2022
Transportation Asset Management Plan

Hamilton

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TRANSPORTATION ASSET MANAGEMENT PLAN

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2.2 LIFECYCLE MANAGEMENT PLAN

The lifecycle management plan details how the City plans to manage these assets at the agreed levels of service and at the accepted lifecycle costs.

2.2.1 Acquisition Plan

Acquisition reflects new assets that did not previously exist or works which will upgrade or improve an existing asset beyond its current capacity. They may result from growth, demand, legal obligations or social or environmental needs. Transportation assets can either be donated through development agreements to the City or through the construction of new assets which are mostly related to population growth.

CURRENT PROJECT DRIVERS – 10 YEAR PLANNING HORIZON

The City prioritizes capital projects based on various drivers to help determine ranking for project priorities and investment decisions. As part of future AM Plans, the City will be continuing to develop its understanding of how projects are prioritized and ensures that multiple factors are being considered to drive investment decisions in the next iteration of the AM Plan. These drivers will include legal compliance, risk mitigation, O&M impacts, growth impacts, health and safety, reputation and others. These drivers should be reviewed during each iteration of the AM Plan to ensure they are appropriate and effective in informing decision making.

SELECTION CRITERIA

Proposed acquisition of new assets and upgrade of existing assets are identified from various sources such as community requests, proposals identified by strategic plans or partnerships with others. Potential upgrade and new works should be reviewed to verify that they are essential to the City’s needs. Proposed upgrade and new work analysis should also include the development of a preliminary renewal estimate to ensure that the services are sustainable over the longer term. Verified proposals can then be ranked by priority and available funds and scheduled in future works programs.

SUMMARY OF FUTURE DONATED ASSET ACQUISITION COSTS

Forecast acquisition asset costs are summarized in Figure 11 and show the cumulative effect of asset assumptions over the next 10-year planning period.

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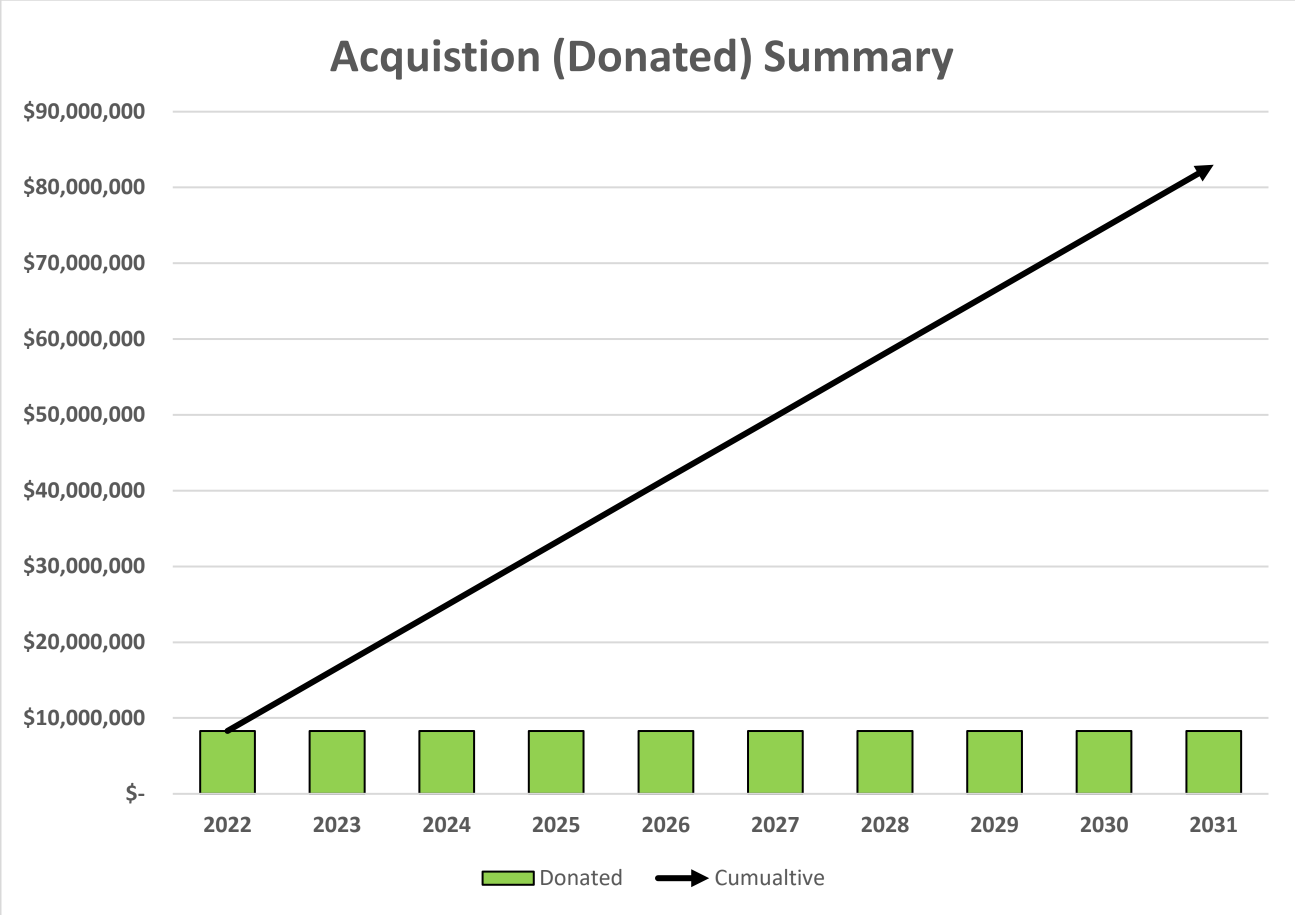
Figure 9: Acquisition (Donated) Summary
All Figures Are In 2021 Dollars.



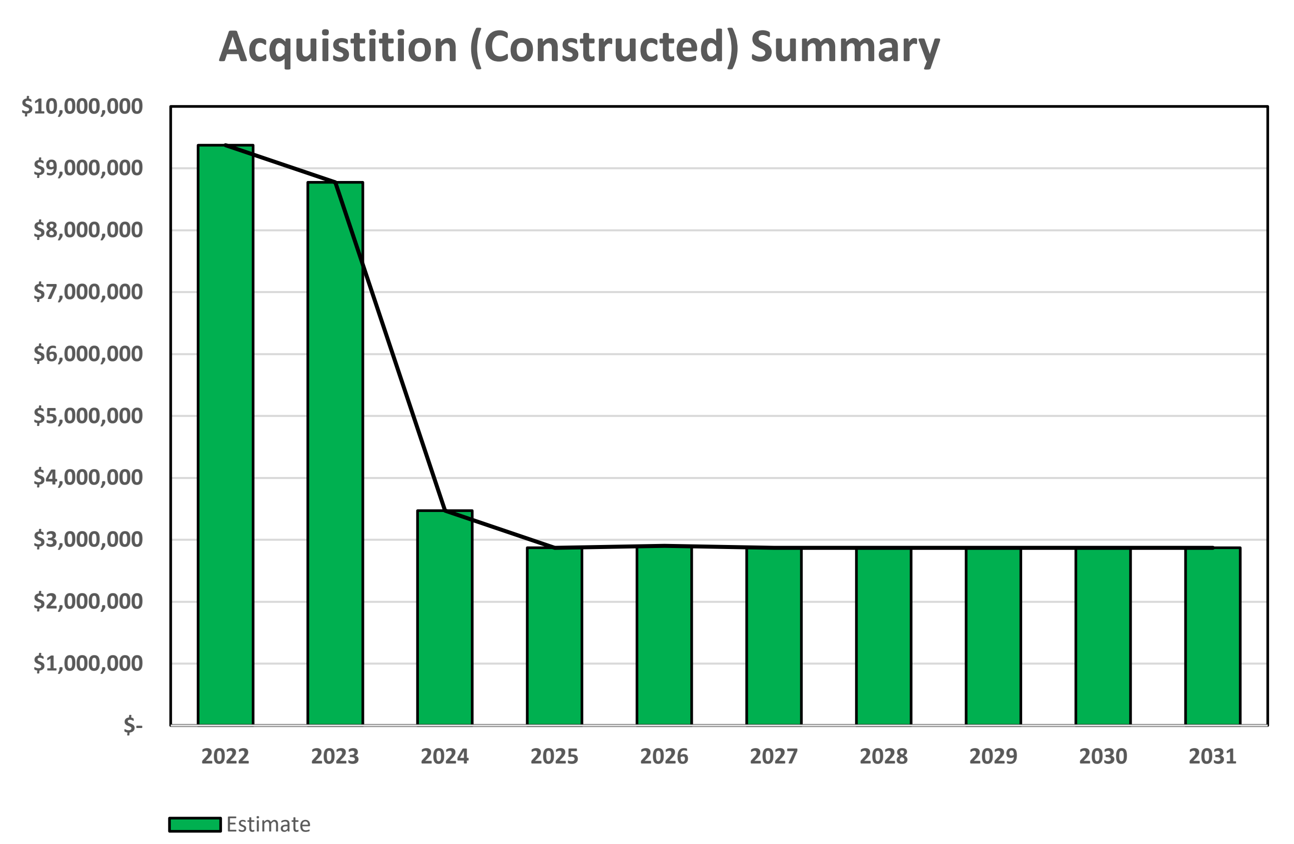
Annually on average, the City assumes over **$8,300,000** of donated transportation assets through subdivision agreements or other development agreements. These assets include approximately **10 km's** of roads, **1,000** road safety signs, **100** streetlights and multiples traffic apparatuses. The City is reviewing its donated asset assumption process to ensure that it proactively understands what assets are being donated annually to ensure they are appropriately planned for. This will allow multiple departments across the City to plan for the assets properly such as:

- AM to forecast the long-term needs and obligations of the assets
- Operations and maintenance can include the assets in their planned activities (inspections, legislative compliance activities)
- Finance can ensure that assets are properly captured and recognized appropriately (Audited Financial Statements, TCA process, Provincial reporting such as the FIR)

The City will need to ensure the required data is updated frequently and to a single source to ensure that all the departments have access to the data they require in a timely manner. Once transportation assets are assumed, the City then becomes the stewards of these assets and is responsible for all ongoing costs for the asset's operation, continued maintenance, inevitable disposal and their likely renewal.

Construction costs are often only **10-15 %** of an asset's whole life costs. When development assets are donated to the City, they then becomes obligated to fund the remaining costs. Over the next ten-year planning period the City anticipates receiving **$83,000,000** of donated assets which, would then obligate the City to fund the remaining costs over the donated assets ESL.

Figure 10: Acquisition (Constructed) Summary
All Figure Values Are Shown In 2021 Dollars.



Over the next 10 Year planning period the City will acquire approximately **$41,597,000** of constructed assets which can either be new assets which did not exist before or expansion of assets when they are to be replaced. Major acquisition expenditures over the next ten years include:

- **$4.5 million** for traffic signal modernization
- **$6 million** for durable pavement markings
- **$6.83 million** for AM system implementations and
- **$2.5 million** dollar for the infill street lighting program

The majority of the constructed assets costs peak between 2022-2024 and after that there is only minimal construction of assets. The lack of acquired assets from 2025-2031 is due to a

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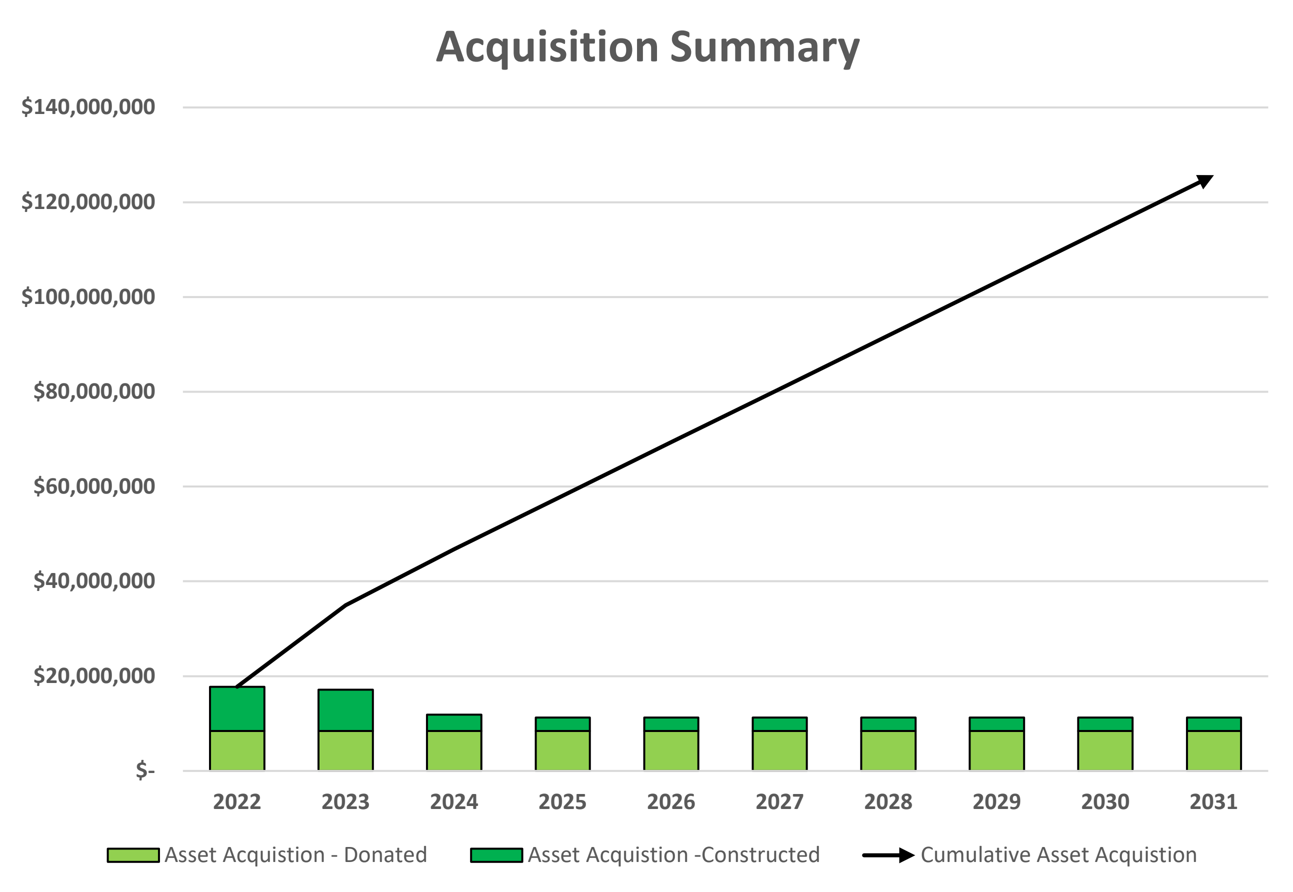
lack of data and limited forecasting ability at this time and not from the likelihood of actual construction projects. As AM knowledge, practices and abilities mature within the City then in all likelihood there will be significant projects with equally significant costs that will appear within the later years of the 10-year planning horizon.

The City has sufficient budget for its planned constructed acquisitions at this time however this does not address future asset needs that may need to be constructed to ensure service levels are maintained over the long term. With competing needs for resources across the entire city there will be a need to investigate tradeoffs and design options to further optimize asset decisions and ensure intergenerational equity can be achieved.

Hamilton will continue to monitor its constructed assets annually and update the AM Plan when new information becomes available.

Figure 11: Acquisition Summary
All Figure Values Are Shown In 2021 Dollars.



