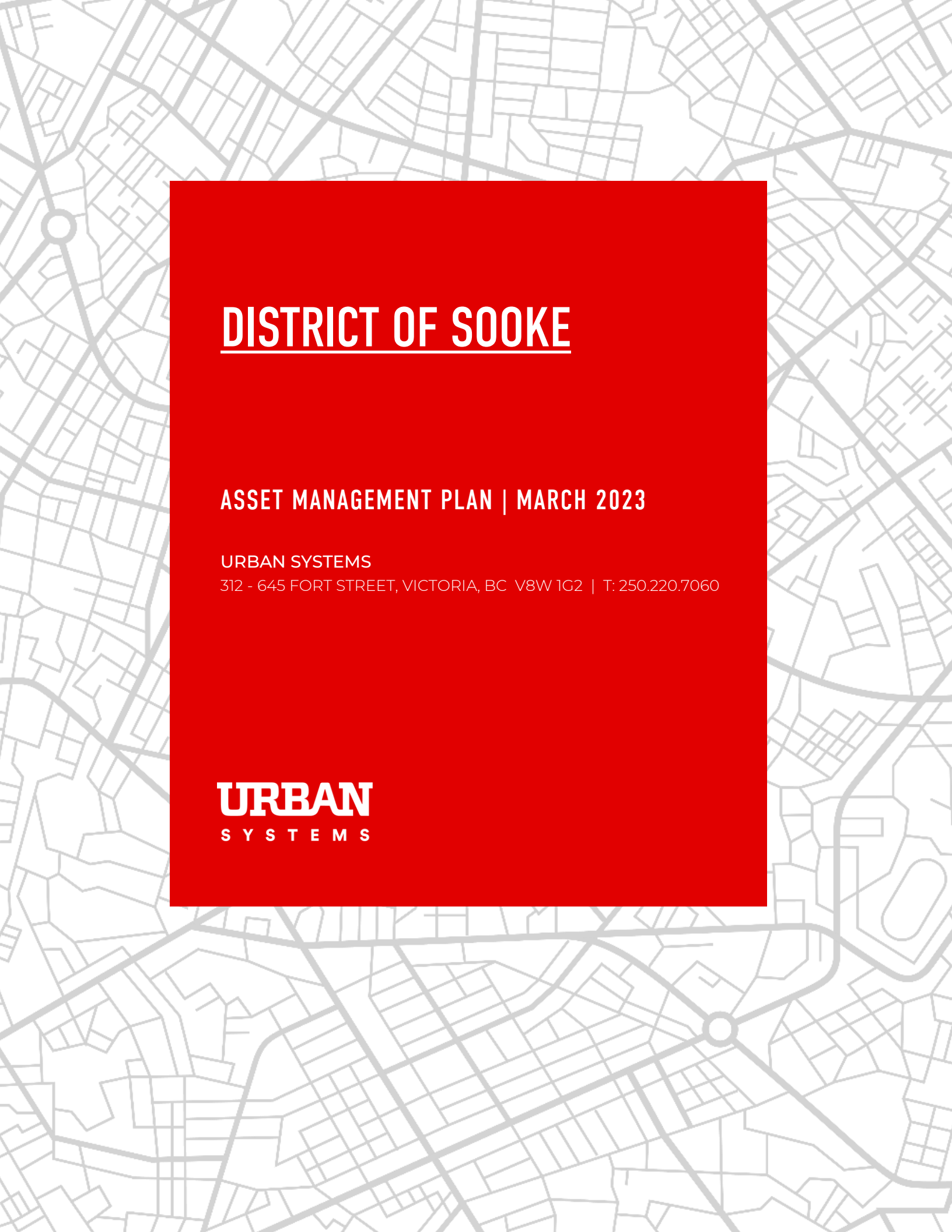


A light gray background map of Sooke, British Columbia, showing a dense network of streets and a few circular features representing roundabouts or parks.

DISTRICT OF SOOKE

ASSET MANAGEMENT PLAN | MARCH 2023

URBAN SYSTEMS

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URBAN
SYSTEMS

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TERMS AND DEFINITIONS

ASSET An engineered, cultural, or natural component that provides a valuable service to the community or otherwise supports service delivery.

ASSET MANAGEMENT A formalized, integrated, collaborative and continuous process of informing and making decisions about the District's assets so that they support sustainable service delivery. It includes the processes, practices, and systems that help support informed decisions that consider lifecycle cost, risk, and level of service. This includes bringing together the skills, expertise, and activities of people, and asset, and financial information.

ASSET CONDITION A measure of the level of service provided by an asset and a factor in the remaining life of the asset. When physical condition is not known, it is assumed to be a function of asset age.

AVERAGE ANNUAL LIFECYCLE INVESTMENT (AALCI) The replacement value of an asset divided by its service life (for example, an asset valued at \$100 with an expected service life of 10 years would be considered to have an AALCI of \$10). It is a long-term, high-level indicator of the reserve levels needed to ensure that like-for-like replacement of existing assets can occur, to support long-term sustainable service delivery.

ENGINEERED ASSETS Infrastructure that have been designed and constructed and are owned by the District (e.g., roads, streetlights, buildings, storm, and sanitary infrastructure). This also includes other physical assets acquired by the District (e.g., vehicles, specialty equipment, and park furniture). These assets must be operated, maintained, managed, and, ultimately replaced as they wear out.

INFRASTRUCTURE BACKLOG The value of assets that have reached their theoretical service life before 2021 and have not yet been replaced.

LEVEL OF SERVICE Includes the types of services provided (e.g., parks, playgrounds, bike lanes, and transportation networks), the standard of infrastructure in place (e.g., concrete sidewalks versus gravel paths), or the standard to which infrastructure is maintained (e.g., the frequency of scheduled curb sweeping, frequency of road surface maintenance).

LIFECYCLE COST (FULL) Considers total cost in today's dollars of the cost to construct or purchase an asset, the cost of maintaining the asset, and the future cost to replace the asset including site rehabilitation.

REMAINING LIFE The number of years remaining until an asset reaches its theoretical service life, measured from the year of installation or previous renewal.

REPLACEMENT VALUE The estimated cost to replace the asset, in 2021 dollars. Note: the replacement values used in this report are suitable for high-level, long-term financial planning; they are not intended for capital planning.

REPLACEMENT FORECAST A high-level indication of when an asset will need to be replaced or rehabilitated.

REVENUE The income received by the District from taxes, user fees, government transfers, and other sources. Own-source revenue refers to income received from taxation, user fees, and any interest income.

RISK(S) The analysis of the 'likelihood' and the 'consequences' of a given event. Establishing the risk associated with lower infrastructure performance due to Levels of Service or postponement of asset replacement will identify system vulnerabilities and assist in prioritizing maintenance standards and asset replacement. For example, puddles on a gravel walkway may have a high likelihood of occurring but the consequences are not significant. In comparison, an ageing sanitary main may have a high likelihood of failure and the consequences of a break may be significant.

SUSTAINABLE SERVICE DELIVERY An approach to delivering services that provides an appropriate level of service to the community while balancing trade-offs between potential risk and fiscally responsible decisions. Sustainable Service Delivery does not compromise the ability of future generations to meet their own needs.

THEORETICAL SERVICE LIFE The number of serviceable years an asset is expected to provide.

USEFUL LIFE The estimated time that an asset should remain in service to avoid asset failure or excessive maintenance costs.

1.0 INTRODUCTION

ASSET MANAGEMENT

Asset management (AM) is a continuous improvement process for making informed decisions that support sustainable service delivery—infrastructure assets exist to support service delivery. Delivering services sustainably requires considering current and future needs, managing risks and opportunities, and making the best use of limited resources.

The District of Sooke (the District) maintains the following infrastructure asset categories for the purpose of providing services to the community:

- Bridges
- Buildings
- Fleet (and equipment)
- Parks
- Stormwater drainage
- Transportation
- Sanitary sewer

Funding for these asset categories comes from two separate funds, or reserves. There is a fund for sanitary sewer assets, and a general fund, which includes all other asset categories.

N.B. Water supply and distribution is provided by the Capital Regional District

ASSET MANAGEMENT PLAN

The Asset Management Plan (AMP) is a way of documenting the current state of District-owned infrastructure assets. AM is a continuous improvement process, but the AMP is a snapshot in time. It should be updated to incorporate new assets and information as required.

The goal of the AMP is to equip staff, Mayor and Council, and the public with information that supports holistic decisions about services, that consider the community's expectations for services, the costs of providing service, and the risks to service delivery.

This AMP summarizes key information about the current state of assets by answering the following key questions:

- What assets do we own?
- How much are our assets worth?
- When might our assets need to be replaced?
- How much do we need to invest in our assets?
- What should the District do next?

When decisions are made that *don't* consider level of service, lifecycle cost, and risk (and the trade-offs between them), they can potentially lead to misalignment between the level of service that is being provided and funding levels required to sustain it.

This can result in service interruptions due to deteriorated asset condition, insufficient funding levels, or other risks and ultimately, erosion of public trust. Good asset management processes and practices help mitigate these problems.

2.0 WHAT ASSETS DO WE OWN?

The number of assets the District owns, and the timing and cost of their replacement, has substantial implications on the funding levels that are required to sustain the services provided by those assets. Below is a summary of the quantity of assets owned by the District, by fund and asset class.

Table 1: Asset Count Summary

Asset Categories and Types	Quantity (ea or m)
GENERAL FUND	
Bridges	6 ea
Buildings	30 ea
Fleet	35 ea
Parks	
Land Improvements and Structures	various
Irrigation systems	1,993 m
Storm	
Cleanout / IC	1,232 ea
Culvert	16,820 m
Headwall / Outfall	21 ea
Mains	31,730 m
Manhole	534 ea
Other	various
Service Connections	11,946 m
Transportation	
Electrical	540 ea
Road Surface	92,798 m
Pedestrian facilities	various
SANITARY FUND	
Sanitary	
Cleanout / IC	2,531 ea
Lift Station	6 ea
Mains	60,102 m
Manhole	629 ea
Other	various
Wastewater Treatment Plant	1 ea (3 components)
Service Connections	20,637 m
<i>N.B. quantity is in meters (m), and number of units/each (ea)</i>	

Asset material will also impact funding levels as it is a key indicator of the theoretical service life of the asset. Below is a summary of material type for the District's linear assets.

Table 2: Linear Asset Material

Asset Materials	Quantity (m)	% of Infrastructure
Sanitary		
HDPE	133	0.2%
PVC	59,969	99.8%
Storm		
Concrete	5,541	11.4%
CSP	13,924	28.7%
DI	584	1.2%
HDPE	1,288	2.7%
PVC	26,109	53.8%
Unknown	1,026	2.1%
Wood	79	0.2%

KEY OBSERVATIONS

Assessment of the District's asset inventory shows a relatively complete inventory for most asset classes, which is held in the District's AssetFinda system. A number of assumptions were made to improve the accuracy of the material life of assets. Assumptions are documented in **Appendix A**.

It is worth noting that the large quantity of PVC in the sanitary sewer system (99.8%) reflects a relatively new sanitary system, installed roughly between 2005 and 2021. Since PVC has a theoretical service life of 100 years, the District can expect less frequent maintenance and replacement requirements.

On the other hand, there are a variety of materials that makeup the stormwater drainage system. CSP in particular (28.7%) has a relatively short theoretical service life (30 years) and can erode more quickly based on environmental conditions. Where appropriate, replacing stormwater assets with PVC will extend the service life of assets and reduce maintenance requirements.

3.0 HOW MUCH ARE OUR ASSETS WORTH?

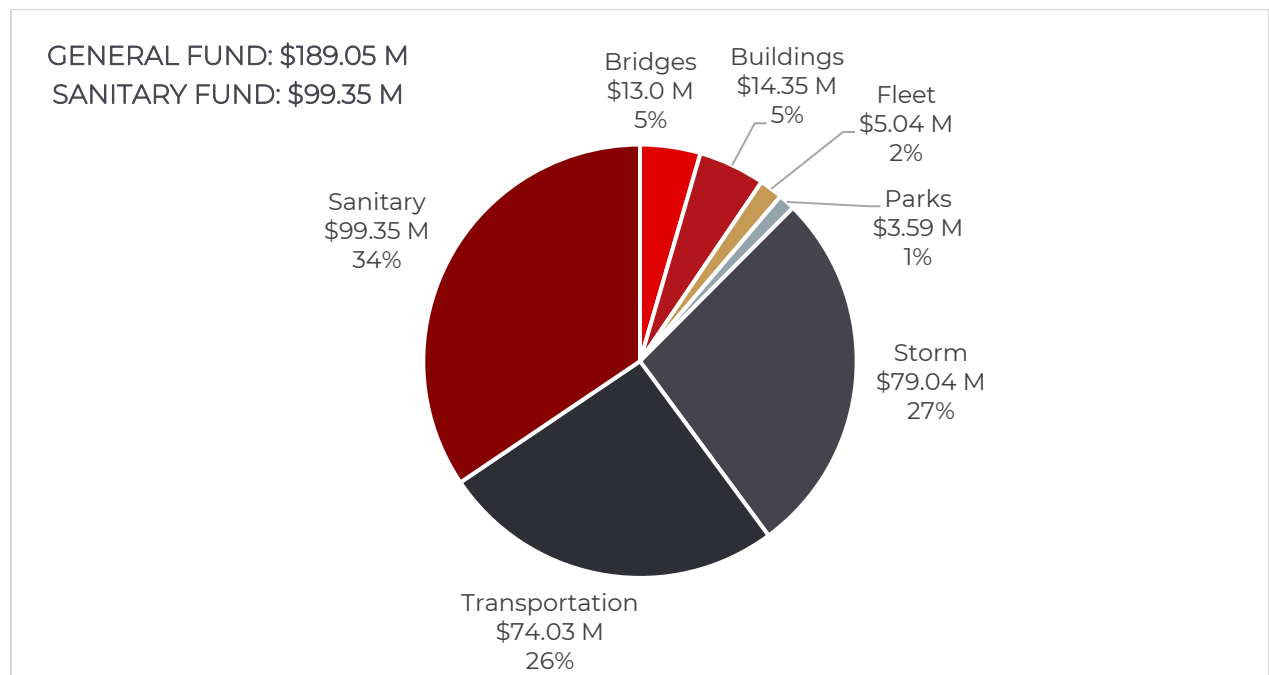
3.1 REPLACEMENT COST

The total replacement cost of the District's existing assets is estimated at **\$288.4 million** (2022 dollars). Replacement costs represent the magnitude of investment required to replace all assets the District currently owns, to the level of service it was designed to provide, assuming "like-for-like" replacement.

Asset replacement costs do not account for additional costs that may be incurred to satisfy growth or level of service increases due to regulatory requirements or other drivers such as safety, economic development, climate change mitigation/adaptation, or other alignment with community goals.

Like-for-like replacement costing represents the base cost of the asset at a minimum. It is a known and reliable cost that is suitable for the purpose of this AMP. The valuation was based on unit rates developed for this project, which are provided in **Appendix B**. Values are reported in millions (M), in 2021 dollars.

Figure 1. Asset Replacement Costs



KEY OBSERVATIONS

The District has a total asset replacement value of approximately \$288.4M, the equivalent of approximately \$19,000 per capita. The District's total asset replacement cost is likely lower than similar sized communities due to the fact that the District is not responsible for its own water supply and the relatively recent development of the sanitary sewer system.

4.0 WHEN MIGHT OUR ASSETS NEED TO BE REPLACED?

4.1 REMAINING ASSET LIFE & REMAINING VALUE

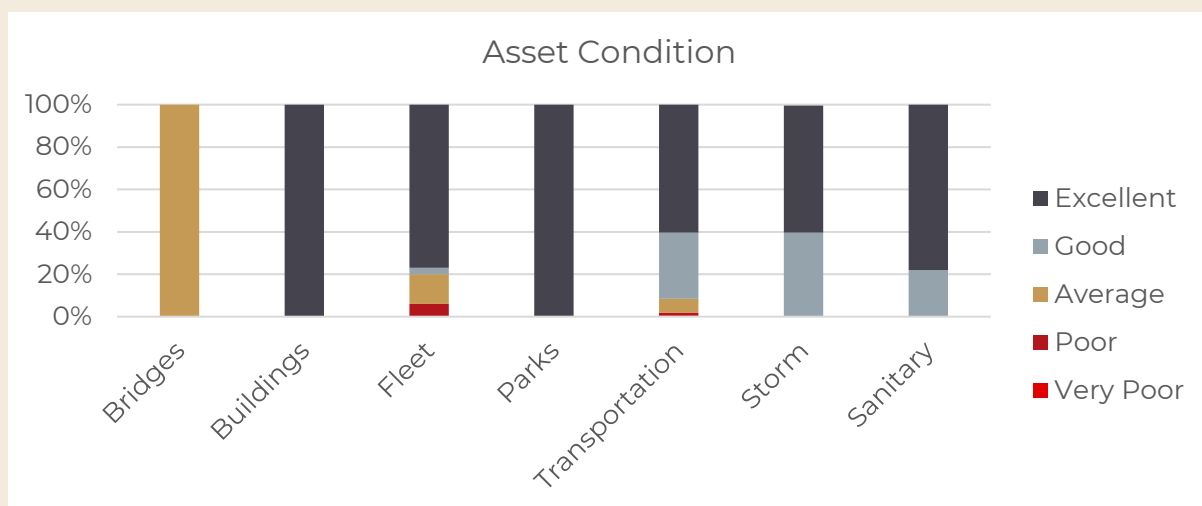
Understanding the remaining life and the remaining value of assets helps the District plan for potentially investment-heavy years and supports long-term financial planning and decision-making. This information can then be used to make decisions on funding and financing strategies, such as increases to contributions to reserves and when the District will rely on debt to finance replacement projects.

For this AMP, the asset remaining life was estimated as a function of the installation year and theoretical service life. They do not consider condition information, nor the impact of regular maintenance or upgrades, which may extend the service life of the asset or improve the asset condition. Regular maintenance is currently performed as required.

Theoretical service life estimates are generally based on rule-of-thumb values and are typically conservative; longer service lives may be achieved in practice due to various context dependent factors. Therefore, the remaining life values outlined in this AMP are a general estimation of how much serviceable life is left before the asset may require replacement and are likely conservative.

