's. Greater Sudbury has recently made significant strides to collect and analyze the data required to generate outputs from the CoF framework. However, the City acknowledges there is still work to be done as the framework and feeder data will continue to improve.

The CoF framework has been developed to adhere to the Corporate Impact and Likelihood Criteria for Enterprise Risk Management recommended by the City's Auditor General. The City also has planned mitigation already in place to maintain service objectives should an asset fail.

### **6.3. Risk Assessment and Exposure**

The probability and consequences of failure allow the corporation to focus on assets that have the greatest impact on service delivery. The following formula demonstrates the PoF and CoF are multiplied to determine risk exposure.

Risk Exposure = Probability of Failure x Consequence of Failure

The risk exposure for all the City's solid waste infrastructure is monitored and implemented for prioritizing projects related to reactive maintenance duties and Greater Sudbury's annual capital budget.

### **6.4. Failure Prediction**

Failure prediction is performed to assess the potential for an asset to deliver an expected level of service over time. Current and historical condition and performance data is analyzed to determine the current position of an asset within its lifecycle. This information informs a judgment about how much remaining service life is available. For this asset management plan, failure prediction and the remaining life of solid waste assets have been determined based on asset condition.

### **6.5. Risk Response**

The City's operating departments have risk response built-in to daily operations. Risk response includes contingency plans and mitigation strategies that have been developed with the experience of delivering levels of service to the community.

The steps to eliminate or avoid risk by reducing the probability and consequences of failure vary by department. An example of a typical mitigation includes residential transfer stations where waste can be redirected to a landfill in the unlikely event that assets fail at a transfer station and warrant the temporary closure while the assets are replaced or rehabilitated. The LoS will be impacted slightly as residents will be required to use alternate sites for the disposal of waste. It should be noted that although this would be a temporary measure put in place, it would not be ideal as there would be an increase in traffic congestion, waiting times and the generation of

emissions. Examples of risk response planning to reduce the disruption of service delivery includes:

- Solid waste works with the operating departments to plan and schedule maintenance. For example, the annual inspection program.
- Solid waste and Environmental Services operate 3 active landfills, 3 closed landfills, 14 Waste Transfer Stations and 3 Hauled Sewage Sites. Redundancy plans are in place if one of the active landfills should be impacted by a closure, waste would be redirected to the nearest landfill by altering contractor schedules and residents directed to dispose of waste at the next convenient site.
- Some unforeseen circumstances such as compliance issues, fires or natural disasters are good examples of reasons an active landfill or transfer depot may experience a decrease in service levels to users. Contingency plans to help minimize the effects this would include; temporary garbage bins being placed at landfill sites where waste would be collected and transported to the nearest landfill.

## 7. Long-Term Needs

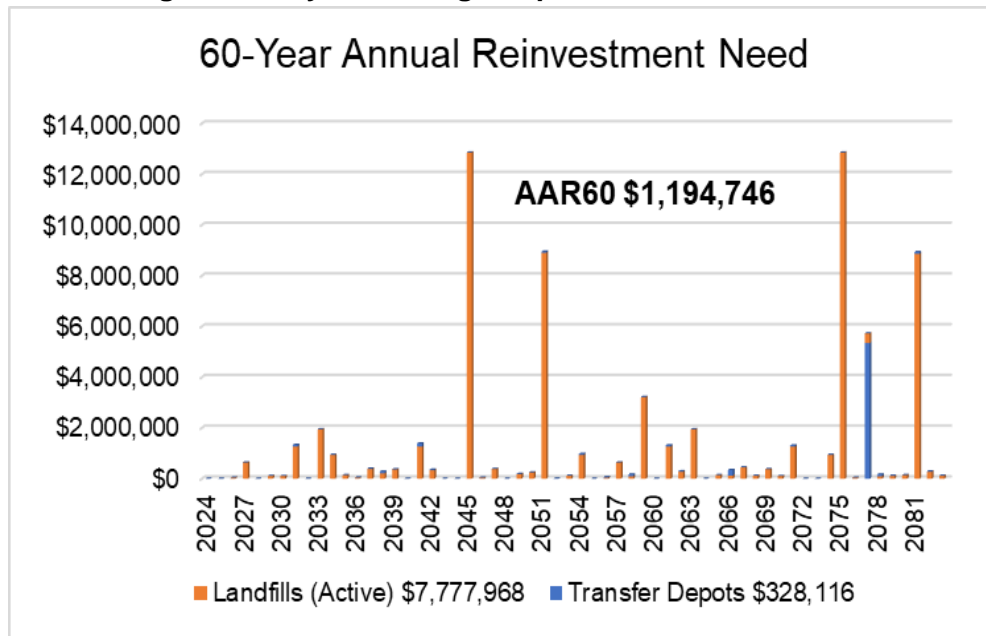
The capital need detailed below is based on lifecycle modeling of Greater Sudbury's solid waste inventory. For this asset management plan, the lifecycle analysis represents the capital investment needed to rehabilitate and replace assets; the cost of operational maintenance is not included. Operational maintenance costs will be included in future updates to the asset management plan as part of full lifecycle cost analysis.