When Hamilton commits to constructing new assets, the municipality must be prepared to fund future operations, maintenance and renewal costs. Hamilton must also account for future depreciation when reviewing long term sustainability. When reviewing the long-term impacts of asset acquisition, it is useful to consider the cumulative value of the acquired assets being taken on by Hamilton. The cumulative value of all acquisition work, including assets that are constructed and contributed shown in Figure 5.4.2. above.

Over the next 10 Year planning period Hamilton will acquire approximately **$124,000,000** of Road network assets.

Hamilton has sufficient budget for its planned constructed acquisitions at this time. It will become critical to understand that through the construction or assumption of new assets, the City will be committing to funding the ongoing operations, maintenance and renewal costs which are very significant. Hamilton will need to address how to best fund these ongoing costs as well as the costs to construct the assets while seeking the highest level of service possible.

Future AM Plans will focus on improving the understanding of Whole Life Costs and funding options. However, at this time the plan is limited on those aspects. Expenditure on new assets and services will be accommodated in the long-term financial plan but only to the extent that there is available funding.

2.2.2 Operations and Maintenance Plan

Operations include all regular activities to provide services. Daily, weekly, seasonal and annual activities are undertaken by staff to ensure the assets perform within acceptable parameters and to monitor the condition of the assets for safety and regulatory reasons. Examples of typical operational activities include snow clearing, street sweeping, road patrol, grading/dust control, sign or road inspections, utility costs and the necessary staffing resources to perform these activities.

Some of the major operational investments over the next 10 years include:

- **$45 million** allocated for support from Engineering Services Division
- **$7.2 million** allocated for Geotechnical Investigation Program
- **$11.9 million** allocated for Vision Zero operational initiatives

Maintenance should be viewed as the ongoing management of deterioration. The purpose of planned maintenance is to ensure that the correct interventions are applied to assets in a proactive manner and to ensure it reaches its intended useful life. Maintenance does not significantly extend the useful life of the asset but allows assets to reach their intended useful life by returning the assets to a desired condition.

Examples of typical maintenance activities include pothole repairs, surface treatments, crack sealing, signal repairs, equipment repairs along with appropriate staffing and material resources required to perform these activities.

Major maintenance projects the City plans to continuously manage over the next 10 years include:

- **$17.5 million** allocated for asphalt repair as part of the LINC rehabilitation
- **$27.9 million** allocated for Arterial Asset Preservation Program
- **$26 million** allocated for asphalt preventative maintenance & improvement

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Proactively planning maintenance significantly reduces the occurrence of reactive maintenance which is always linked to a higher risk to human safety and higher financial costs. The City needs to plan and properly fund its maintenance to ensure the transportation network is reliable and can achieve the desired level of service.

Major investments in road maintenance over the planning horizon are costly but necessary to ensuring roads can achieve their intended useful life. Below is a table of major planned maintenance for **2022 – 2024.**

Table 14: Major Maintenance Projects

YEAR	2022-2024 PLANNED MAJOR MAINTENANCE PROJECTS	BUDGET (M)
2022	Sections of Scenic Drive and on Concession Street	$10
	Asphalt preventative program	$2.3
	Strathearne – Mohawk to Chateau Crt.	$1.9
	Clairmont Access – Inverness to Main Street.	$2.5
	Other Maintenance Projects	$16
2023	Asphalt preventative program	$2.5
	Sections of Upper Wentworth	$2.1
	Clairmont Access – Inverness to Main Street.	$2.5
	Other Maintenance Projects	$8.8
2024	Asphalt repair – Section of the LINC	$2.0
	Sections of Strathearne	$3.3
	Various Roads (Pinelands, Teal, Greensfield)	$2.7
	Other Maintenance Projects	$15.8

From **2025 – 2031** the City will invest an additional **$340.1 million** for various projects across the City. These investments for maintenance are intended to allow these assts to reach their estimated service life and minimize reactive maintenance costs. It should be acknowledged that these forecasted costs do not yet fully include the recommended works that need to be undertaken to ensure the entire inventory of assets will achieve their desired service lives and level of service.

Deferred maintenance (i.e. works that are identified for maintenance activities but unable to be completed due to available resources) will be included in the infrastructure risk management plan in future iterations once those works have been identified and prioritized.

The major lifecycle activities per asset with their accompanying 2021 costs (if known) are shown below in Table 15.

Table 15: Operation And Maintenance Summary

ASSET	LIFECYCLE STAGE	LIFECYCLE ACTIVITY	FREQUENCY	2021 COST	UNIT
Road Pavement	Maintenance	Repair	Ad Hoc/Per MMS	$1,100,000	per year
	Operation	Patrol	Per MMS	$692,000	per year
	Operation	Snow Clearing	Per MMS/Council LOS	$22,200,000	per year
	Operation	Sweeping	Ad Hoc/Council LOS	$2,100,000	per year
	Maintenance	Pothole Repair	Per MMS	$2,955,000	per year
	Maintenance	Crack Sealing	Ad Hoc	$100,000	per year
	Maintenance	Surface Treatment	Ad Hoc	$1,590,000	per year
	Maintenance	Bonded Wearing Course	Ad Hoc	$1,590,000	per year
	Maintenance	Ditching	Ad Hoc	$618,000	per year
	Maintenance	Culvert Rehabilitation (<3M)	Ad Hoc	$724,000	per year
	Maintenance	CB Cleaning	Once every 3 years, and as required	$752,000	per year
	Maintenance	Shoulder Rehabilitation	Ad Hoc	$158,000	per year
	Operation	Pavement Marking Inspection	Annual	Unknown	

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Table 15: Operation And Maintenance Summary

ASSET	LIFECYCLE STAGE	LIFECYCLE ACTIVITY	FREQUENCY	2021 COST	UNIT
Bicycle Lane	Operation	Snow Removal	Per MMS	Not tracked separate from road pavement	
	Operation	Sweeping	Ad Hoc/Council LOS	Not tracked separate from road pavement	
	Maintenance	Pothole Repair	Per MMS	Not tracked separate from road pavement	
	Maintenance	Crack Repair	Ad Hoc	Not tracked separate from road pavement	
	Maintenance	Barrier Repair	Ad Hoc	Not tracked separate from road pavement	
	Operation	Signal Inspection	18 months	Not tracked separate from road pavement	
	Maintenance	Signal Repair	Ad Hoc	Not tracked separate from road pavement	
	Maintenance	Sign Repair	18 months	Not tracked separate from road pavement	
	Operation	Sign Inspection	Ad Hoc	Not tracked separate from road pavement	
	Operation	Lane Inspection	Ad Hoc	Not tracked separate from	

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Table 15: Operation And Maintenance Summary

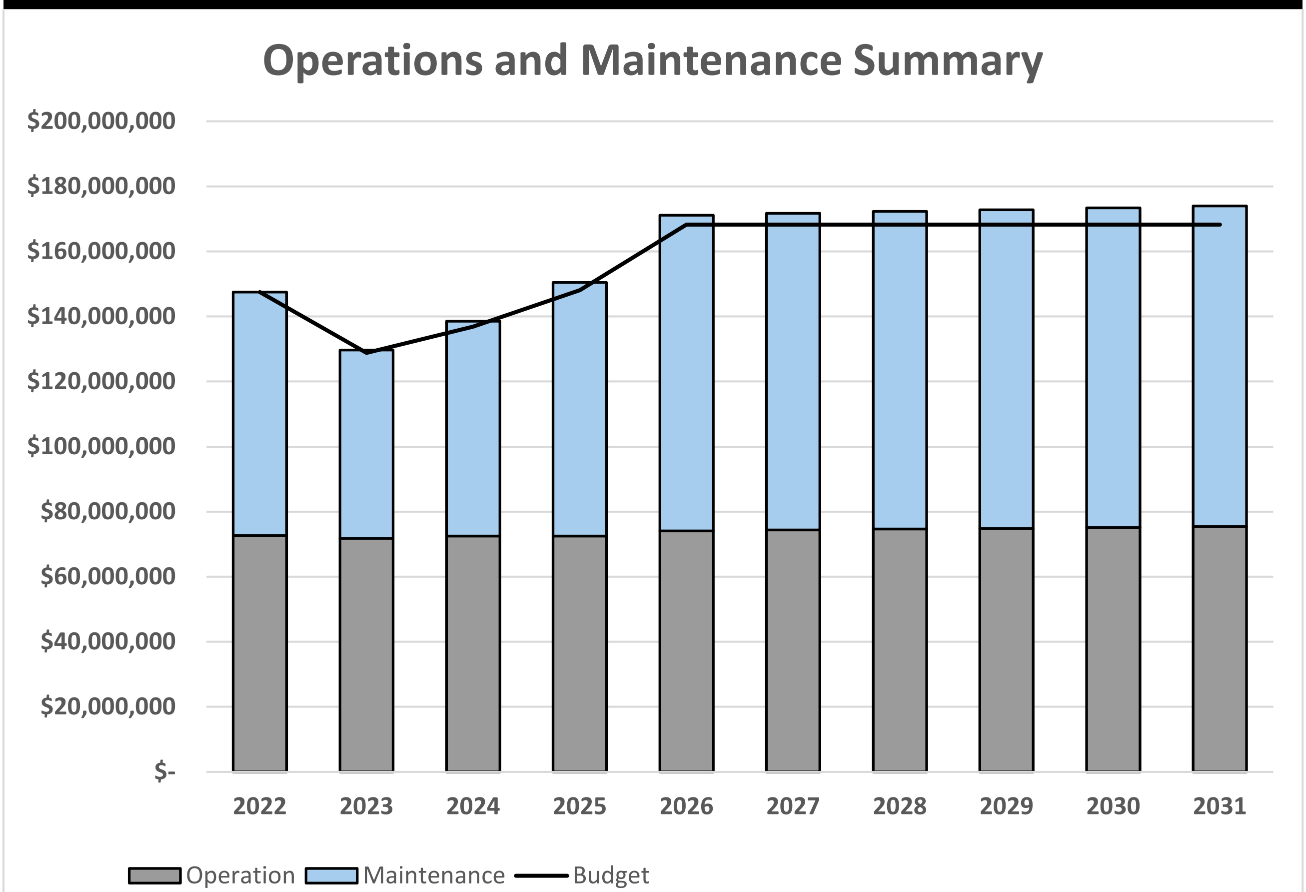
ASSET	LIFECYCLE STAGE	LIFECYCLE ACTIVITY	FREQUENCY	2021 COST	UNIT
				road pavement	
Sidewalk	Operation	Snow Clearing	Per MMS / Council LOS	$1,955,000	per year
	Operation	Inspection	Annually	$80,000	per year
	Maintenance	General Repair	Per MMS / Ad Hoc	$6,100,000	per year
Guide Rail	Maintenance	Repair	Ad Hoc	$400,000	per year
Signalized Intersection	Operation	Inspection	Annually	$170,400	per year
	Maintenance	Repair	Ad Hoc	$1,507,000	per year
Luminaires	Maintenance	HPS Re-lamping	Annual	$37,500	per year
	Maintenance	MH Re-lamping	3 year cycle	$60,000	per cycle
	Maintenance	Arm Maintenance/Rewires	Annual	$30,000	per year
	Operation	Energy	Annual	$3,300,000	per year
	Operation	Night Patrol	Annual	$12,250	per year
Streetlight Poles	Maintenance	MVA Replacements	annual	$100,000	per year
	Maintenance	Painting & Straightening	annual	$30,000	per year
Dynamic Speed Signs	Operation	Installation / Removal	Monthly	$157,000	Per year
Traffic Sign	Operations	Inspection	Annually	$230,000	Per year
Pedestrian Crossover	Operations	Inspection	Annually	Not tracked separately	

Table 15: Operation And Maintenance Summary					
ASSET	LIFECYCLE STAGE	LIFECYCLE ACTIVITY	FREQUENCY	2021 COST	UNIT
				from traffic signals	
Noise Wall & Fencing	Maintenance	Repair	Ad Hoc	$80,000	Per year

Assessment and priority of reactive maintenance is undertaken by staff using experience and judgement.

Forecast operations and maintenance costs vary in relation to the total value of the asset registry. When additional assets are acquired, the future operations and maintenance costs are forecast to increase. When assets are disposed of the forecast operation and maintenance costs are reduced. Figure 12 shows the forecast operations and maintenance costs relative to the proposed operations and maintenance Planned Budget.

Figure 12: Operations and Maintenance Summary
All Figure Values Are Shown In 2021 Dollars.



The forecast costs include all costs from both the capital and operating budget. Asset managment focuses on how taxpayer or ratepayer dollars are invested by lifecycle activities and not by budget allocation since both budgets contain various lifecycle activities, they must both be consolidated for the AM Plans.

The forecast of operations and maintenance costs are increasing steadily over time and it is clear, the City has insufficient budget to achieve all of the works required to ensure that assets will be able to achieve their estimated service life at the desired level of service. It is anticipated that at the current budget levels there will be insufficient budget to address all operating and maintenance needs over the 10-year planning horizon. The graph above illustrates that without increased funding or changes to lifecycle activities there is a significant shortage of funding which will lead to:

- Higher cost reactive maintenance;
- Possible reduction to the availability of the assets;
- Impacts to private property; and,
- Increased financial and reputational risk

This shortfall is primarily due to the significant number of assets that are donated through subdivision agreements annually. Adding additional assets over time significantly impacts the operational and maintenance resources required to sustain the expected or mandatory level of service. It should be noted that a significant amount of operational and maintenance expenditures are mandatory due to legislative requirements and cannot simply be avoided or deferred.

As the City continues to develop condition profiles and necessary works are identified based on their condition, it is anticipated this operation and maintenance forecasts will increase significantly. Where maintenance budget allocations will result in a lesser level of service, the service consequences and risks have been identified and are highlighted in the Risk Section 2.6. Future iterations of this plan will provide a more thorough analysis of operations and maintenance costs including types of expenditures for training, mandatory certifications, insurance, staffing costs and requirements, equipment and maintenance activities.

2.2.3 Renewal Plan

Renewal is major works which does not increase the assets design capacity but restores, rehabilitates, replaces, or renews an existing asset to its original service potential. Works over and above restoring an asset to original service potential is considered to be an acquisition resulting in additional future operations and maintenance costs

Asset renewals are typically undertaken to either ensure the assets reliability or quality will meet the service requirements set out by the City. Renewal projects are often triggered by service quality failure and can often be prioritized by those that have the highest consequence of failure, have high usage, have high operational and maintenance costs and other deciding factors.

The typical useful lives of assets used to develop projected asset renewal forecasts are shown in Table 16 and are based on estimated design life for this iteration. Future iterations of the plan will focus on the Lifecycle approach to ESL which can vary greatly from design life. Asset useful lives were last reviewed in 2022 however they will be reviewed annually until their accuracy reflects the City's current practices.

Table 16: Useful Lives of Assets

ASSET (SUB)CATEGORY	USEFUL LIFE (YEARS)
Road Pavement	35
Sidewalk	50
Bicycle Lanes	35
Noise Walls & Fencing	50
Signs	15
Streetlight Pole	50
Streetlight Luminaire	20
Signalized Intersection	20
Pedestrian Crossover (PXO)	15
Guide Rails	30
Vehicles	9.5

The estimates for renewals in this AM Plan were based on the register method which utilizes the data from the City's asset registry to analyse all available lifecycle information and then determine the optimal timing for renewals.

RENEWAL RANKING CRITERIA

Asset renewal is typically undertaken to either:

- Ensure the reliability of the existing infrastructure to deliver the service it was constructed to facilitate (e.g. replacing a bridge that has a load limit), or
- To ensure the infrastructure is of sufficient quality to meet the service requirements (e.g. condition of a culvert).[1]

[1] IPWEA, 2015, IIMM, Sec 3.4.4, p 3|91.