KEY OBSERVATIONS

Asset condition information is available in the District's asset inventory; however, it was determined that the information is not representative of the condition of assets observed by staff. Information in the asset inventory indicated that asset condition was generally better than what was observed (see graph below). It was determined with staff that the remaining value determined by the theoretical service life and installation year represented a more realistic interpretation of the condition of assets.



As an asset approaches the end of its service life, the remaining value of that asset will decrease in proportion to its replacement cost. This supports understanding where investments will need to be made for the asset's replacement (or upgrade if required).

To further support financial planning and decision-making, it is helpful to examine both percent remaining value and the percent of fund that the assets represent. This helps contextualize the impact of potential asset failure on the overall fund, allowing for informed decision-making on where to prioritize the allocation of resources for asset replacement within funds and on funding and financing strategies, considering all funds.

Table 3: Remaining Life and Remaining Value

Asset Categories and Types	% of Remaining Life	% of Remaining Value	% of Fund
GENERAL FUND	63%	47%	100%
Bridges	42%	53%	7%
Buildings	56%	50%	8%
Fleet	38%	39%	3%
Parks	33%	52%	2%
Land Improvements and Structures	30%	52%	2%
Irrigation systems	43%	57%	0%
Storm	71%	63%	42%
Cleanout / IC	87%	87%	1%
Culvert	38%	40%	14%
Headwall / Outfall	91%	91%	0%
Mains	75%	74%	25%
Other	81%	81%	1%
Service Connections	85%	85%	1%
Transportation	53%	29%	39%
Electrical	76%	76%	3%
Pedestrian facilities	53%	74%	2%
Road Surface	29%	23%	35%
SANITARY FUND	83%	82%	100%
Cleanout / IC	83%	84%	2%
Lift Station	83%	83%	5%
Mains	86%	86%	80%
Other	80%	82%	7%
Wastewater Treatment Plant	40%	34%	7%

Note that the replacement value of manholes and service connections (sanitary), and manholes and catch basins (storm) are included in the linear unit rates for sanitary and stormwater main replacement and are not included in the remaining life and remaining value calculation.

KEY OBSERVATIONS

General Fund

The remaining value of the general fund currently sits at 47% – this represents a remaining value of **\$89.23M**. Similarly, the bridges, buildings, fleet, and parks collectively have a percentage remaining value of approximately 50%, which accounts for 19% of the general fund.

The percentage remaining value of stormwater is slightly higher (63%); however, culverts have a percentage remaining value of only 40%. Culverts constitute 14% of the general fund. Road surfaces have lower percentage remaining value left (23%) and represent 35% of the general fund.

Transportation and storm assets account for 81% of the District's general fund – the District can expect the need for significant investments in these asset categories in future years.

Sanitary Fund

The percentage remaining value of sanitary sewer fund assets is high (82% or **\$81.71M**). This is likely a result of relatively new sanitary infrastructure, using materials (PVC) that have a long service life.

While the remaining value of the wastewater treatment plant is lower (34%), this asset makes up 7% of the total value of the sanitary fund. The treatment plant has various components which have shorter service lives, which will require more frequent replacement. The service life of the mechanical and electrical components (25 years) and structural components (50 years) within the treatment plant were developed with District staff.

4.2 ASSET REPLACEMENT FORECAST

The Asset Replacement Forecast (ARF) below is a high-level, 50-year forecast of approximate asset replacement timing, to illustrate how replacement needs vary over time. The ARF is based on the estimated remaining life of assets and is an estimation of when assets might need to be replaced for the purpose of informing long-term financial planning and decision-making such as funding and financing strategies.

When an asset is actually replaced is a decision that should be based on numerous factors and the trade-offs between them, including but not necessarily limited to asset condition and risk of failure; the cost to replace the asset; other risks to service delivery such as climate change; growth and level of service increases; and needs across asset classes.

There is an ebb and flow of investment over the years due to estimated asset lives: some years there may not be costs associated with a specific asset type as replacement in a previous year commences the new service life.

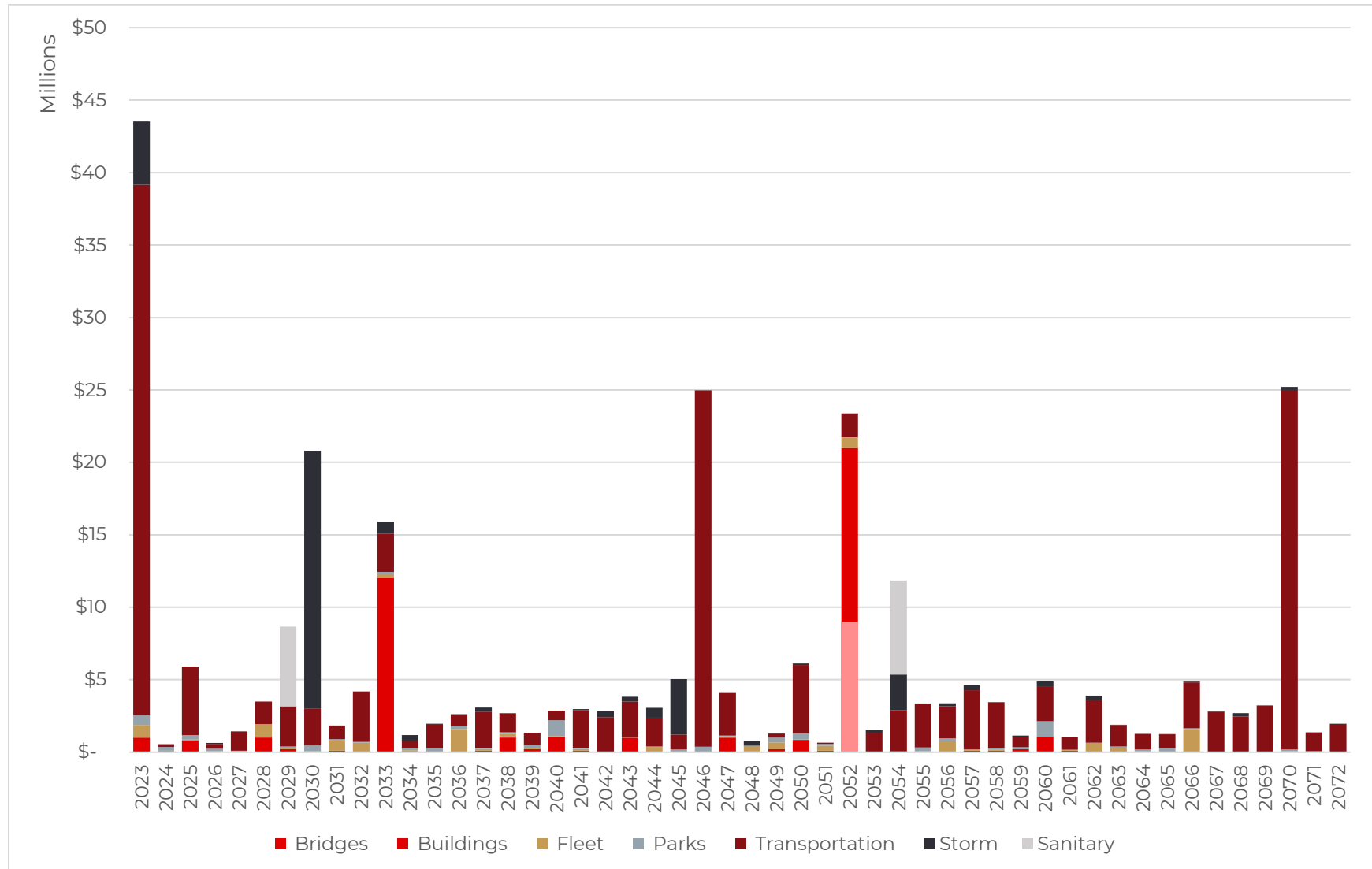
This forecast should be used to inform long-term financial planning decisions – as the data on which the forecast is based is grounded in conservative estimates, the forecast should not be relied upon for capital planning or annual budgeting.

KEY OBSERVATIONS

The ARF predicts a substantial demand for replacing and investing in transportation, storm, buildings, and bridges in the next five decades.

Immediate replacement needs are the result of a backlog of assets that have already exceeded their expected service lives. Within transportation, we can see the result of road surfaces that are beyond their service life, resulting in significant investment needs. Similarly in storm, we can expect that many culverts may require immediate replacement. This aligns with feedback provided by staff on the existing condition of road surfaces and culverts in the District.

Figure 2. 50-year Asset Replacement Forecast (ARF)



5.0 HOW MUCH DO WE NEED TO INVEST IN OUR ASSETS?

5.1 METHODOLOGY

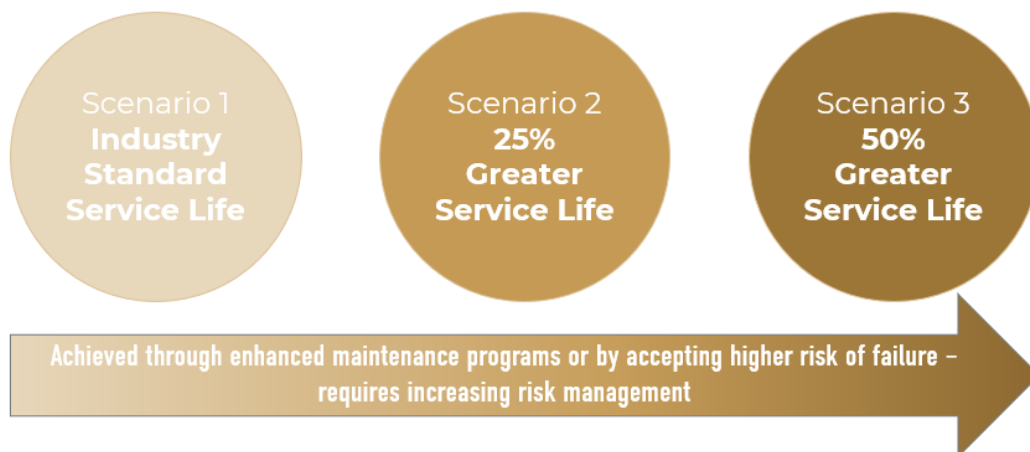
There is no easy answer to what the “right” investment level in long-term asset replacement is. The decision requires thoughtful review and consideration of the trade-offs between cost, risk, and level of service. The preceding sections provided an overview of costs through the lens of replacement cost, and risk of condition-based failure based on asset age. This section provides an assessment of cost, risk, and the District’s capacity for investment, through an evaluation of two key indicators:

- **Average Annual Lifecycle Investment (AALCI)** – the AALCI is the sum of the total replacement cost of each asset divided by its theoretical service life and is expressed in dollars per year. It is a long-term, high-level indicator of the annual funding needed to ensure that like-for-like replacement of existing assets can occur when needed, to mitigate risks and sustain services.

It is not an indication of actual annual costs or of actual annual spending. It does not include funding needed for new assets or upgrades to assets to accommodate growth or increases in level of service

- **Difference between current funding levels and AALCI** – both are annual costs and a high-level comparison between them provides an indication of the extent to which current funding levels may be sufficient over the long term for asset replacement or present risks to sustainable service delivery.

The AALCI is sensitive to assumptions on asset replacement cost and service life. The shorter the service life/faster the replacement cycle, the higher the AALCI. The industry standard theoretical service lives for assets are likely conservative as previously discussed, and in practice, assets could last much longer, which will reduce the resulting AALCI. As such, three scenarios are considered for the AALCI for the District’s assets:



- **Scenario 1 - Theoretical service life** – based on industry standard values for theoretical service life as outlined in Appendix B
- **Scenario 2 - 25% greater service life** – this could potentially be achieved in practice through enhanced maintenance programs OR by accepting a higher risk of failure as assets exceed their theoretical service life
- **Scenario 3 - 50% greater service life** – this could potentially be achieved through even more enhanced maintenance OR by accepting an even higher risk of failure as assets exceed their theoretical service life

Figure 3. Average Annual Lifecycle Investment (AALCI) by Fund

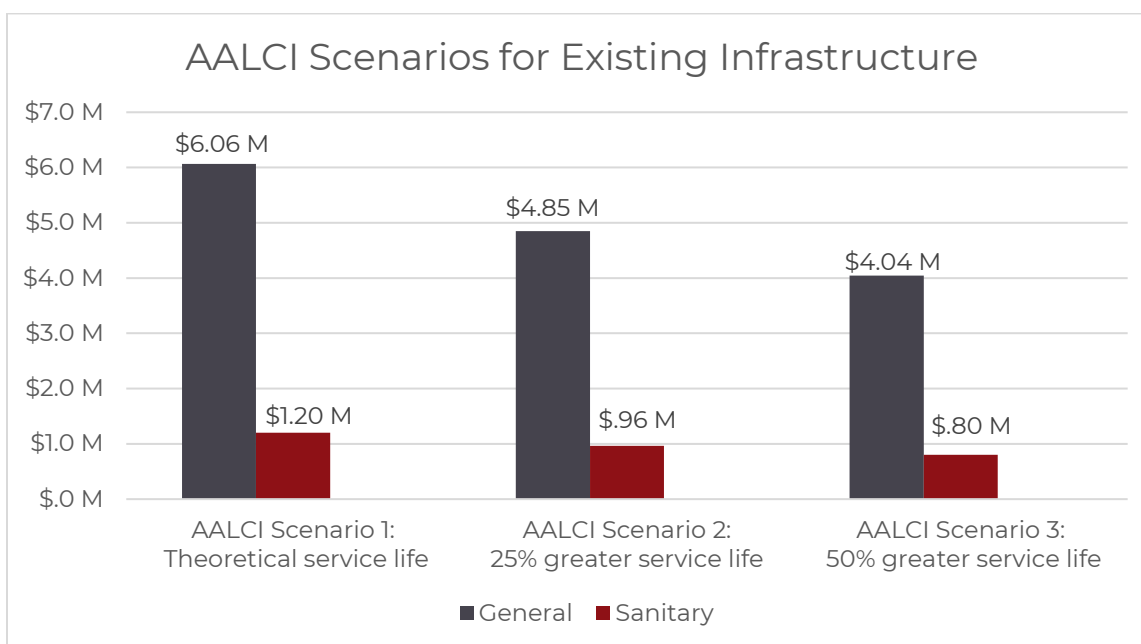


Table 4. Average Annual Lifecycle Investment (AALCI) Scenarios

Asset Category	AALCI Scenario 1: Theoretical service life	AALCI Scenario 2: 25% greater service life	AALCI Scenario 3: 50% greater service life
GENERAL FUND	\$6.06M	\$4.85M	\$4.04M
Bridges	\$0.26M	\$0.21M	\$0.17M
Buildings	\$0.73M	\$0.58M	\$0.49M
Fleet	\$0.24M	\$0.19M	\$0.16M
Parks	\$0.55M	\$0.44M	\$0.37M
Storm	\$2.82M	\$2.25M	\$1.88M
Transportation	\$1.46M	\$1.17M	\$0.98M
SANITARY FUND	\$1.20M	\$0.96M	\$0.80M

5.2 LONG TERM FINANCIAL STRATEGIES

Identifying long-term financial strategies provides strategies for financial resiliency as it is a necessary part of bridging the gap between potential costs and available funding. This is determined by analyzing the difference between current funding levels and the AALCI scenarios.

This plan only focuses on the funding needed to replace the current assets of the District. It does not consider the costs of new and upgraded infrastructure for growth and service needs in decision-making. The District's AALCI will increase with the addition of new infrastructure. Long-term financial strategies can help decide whether the capital program is affordable or requires cost containment.

Residents and ratepayers are both the recipients of services and the primary source of funding. Therefore, adjustments between service levels and funding should reflect the community's priorities, willingness to pay, and Council decisions in fulfilling their stewardship and governance obligations. The AMP will require regular updates (every 5 years to 7 years) and long-term financial planning will act as the foundation for significant parts of the annual budget.

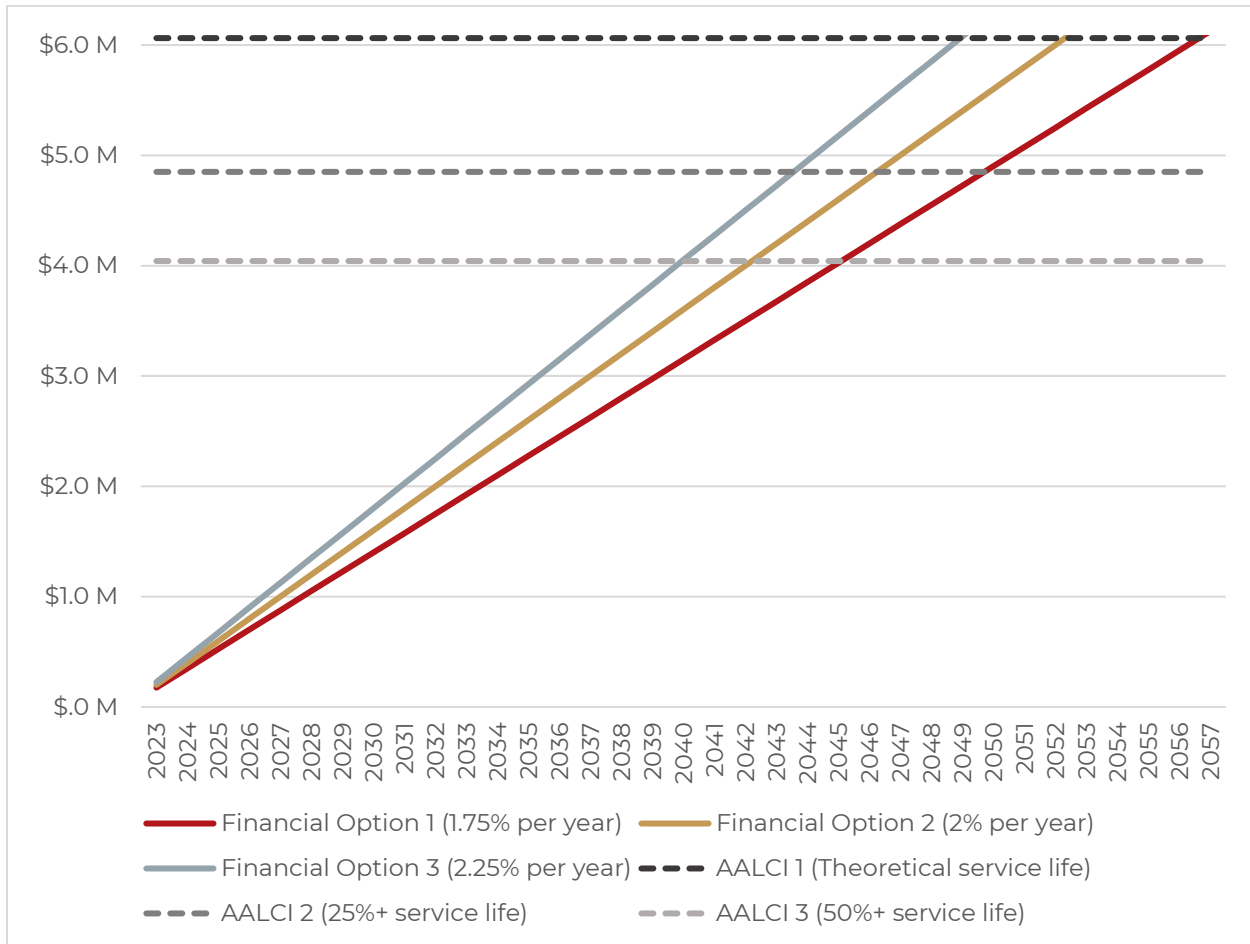
GENERAL FUND

For the General Fund, the following three financial options are considered to achieve the District's AALCI scenarios.