Detailed below is a 60-year average annual reinvestment requirement ( $AAR_{60}$ ) which is the mean annual capital investment required over a 60-year period. The  $AAR_{60}$  is useful for defining the required rate of funding to maintain service levels based on the investment profile. It is recognized that spending will vary from year to year, however this value provides a benchmark upon which to measure whether solid waste assets are being renewed at a rate that is financially sustainable. With the average annual reinvestment requirement value, the City may either benchmark infrastructure investment against the metric while monitoring the variability year to year or contribute to reserves in years where the annual investment is short of the average annual reinvestment requirement value.

It is anticipated that a significant quantity of infrastructure investment need will be captured in an expenditure backlog. The risk-based lifecycle model discussed in Section 6 has been projected to determine upcoming investment requirements of solid waste assets.

Figure 4 below provides the 60-year average capital reinvestment need for solid waste assets to maintain the solid waste inventory at the existing condition. This represents the estimated amount of capital the City is required to reinvest in the solid waste inventory to maintain a state of good repair (SOGR) level of service condition. The 60-year annual average reinvestment requirement in this scenario ( $AAR_{60}$ ) for solid waste assets is \$1,194,746.

**Figure 4: 60-year Average Capital Reinvestment Need**



### 60-Year Capital Need Assumptions

The long-term needs for solid waste are based on the following assumptions:

- Solid waste assets are being upgraded, refurbished and/or replaced with elements that are in similar function
- 60-year average annual reinvestment requirement does not consider service expansion or reduction;
- Risk exposure equivalency of 20 or higher as discussed in Section 6 Failure Prediction and Risk Management and Solid Waste Risk Exposure is immediate need in the year 2023;
- Calculated in 2022 Canadian Dollars where actual costs vary with currency fluctuations.

### 7.1. Infrastructure Reinvestment Financing Strategy

The state of good repair (SoGR) is the condition that an asset can operate at a full level of performance. To maintain the City’s infrastructure assets in a state of good repair, capital work is financed through tax supported capital reserve and utility rate supported capital reserve. The Solid Waste Asset Management Plan in conjunction with the annual capital budget proposes and prioritizes the City’s infrastructure investment requirements according to their respective financing sources.