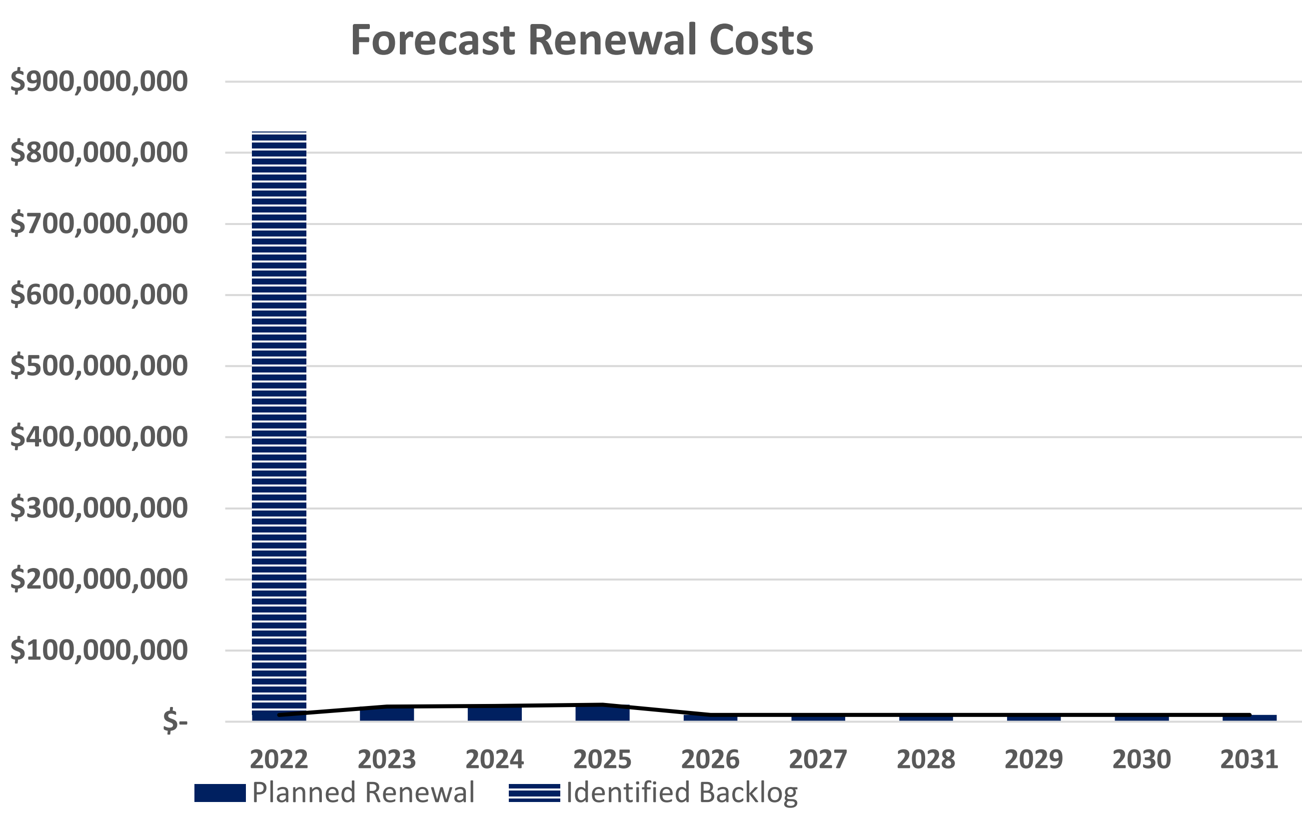
It is possible to prioritize renewals by identifying assets or asset groups that:

- Have a high consequence of failure,
- Have high use and subsequent impact on users would be significant,
- Have higher than expected operational or maintenance costs, and
- Have potential to reduce life cycle costs by replacement with a modern equivalent asset that would provide the equivalent service.[2]

SUMMARY OF FUTURE RENEWAL COSTS

Forecast renewal costs are projected to increase over time if the asset stock increases. The forecast costs associated with renewals are shown relative to the proposed renewal budget in Figure 13.

Figure 13: Forecast Renewal Costs
All Figure Values Are Shown In 2021 Dollars.



The significant amount highlighted in 2022 represents the cumulative backlog of deferred work needed to be completed that has been either identified through its current estimated condition or age per Table 6 when condition was not available. This back log represents nearly

[2] Based on IPWEA, 2015, IIMM, Sec 3.4.5, p 3|97.

$820,000,000 of deferred works that have accumulated over multiple decades and for and have created a significant backlog of necessary works.

Deferred renewals (assets identified for renewal and not funded) are included and identified within the risk management plan. Prioritization of these projects will need to be funded and managed over time to ensure renewal occurs at the optimal time.

There is sufficient budget to support the planned projects only. Without additional funding the backlog will remain and continue to grow as future projects outside of the 10-year planning horizon continue to move forward into the 10-year scope. Continued deferrals of projects will lead to significantly higher operational and maintenance costs and will affect the availability of services in the future.

The expected renewal works over the 10-year planning horizon include **$9.75 million** dollars in **2022** for road sections such as Marion Street and Dundas Street as well as **$1 million** for sidewalk renewals across the City. In **2023** the City will invest **$3.3 million** to renew Arvin Avenue as well as **$5.7 million** renewing sections of Barton Street, **$3.5 million** for select sections of Cannon Street and **$1 million** on sidewalk renewals. **2024** will see the City invest **$4.4 million** to renew Scenic Drive from Chateau Court to Upper Paradise Road, **$4.5 million** for sections of Mohawk Road, streetlights as well as sections of roads along Mohawk Road.

Deferring renewals create risks of higher financial costs, decreased availability, and decreased satisfaction with asset performance. Ultimately, continuously deferring renewals works ensures Hamilton will not achieve intergenerational equality. If Hamilton continues to push out necessary renewals, there is a high risk that future generations will be unable to maintain the level of service the customers currently enjoy. It will burden future generations with significant costs that inevitably they will be unable to sustain.

Properly funded and timely renewals will ensure the assets perform as expected and it is recommended to continue to analyze asset renewals based on criticality and availability of funds for future AM Plans.

2.2.4 Disposal Plan

Disposal includes any activity associated with the disposal of a decommissioned asset including sale, demolition or relocation. At the time of writing this AM Plan, there were no road assets identified for disposal.

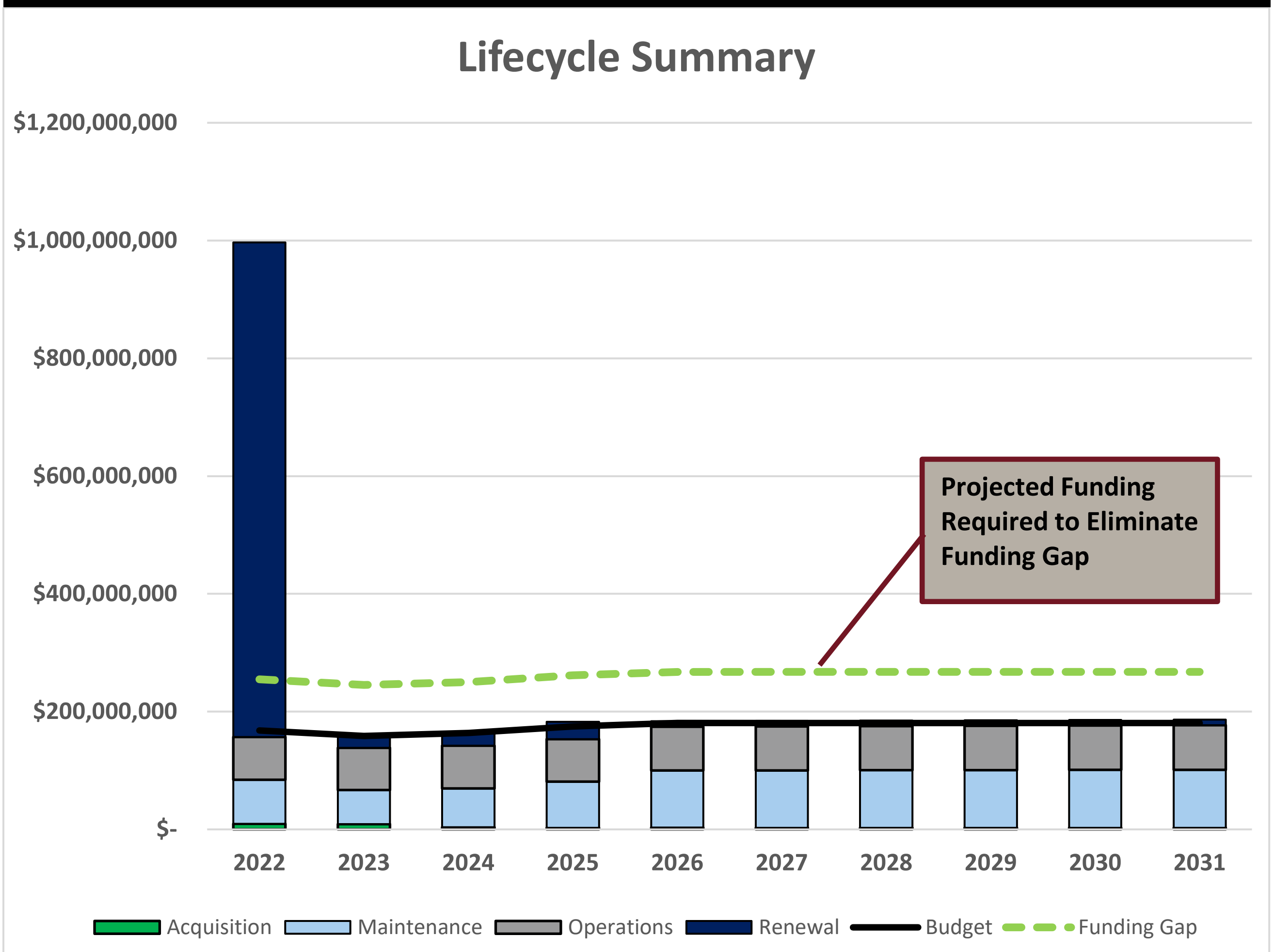
At this time the City does not separate its disposal costs and activities and combines them with its renewal planning. This has been identified as a continuous improvement and will be separated out for the next iteration for the AM Plan.

SUMMARY OF ASSET FORECAST COSTS

The financial projections from this asset plan are shown in Figure 14. These projections include forecast costs for acquisition, operation, maintenance, renewal, and disposal. These forecast costs are shown relative to the proposed budget.

The bars in the graphs represent the forecast costs needed to minimize the life cycle costs associated with the service provision. The proposed budget line indicates the estimate of available funding. The gap between the forecast work and the proposed budget is the basis of the discussion on achieving balance between costs, levels of service and risk to achieve the best value outcome.

Figure 14: All Figure Values Are Shown In 2021 Dollars.



There is sufficient budget to address most of the planned operational and maintenance activities for the planning period. However, with the assumption of assets and their increased costs over time then there may be impacts to the service itself. Without some adjustment to available funds or other lifecycle management decisions there will be insufficient budget to address all planned lifecycle activities.

Hamilton currently has insufficient budget to address the large backlog of renewal work projected by the plan over the 10 year horizon When deferring of renewals occurs Hamilton runs the risk of higher cost reactive maintenance, service interruptions, decreased satisfaction, harm to its reputation along with other risk costs such as legal fees. Deferring renewals is not the optimal recommendation and Hamilton would benefit from seeking out long term financing strategies to enable a more rapid renewal plan.

Without sufficient funding the City has little option but to defer these necessary lifecycle activities. Deferring important lifecycle activities is never recommended. The City will benefit from allocating sufficient resources to developing its long-term financial plan to ensure that over time the City can fully fund the necessary lifecycle activities. Funding these activities helps to ensure the assets are compliant, safe and effectively deliver the service the customers need and desire.

Renewing at a greater rate and increasing major maintenance projects would allow Hamilton to mitigate ever decreasing road conditions proactively. With over 6,400 km’s of roads to manage it is imperative that Hamilton optimize its renewal and major maintenance planning so that over time, high cost reactive maintenance will be avoided or deferred to a later date.

The lack of funding allocated for the backlog of renewals and the necessary lifecycle activities creates an additional issue which is intergenerational equity. Each year the City defers necessary lifecycle activities it pushes the ever-increasing financial burden on to future generations. It is imperative the City begin addressing the lack of consistent and necessary funding to ensure that intergenerational equity will be achieved. Over time, allocating sufficient funding on a consistent basis ensures that future generations will be able to enjoy the same standards being enjoyed today.

Over time the City will continue to improve its lifecycle data, and this will allow for informed choices as how best to mitigate those impacts and how to address the funding gap itself. This gap in funding future plans will be refined over the next 3 years and improve the confidence and accuracy of the forecasts

2.3 MANDATORY O.REG. 588/17 LEVELS OF SERVICE

As previously mentioned, the City is developing this AM Plan in accordance with O.Reg. 588/17 requirements. Table 4 in O.Reg. 588/17 identifies specific metrics that must be reported in the AM Plan for road assets for the purposes of comparison amongst municipalities. These metrics are required to be reported, and so they have been separated from the municipally defined levels of service described in Section 2.4. These metrics are divided into community and technical levels of service.

2.3.1 O.Reg. 588/17 Community Levels of Service

The community levels of service that the City is required to report on in order to meet the provincial level of service requirement are reported below:

Scope
Description, which may include maps, of the road network in the municipality and its level of connectivity.

Different areas of the City have different levels of connectivity. The City is made up of six (6) communities: Hamilton, Stoney Creek, Dundas, Glanbrook, Ancaster, Flamborough. All communities have major routes connecting these communities from east to west and north to south.

EAST AND WEST

In the lower City, Main Street/Queenston Road and King Street are one way streets which become two lanes at various points and are 2 to 5 lanes wide and traverse the entire lower City providing the major connectivity route from east to west for vehicular traffic connecting Dundas to Stoney Creek. In Stoney Creek, Main Street East connects to Queenston Road at Strathearne Avenue, and in Dundas, Main Street West branches out to Osler Drive. In the west end of the City, these connect the City to the 403 East Bound and West Bound, and in the east end of the City, these connect to the Red Hill Valley Parkway allowing access to the Queen Elizabeth Way (QEW). This is the route that the future Light-Rail Transit (LRT) will be following, which will be elaborated on when Transit is added to this AM Plan. The 403 East and West connect to Hwy 6 North and South which connect the other communities to Flamborough and Glanbrook.

In addition, the Cannon Street cycle track provides the east to west urban bicycle connectivity in the lower City from Britannia Avenue to York Boulevard to Plains Road West.

In the upper City, the Lincoln M. Alexander Parkway (The Linc) provides the major east to west connection connecting upper Stoney Creek to Ancaster. The westbound Linc connects the City to the 403 East and 403 West, and the eastbound route eventually becomes the Red Hill Valley Pkwy which connects the north and south at the east end of the City also providing access to the QEW. The 403 East and West connect to Hwy 6 which connects the other communities to Flamborough and Glanbrook.