Table 5. Financial Options for achieving Average Annual Lifecycle Investment (AALCI) Scenarios for the General Fund

	AALCI Scenario 1 (Theoretical service life)	AALCI Scenario 2 (25% greater service life)	AALCI Scenario 3 (50% greater service life)
Financial Option 1 assumes an annual tax increase of 1.75%	2057	2050	2046
Financial Option 2 assumes an annual tax increase of 2%	2053	2047	2043
Financial Option 3 assumes an annual tax increase of 2.25%	2050	2044	2040

Figure 4. General Fund Long Term Financial Scenarios



In **financial option 1**, attaining sustainable funding levels will take longer. The most conservative AALCI scenario 1 (theoretical service life) is attained by 2057. While this scenario has the lowest impact on taxpayers, insufficient funding to replace failing assets poses a strategic financial risk. The District can potentially achieve this scenario by implementing enhanced maintenance practices as assets surpass their theoretical service life. **Financial option 3** is the most accelerated approach with the lowest level of risk. In this option, the funding required for the theoretical service life of assets (AALCI Scenario 1) is attained by 2050.

SEWER FUND

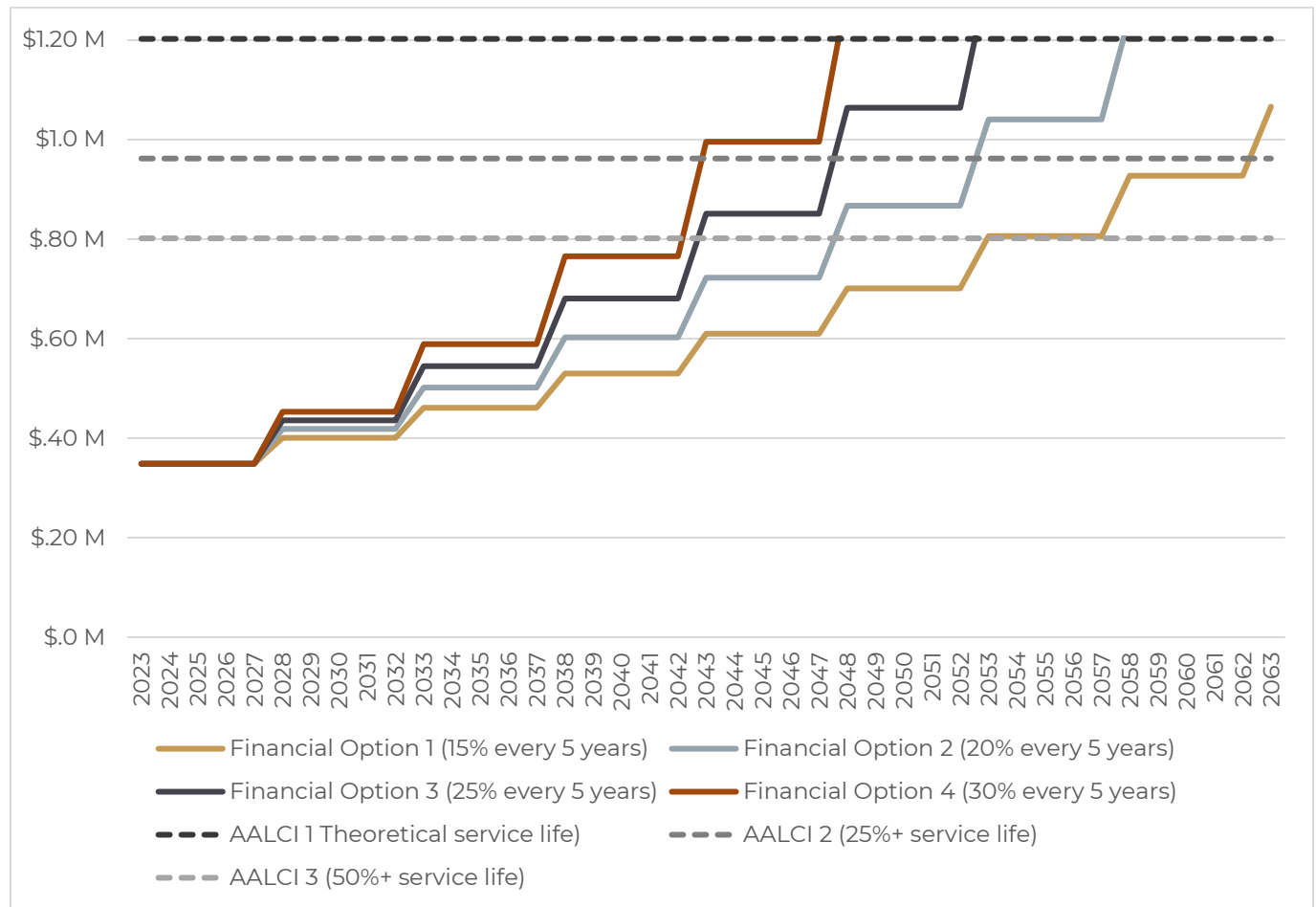
For the Sewer Fund, the following the following four financial options are considered to achieve the District's AALCI scenarios.

Table 6. Financial Options for achieving Average Annual Lifecycle Investment (AALCI) Scenarios for the Sewer Fund

	AALCI Scenario 1 (Theoretical service life)	AALCI Scenario 2 (25% greater service life)	AALCI Scenario 3 (50% greater service life)
Financial Option 1 assumes a user rate increase of 15% every 5 years	n/a	2063	2053
Financial Option 2 assumes a user rate increase of 20% every 5 years	2058	2053	2048
Financial Option 3 assumes a user rate increase of 25% every 5 years	2053	2048	2043
Financial Option 4 assumes a user rate increase of 30% every 5 years	2048	2043	n/a

As in the previous section, **financial option 1** is the slowest to attain sustainable funding levels and requires enhanced maintenance practices as assets surpass their theoretical service life. Each financial option thereafter reduces the level of financial risk. **Financial option 4** is the most accelerated financial approach with the lowest level of risk. In this option, funding for the theoretical service life of assets is attained by 2048.

Figure 5. Sewer Fund Long Term Financial Scenarios



The AALCI contemplates the reserve continuity over the long term and is used for long-term financial planning that can encourage saving for future rehabilitation and replacement. Master Plans provide more detailed information for asset needs in the next 10 years and are more reliable for near-term capital and financial planning. The AALCI is used to transition from those more precise near-term Master Plan cost estimates to longer-term cost estimating and financial planning.

The AALCI is not an indicator of actual annual capital spending, which may be lower or higher depending on the stage of the asset's lifecycle. Newer assets require annual spending that will be less than the AALCI and older assets will require annual spending which will exceed the AALCI. In years of lower spending the portion of the AALCI (if translated to actual funds) not spent in the current year should be directed towards reserves that can be drawn on in later years to balance when spending exceeds the AALCI.

The AALCI represents funding levels needed for replacement of existing assets, assuming like-for-like replacement (with some exceptions on materials as outlined in **Appendix B**). Any upgraded or new infrastructure acquired by the District will incur a future replacement cost that would affect future calculations of the AALCI – it is an ever-evolving value.

Values in the tables below are in 2022 dollars and will need to be adjusted for inflation for future costing. Since inflation is difficult to predict, it is recommended that the AMP be updated at least every 5 to 7 years.

5.3 INCORPORATING CLIMATE CHANGE ADAPTATION

Integrating climate change considerations into asset management planning processes supports a long-term view of sustainable service delivery, more informed decision making and enhance service delivery. Climate change will have minor to significant impacts on community assets and service delivery, including the following:

- Increased levels of risk to delivering target levels of service to residents
- Increased costs associated with managing risks and delivering target levels of service
- Decreased asset lifecycles associated with changes in loads and stresses

Without adaptation, the costs of climate change damage to homes and buildings, roads, railways, and electricity systems are expected to increase dramatically in the years to come. Investments in adaptation are shown to generate benefits almost immediately, and adaptation measures provide up to a \$13-\$15 return on investment for every one dollar spent.¹

To identify and address these impacts, a climate change vulnerability assessment was conducted with the asset management plan in **Appendix C**. The climate change vulnerability assessment draws on available climate change projections and the knowledge of community staff.

To support adapting infrastructure to climate change hazards it is recommended that future work under the AM program looks to rank climate change risks alongside other asset risks to support prioritization of risk management actions such as capital and operational improvements.

Given the high costs of damage and of adapting to climate change it is recommended that an additional minimum of 1% is levied annually to support infrastructure adaptation and mitigate climate change vulnerability to the general fund.

¹ (Canadian Climate Institute, 2022)

6.0 CLOSING REMARKS

The 2023 AMP serves as a tool for Council and staff to make informed decisions on funding levels and communicate with the community regarding service levels and funding needs, with the goal of making more resilient funding decisions for the community's long-term benefit.

Analysis shows that infrastructure maintenance has significantly extended the service life of assets. Updating the AMP every 5 to 7 years to reflect new information, improvements, and additions to the asset inventory is crucial. The updated AMP should inform a review of funding levels and long-term financial strategies to support the District in meeting targeted funding levels for renewal.

Success of the AMP is reliant on implementing incremental and steady annual financial increases to reach revised financial trajectories and regularly reviewing and updating long-term financial strategies.

APPENDIX A

DATA SOURCES AND ASSUMPTIONS

Date: August 3, 2022
To: Jeff Carter
From: Laura Bernier
File: 2493.0015.01
Subject: Gap Assessment and Data Review Memo

1.0 OVERVIEW

In support of the Asset Management Plan being prepared for the District of Sooke, we have conducted a review of the GIS data for the District's major assets, including sewer, water, and general (drainage, roads, transportation, building, parks, fleet).

The datasets were provided by the District to Urban Systems for this project. The following key attributes were assessed for completeness: install date, material, diameter, length, width, and height. Additionally, the data gap assessment provides a existing assumptions in the asset inventory for asset replacement costs and service lives.

The following memo is a snapshot of the District's current Asset Inventory for the purpose of understanding what information is known about the District's assets. However, some gaps in data might not need to be completed. In some cases, the District may determine that it is not worth filling gaps in the data, or that other proxies should be used instead.

General observations from the assessment of the data show a relatively completely inventory for most asset classes. The remainder of the overview sections includes noteworthy observations and assumptions, along with a recommended approach for addressing gaps in the asset inventory.

Observations on Linear Assets

- Service lives of linear assets are universally assumed at 80 years, regardless of material (Section 5.2).
 - o Urban to recommend new proposed service lives to determine the updates replacement schedule.
- Pipe diameters do not consistently follow nominal diameter for pipes (Sections 5.1.1 – 5.1.2)
 - o Discussion with District staff to identify pipe diameters, where known, and determine an approach for assumptions moving forward.
- Replacement costs for some linear assets are missing. However, replacement cost values may change over time, and will be developed through the AMP process.
- It is assumed that the District does not own any municipal water supply or distribution, which is provided by the CRD or from private wells.
- Linear water assets consist of irrigation lines.
 - o These assets and their replacement costs are to be confirmed with District staff.
- There is some diameter and material information missing for culverts in storm systems.

- We propose making assumptions based on the average of the existing inventory given the high level of completion (89%), unless otherwise specified by District staff.
- Some material and width information for roads is missing.
 - We propose assuming all materials are asphalt, unless otherwise specified (e.g., gravel/dirt).
 - Width information will be determined using road classifications, the data for which is complete (100%).
- Linear assets contain some very small lengths.
 - Review and confirm with District staff.
- Linear transportation assets (sidewalks) are missing material information. However, materials (asphalt, concrete, pavers) are captured in the asset description.

Observations on Non-Linear Assets

- Non-linear replacement costs should be reviewed and confirmed by staff. Note that the services lives of all buildings are currently assumed at 1 year.
- Key attributes are missing for bridges. However, there is adequate information based on replacement costs and installation dates that are provided.
- Parks include many asset categories and subcategories with inconsistent levels of information and small replacement values.
 - Parks assets should rely on TCA information alone – this approach is aligned with best practice. District to provide Urban with TCA information.

Additional Questions

- What is the level of staff confidence in the accuracy in the asset inventory (installation dates, and replacement costs and services lives for non-linear assets, etc.)?
- Where unspecified, is there an assumed year that we can use for the development of replacement costs?
- Typically, we use CPI for inflation – confirm this approach.

2.0 SUMMARY OF DATA GAPS (LINEAR AND NON-LINEAR ASSETS)

The following represents a comprehensive summary of the gaps within key attributes. However, as previously mentioned, not all gaps in data need to be completed. In some cases, the District may determine that it is not worth filling gaps in the data, or that other proxies should be used instead.

Asset Class	Dataset	Asset Description and Data Gaps <i>(data is complete unless otherwise specified)</i>
Sanitary System <i>Notes:</i> <i>Some very small lengths (i.e., 0.7m, 0.9m, 1m)</i>	San_Lines	Gravity Main Force Main Low Pressure Main WWTP Gravity Main
	San_Points	Drain Manhole
	San_Service	LPSanServiceConn SanServiceConn SanServicePrivate
Water System <i>Notes:</i> <i>Some very small lengths (i.e., 0.5m, 0.9m)</i>	Wat_Point	Cistern Water Meter Water Nozzle Water Valve
	Wat_Service	Irrigation 0% Diameters (112 missing) 96% Materials (4 missing)
General		
Storm System <i>Notes:</i> <i>Some very small lengths (i.e., 0.03, 0.4, 0.5 – assumed meters)</i>	Drainage Lines	Culvert 89% Diameters (80 missing) 89% Materials (80 missing) Ditch DW-Culvert Storm-Culvert Stormline Swale
	Drainage Points	Area Drain Catch Basin Drain Manhole drnCleanout drnHeadwall drnOutfall Inspection Chamber
	Drainage_Polygon	Rainwater
	Drainage_Service	drnCBLead 99% Materials (4 missing) drnCurtain drnServiceConn

Asset Class	Dataset	Asset Description and Data Gaps (data is complete unless otherwise specified)
Roads Notes: Some road segments have a replacement cost of 1. To be reviewed.	Roads	Roads 53% Materials (465 missing) 0% Width (991 missing)
Transportation	SidewalksTrails	Asphalt Sidewalk 0% Materials (25 missing) Boardwalk Trail Boat Launch Concrete Sidewalk 0% Materials (175 missing) Crosswalk Crosswalk-Signalized Multi-Use Trail Paver Sidewalk 0% Materials (11 missing)
	Street_Signs	Street Signs
	Streetlights	Street Lights
	Bridge	Bridge 0% Materials (6 missing) 0% Length (6 missing) 0% Width (6 missing)
Building Notes: Buildings have a material life of 1. To be reviewed	TCA_Buildings	TCA_Buildings
Parks	Parks_Points	Parks information is more granular than what is useful for asset replacement purposes and should be based on TCA information. A detailed analysis of data gaps is available in Appendix A.
Fleet	Fleet	Fleet

3.0 EXISTING REPLACEMENT COSTS AND SERVICE LIVES

3.1 REPLACEMENT COSTS (LINEAR ASSETS)

Existing replacement cost values are identified based on the average cost for PVC in Sooke's asset inventory based on asset diameter (mm). The following schedules show inconsistent records for pipe diameters. Updated replacement costs values will be costs developed for the AMP.

3.1.1 Drainage

Diameter (mm)	Replacement Cost (\$)
drnCBLed	
100	200
150	200
200	200
250	200
300	n/a
400	n/a
1000	n/a
drnServiceConn	
100	200
150	200
200	200
250	200
750	200
1000	n/a
Stormline	
50	75
75	80
100	120
150	160
200	220
250	250
300	235
350	240
375	245
400	270
450	295
500	312.5
525	330
550	330
600	330
675	330
700	330
750	n/a
800	n/a
900	n/a
1050	n/a

3.1.2 Sewer

Diameter (mm)	Replacement Cost (\$)
Force Main	
50	100
75	125
100	165
150	200
200	175
250	275
300	325
Gravity Main	
100	165
150	200
200	175
250	275
300	325
375	400
Low Pressure Main	
50	100
75	125
100	165
LPServiceConn	
50	1500
75	1500
100	1500
SanServiceConn	
50	1500
100	1500
150	1500
200	1500
250	1500
SanServicePrivate	
50	1500
WWTP Gravity Main	
100	165
150	200
200	175
300	325
500	n/a

3.2 SERVICE LIVES (LINEAR ASSETS)

Existing service lives are identified based on Sooke's asset inventory based on asset material. The following schedules show that there are inconsistent records for pipe diameters and that service lives of linear assets are universally assumed at 80 years, regardless of material. Proposed service lives will be developed to update the replacement cost schedule using nominal diameter for pipes.

Material	Service Life
BOSS	80
CMP	80
Concrete	80
CSP	80
DI	80
DR41	80
HD DI	80
HDPE	80
Natural	80
PVC	80
PVC PERF	80
PVC UR	80
RCP	80
Rock	80
Unknown	80
Wood	80

3.3 REPLACEMENT COSTS AND SERVICE LIVES (NON-LINEAR ASSETS)

Existing non-linear replacement costs are identified based on Sooke's asset inventory.