The 60-year average annual reinvestment requirement is compared to historical expenditure from a period of 5 years to demonstrate the financial risk associated with asset ownership known as a funding gap. The funding gap is the unfunded capital value of infrastructure renewal needs that require attention as of the current year. It is important to note that additional expenditure from the operating budget helps to further reduce the funding gap. Maintenance expenditure can contribute to extending the actual service life of infrastructure. Table 7 demonstrates the building and facilities funding gap.

| <b>Asset Class</b> | <b>5 Yr Expenditure (Mean)</b> | <b>AAR<sub>60</sub></b> | <b>Funding Gap</b> |
|--------------------|--------------------------------|-------------------------|--------------------|
| Solid Waste        | \$896,428                      | \$1,194,746             | \$298,317          |

## 7.2. Sustainability Strategy

The existing level of service for solid waste Operations detailed in Section 5 Levels of Service drive the reinvestment forecasts in the asset management plan. Levels of service are based on regulation, standards, and Council approved service levels. Following the asset management roadmap, Council will be provided with the opportunity to determine level of service targets to manage infrastructure within the City’s capacity to renew and maintain assets and accept the associated risk.

For solid waste one of the most prominent issues that can be addressed is working towards diversion of waste from the existing landfills. Continuing to implement waste diversion programs such as reduction, reuse and recycling, the City can extend the remaining capacity and years of remaining life, prolonging the life of the landfill assets.

## 7.3. Next Steps

Following Council approval of the Solid Waste Operations Asset Management Plan, target level of service options will be prepared for Council review, discussion, and approval. The target level of service framework may require additional key performance indicators and will be the main driver of the sustainability strategy. When target level of service is reviewed, Council will have the option to select service levels that lead to either a reduction or an increase of assets that are in-service and require financing.

Table 8 identifies the next steps that emerged during the development of the asset management plan.

| <b>Section</b>              | <b>Category</b> | <b>Action Item</b>   |
|-----------------------------|-----------------|--|
| State of the Infrastructure | Inventory       | <ul style="list-style-type: none"> <li>• Monitor and refine the solid waste asset inventory to reduce the quantity and quality of data assumptions</li> <li>• Implement a digital solution to track, monitor and analyze assets within the solid waste portfolio</li> <li>• Expand the use of the current asset identification standard</li> </ul> |

|                                    |                              |  |
|------------------------------------|------------------------------|--|
| Level of Service                   | Asset Level of Service       | <ul style="list-style-type: none"> <li>• Develop target service levels for Council review</li> </ul>   |
| Asset Management Strategy          | Lifecycle Management Plan    | <ul style="list-style-type: none"> <li>• Review and refine strategies as necessary</li> </ul>  |
| Failure Prediction Risk Management | Risk Assessment and Exposure | <ul style="list-style-type: none"> <li>• Monitor and refine the deterioration model for solid waste assets as necessary</li> </ul>   |
| Long-Term Needs                    | Funding Sources              | <ul style="list-style-type: none"> <li>• Develop a sustainability strategy to achieve target levels of service for Council review, discussion, and approval.</li> <li>• Determine funding source for infrastructure need.</li> </ul> |

**8. Future Demand**

**8.1. Demand Drivers**

Drivers affecting demand include parameters such as population, legislation, demographics, seasonal factors, technological advancement, economic, environmental awareness, and Council directed service revisions.

**8.2. Demand Forecasts and Impact on Assets**

The present position and projections for demand drivers that may impact future service delivery and use of assets were identified and documented in Table 9. The present position and projection statistics are from the City of Greater Sudbury Outlook for Growth to 2046 that was developed in March 2018.

**8.3. Demand Management Plan**

The City will regulate the demand on assets through a combination of managing existing assets, upgrading of existing assets and providing new assets to meet demand. Opportunities identified for demand management are provided in Table 9. Further opportunities will be developed in future versions of the asset management plan.