NORTH AND SOUTH

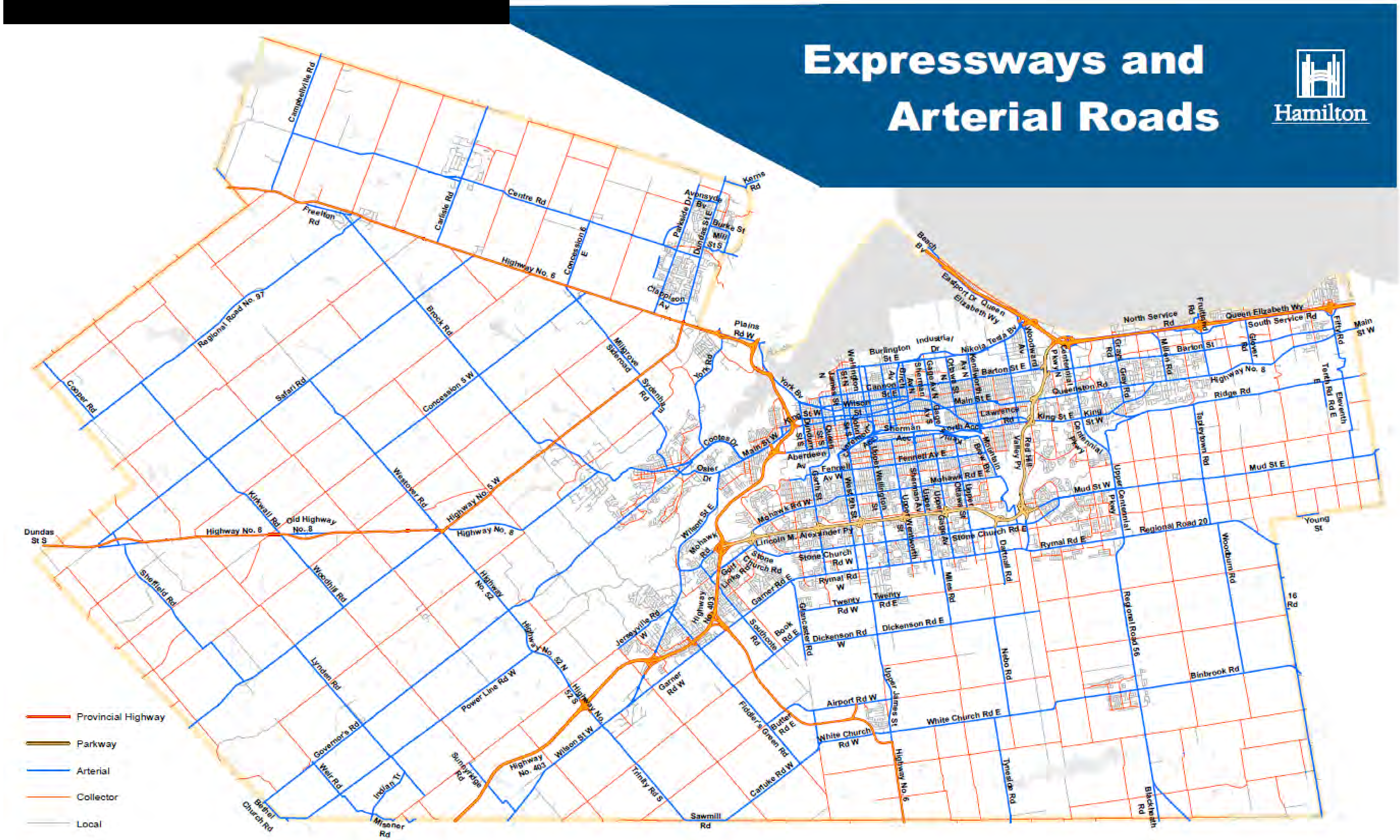
In terms of north and south connections, the City has a unique connectivity issue in the form of the Niagara escarpment which creates a major elevation change separating Hamilton into the lower City and the upper City (sometimes referred to as the Mountain). There are eighteen (18) accesses including major ones such as Claremont, Sherman, Kenilworth, Jolly Cut, Queen Street, and Wilson Street that allow the lower City access to the upper City. Closures associated with these accesses can create major connectivity issues City wide. Unfortunately, since the escarpment itself requires maintenance activities to reduce or treat erosion of the escarpment face, which may create road closure situations, this creates a unique connectivity problem requiring planning and sometimes affecting the level of service. The Niagara escarpment is considered a natural asset, which falls under the non-core asset umbrella, and will be addressed in future plans.

The Red Hill Valley Parkway also provides a north to south connection on the east end of the City connecting upper Stoney Creek to lower Stoney Creek.

In addition, the Bay Street cycle track provides the north to south urban bicycle connectivity in the lower City, and the new Keddy Access Trail along the Claremont Access provides the major urban bike route connectivity from upper City to the lower City.

Figure 15 shows the Hamilton road network colour coded by functional class.

Figure 15: Expressways and Arterial Roads



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Quality

1. Description or images that illustrate the different levels of road class pavement condition.

Table 17 shows photos taken from the last inspection of each road functional class for each OCI condition range. It is evident from this table that different functional road classes may output different OCI scores even when the pavement visually appears to be in different condition. For instance, an expressway segment may output a similar OCI value to an Urban Local road segment even if the expressway visually appears to have less surface distresses. This is because vehicles travel faster over the expressway which emphasizes the Roughness Index described in Section 2.1.3.2. In addition, it is evident that there are no photos of the expressway functional class in Very Poor condition and this is because the City does not allow these segments to reach Very Poor condition because they are considered a critical asset, and they are kept in average Good condition.

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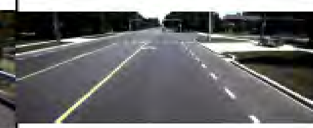
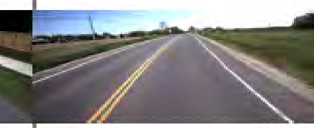
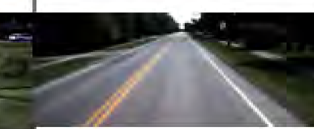
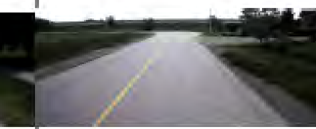
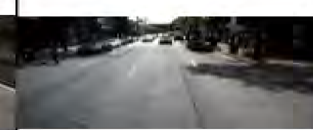
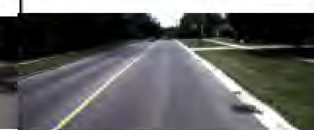
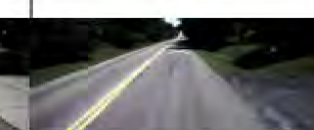
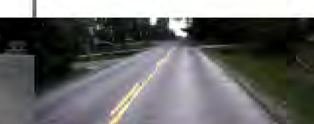
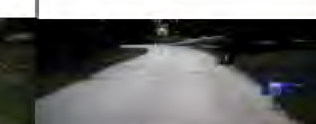
Table 17: OCI Ranges and Condition Descriptions

Condition Category	OCI Range	Condition Description	Functional Class							
			Expressway	Urban Arterial Major	Urban Arterial Minor	Urban Collector	Urban Local	Rural Arterial	Rural Collector	Rural Local
Very Good	86 - 100	The road is well maintained, in good condition, new or recently rehabilitated. Road generally shows little to no surface distresses, with good rideability.	 OCI =100	 OCI = 91	 OCI = 93	 OCI = 88	 OCI = 91	 OCI = 88	 OCI = 91	 OCI =87
			Candidate for localized preventive maintenace							
Good	71 – 85	The road is adequate. It is acceptable and generally within the mid-stage of its expected service life. Road generally shows some low severity surface distresses, with fair to good rideability.	 OCI = 78	 OCI = 76	 OCI = 81	 OCI = 77	 OCI = 76	 OCI = 81	 OCI = 83	 OCI = 77
			Candidate for generalized preventative maintenance							
Fair	56 – 70	The road requires attention. It shows signs of deterioration and some elements exhibit deficiencies. Road generally shows low to moderate surface distresses, with poor to good rideability.	 OCI = 67	 OCI = 65	 OCI = 64	 OCI = 63	 OCI = 62	 OCI = 66	 OCI = 65	 OCI = 63
			Candidate for minor rehabilitation							
Poor	41 – 55	There is an increasing potential for the road condition to affect the service it provides. The road is approaching the end of its service life, the condition is below the standard and a large portion of the road surface exhibits significant deterioration. Road generally shows moderate to severe surface distresses over a large portion of the surface area, with	 OCI = 54	 OCI = 49	 OCI = 49	 OCI = 50	 OCI = 45	 OCI = 51	 OCI = 48	 OCI = 48
			Candidate for major rehabilitation							
Very Poor	0 – 40	The road is near or beyond its expected service life and shows widespread signs of advanced deterioration. Road generally shows moderate to severe distresses over most of the surface area, with very poor to fair	N/A OCI = N/A	 OCI =36	 OCI = 35	 OCI = 31	 OCI = 23	 OCI = 38	 OCI = 36	 OCI = 30
			Candiate for reconstruction							

2.3.2 O.Reg. 588/17 Technical Levels of Service

In addition, there are technical levels of service that the City is required to report on in order to meet the provincial level of service requirement. These quantitative metrics are reported below in Table 18. A map of the road network by OCI is shown in Figure 3 located in Section 2.1.3.3.

Table 18: Technical Levels of Service

SERVICE ATTRIBUTE	TECHNICAL LEVELS OF SERVICE	MEASURE
Scope	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.	Expressway: 0.1 Arterial: 1.4 Collector: 1.8 Local: 2.4
Quality	1. For paved roads in the municipality, the average pavement condition index value.	OCI: 63.78 (Fair)
	2. For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).	OCI: 47.46 (Poor)

2.4 MUNICIPALLY DEFINED LEVELS OF SERVICE

Levels of service are measures for what the City provides to its customers, residents, and visitors. Service levels are best described as the link between providing the outcomes the community desires, and the way that the City provides those services. Service levels defined in three ways, customer values, customer levels of service and technical levels of service which are outlined in this section. An explanation for how these were developed is provided in Section 7.5 of the AMP Overview.

2.4.1 Customer Values

Customer values are what the customer can expect from their tax dollar in "customer speak" which outline what is important to the customer, whether they see value in the service, and the expected trend based on the 10-year budget. These values are used to develop the level of service statements.

To develop these customer values, as stated in the AMP Overview, a Customer Engagement Survey was released in January 2022 on the Engage Hamilton platform. The survey received 279 submissions and contained 24 questions related to road asset service delivery. The survey results can be found in Appendix "A" in the AMP Overview. While these surveys were used to establish customer values and customer performance measures, it's important to note that the number of survey respondents only represents a small portion of the population. The future intent is to release this survey on a regular basis to measure the trends in customer satisfaction and ensure that the City is providing the agreed level of service as well as to improve the marketing strategy to receive more responses. This has been noted in Table 29 in the continuous improvement section.

Table 19: Customer Values

SERVICE OBJECTIVE:

CUSTOMER VALUES	CUSTOMER SATISFACTION MEASURE	CURRENT FEEDBACK	EXPECTED TREND BASED ON PLANNED BUDGET (10-YEAR HORIZON)
Road, sidewalk, and bicycle lanes should be kept in good condition.	Annual Customer Engagement Survey	Survey respondents feel the roads are in Poor to Very Poor condition and sidewalks and bicycle lanes are in Fair condition.	Slight decrease

2.0 ROAD LINEAR

Table 19: Customer Values			
SERVICE OBJECTIVE:			
CUSTOMER VALUES	**CUSTOMER SATISFACTION MEASURE**	**CURRENT FEEDBACK**	**EXPECTED TREND BASED ON PLANNED BUDGET (10-YEAR HORIZON)**
Any road deficiencies should be repaired quickly.	Annual Customer Engagement Survey	Many survey respondents felt potholes should be repaired more quickly.	Maintain
Roads and sidewalks should be cleared quickly after a snowfall.	Annual Customer Engagement Survey	Many survey respondents felt roads were cleared in a reasonable amount of time after a snow event.	Maintain
Roads should feel safe to travel on.	Annual Customer Engagement Survey	Most survey respondents felt safe using the roads in a motor vehicle but did not feel safe cycling in urban areas.	Maintain
Good connectivity should be maintained.	Annual Customer Engagement Survey	Many survey respondents are affected during an escarpment access closure (36%). The City should continue proactively completing preventative maintenance on the escarpment face.	Slight decrease

2.4.2 Customer Levels of Service

Ultimately customer performance measures are the measures that the City will use to assess whether it is delivering the level of service the customers desire. Customer level of service measurements relate to how the customer feels about the City's road linear assets in terms of their quality, reliability, accessibility, responsiveness, sustainability and over course, their cost. The City will continue to measure these customer levels of service to ensure a clear understanding on how the customers feel about the services and the value for their tax dollars.

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The Customer Levels of Service are considered in terms of:

Condition	How good is the service? What is the condition or quality of the service?
Function	Is it suitable for its intended purpose? Is it the right service?
Capacity/Use	Is the service over or under used? Do we need more or less of these assets?

In Table 20 under each of the service measures types (Condition, Function, Capacity/Use) there is a summary of the performance measure being used, the current performance, and the expected performance based on the current budget allocation.

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Table 20: Customer Levels of Service

TYPE OF MEASURE	LEVEL OF SERVICE STATEMENT	SOURCE	PERFORMANCE MEASURE	CURRENT PERFORMANCE	EXPECTED TREND BASED ON PLANNED BUDGET
Condition	Ensure transportation network assets are kept in safe and acceptable repair, and issues are resolved in a timely manner.	Annual Customer Engagement Survey	53.9% of survey respondents rate road surface condition as Poor or Very Poor.	Unsatisfied	Maintain
			62.6% of survey respondents rate the surface condition of sidewalks as Fair.	Unsatisfied	Maintain
			53.1% of survey respondents rate the surface condition of bicycle lanes as Fair.	Unsatisfied	Maintain
			78.5% of survey respondents feel safe using the roads in a motorized vehicle	Fairly Satisfied	Maintain
			58.1% of survey respondents felt unsafe cycling on urban roads	Unsatisfied	Maintain
			78.8% of survey respondents felt safe using sidewalks or multi-use trails	Fairly Satisfied	Maintain
			56.6% of survey respondents thought potholes were not fixed in a reasonable amount of time	Unsatisfied	Maintain
			Confidence levels	Medium	
		Road Inspection Report	Average condition of expressway	Good	Maintain
			Average overall road network condition	Fair	Slight Decrease
			Confidence levels	Medium	
		Annual Sidewalk Inspection	Average sidewalk condition	Good	Maintain
			Confidence levels	Medium	
Function	Ensure good traffic flow and connectivity are maintained.	Annual Customer Engagement Survey	70.7% of survey respondents felt traffic congestion was acceptable or neutral in the City	Satisfied	Slight Decrease
			79.2% of survey respondents felt there is ample notice for road work or were neutral	Satisfied	Maintain
			57.4% of survey respondents thought roads were plowed in a reasonable amount of time after a significant snow event	Satisfied	Maintain
			Confidence levels	Medium	
Capacity	Ensure transportation network is providing and encouraging multi-modal transportation	Annual Customer Engagement Survey	94.6% of survey respondents drive in a motorized vehicle at least once a week	Very Frequently	Unknown
			8.1% of survey respondents cycle through rural areas at least once a week	Infrequently	Unknown
			20.2% of survey respondents cycle through urban areas at least once a week	Somewhat Infrequently	Unknown
			80.6% of survey respondents walk using sidewalks or multi-use trails at least once a week	Frequently	Unknown
			Confidence levels	Medium	

2.4.1 Technical Levels of Service

Technical levels of service are operational or technical measures of performance, which measure how the City plans to achieve the desired customer outcomes and demonstrate effective performance, compliance and management. The metrics should demonstrate how the City delivers its services in alignment with its customer values; and should be viewed as possible levers to impact and influence the Customer Levels of Service. The City will measure specific lifecycle activities to demonstrate how the City is performing on delivering the desired level of service as well as to influence how customer perceive the services they receive from the assets.

Technical service measures are linked to the activities and annual budgets covering Acquisition, Operation, Maintenance, and Renewal. Asset owners and managers create, implement and control technical service levels to influence the service outcomes.[3]

Table 21 shows the activities expected to be provided under the current 10 year Planned Budget allocation and the Forecast activity requirements being recommended in this AM Plan.