Asset Class	Dataset	Asset Description (non-linear)	Replacement costs	Service Life (years)
Water System	Wat_Point	Cistern	\$5,000 each	50
		Water Meter	\$3,500 each	10
		Water Nozzle	\$1,000 each	10
		Water Valve	\$1,000 each	10
General				
Drainage	Drainage Points	Area Drain	\$3,000 each	80
		drnCLeanout	\$1,000 each	80
		drnHeadwall	\$3,000 each	80
		drnOutfall	1 lm @ \$2,000	80
		Inspection Chamber	\$1,000 each	80
Transportation	Street_Signs	Street Signs	\$76,260 (valued at \$100 or \$160)	10, 25, or 50
	Streetlights	Street Lights	\$5,400,000 (each valued at \$10,000)	50
	Bridge	Bridge	\$3,000,000 (each valued at \$500,000)	50
Building	TCA_Buildings	TCA_Buildings	See Facility Replacement Costs	1
Parks	Parks_Points		To be based on TCA information	1 - 50
Fleet	Fleet	Fleet	\$5,040,000	10 - 30

APPENDIX A - GAP ASSESSMENT RESULTS

1.0 SEWER

San_Lines

Gravity Main	# Present	# Missing	Total # of Assets	Completeness %
Diameters	762	0	762	100%
Install Dates	762	0	762	100%
Materials	762	0	762	100%
Length	762	0	762	100%

Force Main	# Present	# Missing	Total # of Assets	Completeness %
Diameters	78	0	78	100%
Install Dates	78	0	78	100%
Materials	78	0	78	100%
Length	78	0	78	100%

Low Pressure Main	# Present	# Missing	Total # of Assets	Completeness %
Diameters	113	0	113	100%
Install Dates	113	0	113	100%
Materials	113	0	113	100%
Length	113	0	113	100%

WWTP Gravity Main	# Present	# Missing	Total # of Assets	Completeness %
Diameters	15	0	15	100%
Install Dates	15	0	15	100%
Materials	15	0	15	100%
Length	15	0	15	100%

San_Points

Drain Manhole	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	3592	0	3592	100%

San_Service

LPSanServiceConn	# Present	# Missing	Total # of Assets	Completeness %
Diameters	449	0	449	100%
Install Dates	449	0	449	100%
Materials	449	0	449	100%
Length	449	0	449	100%

SanServiceConn	# Present	# Missing	Total # of Assets	Completeness %
Diameters	2389	0	2389	100%
Install Dates	2389	0	2389	100%
Materials	2389	0	2389	100%
Length	2389	0	2389	100%

SanServicePrivate	# Present	# Missing	Total # of Assets	Completeness %
Diameters	1	0	1	100%
Install Dates	1	0	1	100%
Materials	1	0	1	100%
Length	1	0	1	100%

2.0 WATER

Wat_Point

Cistern	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	2	0	2	100%

Water Meter	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%

Water Nozzle	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	256	0	256	100%

Water Valve	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	9	0	9	100%

Wat_Service

Irrigation	# Present	# Missing	Total # of Assets	Completeness %
Diameters	0	112	112	0%
Install Dates	112	0	112	100%
Materials	107	5	112	96%
Length	112	0	112	100%

3.0 GENERAL

3.1 DRAINAGE

Drainage Lines

Culvert	# Present	# Missing	Total # of Assets	Completeness %
Diameters	623	80	703	89%
Install Dates	703	0	703	100%
Materials	623	80	703	89%
Length	703	0	703	100%

Ditch	# Present	# Missing	Total # of Assets	Completeness %
Diameters	N/A	N/A	N/A	N/A
Install Dates	1081	0	1081	100%
Materials	1081	0	1081	100%
Length	1081	0	1081	100%

DW-Culvert	# Present	# Missing	Total # of Assets	Completeness %
Diameters	859	0	859	100%
Install Dates	859	0	859	100%
Materials	859	0	859	100%
Length	858	1	859	100%

Storm-Culvert	# Present	# Missing	Total # of Assets	Completeness %
Diameters	60	0	60	100%
Install Dates	60	0	60	100%
Materials	60	0	60	100%
Length	60	0	60	100%

Stormline	# Present	# Missing	Total # of Assets	Completeness %
Diameters	766	0	766	100%
Install Dates	766	0	766	100%
Materials	766	0	766	100%
Length	766	0	766	100%

Swale	# Present	# Missing	Total # of Assets	Completeness %
Diameters	N/A	N/A	6	
Install Dates	6	0	6	100%
Materials	6	0	6	100%
Length	6	0	6	100%

Drainage Points

Area Drain	# Present	# Missing	Total # of Assets	Completeness %
Diameters	N/A	N/A	N/A	N/A
Install Dates	8	0	8	100%
Materials	N/A	N/A	N/A	N/A
Length	8	0	8	100%

Catch Basin	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	663	0	663	100%

Drain Manhole	# Present	# Missing	Total # of Assets	Completeness %
Diameters	534	0	534	100%
Install Dates	534	0	534	100%

drnCleanout	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	118	0	118	100%

drnHeadwall	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	20	0	20	100%

drnOutfall	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%

Inspection Chamber	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1114	0	1114	100%

Drainage_Polygon

Rainwater	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	26	0	26	100%
Materials	26	0	26	100%

Drainage_Service

drnCBLead	# Present	# Missing	Total # of Assets	Completeness %
Diameters	520	0	520	100%
Install Dates	520	0	520	100%
Materials	516	4	520	99%
Length	520	0	520	100%

drnCurtain	# Present	# Missing	Total # of Assets	Completeness %
Diameters	4	0	4	100%
Install Dates	4	0	4	100%
Materials	4	0	4	100%
Length	4	0	4	100%

drnServiceConn	# Present	# Missing	Total # of Assets	Completeness %
Diameters	1148	0	1148	100%
Install Dates	1148	0	1148	100%
Materials	1144	4	1148	100%
Length	1148	0	1148	100%

3.2 ROADS

Roads

Roads	# Present	# Missing	Total # of Assets	Completeness %
Road Class	991	0	991	100%
Install Dates	991	0	991	100%
Materials	526	465	991	53%
Length	991	0	991	100%
Width	0	991	991	0%

3.3 TRANSPORTATION

Sidewalks Trails

Asphalt Sidewalk	# Present	# Missing	Total # of Assets	Completeness %
Diameters	25	0	25	100%
Install Dates	25	0	25	100%
Materials	25	0	25	100%
Length	25	0	25	100%
Width	0	25	25	0%

Boardwalk Trail	# Present	# Missing	Total # of Assets	Completeness %
Diameters	2	0	2	100%
Install Dates	2	0	2	100%
Materials	2	0	2	100%
Length	2	0	2	100%

Boat Launch	# Present	# Missing	Total # of Assets	Completeness %
Diameters	1	0	1	100%
Install Dates	1	0	1	100%
Materials	1	0	1	100%
Length	1	0	1	100%

Concrete Sidewalk	# Present	# Missing	Total # of Assets	Completeness %
Diameters	175	0	175	100%
Install Dates	175	0	175	100%
Materials	175	0	175	100%
Length	175	0	175	100%
Width	0	175	175	0%

Crosswalk	# Present	# Missing	Total # of Assets	Completeness %
Diameters	75	0	75	100%
Install Dates	75	0	75	100%
Materials	75	0	75	100%
Length	75	0	75	100%

Crosswalk-Signalized	# Present	# Missing	Total # of Assets	Completeness %
Diameters	12	0	12	100%

Install Dates	12	0	12	100%
Materials	12	0	12	100%
Length	12	0	12	100%

Multi-Use Trail	# Present	# Missing	Total # of Assets	Completeness %
Diameters	4	0	4	100%
Install Dates	4	0	4	100%
Materials	4	0	4	100%
Length	4	0	4	100%

Paver Sidewalk	# Present	# Missing	Total # of Assets	Completeness %
Diameters	11	0	11	100%
Install Dates	11	0	11	100%
Materials	11	0	11	100%
Length	11	0	11	100%
Width	0	11	11	0%

Street_Signs

Street Signs	# Present	# Missing	Total # of Assets	Completeness %
Street_Signs	749	0	749	100%
Asset Type	749	0	749	100%

Streetlights

Street Lights	# Present	# Missing	Total # of Assets	Completeness %
Street_Signs	540	0	540	100%
Asset Type	540	0	540	100%

Bridge

Bridge	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	6	0	6	100%
Materials	0	6	6	0%
Length	0	6	6	0%
Width	0	6	6	0%

3.4 BUILDINGS

TCA_Buildings	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	33	0	33	100%
Asset Type	33	0	33	100%

3.5 PARKS

Bench	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	73	0	73	100%
Materials	71	2	73	97%

Bike Rack	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	4	0	4	100%
Materials	4	0	4	100%

Bollard	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	19	0	19	100%
Materials	19	0	19	100%

Boom Container	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	2	0	2	100%
Materials	1	1	2	50%

Bridge	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	5	0	5	100%
Materials	5	0	5	100%

Outdoor Washrooms	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	0	1	1	0%

CAIRN	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	1	0	1	100%

Cultural	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	2	0	2	100%
Materials	1	1	2	50%

Fence	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	2	0	2	100%
Materials	2	0	2	100%
Length	2	0	2	100%
Height	0	2	2	0%

Fitness	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	1	0	1	100%
Type	0	1	1	0%

Fitting	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	17	0	17	100%
Materials	17	0	17	100%

Fountain	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	1	0	1	100%

Garbage	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	82	0	82	100%
Materials	63	19	82	77%

Gate	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	5	0	5	100%
Materials	5	0	5	100%
Type	0	5	5	0%

Hand Railing	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	6	0	6	100%
Materials	6	0	6	100%
Length	6	0	6	100%
Height	0	6	6	0%

Light	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	7	0	7	100%
Materials	7	0	7	100%

Ornamental	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	24	0	24	100%
Materials	13	11	24	54%

Picnic Table	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	14	0	14	100%
Materials	14	0	14	100%

Play Equipment	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	6	0	6	100%
Materials	6	0	6	100%
Type	0	6	6	0%

Retaining Wall	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	1	0	1	100%

Sign	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	72	0	72	100%
Materials	72	0	72	100%

Stairs	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	1	0	1	100%
Length	0	1	1	0%

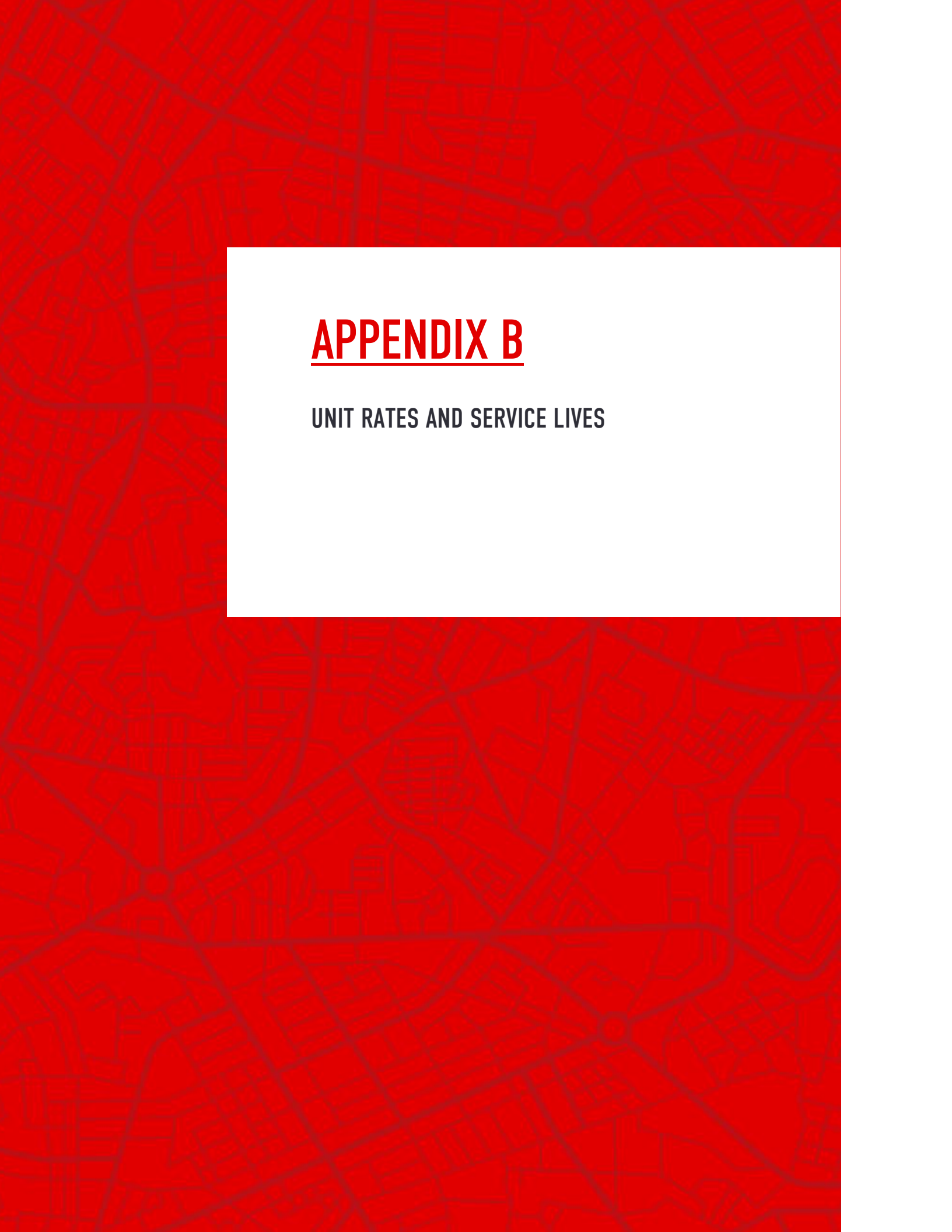
Storage Shed	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	1	0	1	100%
Materials	0	1	1	0%

Structure (Land Improvements/ B	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	15	0	15	100%
Materials	10	5	15	67%

Wheel Stop	Buildings)	# Missing	Total # of Assets	Completeness Percent
Install Dates	3	0	3	100%
Materials	3	0	3	100%

3.6 FLEET

Fleet	# Present	# Missing	Total # of Assets	Completeness %
Install Dates	36	0	36	100%
Existing Life	36	0	36	100%
Replacement Cost	36	0	36	100%



APPENDIX B

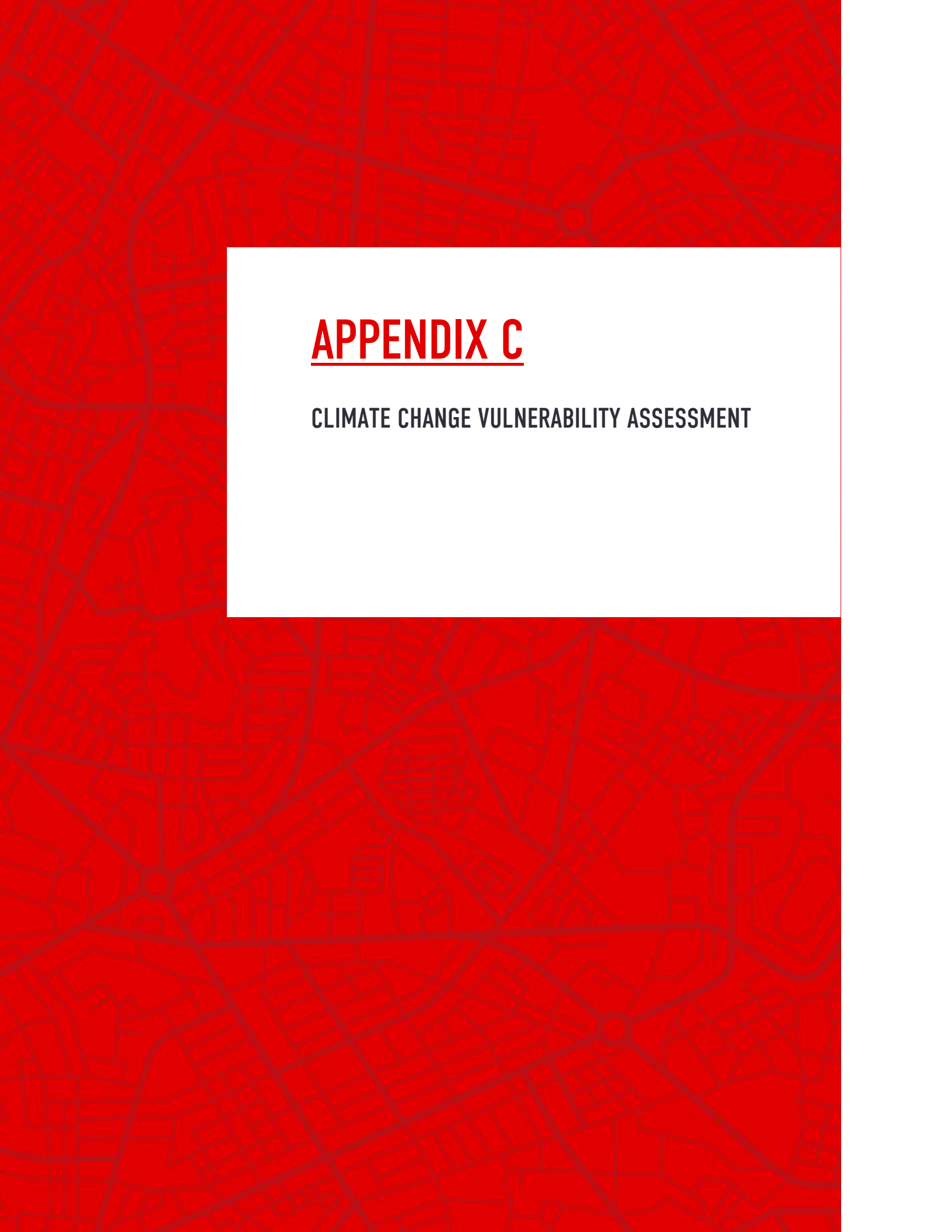
UNIT RATES AND SERVICE LIVES

Diameter (mm)	Service	Unit Cost	Contingency (25%)	Engineering (15%)	TOTALS
SANITARY (INCLUDING MANHOLES AND SERVICE CONNECTIONS)					
50	Sanitary	\$682	\$170	\$102	\$954
75	Sanitary	\$758	\$189	\$114	\$1,061
100	Sanitary	\$817	\$204	\$123	\$1,144
150	Sanitary	\$908	\$227	\$136	\$1,272
200	Sanitary	\$980	\$245	\$147	\$1,372
250	Sanitary	\$1,036	\$259	\$155	\$1,451
300	Sanitary	\$1,093	\$273	\$164	\$1,530
375	Sanitary	\$1,149	\$287	\$172	\$1,609
525	Sanitary	\$1,262	\$315	\$189	\$1,767
STORM (INCLUDING MANHOLES AND CATCH BASINS)					
100	Storm Sewer	\$867	\$217	\$130	\$1,213
150	Storm Sewer	\$908	\$227	\$136	\$1,271
200	Storm Sewer	\$933	\$233	\$140	\$1,307
250	Storm Sewer	\$990	\$247	\$148	\$1,386
300	Storm Sewer	\$1,046	\$262	\$157	\$1,465
375	Storm Sewer	\$1,103	\$276	\$165	\$1,544
450	Storm Sewer	\$1,159	\$290	\$174	\$1,623
525	Storm Sewer	\$1,216	\$304	\$182	\$1,702
600	Storm Sewer	\$1,272	\$318	\$191	\$1,781
675	Storm Sewer	\$1,385	\$346	\$208	\$1,939
750	Storm Sewer	\$1,441	\$360	\$216	\$2,018
900	Storm Sewer	\$1,498	\$374	\$225	\$2,097
1050	Storm Sewer	\$1,724	\$431	\$259	\$2,413
ROADS SURFACE					
Acces /Right-of-way		\$474	\$119	\$71	\$664
Local		\$474	\$119	\$71	\$664
Collector		\$569	\$142	\$86	\$797
Arterial		\$948	\$237	\$142	\$1,327
ROADS BASE					
Access/Right-of-way		\$474	\$119	\$71	\$664
Local		\$474	\$119	\$71	\$664
Collector		\$569	\$142	\$86	\$797