**Table 9: Demand Drivers, Projections, Impact on Services and Management Plan**

| Demand Driver                      | Present Position  | Projection   | Impact on Services   | Demand Management Plan  |
|------------------------------------|---|--|--|---|
| Population                         | City of Greater Sudbury Population: 166,004   | Population (2046):<br>• Low: 165,090<br>• Mid-Range: 172,990 (Reference Scenario)<br>• High: 181,290   | The City's population is anticipated to remain constant. This will minimize the impact on solid waste operations assets.   | The City will continue to monitor population. Should the population deviate from the expected constant, the data will be analyzed to formulate an appropriate plan.   |
| Legislation                        | Solid waste Assets such as landfills and transfer sites are maintained and operated to meet the Ministry Legislations and guidelines  | Additional legislative requirements are anticipated. For example, implementation and enforcement of climate change and environmental concerns to reserve watershed quality.                      | Rehabilitation and remediation cost of landfills are expected to increase with evolving legislation.<br>-Approvals for new landfills and sites can take upwards of approx. 10 years.     | The replacement value of solid waste operations is monitored annually to reflect resulting from legislation and Ministry guidelines.  |
| Demographic                        | Households: 69,152  | Households (2046):<br>• Low: 72,890<br>• Mid-Range: 75,250 (Reference Scenario)<br>• High: 77,590  | The anticipated increase in housing will be monitored against the services provided by solid waste operations assets.  | The City has an expansive geographic area of 3,228 km <sup>2</sup> that is serviced by solid waste operations assets. With an increase in housing, the City will monitor the services provided to the area. For example, adequacy of planned waste collection routes. |
| Population Education and Awareness | The Environmental Services Division is evolving the delivery of solid waste promotions and other environmental services, collaborating with solid waste stakeholders in the area. | The Promotional and Educational Program is intended to provide residents with the necessary information to properly dispose of waste and to encourage - reduction, reuse, or recycling of waste. | The continued commitment to educational programming to the residents will result in more efficient waste streams and may result in a reduction in solid waste collections and treatment. | Demographics of a changing population will determine the type of educational programming that can be brought forth. The City will need to continue to provide demographic appropriate educational material that suit the intended audiences.                          |

**Table 9 Cont'd: Demand Drivers, Projections, Impact on Services and Management Plan**

| Demand Driver             | Present Position  | Projection  | Impact on Services   | Demand Management Plan  |
|---------------------------|---|---|--|---|
| Aging Population          | Median Age from 2021 Canada Census: 41.6  | There is an anticipated increase in median age of population. By 2037 the population of seniors (75+) in Ontario is expected to increase to 2.1 times its current size. | The inevitable increase in median age of population is expected to have an impact on solid waste assets.           | The City will monitor aging population trends and the impact on solid waste assets. With the implementation of the Educational promotional services, discussed above, one of the goals will be to minimize the impact on collection and recycling. They City has been successful in achieving a decrease in garbage pickup from three bags to two bags, increasing the use of recycling and organic programs, thus increasing the landfill life and capacities. Further plans have been implemented to increase recycling and organic programming while decreasing solid waste pick up further to every other week.                                     |
| Seasonal Factors          | Drastic shifts in temperature and precipitation from summer to winter months                                      | Per climate change models, drastic shifts in temperature and precipitation from summer to winter months are expected to continue for the near future.                   | The shifts in temperature and precipitation will be monitored against the services provided by solid waste assets. | Solid waste operations will be monitored for its durability to withstand the shifts in temperature and precipitation. With more sever climatic rain events the landfills will be affected with the runoff of toxins from the landfill to the surrounding areas and potentially watersheds. Periods of extreme drought conditions may result in the parched soils covering a landfill etc. will see wind erosion to surrounding areas and methods of containment may be necessary to control the erosion. Collection of solid waste, organics and recycling can be compromised with more frequent weather events, making these tasks harder to complete. |
| Technological Advancement | The City monitors available technology to improve the level of service provided by solid waste operations assets. | The need for additional investment in technology is anticipated.  | Replacement cost of solid waste assets are expected to increase with technological advancement.                    | The replacement value of solid waste operations is monitored annually to reflect market demand resulting from Ministry guidelines and legislation and the latest technology.  |

|          |              |  |  |   |
|----------|--------------|--|--|---|
| Economic | Jobs: 79,440 | Jobs (2046):<br><ul style="list-style-type: none"> <li>• Modest: 81,230</li> <li>• Mid-Range: 85,750 (Reference Scenario)</li> <li>• High: 90,460</li> </ul> | The City's employment is expected to grow with the minor projected increase in population. Impact on solid waste operations assets is anticipated to be minimal. | The City will continue to monitor employment. Should the employment deviate from the expected constant, the data will be analyzed to formulate an appropriate plan. |
|----------|--------------|--|--|---|