Table 21: Technical Levels of Service

LIFECYCLE ACTIVITY	LEVEL OF SERVICE STATEMENT	ACTIVITY MEASURE	CURRENT PERFORMANCE*	TARGET**	RECOMMENDED PERFORMANCE ***
Operation	Ensure transportation network assets are kept in safe and acceptable repair, and issues are resolved in a timely manner.	% road patrol compliance to MMS standards	95.05%	100%	100%
		% of Monthly Street Light Inspections Completed to Council Approved Standards	100%	100%	100%
		% of sidewalk inspections completed annually	100%	100%	100%
		# Signal Inspections Completed to MMS Standards	672	550	100%
		# of Annual Signal Conflict Monitor Inspections Completed to MMS Standards	399	250	100%
		% of sign inspections completed on time to MMS Standards	85.42%	100%	100%

[3] IPWEA, 2015, IIMM, p 2|28.

Table 21: Technical Levels of Service

LIFECYCLE ACTIVITY	LEVEL OF SERVICE STATEMENT	ACTIVITY MEASURE	CURRENT PERFORMANCE*	TARGET**	RECOMMENDED PERFORMANCE ***
		# 2021 on-road fatal injury traffic collisions	16	0	0
		Budget	$72,263,296		$73,497,640
Maintenance*	Ensure transportation network assets are kept in safe and acceptable repair, and issues are resolved in a timely manner.	Overall Road OCI	63.78	65	65
		% potholes repaired to MMS standards	95.92%	100%	100%
		% of pavement surface cracks repaired to MMS standards	100%	100%	100%
		% of sidewalks repaired to MMS standards	100%	100%	100%
		% of shoulder drop offs repaired to MMS standards	100%	100%	100%
		% of surface discontinuities repaired to MMS standards	95.83%	100%	100%
		% Signal Deficiencies Addressed to MMS Standards	98.36%	100%	100%
		% signs repaired on time to MMS Standards	74.96%	100%	100%
		Budget	**$84,807,304**		**$87,275,976**

Note: * Current activities related to Planned Budget.
**** Current internal target**
***** Expected performance related to forecast lifecycle costs.**

It is important to monitor the service levels regularly as circumstances can and do change. Current performance is based on existing resource provision and work efficiencies. It is acknowledged changing circumstances such as technology and customer priorities will change over time.

At this time, the technical levels of service focus on operations and maintenance lifecycle activities and are typically measuring how the City is performing in accordance with the MMS. It is evident that the City is typically meeting these standards with a few exceptions. However, customer preferences and expectations do not always match minimum legislated requirements, which is discussed in Section 2.4.2.

A future continuous improvement item is to add additional level of service metrics which measure technical levels of service at other lifecycle stages (i.e. acquisition, renewal, disposal), as well as ensure the performance measurements are in line with customer values. In addition, as the City's asset management maturity increases, and with the implementation of the Enterprise Asset Management (EAM) project mentioned in the AMP Overview, the City will also have more capacity to measure additional metrics.

In addition, the Alleyway Management Strategy adopted in November 2019 explains that the City currently delivers a low level of service (LOS) for these assets which involves not including alleyways in capital renewals and only completing operational activities on a reactive basis. The Strategy also identified medium and high LOS scenarios which have broken down the lifecycle management strategies by a defined hierarchy class based on usage. The City has continued to deliver alleyways on a low LOS scenario, but should investigate improving the LOS for the A and B hierarchy classes defined in the Strategy as well as incorporate technical levels of service for this asset if it is adopted. This has been identified as a continuous improvement item in Table 29.

2.4.2 Level of Service Summary

At this time, the City's technical metrics for the road linear service area is based on the MMS. It is evident per Table 21 that the City is typically meeting these standards with a few exceptions. However, customer preferences and expectations do not always match minimum legislated requirements, which is discussed below.

CONDITION

Based on Table 20 above, survey respondents were unsatisfied with the condition of the road network, even though at this time the City is currently maintaining the road network at a Fair condition per the current level of service, and is only one point (64 out of 65) away from achieving the technical target. This shows there is currently a mismatch between the City and the customer as to the level of service that is expected with respect to road condition. Although, it is important to note that as discussed in Section 2.1.3.2, the City is revising the OCI model, and these condition values may change.

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Furthermore, per Figure 3, many sections on the main arterial roads on Main and King St which act as the main connection between the lower City from west to east and east to west are shown to be in poor to very poor condition. The City typically maintains expressways at an average Good condition because they are major transportation routes, and so the City should investigate identifying these major arterial roads as critical assets and increasing the minimum average condition for these roads.

In addition, it was shown that many survey respondents have concerns with the number of potholes they experience while driving on the road network and think they should be repaired faster. Although the City repaired approximately 96% of potholes per the MMS size and depth within the required timeframe based on the functional class, it appears that customers may expect a higher level of service than the minimum requirement.

Therefore, it is imperative that the City investigate improving the level of service with respect to road condition and maintenance, and provide customers with the necessary information on the additional cost and resources required to improve the level of service, and whether they are interested in paying more for this higher level of service.

FUNCTION

Based on Table 20, most survey respondents felt that roads were cleared in a reasonable amount of time after a snowfall. However, survey respondents who felt unsafe using sidewalks or multi-use trails with or without a mobility device cited an operational issue as the reason why they felt unsafe. Although the City has recently contracted out a service to clear sidewalks downtown, at this time, most sidewalks are not cleared by the City and are cleared by property owners.

Therefore, expectations and the monetary amount required to increase this level of service must be communicated clearly to the public, and technical metrics associated with snow clearing should be added to the balanced scorecard.

CAPACITY

Based on Table 20, many survey respondents felt unsafe cycling on urban roads and the most common reason was infrastructure design. Since the City is working towards improving the active transportation network, and survey respondents feel unsafe due to infrastructure design, the usage of bicycle lanes likely could be increased if more safety features were added.

The City should also investigate providing separation in areas where it does not exist, and increasing cycling route connectivity, and communicating the monetary amount required to increase this level of service. In addition, technical metrics associated with bicycle lanes should be added to the balanced scorecard to ensure the City levels of service are matching customer values.

2.5 FUTURE DEMAND

The ability for the City to be able to predict future demand for services enables the City to plan ahead and identify the best way of meeting the current demand while being responsive to inevitable changes in demand. Demand will inevitably change over time and will impact the needs and desires of the community in terms of the quantity of services (assumption of assets due to development growth) and types of service required (alternative pavement options or traffic calming devices)

Demand is defined as the desire customers have for assets or services and that they are willing to pay for. These desires are for either new assets/services or current assets.

Since demand is not yet an extensive requirement in O.Reg. 588/17 for the July 1st, 2022 deadline, this section is not as robust as some other sections of the report, but is an obligation for the report by July 1st, 2025, and will be expanded on in future iterations of the report.

2.5.1 Demand Drivers

For the road linear service area, the key drivers are population change, climate change, and customer preferences and expectations. A future continuous improvement item is to identify additional demand drivers.

In addition, the City is moving towards a “Complete Streets” model, and is currently developing a Complete, Livable, Better (CLB) Streets Design Manual, which will likely affect future demand. The intent is to build streets that are safer for all road users including pedestrians, cyclists, transit users, drivers, and people of all ages and abilities.

2.5.2 Demand Forecasts

The high level present position and projections for demand drivers that may impact future service delivery and use of assets have been identified and documented in Table 22. At this time, specific projections have not been calculated and will be updated in the 2025 AM Plan per the timelines stated in the AMP Overview. In addition, growth projections have been shown in the AMP Overview.

2.5.3 Demand Impact and Demand Management Plan

The impact of demand drivers that may affect future service delivery and use of assets are shown in Table 22.

Demand for new services will be managed through a combination of managing existing assets, upgrading of existing assets and providing new assets to meet demand and demand management. Demand management practices can include non-asset solutions, insuring against risks, and managing failures.

Opportunities identified to date for demand management are shown in Table 22. Climate change adaptation is included in Table 23. Further opportunities will be developed in future revisions of this AM Plan, as identified in Table 29 in the continuous improvement section.

Table 22: Demand Management Plan

DEMAND DRIVER	CURRENT POSITION	PROJECTION	IMPACT ON SERVICES	DEMAND MANAGEMENT PLAN
Customer Preferences and Expectations	The City is responsible for sidewalks along transit routes and city owned property.	The level of service may increase in the future.	Increased costs to deliver service. May require more staffing.	Service may be contracted out, property taxes would reflect new levels of service.
Regulations	Status quo soil management regulations.	Soil management regulation changes Jan 2022	Increased costs, Increased oversight, Possible fines	Staff training; Implement tracking tool; Hire new staff to track soil; Repurpose soil

2.5.4 Asset Programs to Meet Demand

The new assets required to meet demand may be acquired, donated or constructed. At this time there approximately 100 km of road planned over the 10-year planning horizon. Acquiring new assets would commit the City to ongoing operations, maintenance and renewal costs for the period that the service provided from the assets is required.

2.5.5 Climate Change Adaptation

The impacts of climate change may have a significant impact on the assets we manage and the services they provide. In the context of the Asset Management Planning process climate change can be considered as both a future demand and a risk.

Climate change impacts on assets will vary depending on the location and the type of services provided, as will the way in which those impacts are responded to and managed.[4]

As a minimum the City must consider how to manage our existing assets given potential climate change impacts for our region.

[4] IPWEA Practice Note 12.1 Climate Change Impacts on the Useful Life of Infrastructure

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Risk and opportunities identified to date are shown in Table 23. This is a continuous process and will be updated in the 2025 AM Plan per the timelines outlined in the AMP Overview.

Table 23: Managing the Impact of Climate Change on Assets and Services

CLIMATE CHANGE DESCRIPTION	PROJECTED CHANGE	POTENTIAL IMPACT ON ASSETS AND SERVICES	MANAGEMENT
GHG Emissions	Increased GHG emissions due to increased demand for transportation.	Increased GHG emissions contribute to climate change.	Investigate opportunities to change the modal split; Invest in sustainable transportation so that the increase in transportation demand will not be predominately single use occupancy vehicles.
Storm Events	Increased frequency of large storm events which may overwhelm the stormwater system.	Delays in transportation network may occur if road asset is flooded in large storm event.	Prioritize replacements; Planning for sufficient funds to implement plans; Model stormwater network to ensure capacity; Investigate problem areas.

Additionally, the way in which the City constructs new assets should recognize that there is opportunity to build in resilience to climate change impacts. Building resilience can have the following benefits:

- Assets will withstand the impacts of climate change;
- Services can be sustained; and
- Assets that can endure may potentially lower the lifecycle cost and reduce their carbon footprint

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Table 24 summarizes some asset climate change resilience projects the City is currently pursuing.

Table 24: Building Asset Resilience to Climate Change

PROJECT	PROJECT DESCRIPTION	CLIMATE CHANGE IMPACT	BUILD RESILIENCE IN NEW WORKS
LAMP Project	LED street lighting retrofit, 38,874 street lights converted to LED	Older light bulbs lead to wasted energy which increases GHG emissions.	To increase the number of new and existing high-performance state-of-the-art assets that improve energy efficiency and adapt to a changing climate
Complete Liveable Better Streets Manual	Following the approval of the City-Wide Transportation Master Plan (2017) prepare the Complete Liveable Better Streets Manual for designing and construction of future roadways in the City.	Continued emphasis on single occupancy vehicles will lead to an increase in GHG emissions.	To change the modal split and investigate strategies so that more trips are taken by active and sustainable transportation than single use occupancy vehicles
Roadway Redesign	Through various construction projects - existing roadways are designed to prioritize multi-modal transportation such as transit, cycling and walking.		
Vision Zero	Vision Zero encourages active modes of transportation by addressing road safety for vulnerable road users of all ages and abilities – reducing Hamilton’s contribution to climate change and encouraging a healthy lifestyle.		
Bicycle Boulevard (Neighbourhood Greenways) Program	To upgrade existing bicycle infrastructure with improved protection measures for cycle tracks and at intersections at strategic locations.		
Hatt Street Bikeway	Implementation of bike lanes on Hatt Street from John Street to Baldwin Street		

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Table 24: Building Asset Resilience to Climate Change			
PROJECT	**PROJECT DESCRIPTION**	**CLIMATE CHANGE IMPACT**	**BUILD RESILIENCE IN NEW WORKS**
Frid Street Extension - Chatham to Longwood	New 3 lane roadway with bike lanes. 2019 DC Background Study Item -124 - 95% Growth		
On Street Bike Facilities	To create and improve cycling infrastructure through the implementation and maintenance of on and off road paths, lanes, signed routes and cycling infrastructure.		
Hunter Street Cycle Track	Install planned bicycle lanes with barrier curb (MacNab to Catharine), related signal works, and resurfacing (James to Catharine).		
Bike Lane Maintenance	Maintenance of bike lanes with in the City to (total of 206.5km of bikes lanes) to encourage the use of non vehicular transportation which reduces GHG emission		
Continued emphasis on single occupancy vehicles will lead to an increase in GHG emissions.	To change the modal split and investigate strategies so that more trips are taken by active and sustainable transportation than single use occupancy vehicles		

The impact of climate change on assets is a new and complex discussion and further opportunities will be developed in future revisions of this AM Plan.

2.6 RISK MANAGEMENT

The purpose of infrastructure risk management is to document the findings and recommendations resulting from the periodic identification, assessment and treatment of risks associated with providing services from infrastructure, using the fundamentals of International Standard ISO 31000:2018 Risk management – Principles and guidelines.

Risk Management is defined in ISO 31000:2018 as: ‘coordinated activities to direct and control with regard to risk’[5].

The City is developing and implementing a formalized risk assessment process to identify risks associated with service delivery and to implement proactive strategies to mitigate risk to tolerable levels. The risk assessment process identifies credible risks associated with service delivery and will identify risks that will result in loss or reduction in service, personal injury, environmental impacts, a ‘financial shock’, reputational impacts, or other consequences.

The risk assessment process identifies credible risks, the likelihood of those risks occurring, and the consequences should the event occur. The City utilizes two risk assessment methods to determine risk along with subject matter expert opinion to inform the prioritization. Hamilton is further developing its risk assessment maturity with the inclusion of a risk rating, evaluation of the risks and development of a risk treatment plan for those risks that are deemed to be non-acceptable in the next iteration of the plan.

2.6.1 Critical Assets

Critical assets are defined as those which have a high consequence of failure causing significant loss or reduction of service. Critical assets have been identified and along with their typical failure mode, and the impact on service delivery, are summarized in Table 25. Failure modes may include physical failure, collapse or essential service interruption.

Table 25: Critical Assets

CRITICAL ASSET(S)	FAILURE MODE	IMPACT
Expressway/Major Arterial Roads	Physical Failure, Essential Service Interruption	Injury Service Interruption Financial Reputational
Signalized Intersections	Essential Service Interruption	Service Interruption Financial Injury

[5] ISO 31000:2009, p 2

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By identifying critical assets and failure modes an organization can ensure that investigative activities, condition inspection programs, maintenance and capital expenditure plans are targeted at critical assets.

2.6.2 Risk Assessment

The risk assessment process identifies credible risks, the likelihood of the risk event occurring, the consequences should the event occur, development of a risk rating, evaluation of the risk and development of a risk treatment plan for non-acceptable risks.

An assessment of risks associated with service delivery will identify risks that will result in loss or reduction in service, personal injury, environmental impacts, a ‘financial shock’, reputational impacts, or other consequences.

Critical risks are those assessed with ‘Very High’ (requiring immediate corrective action) and ‘High’ (requiring corrective action) risk ratings identified in the Infrastructure Risk Management Plan. The residual risk and treatment costs of implementing the selected treatment plan is shown in Table 6.2. It is essential that these critical risks and costs are reported to management. Additional risks will be developed in future iterations of the plan and is identified in Table 29 in the Continuous Improvement Section the plan.

Table 26: Risks And Treatment Plans
Note * The Residual Risk Is The Risk Remaining After The Selected Risk Treatment Plan Is Implemented.