MATERIALS AND SERVICE LIFE	
Materials	Service Life (years)
HDPE	100
CSP	30
DI	60
PVC	100
Concrete	45
Wood	30
Unknown/Blank	45
Road Surface	Service Life (years)
Collector	25
Local	25
Access	75

Notes:

- Inflation applied from 2020 to 2022 dollars (2021, 5% inflation; 2022, 7.50% inflation)
- Pipe diameters are rounded up to nearest typical nominal diameter
- Costs assumptions are largely from 2019 and will be inflated according to CPI to 2022 dollars
- Stormwater assets assume diameter and material based on average of the existing inventory
- Road material is assumed to be asphalt, unless otherwise specified (e.g., gravel/dirt).
- Road types of 'Private' and 'Access' have been given the unit replacement cost value of Local roads



APPENDIX C

CLIMATE CHANGE VULNERABILITY ASSESSMENT

TECHNICAL MEMORANDUM

DATE: March 28, 2023
TO: Raphiel Mattson, Manager of Engineering and Infrastructure
FROM: Ali Mujahid, Aaron Coelho, M.Sc., P.Ag.
FILE: 2493.0015.01
SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

1.0 INTRODUCTION

The District of Sooke (Sooke) prides itself on serving its citizens and being proactive in meeting the needs of the community. With the establishment of an Asset Management Plan, Sooke is developing internal processes to support decision making and enhance service delivery. With a long-term view of sustainable service delivery, Sooke is integrating climate change considerations into their asset management planning process.

Climate change presents one of the greatest challenges of our time. Ongoing trends and future projections indicate that the current impacts to the natural environment and communities we live in will continue to intensify. In relation to asset management practices, there is particular concern for the impacts of climate change on community infrastructure.

It has been recognized that climate change will likely have minor to significant impacts on community assets and service delivery, including the following:

- Increased levels of risk to delivering target levels of service to local residents;
- Increased costs associated with managing risks and delivering target levels of service; and
- Decreased asset lifecycles associated with changes in loads and stresses.

To identify and address these impacts, a climate change vulnerability assessment has been included in the asset management plan. The climate change vulnerability assessment focuses on Sooke's bridges, buildings, fleet, parks, transportation, storm and sanitary systems and draws on available climate change projections and the knowledge of community staff.

The objectives of the assessment include:

- Review of asset systems and service delivery
- Develop localized climate change projections;
- Identify exposure to impacts of climate change;
- Assign vulnerability rating based on sensitivity and adaptive capacity;
- Prioritization of vulnerabilities; and
- Delivery of findings in a final report.

2.0 ASSET SYSTEMS

Sooke's bridges, buildings, fleet, parks, transportation, storm and sanitary systems are the asset systems included in the climate change vulnerability assessment. Table 2-1 summarizes the subcomponents and quantities for each asset system.

Table 2-1: District of Sooke Asset Summary

Asset	Quantity (ea or m)
Bridges	6 ea
Buildings	30 ea
Fleet	35 ea
Parks	
Land Improvements and Structures	various
Irrigation systems	1,993 m
Storm	
Cleanout / IC	1,232 ea
Culvert	16,820 m
Headwall / Outfall	21 ea
Mains	31,730 m
Manhole	534 ea
Transportation	
Electrical	540 ea
Road Surface	92,798 m
Pedestrian facilities	various
Sanitary	
Cleanout / IC	2,531 ea
Lift Station	6 ea
Mains	60,102 m
Manhole	629 ea
Wastewater Treatment Plant	1 ea

3.0 LOCALIZED CLIMATE CHANGE PROJECTIONS

Sooke has identified several climate hazards that are expected to impact asset systems and service delivery. The hazards are as follows:

- Wildfire
- Flooding
- Extreme Heat
- Storm Surge
- Heavy Snow
- Heavy Snow
- Extreme Storms/Wind
- Drought
- Seal Level Rise
- Landslides

Climate change is expected to influence the frequency and severity of these events. To demonstrate this influence, localized climate change projections were assessed with a focus on climate indicators that influence the identified climate hazards.

Climate change data and summaries were prepared using online tools. The tools used included:

- **Climatedata.ca¹** - Climatedata.ca is a collaboration between Environment and Climate Change Canada (ECCC), the Computer Research Institute of Montréal (CRIM), Ouranos, the Pacific Climate Impacts Consortium (PCIC) and the Prairie Climate Centre (PCC). It provides statistically downscaled climate data for individual General Circulation Models (GCM) for specific areas of interest with annual, seasonal and monthly time resolutions. In addition, this tool provides historical climate data (recorded by Natural Resources Canada) for specific areas of interest.
- **Western University IDF_CC Tool²** - Provides local climate change projections for the intensity, duration and frequency of precipitation events.

Climatedata.ca was used to download and generate summaries of annual and seasonal climate change projections for the District of Sooke. The IDF_CC Tool was used to generate summaries of projected changes in storm events.

The data analysis for each variable focuses on the Coupled Model Intercomparison Project 6 (CMIP 6). There are three emissions pathway options for CMIP6: low, moderate, and high. However, these are now called Shared Socioeconomic Pathways (SSPs) instead of Representative Concentration Pathways (RCPs). SSPs provide an enhanced understanding of the relationship between socio-economic factors (such as education, population, environmental policy, and more more) and climate change. CMIP6 models have increased spatial resolution, representing the atmosphere, oceans and small-scale processes (such as clouds, water vapor, and aerosols) in more detail.

We have elected to use only the SSP5-8.5 scenario. This is often considered the “business as usual” scenario, which means that little is done to reduce GHG emissions over the next few decades. While

¹ [Climate Data Canada](#)

² [Computerized IDF CC Tool for the Development of Intensity-Duration-Frequency Curves under a Changing Climate: \(idf-cc-uwo.ca\)](#)

efforts by many governments are currently being implemented, this scenario offers a “worst-case” scenario for assessment purposes, tempered by using only the median values from the GCM ensemble, and allows for adequate preparedness and mitigation efforts.

3.1 TIME HORIZONS

The historical data timeframe (baseline) for this assessment was:

- 1971 – 2000 (Baseline)

The climate data projections focused on three future climate normals periods:

- 2011 – 2040 (2020s)
- 2041 – 2070 (2050s)
- 2071 – 2100 (2080s)

3.2 INDICATORS FOR CLIMATE HAZARDS

Indicators were identified that are expected to influence the frequency and severity of the climate hazards. These indicators were the focus for accessing and summarizing climate change projections for this project. The hazards and their relevant climate indicators are as follows:

- Wildfire:
 - Mean temperature during summer season
 - Days with Tmax > 30 C, > 32 C
 - Max number of consecutive dry days
 - Total precipitation during summer season
- Extreme Heat:
 - Days with Tmax > 30C, > 32C
 - Hottest day
- Floods
 - Wet days >= 10 mm, Wet days >= 20 mm
 - Maximum 1-day Total Precipitation
 - Maximum 5-day Precipitation
 - Precipitation Intensity, Duration and Frequency (IDF)
- Heavy Snow:
 - Total precipitation during winter season
 - Wet days >= 10 mm. Wet days >= 20 mm - Winter
- Extreme Storms/Wind:

- Precipitation Intensity, Duration and Frequency (IDF)
- Drought:
 - Total precipitation during summer season
 - Mean temperature during summer season
 - Days with Tmax > 30C, > 32C
- Storm Surge: No direct indicator (typically influenced by high winds and low-pressure storms)
- Sea-level Rise: Influenced by many indicators and demonstrated in coastal models^{3,4}
- Landslides: No direct indicator (typically influenced by heavy precipitation and site-specific slope and geotechnical factors)

3.3 TEMPERATURE PROJECTIONS

Climate change projections for key temperature indicators are summarized in Table 3-1 and 3-2.

Table 3-1: Mean Temperature and Hottest Day Projections for District of Sooke

Climate Indicator (30 yrs. avg)	Time Horizon						
	Baseline (1971-2000)	2020s (2011-2040)		2050s (2041-2070)		2080s (2071-2100)	
	Temperature (°C)	Temperature (°C)	Change (°C)	Temperature (°C)	Change (°C)	Temperature (°C)	Change (°C)
Annual Mean Temperature	9.6	10.8	+1.2	12.1	+2.5	14.1	+4.5
Spring	8.6	9.7	+1.1	10.6	+2.0	12.3	+3.7
Summer	14.8	16.4	+1.6	17.9	+3.1	20.2	+5.4
Fall	10.0	11.4	+1.4	12.8	+2.8	14.9	+4.9
Winter	4.7	5.9	+1.2	7.3	+1.2	8.8	+4.1
Hottest Day (C)	27.4	29.4	+2.0	30.5	+3.1	33.2	+4.8

³ Strauss, BH, Kulp, SA, Rasmussen, DJ and Leverman, A. 2021. Unprecedented threats to cities from multi-century sea level rise. *Environ. Res. Lett.* 16.

⁴ [Climate Central - Coastal Risk Screening Tool](#)

Table 3-2: Number of Hot Days Projections for District of Sooke

Climate Indicator (30 yrs. avg)	Time Horizon						
	Baseline (1971-2000)	2020s (2011-2040)		2050s (2041-2070)		2080s (2071-2100)	
	# of Days	# of Days	Change	# of Days	Change	# of Days	Change
Days with Tmax > 30 C (days)	0	1	+1	3	+3	7	+7
Days with Tmax > 32 C (days)	0	0	0	1	+1	3	+3

The data in the Table 3-1 and 3-2 indicate the following trends:

- Average annual temperature is expected to increase for all seasons and across all future time horizons with temperatures reaching 4 to 5 °C above the 1971-2000 baseline by the end of the century.
- For future time periods, the District of Sooke can expect to experience several days per year in which maximum daily temperatures are great than 30°C and 32°C.

3.4 PRECIPITATION PROJECTIONS

Climate change projections for key precipitation indicators are summarized in Table 3-3.

Table 3-3: Precipitation Projections for Sooke

Climate Indicator	Time Horizon			
	Baseline (1971-2000)	2020s (2011-40)	2050s (2041-2070)	2080s (2071-2100)
Annual Total Precipitation (mm) (% change)	1,226	1,251 (+2%)	1,276 (+4%)	1,357 (11%)
Spring (mm) (% change)	227	229 (+1%)	237 (+4%)	245 (8%)
Summer (mm) (% change)	84	71 (-16%)	66 (-21%)	66 (-21%)
Fall (mm) (% change)	382	393 (+3%)	409 (+7%)	455 (+19%)
Winter (mm) (% change)	550	578 (+5%)	586 (+7%)	608 (+11%)
Wet Days >= 10 mm (# of days)	38	39	41	43
Wet Days >= 10 mm in winter (# of days)	6	7	7	8
Max no. of consecutive dry days (# of days)	28	31	32	37
Max 1-day total precipitation (mm) (% change)	61	66 (+8%)	68 (+12%)	74 (+21%)
Max 5-day Precipitation (mm) (% change)	133	138 (+4%)	144 (+8%)	151 (+14%)

From Table 3-3, the annual average precipitation is projected to increase over the three future time horizons:

- 2% during the 2020s (2011-2040)
- 4% by the 2050s (2041-2070)
- 11% by the 2080s (2071-2100)

Additional trends observed from Table 3-3 include:

- Although annual precipitation is projected to increase, summer precipitation is expected to decrease by as much as 20%
- The largest increases in precipitation are expected in the Fall and Winter, followed by the Spring
- The number of wet days $\geq$ to 10 mm are projected to increase moderately in future time periods with the number of consecutive dry days projected to increase more significantly
- Maximum 1-day and 5-day precipitation is expected to increase by 20% and 15% by the end of the century, respectively

To further understand the projected changes in storm events, the full range of IDF projections using the IDF_CC Tool for the Victoria Marine (ID 1018642) climate station were assessed. Table 3-4 summarizes the historical IDF values. Tables 3-5, 3-6, and 3-7 summarize the projected percentage change for the selected time horizons; 2020s, 2050s and 2080s. Note, the IDF_CC tool only provides data for a minimum of 30 years and the starting year is 2015, therefore the 2020s data in Table 3-5 is based on the range 2014-2045.

Table 3-4: Historical Rainfall Intensity (IDF_CC Tool – Victoria Marine Weather Station)

Duration	2-Yr	5-Yr	10-Yr	20-Yr	25-Yr	50-Yr	100-Yr
1 h (mm)	9.29	11.26	12.75	14.35	14.89	16.68	18.66
2 h (mm)	16.26	19.46	21.33	22.95	23.43	24.82	26.07
6 h (mm)	32.57	40.56	46.25	52.01	53.90	59.94	66.25
12 h (mm)	48.54	61.61	70.94	80.45	83.59	93.61	104.15
24 h (mm)	67.55	90.84	106.76	122.40	127.44	143.21	159.23

Table 3-5 Projected Rainfall Intensity Changes for 2020s (Victoria Marine Weather Station)

Duration	2-Yr	5-Yr	10-Yr	20-Yr	25-Yr	50-Yr	100-Yr
1 h (%)	6	5	7	7	7	7	6
2 h (%)	6	6	9	9	9	9	9
6 h (%)	5	6	5	8	8	7	7
12 h (%)	5	6	6	8	8	7	7
24 h (%)	5	7	6	8	8	8	7

Table 3-6 Projected Rainfall Intensity Changes for 2050s (Victoria Marine Weather Station)

Duration	2-Yr	5-Yr	10-Yr	20-Yr	25-Yr	50-Yr	100-Yr
1 h (%)	13	16	16	12	12	12	12
2 h (%)	13	15	13	12	12	13	14
6 h (%)	13	16	14	13	11	12	13
12 h (%)	13	16	14	12	11	13	13
24 h (%)	13	14	14	12	12	12	14

Table 3-7 Projected Rainfall Intensity Changes for 2080s (Victoria Marine Weather Station)

Duration	2-Yr	5-Yr	10-Yr	20-Yr	25-Yr	50-Yr	100-Yr
1 h (%)	20	25	25	21	21	24	23
2 h (%)	20	25	26	23	24	26	28
6 h (%)	20	25	25	22	22	25	26
12 h (%)	29	25	25	22	22	25	25
24 h (%)	20	24	25	22	22	25	27

Table 3-5, 3-6 and 3-7 indicate that the intensity, duration and frequency of extreme rainfall events are estimated to increase by approximately 8% for the 2020s, 14% for the 2050s and 24% for the 2080s.

3.5 WIND

There is little data regarding wind speeds and direction for the study area, and this variable is not provided as an output from GCMs. However, a study prepared for Environment Canada⁵ includes the following findings:

- Canada could potentially experience more wind gust events late this century than has been historically experienced.
- The magnitude and frequency of future wind gust events would be generally greater for more severe wind gust events. For example, the percentage increases in the frequency of future hourly wind gust events ≥ 28 and ≥ 70 km/h are projected to be approximately 10% and 20%–30%, respectively.
- The corresponding increases for future hourly wind gust events ≥ 90 km/h are projected to be more than 100%.

⁵ Cheng, Chad S; Lopes, Edwina; Fu, Chao; Huang, Zhiyong (2014). Possible Impacts of Climate Change on Wind Gusts under Downscaled Future Climate Conditions: Updated for Canada. Journal of Climate. Vol 27: 1255-1270.

3.6 HAZARDS SUMMARY

Table 3-8 provides a summary of the climate hazards and how the projections for the climate indicators influence their severity and likelihood.

Table 3-8: Summary of Climate Hazards and Projected Changes in Key Climate Indicators

Climate Hazard	Climate Indicator Influence on Severity/Likelihood
Wildfire	There is good agreement among GCMs that summer temperatures will increase, and summer precipitation will decrease, increasing the likelihood of conditions conducive to wildfires.
Extreme Heat	Days with Tmax > 30C and 32C and the magnitude of the hottest days are projected to increase for future time periods, indicating a likely increase in the frequency of extreme heat events.
Flooding	Increasing precipitation indicators and IDF data indicate a likely increase in the frequency of riverine flooding and surface water runoff flooding events.
Storm Surge	Storm surge is typically influenced by high winds and low-pressure storms and both storm events and high winds are projected to increase for future time periods.
Heavy Snow	Annual winter precipitation is projected to increase by approximately 7% during the 2050s. With interannual variability in temperature this could lead to periodic heavy snowfall events.
Extreme Storms/Wind	Projections show that the intensity, duration and frequency of extreme rainfall events are estimated to increase considerably and there is some research indicating an increased frequency of high-speed wind events.
Drought	Rising summer temperatures and decreasing summer precipitation will increase the likelihood of conditions conducive to drought.
Sea level rise	The District of Sooke took part in the Regional Coastal Flood Inundation ⁶ project which identified sea level rise as a risk for Sooke. ⁷
Landslides	Landslides are typically influenced by heavy precipitation (which is projected to increase for future time periods) and site-specific slope and geotechnical factors.