**Table 9 Cont'd: Demand Drivers, Projections, Impact on Services and Management Plan**

| Demand Driver           | Present Position  | Projection   | Impact on Services  | Demand Management Plan   |
|-------------------------|---|--|---|--|
| Environmental Awareness | Through legislation and the City's own actions, the City has demonstrated that it recognizes the need for environmental and climate protection. | In recent years, environmental awareness has received more attention. This is expected to continue. Environmental awareness is anticipated to result in additional legislative requirements and stricter best practices. | New solid waste assets procedures and operations/sequences are being developed to produce lower emission outputs. Replacement cost of assets are expected to increase as environmental awareness increases. | The replacement value of solid waste operations is monitored annually to reflect Ministry legislations and the latest technologies. A review of policies will be reviewed and implemented as part of the solid waste management master plan update (2025-2035), which is underway. |

## 9. Climate Change

In September 2020, Council approved the Community Energy Emissions Plan (CEEP) that is the long-term plan to reduce carbon emissions and pollution in Greater Sudbury. The CEEP is a response to the City of Greater Sudbury Council’s Climate Emergency declaration in May 2019. The CEEP outlines 18 goals that need to be met to attain the City’s target of becoming a net-zero GHG emission community by 2050. For further information with respect to the Community Energy Emissions Plan, please visit: <https://www.greatersudbury.ca/live/environment-and-sustainability1/net-zero-2050/>.

Global climate models for the Greater Sudbury geographic area are available through various online resources, namely:

- Climatedata.ca, undertaken with the support of Environment and Climate Change Canada;
- Climateatlas.ca, undertaken with the support of Environment and Climate Change Canada, Public Health Agency of Canada, and Health Canada.

The City is beginning to monitor the effects of climate change on its infrastructure assets. The data provided in the websites suggest that it is a possibility that there will be an increase in precipitation and an overall increase in mean temperature for the municipality. The climate projection scenarios from climateatlas.ca suggest that the increase in mean temperature within the Greater Sudbury area may result in the possibility a decrease of freeze-thaw days, additional summer days, more extremely hot days, and additional tropical nights.

The long-term goal for solid waste, from the CEEP, is to achieve 90% solid waste diversion by 2050 and that an organics and biosolids anaerobic digestion facility is operational by 2030. The City of Greater Sudbury continues to work towards these goals.

Table 10 below outlines some of the climate change scenarios that are anticipated to have an impact on the assets that make up the solid waste portfolio.

| Variable                | Current Mean | RCP                 | 2021 - 2050    | 2051 - 2080    | Anticipated Impact  |
|-------------------------|--------------|---------------------|----------------|----------------|---|
|                         |              |                     | Mean           | Mean           |   |
| Precipitation (mm)      | 848          | High 8.5            | 904            | 938            | The increase in precipitation may require additional winter maintenance activities and landfill containment cover remedies. Leachate and stormwater management/containment may not be sufficient. |
|                         |              | Low 4.5             | 890            | 924            |   |
| Mean Temperature        | 4.3°C        | High 8.5<br>Low 4.5 | 6.5°C<br>6.3°C | 8.8°C<br>7.3°C | No specific impact.   |
| Tropical Nights (+20°C) | 1            | High 8.5            | 5              | 17             | With tropical nights and days, the humidity/fog make it harder for odors to dissipate into the atmosphere as they are trapped near the ground level.  |
|                         |              | Low 4.5             | 4              | 7              |   |
| Very Cold Days          | 5            | High 8.5            | 1              | 0              | “Turning” of organics can be  |