SERVICE OR ASSET AT RISK	WHAT CAN HAPPEN	RISK RATING	RISK TREATMENT PLAN	RESIDUAL RISK *	TREATMENT COSTS
Road Pavement Line Markings	Faded, not repainted	High	Regular line marking inspections. Hire contractor for line marking services.	Low	$100,000
Solar Powered PXOs	Batteries can drain out of charge, beacons do not light up due to undersized solar panel.	Very High	Install large solar panels & batteries or hard-wire to electrical grid power source.	Medium / Low	$4,500/Unit
Regulatory / Warning Signs	Sign can go missing and left unreplaced	High	Continue road patrol. Create location based asset registry. Report monitored daily	Low	$50,000

2.6.3 Infrastructure Resilience Approach

The resilience of our critical infrastructure is vital to the ongoing provision of services to customers. To adapt to changing conditions the City needs to understand its capacity to 'withstand a given level of stress or demand', and to respond to possible disruptions to ensure continuity of service. An example would be how the transportation network operates during times of peak usage (3 busiest days of the year). We do not currently measure our resilience in service delivery and this will be included in the next iteration of the AM Plan.

Resilience covers the capacity of the City to withstand any service disruptions, act appropriately and effectively in a crisis, absorb shocks and disturbances as well as adapting to ever changing conditions. Resilience is built on aspects such as response and recovery planning, financial capacity, climate change risk, assessment and crisis leadership.

2.6.4 Service and Risk Trade-Offs

The decisions made in AM Plans are based on the objective to achieve the optimum benefits from the available resources. At this time, the City does not have sufficient data to present risks and tradeoffs. This information will be presented in the 2025 AM Plans regarding proposed levels of service per the timelines outlined in the AMP Overview.

2.7 FINANCIAL SUMMARY

This section contains the financial requirements resulting from the information presented in the previous sections of this AM Plan. Effective asset and financial management will enable the City to ensure its Transportation network provides the appropriate level of service for the City to achieve its goals and objectives. Reporting to stakeholders on service and financial performance ensures the City is transparently fulfilling its stewardship accountabilities.

Long-Term financial planning (LTFP) is critical for the City to ensure the networks lifecycle activities such as renewals, operations, maintenance, and acquisitions can happen at the optimal time. The City is under increasing pressure to meet the wants and needs of its customer while keeping costs at an affordable level and maintaining its financial sustainability.

Without funding asset activities properly for its Transportation network; the City will have difficult choices to make in the future which will include options such as higher costs reactive maintenance and operational costs, reduction of service and potential reputational damage.

Aligning the LTFP with the AM Plan is critical to ensure the all of the networks needs will be met while the City is finalizing a clear financial strategy with measurable financial targets. The financial projections will be improved as the discussion on desired levels of service and asset performance matures.

2.7.1 Sustainability of Service Delivery

There are two key indicators of sustainable service delivery that are considered within the AM Plan for this service area. The two indicators are the:

- asset renewal funding ratio (proposed renewal budget for the next 10 years / forecast renewal costs for next 10 years); and,
- medium term forecast costs/proposed budget (over 10 years of the planning period).

ASSET RENEWAL FUNDING RATIO

Asset Renewal Funding Ratio[6] **13.84%**

The Asset Renewal Funding Ratio is used to determine if the City is accommodating asset renewals in an **optimal** and **cost effective** manner from a timing perspective and relative to financial constrains, the risk the City is prepared to accept and targeted service levels it wishes to maintain. The target renewal funding ratio should be ideally between **90% - 110%** over the entire planning period. A low indicator result generally indicates that service levels are achievable however the expenditures are below this level because the City is reluctant to fund the necessary work or prefers to maintain low levels of debt.

Over the next ten (10) years the City expects to have **13.84%** of the funds required for the optimal renewal of assets. This is a significantly low number and should be addressed through this plan

[6] AIFMM, 2015, Version 1.0, Financial Sustainability Indicator 3, Sec 2.6, p 9.

in the next iteration. By only having sufficient funding to renew **13.84%** of the required assets in the appropriate timing it will inevitably require difficult trade off choices that could include:

- A significant reduction of the level of service and availability of assets;
- Increased complaints and reduced customer satisfaction;
- Substantially increased reactive maintenance and renewal costs; and,
- Damage to the City's reputation and risk of fines or legal costs.

The lack of renewal resources will be addressed in future AM Plan's while aligning the plan to the LTFP. This will allow staff to develop options and long-term strategies to address the renewal rate. The City will review its renewal allocations once the entire inventory has been confirmed and amalgamated.

The Asset Renewal Funding Ratio is an important indicator and illustrates that over the next 10 years we expect to have **13.84 %** of the funds required for the optimal renewal of assets.

MEDIUM TERM – 10 YEAR FINANCIAL PLANNING PERIOD

This AM Plan identifies the forecast operations, maintenance and renewal costs required to provide an agreed level of service to the community over a 10 year period. This provides input into 10 year financial and funding plans aimed at providing the required services in a sustainable manner.

This forecast work can be compared to the proposed budget over the first 10 years of the planning period to identify any funding shortfall.

The forecast operations, maintenance and renewal costs over the 10 year planning period is **$257,153,344** on average per year. Over time as improved information becomes available it is anticipated to see this number increase. In future AM Plans, staff will connect the operational and maintenance needs to the forecasts, and this will result in a significantly higher cost than is outlined here.

The proposed (budget) operations, maintenance and renewal funding is **$170,496,096** on average per year giving a 10 year funding shortfall of **$86,657,240** per year or **$866,572,400** over the 10 year planning period. This indicates that **66.3%** of the forecast costs needed to provide the services documented in this AM Plan are accommodated in the proposed budget. Note, these calculations exclude acquired assets (if any).

Providing sustainable services from infrastructure requires the management of service levels, risks, forecast outlays and financing to achieve a financial indicator of approximately **1.0** for the first years of the AM Plan and ideally over the 10 year life of the Long-Term Financial Plan.

2.7.2 Forecast Costs (Outlays) For the Long-Term Financial Plan

Table 27 shows the forecast costs (outlays) required for consideration in the 10 year long-term financial plan.

4.0 ROAD LINEAR

Providing services in a financially sustainable manner requires a balance between the forecast outlays required to deliver the agreed service levels with the planned budget allocations in the operational and capital budget. The City will begin developing its long-term financial plan (LTFP) to incorporate both the operational and capital budget information and help align the LTFP to the AM Plan which is critical for effective asset management planning.

A gap between the forecast outlays and the amounts allocated in the financial plan indicates further work is required on reviewing service levels in the AM Plan (including possibly revising the long-term financial plan).

The City will manage the ‘gap’ by continuing to develop this AM Plan to provide guidance on future service levels and resources required to provide these services in consultation with the community. Options to manage the gap include reduction and closure of low use assets, increased funding allocations, reduce the expected level of service, utilize debt based funding over the long term, adjustments to lifecycle activities, improved renewals and multiple other options or combinations of options.

These options will be explored in the next AM Plan and the City will provide analysis and options for Council to consider going forward.

Table 27: Forecast Costs (Outlays) For the Long-Term Financial Plan Forecast Costs Are Shown In 2021 Dollar Values.

YEAR	ACQUISITION	OPERATION	MAINTENANCE	RENEWAL	DISPOSAL
2022	$9,304,000	$72,686,000	$74,809,000	$839,707,968	0
2023	$8,775,000	$71,777,288	$57,922,292	$ 21,080,000	0
2024	$3,470,000	$72,531,608	$66,058,608	$ 22,310,000	0
2025	$2,870,000	$72,478,296	$77,972,296	$ 29,391,000	0
2026	$2,900,000	$74,059,984	$97,085,152	$ 9,580,000	0
2027	$2,870,000	$74,342,424	$97,367,592	$ 9,580,000	0
2028	$2,870,000	$74,624,120	$97,649,288	$ 9,580,000	0
2029	$2,870,000	$74,905,808	$97,930,976	$ 9,580,000	0
2030	$2,870,000	$75,187,496	$98,212,664	$ 9,580,000	0
2031	$2,870,000	$75,469,192	$98,494,360	$ 9,580,000	0

2.7.3 Funding Strategy

The proposed funding for assets is outlined in the City’s operational budget and 10 year capital budget.

These operational and capital budgets determines how funding will be provided, whereas the AM Plan typically communicates how and when this will be spent, along with the service and risk consequences. Future iterations of the AM plan will provide service delivery options and alternatives to optimize limited financial resources.

2.7.4 Valuation Forecasts

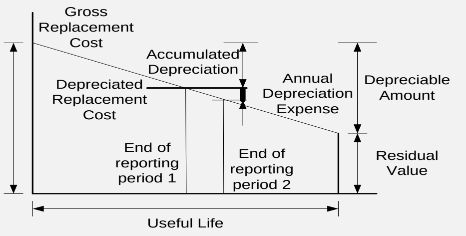
Asset values are forecast to increase as additional assets are added into service.

Additional assets will add to the operations and maintenance needs in the longer term. Additional assets will also require additional costs due to future renewals. Any additional assets will also add to future depreciation forecasts. Any disposals of assets would decrease the operations and maintenance needs in the longer term and removes the high costs renewal obligations. At this time, it is not possible to separate the disposal costs from the renewal or maintenance costs however this will be improved for the next iteration of the plan.

2.7.5 Asset Valuations

The best available estimate of the value of assets included in this AM Plan are shown below. The assets are valued at estimated replacement costs:

Replacement Cost (Current/Gross)	**$5,135,000,000**
Depreciable Amount	**$5,135,000,000**
Depreciated Replacement Cost[7]	**$3,211,000,000**
Depreciation	**$ 130,980,000**



[7] Also reported as Written Down Value, Carrying or Net Book Value.

The current replacement cost is the most common valuation approach for specialized infrastructure assets. The methodology includes establishing a comprehensive asset registry, assessing replacement costs (based on market pricing for the modern equivalent assets) and useful lives, determining the appropriate depreciation method, testing for impairments, and determining remaining useful life.

As the City matures its asset data, it is highly likely that these valuations will fluctuate significantly over the next 3 years and they should increase over time based on improved market equivalent costs

2.7.6 Key Assumptions Made in Financial Forecasts

In compiling this AM Plan, it was necessary to make some assumptions. This section details the key assumptions made in the development of this AM plan and should provide readers with an understanding of the level of confidence in the data behind the financial forecasts.

Key assumptions made in this AM Plan are:

- Operational forecasts are based on current budget allocations and are the basis for the projections for the 10-year horizon and do not address other operational needs not yet identified;
- Maintenance forecasts are based on current budget allocations and do not identify asset needs at this time. It is solely based on planned activities;
- 1.47% p.a. has been added to maintenance forecasts to accommodate for donated assets assumed over the 10-year planning horizon; and,
- 1.42 % p.a has been added to operational forecasts to accommodate for donated assets assumed over the 10-year planning horizon.

2.7.7 Forecast Reliability and Confidence

The forecast costs, proposed budgets, and valuation projections in this AM Plan are based on the best available data. For effective asset and financial management, it is critical that the information is current and accurate. Data confidence is defined in the AMP Overview.

Table 28: Data Confidence Assessment for Data Used in Am Plan

DATA	CONFIDENCE ASSESSMENT	COMMENT
Demand drivers	Low	Growth Demand Driver data is considered high confidence while other drivers require further investigation. All drivers require annual monitoring
Growth projections	Low	Population Data is of high confidence. Current growth projection will need to be vetted and improved.

Table 28: Data Confidence Assessment for Data Used in Am Plan		
DATA	**CONFIDENCE ASSESSMENT**	**COMMENT**
Acquisition forecast	Medium	Currently based on 2019 DC study and SME opinion. Improvement to the model is required and identified in the continuous improvement section of the AM Plan
Operation forecast	Low	Currently budget based and requires future improvement to ensure allocation is accurate
Maintenance forecast	Low	Currently budget based and requires future improvement to ensure allocation is accurate
Renewal forecast **- Asset values**	Low	Valuation will need to be reviewed as they are mixture of historical costs and future based estimates of replacement costs.
- Asset useful lives	Low	Based on SME opinion. Continuous improvement required to ensure data is vetted and ensure it aligns with Hamilton's actual practices
- Condition modelling	Medium	Mixture of assessment methods. Requires standardization along with predictable timelines for assessments
Disposal forecast	Low	Current disposal information is rolled into renewal. Continuous improvements are required to ensure accurate data is available.

The estimated confidence level for and reliability of data used in this AM Plan is considered to be a **Low -Medium** confidence level.

2.8 PLAN IMPROVEMENT AND MONITORING

2.8.1 Status of Asset Management Practices[8]

ACCOUNTING AND FINANCIAL DATA SOURCES

This AM Plan utilizes accounting and financial data. The sources of the data are:

- 2022 Capital & Operating Budgets;
- 2021 Tender Documents (various);
- Asset Management Data Collection Templates;
- Audited Financial Statements and Government Reporting (FIR, TCA etc);
- Financial Exports from internal financial systems; and,
- Historical cost and estimates of budget allocation based on SME experience.

ASSET MANAGEMENT DATA SOURCES

This AM Plan also utilizes asset management data. The sources of the data are:

- Data extracts from various city applications and management software;
- Asset Management Data Collection Templates;
- Tender documents, subdivision agreements and projected growth forecasts as well as internal reports;
- Condition assessments;
- Subject matter Expert Opinion and Anecdotal Information; and,
- Reports from the mandatory biennial inspection, operational & maintenance activities internal reports.

2.8.2 Improvement Plan

It is important that the City recognize areas of the AM Plan and planning processes that require future improvements to ensure both effective asset management and informed decision making. The tasks listed below are essential to improving the AM Plan and the City's ability to make evidence based and informed decisions. These improvements span from improved lifecycle activities, improved financial planning and to plans to physically improve the assets.

The Improvement plan table 29 below highlights proposed improvement items that will require further discussion and analysis to determine feasibility, resource requirements and alignment to current workplans. Future iterations of this AM Plan will provide updates on these improvement plans.