4.0 VULNERABILITY ASSESSMENT

The first step towards taking meaningful action to respond to climate change through asset management is to conduct an assessment to identify asset vulnerabilities. The overall objective of this assessment is to conduct a systematic analysis and prioritization of the vulnerability of Sooke's asset systems by examining their sensitivity, exposure and adaptive capacity to climate hazards.

⁶ [Coastal Flood Inundation Mapping Project | CRD](#)

⁷ [Climate Action Plan.cdr \(sooke.ca\)](#)

This assessment will lay a foundation for Sooke to maintain target levels of service delivery and avoid/minimize costs associated with climate hazards by providing staff with climate change vulnerability information to consider in capital and operations and maintenance planning in key asset systems and by providing direction on how to enhance climate resiliency by integrating these considerations into the overall asset management process.

The following sections outline the approach and results of the vulnerability assessment process.

4.1 VULNERABILITY ASSESSMENT APPROACH

The approach to the vulnerability assessment is based on a process that has been developed using elements of existing frameworks from the Public Infrastructure Engineering Vulnerability Committee (PIEVC), Changing Climate, Changing Communities – Guide and Workbook – ICLEI, and MRAT Insurance Bureau of Canada. Please note that a risk assessment process typically follows the vulnerability assessment, however, the risk assessment phase is out of scope of the current project.

The process used in this vulnerability assessment is shown in Figure 4-1. Note that steps 3 and 4 are shown for information purposes only and as recommendations for next steps to further define specific risks and develop adaptation measures.

ASSET SYSTEM RISK ASSESSMENT PROCESS

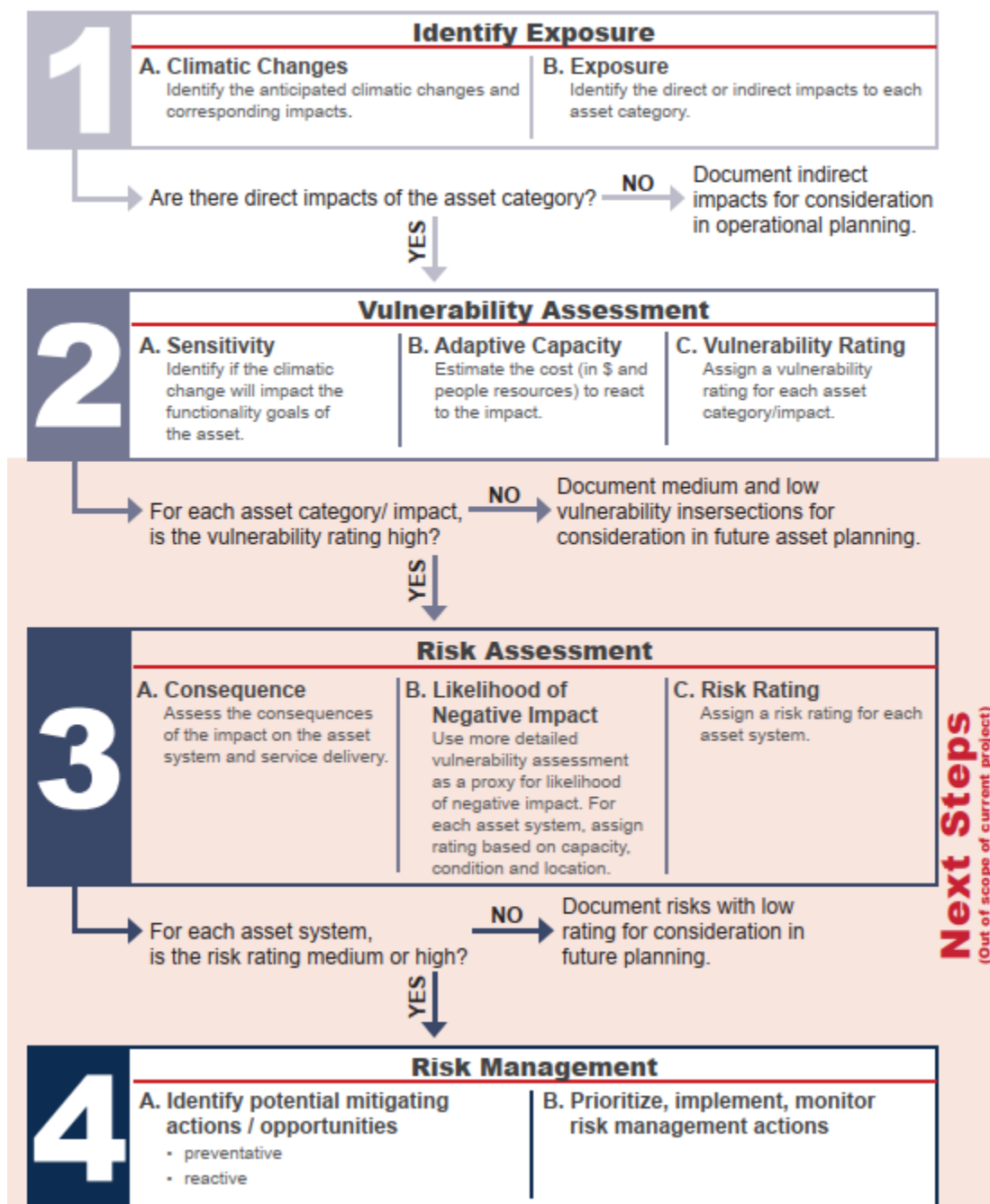


Figure 4-1: Asset Management Climate Change Vulnerability Assessment Process

4.1.1 Step 1: Identifying Exposure

Based on the projected climate change conditions (hotter and drier summers, warmer and wetter winters and springs, increased annual precipitation and longer and more intense storms) for Sooke, the potential exposure of key asset systems was identified. In other words, consideration was given to the impacts of various climatic hazards to an asset system. For example, the exterior of buildings may be negatively impacted by the longer and more intense storms projected for Sooke.

Further, exposure was assessed by considering the question, ***“Will the climate hazard impact the asset system and/or the service it provides?”*** In order to answer this question, the potential for impacts between a climate hazard and each asset system was assessed to identify exposure.

Local knowledge is a critical component of understanding the vulnerability of community infrastructure to climate change. To gather this knowledge a workshop was facilitated on November 30th, 2022 with the following members of Sooke’s staff:

- Raechel Gray – Director of Financial Services
- Ben Currie – Deputy Director of Financial Services
- Vasile Dumitru – Engineering Technologist
- Paul Bohemier – Manager of Wastewater
- Raphael Mattson – Manager of Engineering and Infrastructure
- Laura Hooper – Manager of Parks and Environmental Services

The purpose of the workshop was to develop an understanding of both historical and potential climate impacts to asset system service delivery. Exposure was assessed by considering the question, “Will the climate hazard impact the asset system and/or the service it provides?” The potential for impacts between each climatic change and each asset system was assessed to identify exposure. The information from the workshop formed the basis for evaluating exposure and assessing asset system sensitivity.

4.1.2 Step 2: Evaluating Vulnerability

The vulnerability of an asset system was assessed based on the sensitivity and adaptive capacity of the asset system to each of the impacts considered in the previous (identifying exposure) portion of the assessment. Further details on the process for determining the sensitivity and adaptive capacity of an asset system are outlined in the following sections.

It should be noted that information for the vulnerability assessment is based on professional judgement and asset condition information, where available. As previously mentioned, a meeting/workshop occurred with Sooke staff to determine asset conditions and existing vulnerabilities in various asset systems.

4.1.2.1 Sensitivity

In order to rate the sensitivity of an impact on an asset system, consideration was given to the asset system’s functionality and level of service after being affected by a climate hazard impact. Essentially,

sensitivity was rated by considering the question “***If the impact occurs, will it impact the level of service of the asset system?***”

A sensitivity rating scale was used to determine the sensitivity of an asset system, as summarized in 4-1.

Table 4-1: Sensitivity Rating Scale

Sensitivity Rating				
If the impact occurs, will it impact the level of service of the asset system?				
S1	S2	S3	S4	S5
No - functionality will stay the same.	Possibly - functionality may get worse.	Yes - functionality will get worse on a temporary basis.	Yes - functionality will get worse permanently, or unmanageable temporarily.	Yes - functionality will become permanently unmanageable.

Using an example impact and the sensitivity rating scale shown above, the asset system’s sensitivity to a climate hazard would be assessed as follows:

- Example Impact:** Wildfires (of increasing frequency and magnitude, caused by decreasing summer precipitation and increasing summer temperatures) could possibly impact buildings. This could potentially result in infrastructure damage and injuries to staff.
- Sensitivity Analysis:** Will the climactic hazard impact the level of service of the asset system?
- Sensitivity Rating:** The functionality of buildings could become worse or they could possibly be destroyed by wildfire. The asset system’s sensitivity rating to this impact would be S4.

4.1.2.2 Adaptive capacity

Adaptive capacity of the asset system reflects whether ***the asset system or service can adjust to the projected impact with minimal cost or disruption***. The adaptive capacity rating was determined by estimating the cost and staff intervention required to react to the impact. The scale used to rate an asset system’s adaptive capacity is shown in Table 4-2.

Table 4-2: Adaptive Capacity Rating Scale

Adaptive Capacity Rating				
Can the asset system/service adjust to the projected impact with minimal cost and disruption?				
AC1	AC2	AC3	AC4	AC5
No, will require substantial costs (\$\$\$\$\$) and staff intervention.	No, will require substantial costs (\$\$\$\$) and staff intervention.	Maybe, will require some costs (\$\$\$) and staff intervention.	Yes, but will require some costs (\$\$) and staff intervention.	Yes, will require minimal costs (\$) and staff intervention.

Once again using the example impact and the adaptive capacity rating table provided above, the asset system's adaptive capacity would be assessed as follows:

1. **Example Impact:** Wildfires (of increasing frequency and magnitude, caused by decreasing summer precipitation and increasing summer temperature) could damage buildings. This could potentially result in infrastructure damage and injuries to staff.
2. **Adaptive Capacity Analysis:** Can the asset system/service adjust to the projected impact with minimal cost and disruption?
3. **Adaptive Capacity Rating:** The impacted buildings would likely require staff intervention and potentially considerable costs, depending on the severity of the infrastructure damage and/or injuries. The asset system's adaptive capacity rating to this impact would be AC3.

4.1.2.3 Vulnerability

The main consideration for vulnerability was the propensity or predisposition of an asset system to be adversely affected by impact of a climactic change.

In order to determine the vulnerability rating of an asset system, the product of the sensitivity rating and the adaptive capacity rating is taken, resulting in the asset system's vulnerability rating. Figure 4-2 below shows the vulnerability rating scale and the meaning of each rating.

Asset System Vulnerability Rating					
	S1	S2	S3	S4	S5
AC1	V1	V2	V4	V5	V5
AC2	V1	V2	V4	V5	V5
AC3	V1	V2	V4	V4	V4
AC4	V1	V2	V3	V3	V3
AC5	V1	V1	V3	V3	V3

V5	Risk assessment to prioritize implementation of actions.
V4	Risk assessment to prioritize implementation of actions.
V3	Actions to be implemented, prioritized based on S rating.
V2	Monitor changes in functionality or adaptive capacity.
V1	No action required at this time.

Figure 4-2: Vulnerability Rating Scale

Using the example provided above, the vulnerability rating of an asset system or component of an asset system would be calculated as follows:

1. **Example Impact:** Wildfires (of increasing frequency and magnitude, caused by decreasing summer precipitation and increasing summer temperature) could damage buildings. This could potentially result in infrastructure damage and injuries to staff.
2. **Sensitivity Rating:** As previously described, the asset system's sensitivity rating to this direct impact would be **S4**.
3. **Adaptive Capacity Rating:** As previously described, the asset system's adaptive capacity rating to this direct impact would be **AC3**.

4. **Vulnerability Rating:** Referring to the table, an **S4** sensitivity rating and an **AC3** adaptive capacity rating results in a **V4** vulnerability rating for the asset system.

Upon completion of the sensitivity rating, adaptive capacity rating and vulnerability rating process, each impact that resulted in a moderate to high vulnerability rating (V4 or V5) was flagged for attention and future discussion with Sooke staff. Impacts with low vulnerability ratings (V1, V2 or V3) for each asset system have been noted for consideration in future planning.

4.2 VULNERABILITY ASSESSMENT RESULTS

The results presented in this section summarize the climate change impacts and the highest asset vulnerabilities for Sooke's bridges, buildings, fleet, parks, transportation, storm, and sanitary systems. It should be noted that the vulnerability register used to inform this report is a snapshot in time of Sooke's asset systems can be used as a living document by Sooke staff to be updated as new information becomes available. The following sections describe the impacts on asset systems and the vulnerability assessment results.

4.2.1 Exposure

Based on the workshop with staff, potential climate change impacts to each asset class were identified.

Table 4-3 summarizes the exposure of each asset class to the various hazards.

Table 4-3: Exposure of Asset Classes to Climate Hazards

Climate Hazard	Bridges	Buildings	Fleet	Parks	Storm	Transportation	Sanitary
Wildfire		Y		Y		Y	Y
Flooding	Y	Y		Y	Y	Y	Y
Extreme Heat		Y	Y	Y		Y	Y
Storm Surge					Y	Y	
Heavy Snow		Y		Y	Y		Y
Extreme Storms/Wind		Y		Y	Y	Y	Y
Drought				Y			
Sea level rise		Y		Y			
Landslides	Y				Y		

Each asset class/climate hazard pair marked with a 'Y' was carried forward to the vulnerability assessment.

4.2.2 Vulnerability Assessment

Based on the previously identified impacts, the vulnerability assessment analyzed the asset systems that will likely be impacted by the climate changes projected for Sooke. Each impact was assigned a sensitivity and adaptive capacity rating using the previously discussed methodology. These ratings were then used to determine the asset system or asset component's vulnerability rating.

Each asset system which received a V4 or V5 vulnerability rating are summarized in Table 4-4. For additional information, including the rationale for the sensitivity and adaptive capacity ratings and the V1, V2 and V3 vulnerability ratings, please refer to Appendix A.

Table 4-4: Summary of Highest Vulnerabilities by Asset System

Asset Class	Climate Hazard	Sensitivity Rating	Adaptive Capacity Rating	Vulnerability Rating
Bridges	Flooding	S4	AC1	V5
Bridges	Landslides	S3	AC3	V4
Buildings	Wildfire	S4	AC3	V4
Buildings	Flooding	S4	AC3	V4
Buildings	Extreme Heat	S3	AC3	V4
Buildings	Sea Level Rise	S3	AC2	V4
Parks	Flooding	S3	AC3	V4
Parks	Extreme Storms/Wind	S3	AC2	V4
Parks	Drought	S3	AC2	V4
Parks	Sea Level Rise	S3	AC2	V4
Sanitary	Wildfire	S3	AC2	V4
Storm	Storm Surge	S4	AC2	V5
Storm	Flooding	S4	AC2	V5
Storm	Heavy Snow	S3	AC2	V4
Storm	Extreme Storms/Wind	S4	AC3	V4
Storm	Landslides	S3	AC2	V4

Asset Class	Climate Hazard	Sensitivity Rating	Adaptive Capacity Rating	Vulnerability Rating
Transportation	Flooding	S4	AC2	V5
Transportation	Extreme Heat	S3	AC2	V4
Transportation	Extreme Storms/Wind	S3	AC2	V4
Transportation	Storm Surge	S3	AC2	V4

Additional information on each of the vulnerabilities summarized in the above table is provided below.

Bridge System Vulnerabilities:

- Flooding (V5): As bridges are constructed over water bodies, they are sensitive to damage from flood events. Repairing or replacing a damaged bridge will require considerable expenditure and disruption to the level of service .
- Landslides (V4): Erosion can cause banks adjacent to bridges to fail. While they can be cleared of landslide debris and additional measures such as retaining walls and debris fences can be implemented to mitigate further impacts, this will require additional expenditure and disruption to the level of service.

Building System Vulnerabilities:

- Wildfire (V4): Considerable woodland interface within the community and the lack of FireSmart practices for most buildings makes the asset system vulnerable to wildfire. Implementing FireSmart practices for the asset system and enhancing the role of the FireSmart coordinator may mitigate the risk.
- Flooding (V4): Some buildings are sensitive to riverine flooding.
- Extreme heat (V4): Despite most buildings being equipped with heat pumps, the asset class is sensitive to with extreme heat. This is compounded by the fact that the power supply is not always reliable. Some buildings not in the asset class do not have adequate shade or wind breaks, cannot cope with extreme heat and there is no cooling center identified within community.
- Sea level rise (V4): Some buildings are vulnerable to coastal flooding due to their location. Increasing adaptive capacity of asset system to adjust to the projected climate hazard through potential measures like installing water pumps or creating living shorelines will entail considerable cost and service disruption.

Park System Vulnerabilities:

- Flooding (V4): Asset system is exposed to not only direct damage by climate hazard but also to erosion caused by flooding. The asset system can possibly adjust to the projected climate hazard through potential measures like installing infiltration trenches or stormwater ponds though incorporating these measures may be costly and cause unnecessary service disruption.

- Extreme Storms/Wind (V4): Several trees/vegetation within the asset class have roots that are in poor shape. Marked places within the asset class are exposed to the risk of tree fall. Since tree assessment is conducted on a complaint basis, not a systematic one, the asset class is vulnerable. The asset system may adjust to the projected climate hazard through potential measures like a systematic tree assessment, however that may require significant cost.
- Drought (V4): Parks have many natural features that require irrigation and are therefore sensitive to shortages in water supply. Ensuring adequate water supply to parks amidst irrigation restrictions imposed during drought conditions may be possible but will entail significant cost.
- Sea Level Rise (V4): Some asset classes within the system are sensitive to the climate hazard. Adjusting to the projected climate hazard will require significant expenditure for adaptive measures like berms and other flood mitigation measures and will likely cause possible service disruption.