|                          |       |          |       |      |  |
|--------------------------|-------|----------|-------|------|--|
| (-30°C)                  |       | Low 4.5  | 2     | 1    | problematic with frozen earth.   |
| Very Hot Days (+30°C)    | 6     | High 8.5 | 18    | 39   | Landfill gases can be emitted and enhanced with hotter weather. Measures to control the fumes/odors.                       |
|                          |       | Low 4.5  | 16    | 24   |  |
| Frost-Free Season (days) | 137   | High 8.5 | 163   | 184  | The decrease in frost days will allow for easier waste collection and processing.  |
|                          |       | Low 4.5  | 157   | 168  |  |
| Freeze Thaw Cycles       | 68    | High 8.5 | 64.2  | 61.5 | No specific impact   |
|                          |       | Low 4.5  | 65.4  | 64.3 |  |
| Mild Winter Days (-5°C)  | 120.1 | High 8.5 | 103.6 | 84.2 | Decrease the time required to achieve the composting process for organic materials (green cart and leaf & yard trimmings). |
|                          |       | Low 4.5  | 104.5 | 96.6 |  |
| Summer Days (+25°C)      | 42.9  | High 8.5 | 68.9  | 93.8 | Potential for an increase in risk of brush fires.  |
|                          |       | Low 4.5  | 65.2  | 77.4 |  |
| Winter Days (-15°C)      | 58.4  | High 8.5 | 42    | 24.8 | No specific impact   |
|                          |       | Low 4.5  | 43.9  | 35.3 |  |

## 10. Improvement Opportunity

The City will take the following steps towards sustainability:

- Maintain full compliance with legislation;
- Continue to explore and bring forward opportunities to reduce and divert waste to extend the life of the existing landfill;
- Increase the emphasis on consistent initiative-taking maintenance and lower the volume of reactive maintenance;
- Environmentally sustainable initiatives;
- Monitor asset lifecycles for scheduled replacements;
- Advance technologies and maintain in house expertise;
- Look for opportunity to improve training and departmental workforce depth.
- Council will be provided with the opportunity to adjust the level of service provided to the community.

## 11. Appendix

| <b>Table ##: Consequences of Failure (CoF) for Solid Waste</b> |  |                  |
|--|--|------------------|
| <b>CoF Categories</b>  | <b>CoF Parameters</b>  | <b>Weighting</b> |
| <b>Sustainable Service Delivery</b>                            | Ensures that current service needs, and those services are delivered in a socially, economically, and environmentally responsible manner. Does not compromise the ability of future generations to meet their own needs.<br>Communities build and maintain infrastructure to provide services that support our quality of life, protect our health and safety, and promote social, economic, and environmental well-being.   | 20%              |
| <b>Strategic, Legislation and Environmental</b>                | Assets acquired, maintained, and disposed of strategically and in line with the City's strategic goals while following all legislation set forth by Federal, Provincial and Municipal bodies. Asset Management decisions are made in line with the environmental impacts   | 20%              |
| <b>Social Repercussions</b>                                    | When an asset fails, there may be minor or major impacts or inconveniences to the community. Social consequences can relate to safety, public health, service outages, or the public's ability to use or enjoy a park and recreation asset. Inconveniences may appear insignificant, but to members of the community, the inconvenience may be extremely important and may affect how they feel about the asset class in general. More consequential social costs include impacts related to public health and safety.   | 20%              |
| <b>Economic and Financial Losses</b>                           | A framework for the clear value of infrastructure planning and maintenance, while adjusting economic factors. Decision-making and investment planning best practices transform complex and technical material into non-technical principles and guidelines for decision making and facilitate the realization of adequate funding over the life cycle of the infrastructure. Examples include protocols for determining costs and benefits associated with desired levels of service; and strategic benchmarks, indicators or reference points for investment policy and planning decisions. | 20%              |
| <b>Redundancy and Mitigation</b>                               | Redundancy involves the use of duplicate assets in critical areas to provide a backup in the event of failure, as well as to allow for operational flexibility during day-to-day operations. If an asset fails, there is another asset that can operate in its place without causing downtime.   | 20%              |