[8] ISO 55000 Refers to this as the Asset Management System

4.0 ROAD LINEAR

Table 29: Improvement Plan
***p.a – per annum**

TASK	TASK	RESPONSIBILITY	RESOURCES REQUIRED	TIMELINE
1.	Review OCI Methodology and provide recommendations for best practice.	Chief Road Official, Consultant	**$3,000** Internal staff time	**1 year** 2022
2.	Improve annual engagement survey process to optimize engagement and respondents.	CAM, TOM, Communications	**$7,500** (Annual) **$30,000** (Total) Internal staff time	**4 Years** 2022-2025
3.	Review current demand drivers and identify additional drivers to be utilized within the plan.	CAM, TOM, Economic Development, Environmental Services	**$3,000** Internal staff time	**Annually**
4.	Standardize and develop risk management knowledge along with supporting documentation.	CAM, TOM, Continuous Improvement & Quality	**$12,500** (Annual) **$25,000** (Total)	**2 Years** 2022-2023
5.	Integrate condition data collection into routine inspections for various assets such as sidewalks, bicycle lanes, traffic signs, and traffic signals.	CAM, TOM	**$10,000** (Annual) **$20,000** (Total) Internal Staff Time	**2 Years** (2022-2023)
6.	Review and verify data from various systems such as Hansen and GIS before importing into EAM.	TOM, Engineering Services	**$17,500** (Annual) **$35,000** (Total) Internal Staff Time	**2 Years** (2022-2023)
7.	Standardize condition assessment outcomes and timed deliverables for future condition assessments.	TOM, CAM, Engineering Services	**$6,000 p.a.** **$18,000** (Total) Internal Staff Time	**3 Years** (2022-2024)
8.	Review and verify functional classes for roads.	Transportation Planning, CAM	**$5,000 p.a.** **$10,000 total** Internal Staff time	**2 Years** (2022-2023)

4.0 ROAD LINEAR

Table 29: Improvement Plan
***p.a – per annum**

TASK	TASK	RESPONSIBILITY	RESOURCES REQUIRED	TIMELINE
9.	Revisit level of service for assumed alleyways.	Chief Road Official, TOM, CAM	**$5,000 p.a.** **$10,000 total** Internal Staff time	**2 Years** (2022-2023)
10.	Complete guide rail condition assessment.	TOM, CAM	**$150,000 p.a** **$450,000 total** Internal Staff time, tender process, consultant	**3 Years** (2022-2024)
11.	Review Balanced Scorecard reporting and ensure data and assumptions are consistent with ministry and City reporting and develop additional technical metrics.	Chief Road Official, TOM, CAM	**$5,000 p.a.** **$25,000** total Internal Staff time	**5 Years** (2022-2026)
12.	Develop a Long-Term Financial Plan to connect the budgeting process to the AM planning process.	CAM, TOM, Finance	**$15,000 p.a** **$60,000 Total** Internal Staff Time	**4 Years** (2022-2025)
13.	Improve asset replacement costs by vetting with current market prices instead of historical costs/estimates or internal models.	CAM, TOM, Finance	**$10,000 p.a.**	**Annual**
14.	Review Capital planning process and categorize projects by lifecycle activities.	CAM, TOM, Finance, Engineering Services	**$4,000 p.a.**	**Annual**
15.	Identify transportation assets in other divisions and incorporate into next AM Plan.	CAM, Chief Road Official, TOM	**$10,000 p.a.** **$30,000 Total** Internal Staff Time	**3 Years** (2022-2024)
16.	Improve process for collecting and inputting inventory data into databases.	Chief Road Official, TOM, Continuous Improvement,	**$5,000 p.a.** **$15,000 total** Internal Staff time	**3 Years** (2022-2023)

Table 29: Improvement Plan *p.a – per annum				
TASK	**TASK**	**RESPONSIBILITY**	**RESOURCES REQUIRED**	**TIMELINE**
		Engineering Services		
17.	Separate disposal costs and renewal activities	CAM, TOM, Finance, Engineering Services	**$10,000 p.a.** **$30,000 Total** Internal Staff Time	**3 Years** (2022-2024)
18.	Analyze operational budget to improve AM allocations for lifecycle activities.	CAM, TOM, Finance, Engineering Services	**$10,000 p.a.** **$40,000 Total** Internal Staff Time	**4 Years** (2022-2025)
19.	Analyze maintenance activities to identify future needs and recommended actions.	CAM, TOM, Finance, Engineering Services	**$6,000 p.a.** **$24,000 Total** Internal Staff Time	**4 Years** (2022-2025)
20.	Develop Renewal forecasting prioritization to optimize resources and ensure level of services can be maintained.	CAM, TOM, Finance, Engineering Services	**$10,000 p.a.** **$30,000 Total** Internal Staff Time	**3 Years** (2022-2024)

2.8.3 Monitoring and Review Procedures

This AM Plan will be reviewed during the annual budget planning process and revised to show any material changes in service levels, risks, forecast costs and proposed budgets as a result of budget decisions.

The AM Plan will be reviewed and updated on a regular basis to ensure it represents the current service level, asset values, forecast operations, maintenance, renewals, acquisition and asset disposal costs and planned budgets. These forecast costs and proposed budget will be incorporated into the Long-Term Financial Plan once completed.

2.8.4 Performance Measures

The effectiveness of this AM Plan can be measured in the following ways:

- The degree to which the required forecast costs identified in this AM Plan are incorporated into the long-term financial plan;
- The degree to which the 1-10 year detailed works programs, budgets, business plans and corporate structures consider the ‘global’ works program trends provided by the AM Plan;
- The degree to which the existing and projected service levels and service consequences, risks and residual risks are incorporated into the Strategic Planning documents and associated plans; and
- The Asset Renewal Funding Ratio achieving the Organizational target (this target is often 90 – 100%).

2022

Engineered Structures Asset Management Plan

Hamilton

3.0 ENGINEERED STRUCTURES

BRIDGES

Currently five (5) bridges are closed. Two (2) bridges are closed due to construction, which were previously identified to be in Very Poor condition. While a bridge being under construction is a temporary service deficiency, it is an interruption of service and so it has been included in this table. The three (3) other bridges which are closed and not under construction are being considered for disposal. In addition, three (3) vehicular bridges have loading restrictions at this time.

The City recognizes that a continuous improvement action is required to investigate the boundary agreement for Bridge 31 to ensure that its lifecycle activities are being appropriately budgeted. Additionally, Schedule 29 By-Law which details which bridges have load restrictions requires updating. Staff provided up to date loading restrictions for this AM Plan.

MAJOR CULVERTS

One (1) major culvert has a loading restriction.

OSSS

As previously mentioned, one (1) OSSS was given a very poor condition rating during the inspection. In response it was made safe and is under consideration for disposal.

3.1.7 Asset Specific Information

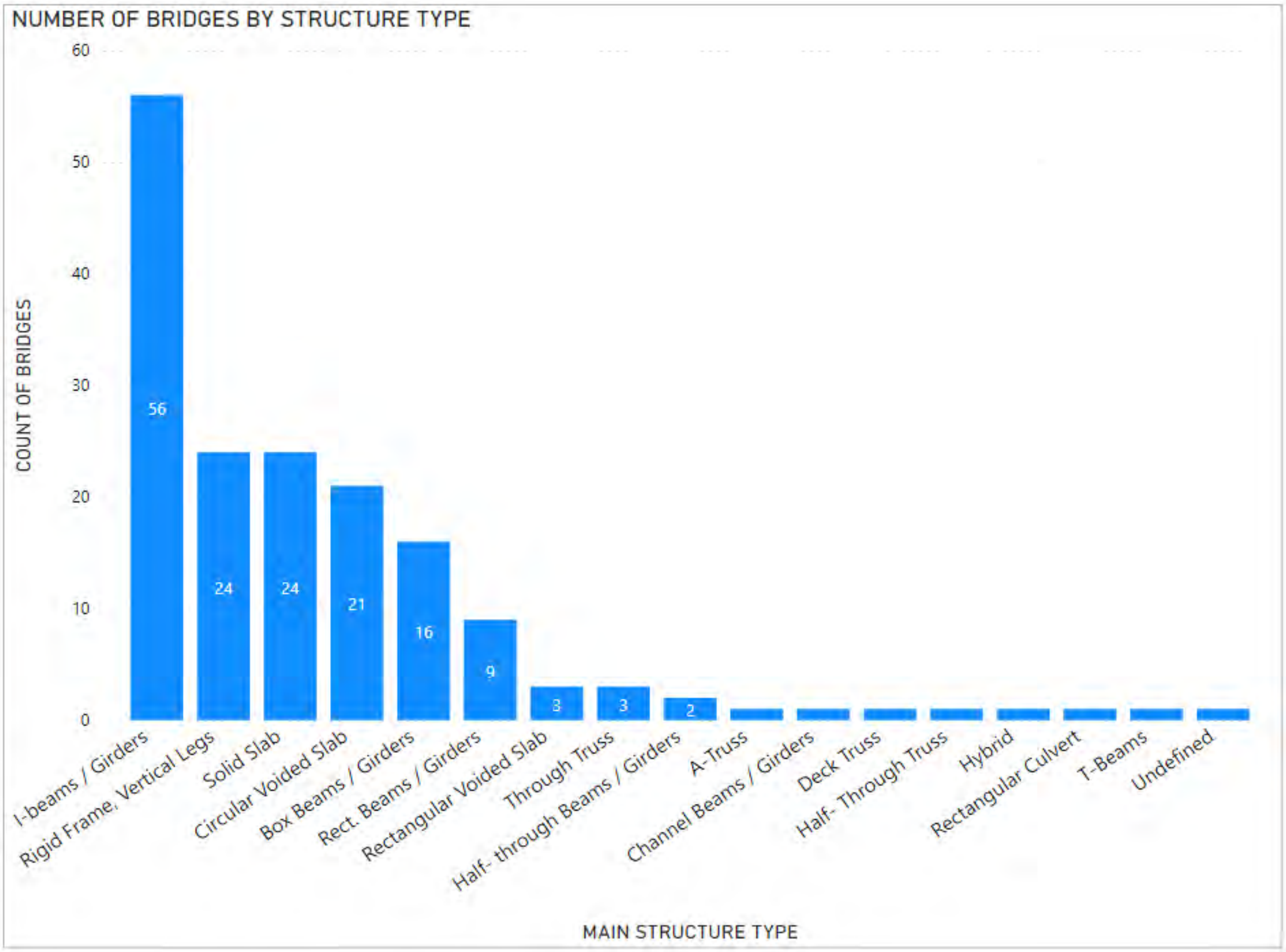
To assist with the analysis and provide some context to readers of the report, pertinent asset specific information is presented below. Different structures have different maintenance requirements and so it is imperative for the City to be aware of the different types of structures in our inventory to ensure the effective lifecycle management of these assets can be undertaken.

BRIDGES

Figure 18 shows the different bridge structure types which exist in the City. The most common bridge is an I-beam/Girder bridge, an example is shown in Figure 19.

3.0 ENGINEERED STRUCTURES

Figure 18: Bridges by Structure Type



3.0 ENGINEERED STRUCTURES

Figure 19: Example of an I-Beam / Girder Bridge on York Blvd

CULVERTS

Figure 20 shows the different major culvert structure types which the City is responsible for. The most common major culvert is a rectangular culvert, an example is shown in Figure 21.

3.0 ENGINEERED STRUCTURES

Figure 20: Major Culverts by Structure Type

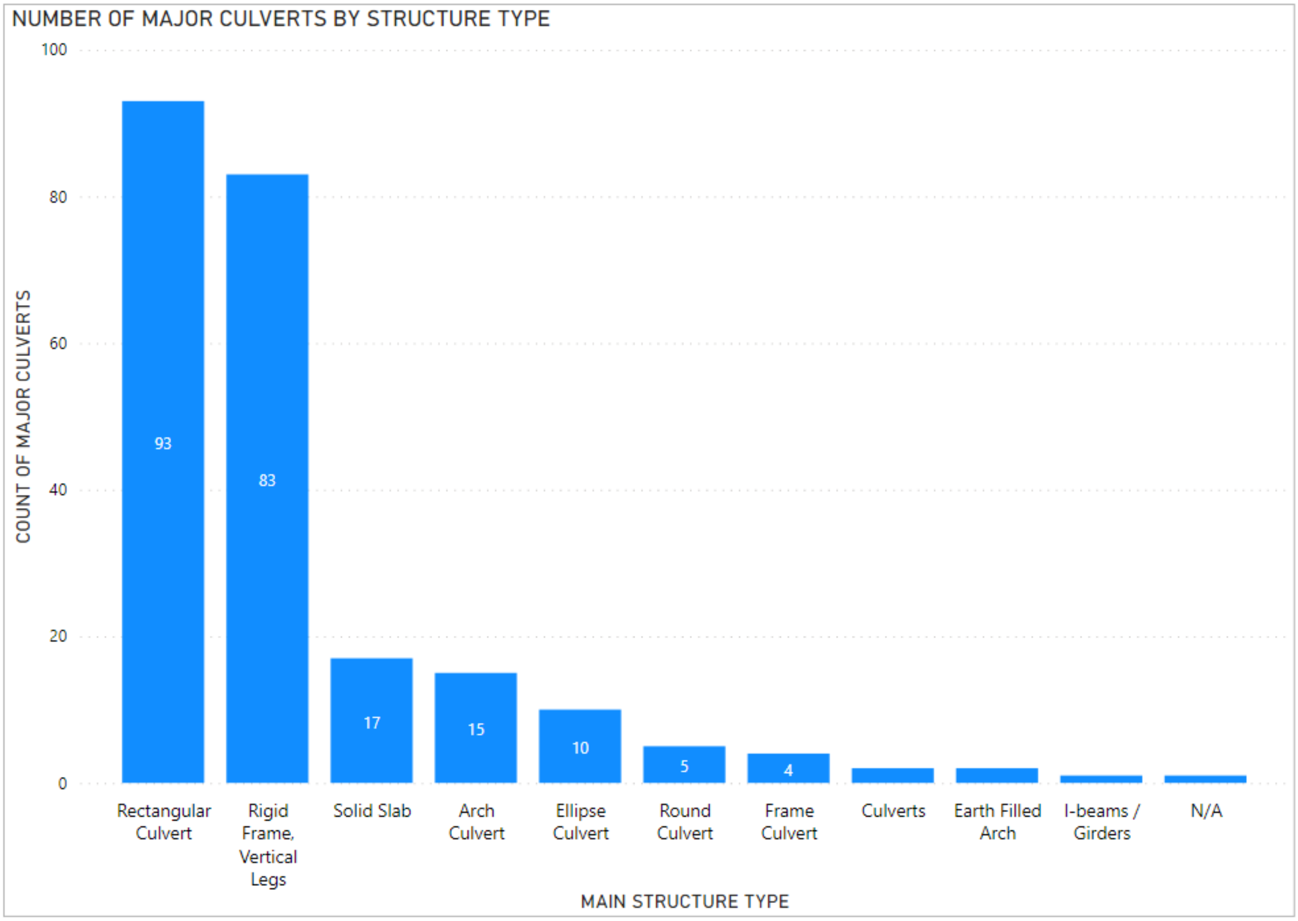


Figure 21: Example of a Culvert

3.0 ENGINEERED STRUCTURES

RETAINING WALL

At this time, it is difficult to effectively group the types of retaining walls in the City inventory and a continuous improvement item has been actioned to improve the data quality. An image of a retaining wall in the City is shown below (Figure 22).

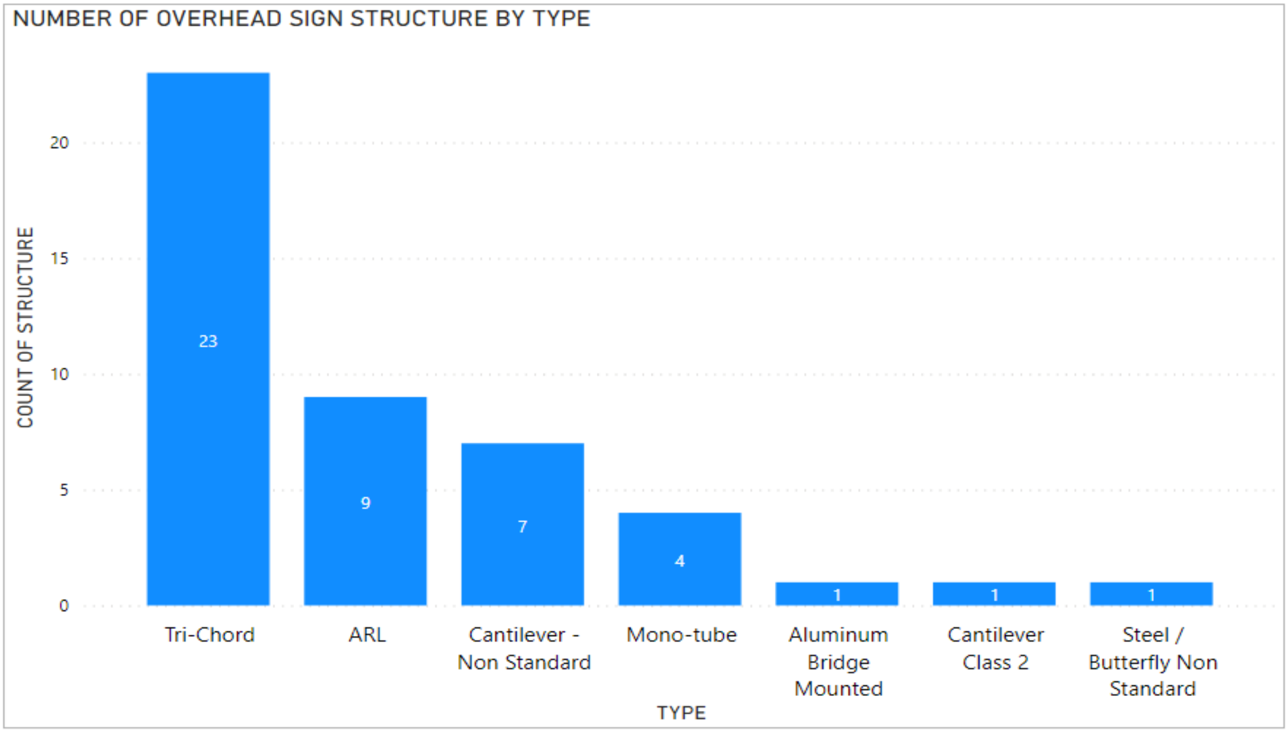
Figure 22: Example of a Major Retaining Wall on James St South

OSSS

Figure 23 shows the different types of overhead sign support structures which exist in the City with the most common support type being a tri-chord structure.