In addition to the vulnerability described above, the following moderate risk vulnerabilities (V3) were identified for the Sooke park system:

- Wildfire: Parks are natural areas that are sensitive to wildfire spread from adjacent areas and ember showers. Since parks are usually maintained, have irrigation systems like sprinkler systems and not all are present within the wildfire urban interface, the asset system may be able to adjust to the projected climate hazard with minimal cost and disruption.
- Extreme Heat: Climate hazard will affect service delivery due to shortened working hours to protect staff. Extreme heat will impact park vegetation. Asset system can adjust to projected impact with measures like increased irrigation and staff attention with minimal cost and disruption.
- Heavy Snow: Park amenities are sensitive to snow accumulation, limiting their ability to provide the desired level of service. The asset system can adjust to the projected climate hazard through potential measures like regular snow clearing, though this may require the allocation of additional resources.

Transportation System Vulnerabilities:

- Flooding (V5): Asset class is exposed to consistent flooding. Climate hazard will also result in severe disruption of service delivery along with compromising emergency access routes. Adjusting to the projected climate hazard through potential measures like low embankments with floodways or adequate drainage will require significant cost and disruption to the asset system.
- Extreme Heat (V4): Past experiences with climate hazard have resulted in direct damage to asset. Sidewalks and curbs heaved and had to be replaced. Adjusting to the projected climate hazard through guarding against thermal expansion and replacing damaged assets will require significant cost and disruption to the asset system.
- Storm Surge (V4): Previous instances of the climate hazard resulted in ocean spray impacts on the highway as well as flooding. Adjusting to the projected climate hazard through potential measures like protecting asset system with natural infrastructure or building sea walls will require significant cost and disruption.
- Extreme Storms/Wind (V4): Previous instances of extreme storms have overwhelmed drainage systems and impacted roadways. Adjusting to the projected climate hazard through potential measures like adequate drainage will require significant cost and disruption to the asset system.

Storm System Vulnerabilities:

- Flooding (V5): Due to the purpose and nature of the asset system it is sensitive to flood events. Adjusting to the projected climate hazard through potential measures like upgrading drainage systems to handle more frequent and intense flood events or increased maintenance to clear debris and sediment from drainage systems may require considerable cost and will likely be disruptive to normal operations.
- Storm Surge (V5): Insufficient coastal drainage systems and past instances show that the asset is sensitive to the climate hazard. Adjusting to the projected climate hazard through potential measures like installing bypass systems will result in considerable cost and disruption to the asset system.
- Heavy Snow (V4): Asset system is sensitive to snow accumulation in culverts that freezes and causes blockages. There is no equipment present to deal with plugged drains. Snow load combined with heavy precipitation may cause a more severe impact on the asset. Adjusting to the projected climate hazard through potential measures like purchasing de-icing equipment can result in considerable cost and disruption to the asset system.
- Extreme Storms/Wind (V4): The asset system is sensitive to being overwhelmed by extreme rainfall. Extreme wind may cause treefall which can lead to blockage of the asset system, causing issues with service delivery as well as possibly resulting in asset damage. Adjusting to the projected climate hazard through potential measures like assessing storm system capacity and making upgrades as well as regular tree assessments may entail considerable cost and disrupt operations.
- Landslides (V4): Parts of the asset system may be sensitive to landslides that would cause blockages that would impair functionality. Adjusting to the projected climate hazard through potential measures improving storm system drainage and removing blockages may result in considerable cost and service disruption.

Sanitary System Vulnerabilities:

- Wildfire (V4): Asset infrastructure above ground is at risk of direct damage from ember showers. Adjusting to the projected climate hazard through potential measures like fire protection and using fire retardant materials for construction may result in considerable cost.

In addition to the vulnerability described above, the following moderate risk vulnerability (V3) was identified for the Sooke sanitary system:

- Extreme Storms/Wind: Asset system is sensitive to the climate hazard, especially if it results in power outages. If backup power fails, there is no way to pump sewage. Treefall on top of the storage tanks can cause direct damage to the asset. The system may be able to adjust to the projected climate hazard through potential measures like ensuring adequate backup power and regular tree assessment and clearing.

5.0 CLOSING AND RECOMMENDED NEXT STEPS

Asset management practices can increase a community's resilience to the impacts of changing climate and improve response to natural disasters. Proactive risk management, adequate maintenance of engineered and natural assets, and timely asset improvements or renewal can improve the overall resilience of asset systems to impacts of climate change, whereas not keeping up with these requirements can make systems more vulnerable to climate change. Without adaptation, the costs of climate change damage to homes and buildings, roads, railways, and electricity systems are expected to increase dramatically in the years to come. Investments in adaptation are shown to generate benefits almost immediately, and adaptation measures provide up to a \$13-\$15 return on investment for every one dollar spent.

This vulnerability assessment provides Sooke with the first steps to integration of climate change resilience within the asset management planning process. The results provide staff an indication of where to allocate additional time and resources to further understanding risks to service delivery and how to mitigate them. For example, there were minimal vulnerabilities identified for the sanitary system, making this system a relatively low priority with respect to investments in climate change resilience. Whereas several vulnerabilities were identified for the storm system, parks, buildings and road network, indicating a need to further investigate specific risks and make strategic investments in resilience.

This vulnerability assessment lays the foundation for a full-fledged risk assessment. A full risk assessment will identify specific impacts to levels of service, service delivery risks, actions for managing risks (capital and operational), and costs and includes considerations for adaptation and mitigation. The asset management policy will document the activities required to deliver the desired levels of service, manage risks, and contain costs over time. This will provide an opportunity to consider climate change impacts in the context of other asset risks, costs, and service objectives, and develop an integrated and cost-effective set of actions.

The following next steps are recommended for consideration:

1. Integrate results into operations and planning

At the operation and planning level, the following steps should be considered:

- a) Check existing plans for potential gaps (e.g. emergency response plans, etc.)
- b) Update operation plans to reduce vulnerabilities where appropriate
- c) Improve data confidence to refine vulnerability and risk ratings (e.g., monitoring operations and maintenance activities, incident reporting - including incidents related to climatic variables).

Ensuring operations and planning staff have the appropriate background context and time allowance to incorporate these steps will be key to successfully integrating the results.

2. *Given the high costs of adapting to climate change it is recommended that an additional minimum of 1% is levied annually for the general fund asset class to support infrastructure adaptation.*

While Sooke is working towards identifying and prioritizing specific projects to improve resilience, it is important to start generating the financial reserves to implement the projects.

3. *Conduct a Climate Change Infrastructure Risk Assessment*

Key actions for the risk assessment include:

- Integrating local knowledge (history of past events, current condition and known risks to specific assets).
- Developing custom weighted consequence scales that align with the community's priorities and values to prioritize risks.
- Establishing risk assessment scores that are based on the consensus of owners/operators of the assets and infrastructure and climate change professionals
- Rank climate change risks alongside other asset risks to support prioritization of risk management actions such as capital and operational improvements. Identify these actions and corresponding financial strategies in the asset management plan.

URBAN SYSTEMS MEMORANDUM

DATE: MARCH 28, 2023

FILE: 2493.0015.01

SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Appendix A

Vulnerability Assessment Tables

DATE: MARCH 28, 2023 FILE: 2493.0015.01

SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Bridges
Asset System Description	6 ea

SENSITIVITY		
Climate Hazard	Flooding	Landslides
Rationale	As bridges are constructed over water bodies, they are sensitive to damage from flood events	It is possible that erosion due to flooding can cause banks next to bridges to fail
Within the asset category, will there be greater impact on a specific asset?	Yes	Yes
If yes, which locations or specific assets will be impacted?	Todd Creek Bridge, Demamiel Creek	Phillips Road
SENSITIVITY RATING	S4	S3

ADAPTIVE CAPACITY		
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	No	Maybe
Rationale	Repairing or replacing a damaged bridge will require considerable expenditure and disruption to the level of service	Bridges can be cleared of landslide debris and additional measures such as retaining walls and debris fences can be implemented to mitigate further impacts, however this will require additional expenditure and disruption to the level of service
ADAPTIVE CAPACITY RATING	AC1	AC3
VULNERABILITY		
VULNERABILITY RATING	V5	V4

DATE: MARCH 28, 2023 FILE: 2493.0015.01
SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Buildings
Asset System Description	30 ea

SENSITIVITY						
Climate Hazard	Wildfire	Flooding	Extreme Heat	Heavy Snow	Extreme Storms/ Wind	Sea Level Rise
Rationale	Considerable woodland interface within the community makes the asset system sensitive to wildfire.	Some buildings within the asset class are sensitive to riverine flooding.	Despite most buildings being equipped with heat pumps, the asset class is sensitive to with extreme heat. This is compounded by the fact that the power supply is not always reliable.	Buildings within asset class that have flat roofs may be at risk from extreme snow loads	Extreme storm/wind events in the past (2006) have not damaged buildings	Some buildings within the asset class are sensitive to coastal flooding.
Within the asset category, will there be greater impact on a specific asset?	Yes	Yes	Yes	Yes	No	Yes
If yes, which locations or specific assets will be impacted?	Fire Station #2	Fire Station #2	Fire Station #2	Fire Station #2, Municipal Hall	N/A	Fire Station #2
SENSITIVITY RATING	S4	S4	S3	S1	S1	S3

ADAPTIVE CAPACITY						
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	Maybe	Maybe	Maybe	Yes	Maybe	No
Rationale	While a FireSmart coordinator has been hired and most of the assets in the asset class assessed, most buildings have not been FireSmarted.	Some buildings within the asset class are not built above the flood plain, doing so will entail considerable cost and service disruption.	Some buildings not in the asset class do not have adequate shade or wind breaks, cannot cope with extreme heat. Power outages are frequent. No cooling center identified within community.	Adjusting to the projected climate hazard can be done with low cost and minimal disruption through potential measures like regular snow clearing during heavy snowfall	While previous storms (2006) did no damage, adjusting to the increasing intensity of extreme weather events through potential measures like wind resistant roof design may result in significant costs and service disruption	Increasing adaptive capacity of asset system to adjust to the projected climate hazard through potential measures like installing water pumps or creating living shorelines will entail considerable cost and service disruption
ADAPTIVE CAPACITY RATING	AC3	AC3	AC3	AC5	AC3	AC2
VULNERABILITY						
VULNERABILITY RATING	V4	V4	V4	V1	V1	V4

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SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Fleet
Asset System Description	35 ea

SENSITIVITY	
Climate Hazard	Extreme Heat
Rationale	Fleet vehicles are often old, not properly maintained and stored outside. The lack of proper maintenance results in the air conditioning often not working, leading to a work environment in which extreme heat is a health hazard for Sooke staff
Within the asset category, will there be greater impact on a specific asset?	Yes
If yes, which locations or specific assets will be impacted?	Entire fleet except fire trucks
SENSITIVITY RATING	S3

ADAPTIVE CAPACITY	
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	Yes
Rationale	Repairing air conditioning systems within affected vehicles or upgrading the fleet will have only a minor impact on finances and operations
ADAPTIVE CAPACITY RATING	AC4

VULNERABILITY	
VULNERABILITY RATING	V3

DATE: MARCH 28, 2023 FILE: 2493.0015.01
SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Parks
Asset System Description	Land Improvements, TCA Buildings, Water

SENSITIVITY							
Climate Hazard	Wildfire	Flooding	Extreme Heat	Heavy Snow	Extreme Storms/Wind	Drought	Sea level rise
Rationale	Parks are natural areas that are sensitive to wildfire spread from adjacent areas and ember showers	Asset system is sensitive to not only direct damage by the climate hazard but also to erosion caused by flooding.	Climate hazard will affect service delivery due to shortened working hours to protect staff. Extreme heat will impact park vegetation.	Park amenities are sensitive to snow accumulation, limiting their ability to provide the desired level of service.	Several trees/vegetation within the asset class have roots that are in poor shape. Marked places within the asset class are sensitive to the risk of tree fall. Since tree assessment is conducted on a complaint basis, not a systematic one, the asset class may be sensitive to the climate hazard.	Parks have many natural features that require irrigation and are therefore sensitive to shortages in water supply	Some asset classes within the system are sensitive to the climate hazard
Within the asset category, will there be greater impact on a specific asset?	No	Yes	No	Maybe	No	No	Yes
If yes, which locations or specific assets will be impacted?	N/A	The Spit	N/A	Marina Boardwalk	N/A	N/A	Winston Park

ADAPTIVE CAPACITY							
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	Yes	Maybe	Yes	Yes	No	No	No
Rationale	Since parks are usually maintained, have irrigation systems like sprinkler systems and not all are present within the wildfire urban interface, the asset system may be able to adjust to the projected climate hazard with minimal cost and disruption.	The asset system can possibly adjust to the projected climate hazard through potential measures like installing infiltration trenches or stormwater ponds though incorporating these measures may be costly and cause unnecessary service disruption	Asset system can adjust to projected impact with measures like increased irrigation and staff attention with minimal cost and disruption	The asset system can adjust to the projected climate hazard through potential measures like regular snow clearing, though this may require the allocation of additional resources	The asset system may adjust to the projected climate hazard through potential measures like a systematic tree assessment, however that may require significant cost	Ensuring adequate water supply to parks amidst irrigation restrictions imposed during drought conditions may be possible but will entail significant cost	Adjusting to the projected climate hazard will require significant expenditure for adaptive measures like berms and other flood mitigation measures and will likely cause possible service disruption
ADAPTIVE CAPACITY RATING	AC4	AC3	AC4	AC4	AC2	AC2	AC2
VULNERABILITY							
VULNERABILITY RATING	V3	V4	V3	V3	V4	V4	V4

DATE: MARCH 28, 2023 FILE: 2493.0015.01

SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Transportation
Asset System Description	Electrical, Road Surface, Pedestrian Facilities

SENSITIVITY					
Climate Hazard	Wildfire	Flooding	Extreme Heat	Storm Surge	Extreme Storms/Wind
Rationale	Wildfires are not sensitive to ember showers or wildfire smoke and direct damage to the asset system is unlikely	Asset class is exposed to consistent flooding. Climate hazard will also result in severe disruption of service delivery along with compromising emergency access routes.	Past experiences with climate hazard have resulted in direct damage to asset. Sidewalks and curbs heaved and had to be replaced.	Previous instances of the climate hazard resulted in ocean spray impacts on the highway as well as flooding.	Previous instances of extreme storms have overwhelmed drainage systems and impacted roadways
Within the asset category, will there be greater impact on a specific asset?	No	Yes	No	Yes	Yes
If yes, which locations or specific assets will be impacted?	N/A	Sooke River Road	N/A	Road near Fire Station #2, Goodrich Road, Church Road, Helgesen Road	Keltasin Road
SENSITIVITY RATING	S2	S4	S3	S3	S3

ADAPTIVE CAPACITY					
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	Yes	No	No	No	No
Rationale	Adjusting adequately to the projected climate hazard with potential measures like firebreaks or implementing FireSmart practices around non-road assets may be implemented without considerable cost or disruption	Adjusting to the projected climate hazard through potential measures like low embankments with floodways or adequate drainage will require significant cost and disruption to the asset system	Adjusting to the projected climate hazard through guarding against thermal expansion and replacing damaged assets will require significant cost and disruption to the asset system	Adjusting to the projected climate hazard through potential measures like protecting asset system with natural infrastructure or building sea walls will require significant cost and disruption.	Adjusting to the projected climate hazard through potential measures like adequate drainage will require significant cost and disruption to the asset system
ADAPTIVE CAPACITY RATING	AC4	AC2	AC2	AC2	AC2
VULNERABILITY					
VULNERABILITY RATING	V2	V5	V4	V4	V4

DATE: MARCH 28, 2023 FILE: 2493.0015.01
SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Storm
Asset System Description	Cleanout/IC, Culverts, Headfall/Outfall, Mains, Manhole

SENSITIVITY					
Climate Hazard	Flooding	Storm Surge	Heavy Snow	Extreme Storms/Wind	Landslides
Rationale	Due to the purpose and nature of the asset system it sensitive to flood events	Lack of bypass systems and past instances show that the asset is sensitive to the climate hazard.	Asset system is sensitive to snow accumulation in culverts that freezes and causes blockages. There is no equipment present to deal with plugged drains. Snow load combined with heavy precipitation may cause a more severe impact on the asset	The asset system is sensitive to being overwhelmed by extreme rainfall. Extreme wind may cause treefall which can lead to blockage of the asset system, causing issues with service delivery as well as possibly resulting in asset damage.	Parts of the asset system may be sensitive to landslides that would causes blockages that would impair functionality
Within the asset category, will there be greater impact on a specific asset?	No	Yes	No	No	Yes
If yes, which locations or specific assets will be impacted?	N/A	Municipal Hall, CUL DE SAC	N/A	N/A	Church/Charter Street
SENSITIVITY RATING	S4	S4	S3	S4	S3

ADAPTIVE CAPACITY					
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	No	No	No	Maybe	No
Rationale	Adjusting to the projected climate hazard through potential measures like upgrading drainage systems to handle more frequent and intense flood events or increased maintenance to clear debris and sediment from drainage systems may require considerable cost and will likely be disruptive to normal operations	Adjusting to the projected climate hazard through potential measures such as improving coastal drainage systems will require a considerable investment	Adjusting to the projected climate hazard through potential measures like purchasing de-icing equipment can result in considerable cost and disruption to the asset system	Adjusting to the projected climate hazard through potential measures like assessing storm system capacity and making upgrades as well as regular tree assessments may entail considerable cost and disrupt operations	Adjusting to the projected climate hazard through potential measures improving storm system drainage and removing blockages may result in considerable cost and service disruption
ADAPTIVE CAPACITY RATING	AC2	AC2	AC2	AC3	AC2
VULNERABILITY					
VULNERABILITY RATING	V5	V5	V4	V4	V4

DATE: MARCH 28, 2023 FILE: 2493.0015.01
SUBJECT: District of Sooke - Asset Management Climate Change Vulnerability Assessment

Asset System	Sanitary
Asset System Description	Cleanout/IC, Lift Station, Mains, Manhole, Wastewater Treatment Plant

SENSITIVITY					
Climate Hazard	Wildfire	Flooding	Extreme Heat	Heavy Snow	Extreme Storms/Wind
Rationale	Asset equipment above ground is at risk of direct damage from ember showers	Buildings within the asset system are sensitive to the climate hazard.	Climate hazard will have a direct effect on how much chemicals are used to treat the water and may cause environmental issues with effluent release. Climate hazard may also cause odour issues. Backup equipment is sensitive to the climate hazard.	Some asset classes within the asset system are sensitive to the climate hazard. Snow freezing on top of the tanks at the wastewater plant may cause issues with service delivery.	Asset system is sensitive to the climate hazard, especially if it results in power outages. If backup power fails, there is no way to pump sewage. Treefall on top of the storage tanks can cause direct damage to the asset.
Within the asset category, will there be greater impact on a specific asset?	No	Yes	Yes	No	No
If yes, which locations or specific assets will be impacted?	N/A	Wastewater Plant	Wastewater Plant	N/A	N/A
SENSITIVITY RATING	S3	S2	S2	S2	S3

ADAPTIVE CAPACITY					
Can the asset system adjust to the projected climate hazard with minimal cost and disruption?	No	No	Yes	Yes	Yes
Rationale	Adjusting to the projected climate hazard through potential measures like fire protection and using fire retardant materials for construction may result in considerable cost	Adjusting to the projected climate hazard through potential measures like enhanced drainage measures or berming may result in considerable cost and significant disruption to the asset system	Adjusting to the projected climate hazard through potential measures like increased chemical usage are often part of existing treatment plans and can be implemented without considerable cost or significant disruption	Adjusting to the projected climate hazard through potential measures like de-icing procedures or regular snow removal can be done without significant cost or service disruption	The system may be able to adjust to the projected climate hazard through potential measures like ensuring adequate backup power and regular tree assessment and clearing
ADAPTIVE CAPACITY RATING	AC2	AC2	AC4	AC5	AC4
VULNERABILITY					
VULNERABILITY RATING	V4	V2	V2	V1	V3

APPENDIX D

NATURAL ASSET REVIEW MEMO

DATE: May 11, 2023
SUBJECT: Natural Asset Review Memo

FILE: 2493.0015.01

PAGE: 1 of 12

DATE: May 11, 2023
TO: Jeff Carter
FROM: Laura Bernier
FILE: 2493.0015.01
SUBJECT: Natural Asset Review Memo

1.0 INTRODUCTION

1.1 PURPOSE AND ALIGNMENT

An emerging best practice in Asset Management (AM) is considering natural assets in municipal planning and decision-making processes, as these assets provide valuable services to the community and offer co-benefits that are not easily replicated through engineered infrastructure. The District seeks to integrate best practices in asset management into this approach, which will help the District deliver core municipal services in a way that is sustainable over the long term.

The District's Sooke2030: Climate Action Plan recommends including natural assets within the District's asset management program to financially account for ecological values, increase and protect the urban tree canopy, and prioritize nature-based solutions in all capital projects¹.

The purpose of this memorandum is to help build awareness within the District of the following:

- Key concepts in natural asset management
- The natural assets within the district that provide core municipal services
- Potential approaches to valuating the services those assets provide
- Opportunities for the district to integrate natural assets into municipal planning and decision-making processes

1.2 WHAT ARE NATURAL ASSETS?

Natural assets are the naturally occurring resources and ecosystems that provide services that are critical to the functioning of our communities. They provide ecological services such as clean air, habitat, climate regulation, water treatment, pollination, and more. Communities have intuitively understood the ecological services provided by these natural systems. Now, local governments are developing ways to identify and manage these systems as assets that deliver core municipal services, such as water storage, treatment, rainwater attenuation, and flood protection².

1.3 WHY CONSIDER NATURAL ASSETS

Considering natural assets as part of AM processes is **quickly becoming a best practice**. While AM processes have traditionally focused on engineered infrastructure, there is growing evidence that integrating natural assets

¹ District of Sooke. (2019). Sooke2030: Climate Action Plan. Retrieved from <https://sooke.ca/wp-content/uploads/2019/12/Sooke2030-Climate-Action-Plan.pdf> (p. 90)

² For further information on natural assets, refer to resources prepared by the Municipal Natural Asset Initiative, www.mnai.ca.

into AM processes can reduce costs, increase levels of service, enhance the community's ability to adapt to climate change, and reduce unfunded liabilities while protecting and enhancing the multitude of other benefits that natural assets bring to communities³. Therefore, it is now expected that municipalities will integrate natural assets into their broader AM processes and practices.

Like many communities, the District faces an infrastructure funding gap. This infrastructure funding gap refers to the difference between actual funding levels and the theoretical funding levels required to maintain service levels provided by engineered assets. Considering natural assets is essential for local governments to **manage their infrastructure funding gap** effectively. Without natural assets that provide core municipal services, local governments tend to rely on costly engineered infrastructure to provide the same services. Increased reliance on engineered infrastructure can result in higher lifecycle costs, including upfront construction, ongoing operations and maintenance, and renewal and eventual replacement. However, by choosing to protect, maintain, or enhance natural assets and the services they provide, the District can contain and even reduce this funding gap. This approach could lead to either containing the infrastructure deficit, reducing it, or increasing the level of service.

Natural assets **contribute to the community's resilience to climate change**. Unlike engineered infrastructure, natural assets are more resilient to a wide range of loads, including precipitation volume and intensities that vary with climate change⁴.

Natural asset management involves understanding the strengths and limitations of engineered assets and natural assets, their interactions, and how the District's decisions can change as a result of viewing natural assets as an integral part of the overall system of service delivery. By considering natural assets, local governments can achieve more sustainable and cost-effective service delivery, increase resilience to climate change, and protect the community's long-term interests.

1.4 HOW DO NATURAL ASSETS DIFFER FROM GREEN INFRASTRUCTURE?

Natural assets are features found in the environment that provide ecosystem services to communities without human intervention. Green infrastructure is designed and engineered to mimic natural systems and processes that provide ecosystem and municipal services. Both natural assets and green infrastructure should be managed as part of a local government's AM process.

1.5 HOW TO CONSIDER NATURAL ASSETS IN ASSET MANAGEMENT PROCESSES?

Natural asset management is about understanding the strengths and limitations of engineered assets and natural assets, how they interact, and how local government decisions can change as a result of viewing natural assets as an integral part of the overall system of service delivery.

Integrating Natural Assets into Asset Management: A Sustainable Service Delivery Primer (Urban Systems for Asset Management BC, 2019) provides guidance on how to integrate natural assets in asset management processes. The process is summarized as follows:

³ Integrated Natural Assets into Asset Management: A Sustainable Service Delivery Primer (Urban Systems for Asset Management BC, 2019).

⁴ Pilot studies conducted by the Municipal Natural Asset Initiative found that the value of services provided by natural assets often increased in a climate change scenario.

URBAN SYSTEMS MEMORANDUM

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ASSESS	• Assess current natural asset management processes and practices • Develop an inventory of natural assets • Assess the value and condition of natural assets • Identify risks to natural assets and sustainable service delivery
PLAN	• Formalize the organization's commitment to including natural assets in asset management via an Asset Management Policy • Identify the approach the organization is taking to integrate natural assets in asset management via an Asset Management Strategy • Identify specific risks, impacts to levels of service, an actions and costs for managing risks • Update the long-term financial plan to include natural asset considerations. Include funding strategies and risks to them. Identify financial risks of not managing natural assets.
IMPLEMENT	• Implement the Policy, Strategy, plans and actions • Measure the health of natural assets and the effectiveness of natural asset management practices. Report to staff, Council, and the public.

2.0 NATURALS ASSETS THAT PROVIDE CORE SERVICES WITHIN THE DISTRICT OF SOOKE

As described above, the “assess” component of the asset management process includes developing an inventory of natural assets and the services they provide. There are numerous natural assets within the District that provide core municipal services, summarized in Table 1. The inventory was developed by a review of existing GIS information that was readily available from the District and other sources.

In total, the inventory accounts for **4,300 hectares** (ha) and **160 kilometres** (km) of natural assets that provide the following core municipal services, along with numerous other additional benefits to the community:

- Carbon storage and sequestration
- Erosion control
- Erosion control
- Flood protection
- Stormwater conveyance
- Stormwater detention
- Stormwater retention
- Stormwater treatment

The inventory uses various data sources (see Appendix A), which were mapped to mitigate any overlap in the natural asset inventory, in which case assets could be counted twice. A map of natural asset is included in Appendix B.

It is recommended that the inventory summarized in Table 1 is refined to consider specifics such as: the location of natural assets, the quantity of services that are provided by them, and risks to natural assets and the services they provide (i.e., local land use changes and climate change). It is likely that the quantity of natural assets is currently underestimated since the District’s natural asset data and inventory is relatively new and therefore not complete.

It should be noted that while additional green infrastructure exists in the District of Sooke; green infrastructure and engineered assets are excluded from this natural asset inventory and memo. Green infrastructure assets in the District of Sooke include:

- Engineered ponds (engineered) (2.0 ha)
- Community parks (34.6 ha)
- Rainwater management parks (2.6 ha)
- Urban trees (2,124 units)

Table 1. Inventory of natural assets

Natural Asset	Length (m) / Area (ha)	Count	Core Services Provided	Additional services provided	Risks to service provision
Wetlands	9.9 ha	2	Flood protection Stormwater detention (runoff rate control) Stormwater treatment Carbon storage and sequestration Erosion control	Habitat Recreation Nutrient cycling Climate and temperature regulation Groundwater flow recharge	Climate change Sea level rise Development
Waterbodies	3.9 ha	17	Stormwater detention (runoff rate control) Stormwater retention (runoff volume control)	Habitat Recreation Climate and temperature regulation Groundwater flow recharge Irrigation	Development Climate Change
Sooke River - Area (Length)	44.0 ha (11.5 km)	1			
Pond (Natural)	2.3 ha	3			
Stream	83.8 km	167	Stormwater conveyance Erosion control	Habitat Nutrient cycling Groundwater flow recharge	Development Climate Change
Ditch (Natural)	31.6 km	1,082			
Swale (Natural)	230 m	3			
Coastline	31.6 km	22	Stormwater conveyance Flood protection (storm surge and wave dissipation) Erosion control Carbon storage and sequestration	Habitat Recreation	Climate change Sea level rise
Nature Park or Greenway	60.5 ha	22	Stormwater detention (runoff rate control) Erosion control Stormwater retention (runoff volume control) Stormwater treatment Carbon storage and sequestration	Recreation Habitat Climate and temperature regulation	Development Climate change Forest fires
Forest	4,166.7 ha	n/a	Stormwater detention (runoff rate control) Erosion control Stormwater retention (runoff volume control) Stormwater treatment Carbon storage and sequestration	Recreation Habitat Nutrient cycling Climate and temperature regulation	Development Climate change Forest fires Pests and disease

N.B. Engineered ditches , ponds, swales, and reservoirs are assumed to be engineered stormwater assets and are excluded from the natural asset inventory.

3.0 FINANCIAL VALUATION METHODS

The “assess” component of the asset management process also includes valuating the services provided by natural assets. Understanding the financial value of natural assets can help inform land use planning and infrastructure servicing decisions, operations and maintenance planning, capital planning, and financial planning. Current Public Sector Accounting Board (PSAB) standards do not permit the inclusion of natural assets as a tangible capital asset (TCA) except where there is a historic cost. This limitation only impacts reporting on audited financial statements – it does not affect financial planning or service delivery decision-making and so should not be considered a barrier to assessing the financial value of a natural asset.

There is no single “right” way of assigning a financial value to nature’s services. It is important to understand the limitations of whatever method is selected and ensure that method aligns with the types of decisions it may inform. Similar to engineered assets, the worth of natural assets is dependant on the services they provide. Unlike engineered assets, natural assets will always provide an ecological service as well. Also, while engineered assets depreciate over time, some natural assets may appreciate.

For the purposes of estimating the value of natural assets for the services they provide, the District may decide to limit the scope of the valuation to specific ‘core’ services and exclude the ecological services they provide. For example, in an initial inventory, the District may consider cataloguing wetlands for their ability to attenuate rainwater (a stormwater service) but not for the value they provide in providing habitat to wildlife.

An estimated financial value of a natural asset can help to supplement qualitative knowledge of the value placed on the natural asset by the broader community. Various processes for assigning a financial value to natural assets exist – the most common methods are summarized in the following table.

Table 2. Common methods for valuating natural assets

Method	Description	Considerations
Replacement (or Avoided) Cost Valuation	The value of the service provided by the natural asset is estimated based on the cost of engineered assets that would be required to provide the same services.	• Useful for valuing services that have an equivalent cost for engineered assets, such as natural coastal protection versus a sea wall. • Aligns well with assessments focused on core municipal services. • Finding human-made equivalents for ‘natural’ services presents limitations. • Evaluation may not capture the full suite of services provided and can lead to underestimating the value of natural assets. Distinguishing between the value of core services and additional services can mitigate this.
Damage Cost Avoided	The value of the service provided by the natural asset is estimated based on the costs of damages avoided through the	• Conservative estimates may not capture the full capacity for service levels in all conditions, nor the comprehensive amount of the avoided damages.

Method	Description	Considerations
	maintenance, protection, or enhancement of natural assets.	• Can provide impactful results with limited time and resources and may provide a basis for more comprehensive work. • The use of tangible data and the cost of damages can be more apparent to the public than benefits.
Benefits Transfer (BT)	The previously determined value of an asset is transferred to other similar assets to provide an approximate estimate.	• It uses primary valuation studies from other sites to inform decision making. • Comprehensively assesses the value of services delivered by natural assets beyond municipal core services. • Inexpensive and expedient; however, less precise as a primary valuation method. • Can provide impactful results with limited time and resources and may provide a basis for more comprehensive work. • An in-depth primary valuation requires significant expertise and statistical analysis.
Ecological Accounting Process (EAP)	The value of the natural asset is estimated by defining the assessed value of the land underlying the asset, based on an average unit rate of adjacent properties, multiplied by the total area of the natural asset.	• The method is derived to optimize hydrological function of watersheds and focuses on wetlands, streams, ponds, and riparian areas. • A limitation to this method is that it is difficult to place specific financial values on ecological services. • Best suited to valuing natural assets based on current conditions.

As previously described, financial valuation of natural assets is a key component in the “assess” step of the natural asset management process to inform decision making; however, there are other steps in natural asset management that are just as important. In addition to inventorying the assets and valuating their services, it is important to assess their condition and risks to the assets and the services they provide. These steps are beyond the scope of this memorandum, but they should also be considered in the development of natural asset management studies.

4.0 INTEGRATING NATURAL ASSETS INTO PLANNING AND DECISION-MAKING

The objectives of managing risks to natural assets are to maintain the important services that natural assets provide, ultimately reducing lifecycle costs, maintaining community resilience, and achieving both development and environmental objectives.

Strategies and approaches for managing risk include integrating natural assets within ongoing AM processes, designating land use and structuring development in ways that maintain natural asset services, shifting land ownership to protect natural assets, providing incentives for private property owners and members of the public to maintain or protect natural assets, monitoring natural assets, running public education programs, and restoration or enhancement projects.

There are various opportunities available to the District to consider natural assets in the planning and decision-making process. A significant opportunity is in ISMPs; others include planning processes such as land use planning. The District can integrate natural assets in several ways into various planning and decision-making processes. Specifically,

1. Continue to include natural assets in the overall AM processes and ISMPs, to inform decisions about the construction, renewal, and maintenance of existing engineered assets and new ones.
2. Recognize the significance, role, and services of natural assets in the Official Community Plan (OCP).
3. Ensure that specific local area planning is informed by an understanding of the current role of natural assets and how development may impact the services provided by natural assets. Through area planning, consider scenarios that preserve the function of significant natural assets, reducing overall costs to the District and maintaining community resilience.
4. Consider costs to maintain natural assets in the annual operating budget.
5. Implement protection strategies for natural assets through land use planning and acquisition strategies, partnerships with neighbouring jurisdictions, private property incentives, operations and maintenance activities, and capital projects.

More specific instructions on how to include natural asset management in municipal planning and decision-making processes is described in *Integrating Natural Assets into Asset Management: A Sustainable Service Delivery Primer*.⁵

⁵ Available online at <https://www.assetmanagementbc.ca/wp-content/uploads/Integrating-Natural-Assets-into-Asset-Management.pdf>

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APPENDIX A: ASSUMPTIONS AND SOURCES

Table A-1. Assumptions and Sources

Natural Asset (Sub-Category)	Source	Notes
Ditch (Natural)	District of Sooke; Ditches_Swales	Grouped by AssetType and Material
Swale (Natural)	District of Sooke; Ditches_Swales	Grouped by AssetType and Material
Stream	District of Sooke; Streams	Filtered by TYPE does not include "Ditch" or "Shoreline", includes "River", "River-Intermittent" and "River-Mainstem". Ditch excluded as all features are duplicated in Ditches and Swales dataset. Shoreline excluded due to geometry and to avoid duplicate count as shoreline accounted for in shoreline dataset.
Pond (Natural)	District of Sooke; Ponds	
Major River (Sooke River)	Province of BC; Freshwater Atlas, Rivers	
Wetlands	Province of BC; Freshwater Atlas, Wetlands and OpenStreetMaps Waterbodies	Some wetland area removed from original dataset due to agricultural development visible in aerial imagery
Other Waterbody	OpenStreetMaps and Freshwater Atlas Lakes, Lakes	Datasets were reviewed against aerial imagery to confirm presence of water body. Kemp Lake excluded as not within jurisdictional boundary (boundary follows lake shoreline).
Coastline	Province of BC; Freshwater Atlas, Coastline	
Nature Park or Greenway	District of Sooke; Park_Land	"Shoreline Access Parks", "Walkways", "Special Purpose Areas" and "Parking" subtypes excluded. Community Park category includes "Neighbourhood Parks".
Forest	Sentinel-2 L2A 10m Land Cover Forest Class 2022: https://www.arcgis.com/home/item.html?id=cfc7609de5f478eb7666240902d4d3d	Converted land cover raster to polygons. Area calculated for Forest class.

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APPENDIX B: MAP OF NATURAL ASSETS

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