3.0 ENGINEERED STRUCTURES

Figure 23: Overhead Sign Support Structure by Type



The older sign support referenced in Section 3.1.4 which requires more frequent inspection applies to the Aluminum Rectangular Leg (ARL) structure type shown below in Figure 24. These older aluminium structures are common on the Lincoln M Alexander Parkway, and all nine (9) of these structures are scheduled for disposal in 2022 as shown in Table 38.

Figure 24: Example of ARL OSSS on the Lincoln Alexander Parkway

3.2 LIFECYCLE MANAGEMENT PLAN

The lifecycle management plan details how the City plans to manage these assets at the agreed levels of service at the accepted lifecycle costs.

3.2.1 Acquisition Plan

Acquisition reflects new assets that did not previously exist or works which will upgrade or improve an existing asset beyond its current capacity. They may result from growth, demand, social or environmental needs. Assets are donated to the City through development agreements or through the City constructing assets to meet broader program or community needs.

SELECTION CRITERIA

Proposed acquisition of new assets, and upgrade of existing assets, are identified from various sources such as community requests, proposals identified by strategic plans, growth, or partnerships with others. Potential upgrade and new works should be reviewed to verify that they are essential to the entities needs. Proposed upgrade and new work analysis should also include the development of a preliminary renewal estimate to ensure that the services are sustainable over the longer term. Verified proposals can then be ranked by priority and available funds and scheduled in future works programs.

CURRENT ACQUISITIONS

At this time Hamilton has bridge construction projects planned for Waterdown Road, Sam Lawrence ROW bridge and a pedestrian bridge at limedridge across the LINC. At the time of writing this report there was limited availability of some information and so there may be other planned bridge projects not yet acknowledged within this AM Plan. Hamilton will seek to consolidate its bridge information across multiple divisions for the next iteration of the AM Plan.

SUMMARY OF FUTURE ASSET ACQUISITION COSTS

When the City commits to acquiring new assets, they must be prepared to fund future operations, maintenance, disposal, and renewal costs. They must also account for future depreciation when reviewing long term sustainability. The City will continue to monitor this annually and update the AM plan when new information becomes available.

3.2.2 Operations and Maintenance Plan

The City’s operational and maintenance activities are centered on ensuring that engineered structures are consistently considered in good working order. Daily, weekly, seasonal, and annual activities are undertaken by staff to ensure the assets perform within acceptable parameters and to monitor the condition of the assets for safety and regulatory reasons.

OPERATIONS: This lifecycle activity includes regular actions to ensure the ongoing availability of the service such as winter mitigation, regulatory condition inspections, bridge cleaning, monitoring climate events and drain cleaning.

3.0 ENGINEERED STRUCTURES

MONITOR CLIMATE EVENTS

As part of the City's road network, these assets are monitored on a consistent basis for events that can affect the use of the assets. The City regularly monitors weather/climate risks that may require the public to be updated as to the condition and usability of the assets. Staff respond to events such as washouts, flooding, extreme freezing, and regular seasonal weather conditions.

WINTER MITIGATION FOR THE ROAD NETWORK

The Province provides a minimum standard for winter operations such as snow plowing, mitigation efforts (e.g. salt, ice prevention and treatment), monitor for closure events and posting temporary warning signs when necessary. Winter road work for bridges and culverts are integrated with all other road network assets as they are considered part of the overall transportation network.

BRIDGE/CULVERT CLEANING

Bridge or Culvert cleaning occurs in the spring after winter maintenance activities such as salting/sanding/spraying have ceased for the season. The winter maintenance treatments (chlorides) need to be cleaned from the roadway surfaces, expansion joints, bearing seats and other components to minimize the deterioration of these structural elements and maximum the useful service life of the assets.

REGULATORY COMPLIANCE & CONTINUOUS MONITORING

Through legislation, the Province provides standards of care for bridge and culvert assets as well as the timing for biennial inspection to be performed by qualified engineers. The biennial inspection informs the AM Plan with bridge and culvert renewal data and itemizes suggested minor and major planned maintenance activities that will allow these structures to achieve their intended useful live. On average The City invests **$525 thousand** annually to inspect its engineered structures and ensure their safety and inform the City of recommended planned maintenance activities.

MAINTENANCE: This lifecycle activity should be viewed as the ongoing management of deterioration. The purpose of planned maintenance is to ensure that the correct interventions are applied to assets in a proactive manner and to ensure it reaches its intended useful life. Maintenance does not significantly extend the useful life of the asset but allows assets to reach their intended useful life by returning the assets to a desired condition.

Proactively planning maintenance significantly reduces the occurrence of reactive maintenance which is always linked to a higher risk to human safety and higher financial costs. The City needs to plan and properly fund its maintenance to ensure the engineered structures are reliable and achieve their desired level of service.

Maintenance includes all actions necessary for retaining an asset as near as practicable to the appropriate service condition and includes activities such as approach repairs, deck repairs, joint repairs, erosion control, handrail repairs, surface sealing or gabion basket repairs . Examples of typical operations and maintenance activities with their accompanying 2021 costs (if known) are shown in Table 35.

3.0 ENGINEERED STRUCTURES

Table 35: 2022-2024 Planned Maintenance		
YEAR	**MAINTENANCE**	**BUDGET (M)**
2022	#403 – Southcote – Garner	$3.0
	#404 – Harrison Road	$1.4
	#159 – Regional Road 56	$1.3
	Other Maintenance Projects	$9.3
2023	#126 – Regional Road 56	$1.3
	#189 – Regional Road 56	$0.9
	Other Maintenance Projects	$5.7
2024	#451 – Highway 5 East	$4.9
	#329 – Burlington St East	$3.6
	#330 – Birch Ave.	$7.0
	Other Maintenance Projects	$4.6

From **2025** to **2031** the City will invest an additional **$60 million** for various maintenance projects across the City. These investments are intended to allow these assets to reach their estimated service life and minimize reactive maintenance costs. It should be acknowledged that these forecasted costs do not fully include the recommended works that need to be undertaken to ensure the entire inventory of assets will achieve their desired services lives and level of service.

Currently unit costs associated with these activities are mostly unknown, which is a future continuous improvement item presented in Table 50 in the Continuous Improvement section. In addition, there is no dedicated funding for OSSS other than for condition assessments and this concern has also been identified in the continuous improvement section.

Table 36: Lifecycle Activities				
ASSET	**LIFECYCLE STAGE**	**LIFECYCLE ACTIVITY**	**FREQUENCY**	**2021 COST**
Bridges, Major culverts (>3m)	Operation	Cleaning	Annually	Unknown
		Inlet/Outlet Cleaning	After rain event	Unknown
		Drain Cleaning	Annually	Unknown
		Animal Control	Ad Hoc	Unknown

3.0 ENGINEERED STRUCTURES

Table 36: Lifecycle Activities				
ASSET	**LIFECYCLE STAGE**	**LIFECYCLE ACTIVITY**	**FREQUENCY**	**2021 COST**
		OSIM Inspection	2 - year cycle	$300,000 per annum
	Maintenance	Material Repairs (Steel, Concrete, Timber)	Ad Hoc	Unknown
		Bridge Surface Repair	Ad Hoc	Unknown
		Expansion Joint Repair	Ad Hoc	Unknown
		Railing Repair	Ad Hoc	Unknown
		Route and Seal	Ad Hoc	Unknown
		Painting	Ad Hoc	Unknown
		Component Maintenance (Bearing, Cathodic Protection)	Ad Hoc	Unknown
		Erosion Control	Ad Hoc	Unknown
		Minor Component Replacement (Railing, Bearing)	Ad Hoc	Unknown
Retaining Wall	Operation	Graffiti Control	Ad Hoc	Unknown
		OSIM Inspection (>2m)	2 - year cycle	Included above.
		Non-OSIM Inspection (<2m)	Ad Hoc	Unknown
	Maintenance	Material Repair (Concrete, Wood, Steel, Masonry)	Ad Hoc	Unknown
		Gabion Basket Repair	Ad Hoc	Unknown
Overhead Sign Support Structures	Operation	Inspection	2- or 4 - year cycle	$149,950

At this time, many operational and maintenance activities are not being completed on all bridges/culverts at the suggested interval due to budget and resourcing constraints. When operational and maintenance activities are not completed in a timely and consistent manner it may lead to high cost reactive maintenance, a greater risk to public safety and reputational damage to the City.

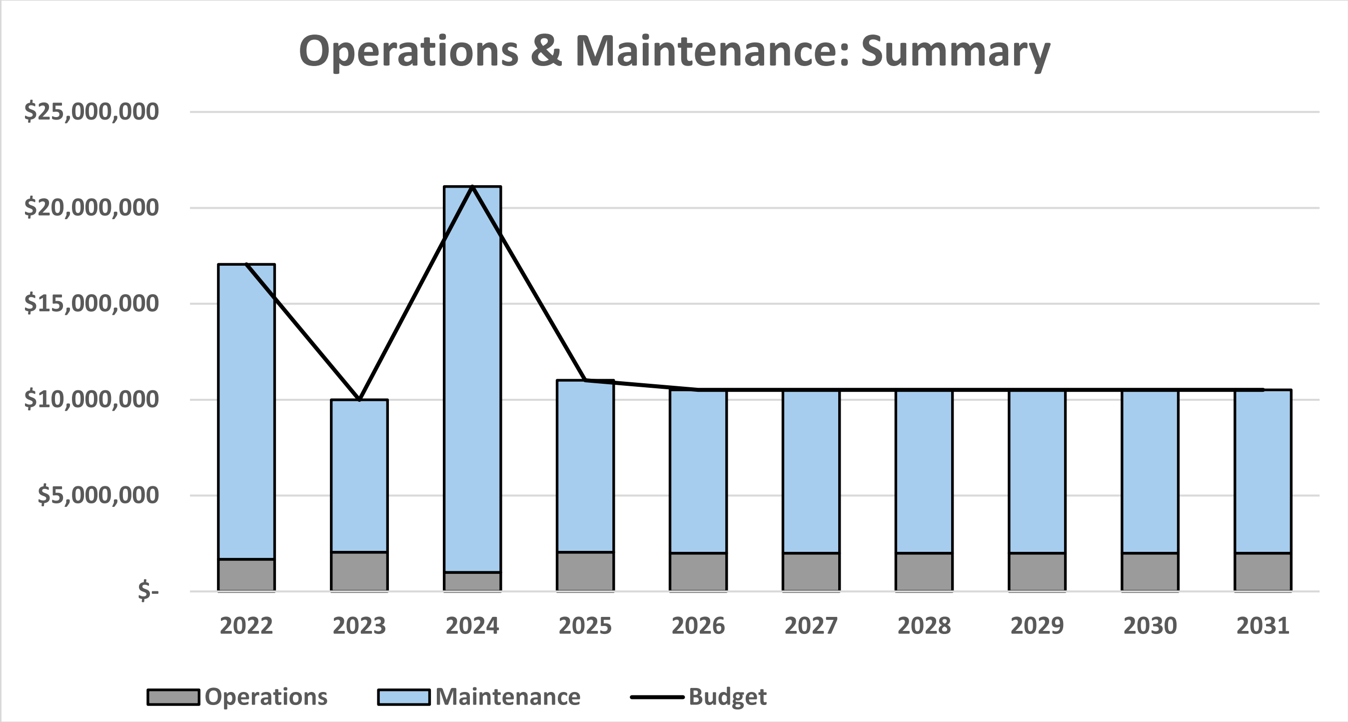
When the City completes the necessary operational and maintenance activities, high cost reactive repairs can be prevented. For example, cleaning drains at the appropriate time annually will lead to less erosion of piers and this will ensure the assets reach their estimated service life. This need has been identified as a risk in the Section 3.6. Currently, assessment and priority of reactive maintenance is undertaken by staff using subject matter expert experience and judgement. Any reactive repairs are completed by City staff. The City is investigating options to add necessary resources as well as retaining a contractor to complete these operational and maintenance activities.

The City does complete the regulated inspections for Bridges and Culverts and is meeting its regulatory responsibilities for those assets.

SUMMARY OF FORECAST OPERATIONS AND MAINTENANCE COSTS

Forecast operations and maintenance costs are expected to vary in relation to the total value of the asset registry. If additional assets are acquired, the future operations and maintenance costs are forecast to increase. If assets are disposed of, the forecast operation and maintenance costs are expected to decrease. Figure 25 shows the forecast operations and maintenance costs relative to the proposed operations and maintenance Planned Budget.

Figure 25: Operations and Maintenance Summary
All figure values are shown in 2021 dollars.



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The forecast costs include all costs from both the capital and operating budget. Asset management focuses on how taxpayer or ratepayer dollars are invested by lifecycle activities and not by budget allocation since both budgets contain various lifecycle activities, they must both be consolidated for the AM Plans.

The City is providing sufficient budget for planned operation and maintenance works only. It is clear from the analysis of recommended works needing completion, the City has insufficient budget to achieve all of the works required to ensure that assets will be able to achieve their estimated service life at the desired level of service. The City will address the operational and maintenance shortfalls and forecasted costs for the next iteration of the plan as there was insufficient data to develop reliable forecasts at the time of writing this report.

As the City continues to develop condition profiles and necessary works are identified based on their condition, it is anticipated this operation and maintenance forecasts will increase significantly. Where maintenance budget allocations will result in a lesser level of service, the service consequences and risks have been identified and are highlighted in the Risk Section 3.6. Future iterations of this plan will provide a much more thorough analysis of operations and maintenance costs including types of expenditures for training, mandatory certifications, insurance, staffing costs and requirements, equipment and maintenance activities

3.2.3 Renewal Plan

Renewal is major works which does not increase the assets design capacity but restores, rehabilitates, replaces, or renews an existing asset to its original service potential. Works over and above restoring an asset to original service potential is considered to be an acquisition resulting in additional future operations and maintenance costs.

Engineered structure renewals are typically undertaken to either ensure the assets reliability or quality will meet the service requirements set out by the City. Renewal projects are often triggered by service quality failure and can often be prioritized by those that have the highest consequence of failure, have high usage, have high operational and maintenance costs and other deciding factors.

The typical useful lives of assets used to develop projected asset renewal forecasts are shown in Table 37, and are based on estimated design life for this iteration. Future iterations of the plan will focus on the Lifecycle approach to estimated service life which can vary greatly from design life. Asset useful lives were last reviewed in 2022 and will be reviewed in 2023.

Table 37: Useful Lives Assets

ASSET (SUB)CATEGORY	USEFUL LIFE
Bridges	75 years
Major Culverts (>3m)	75 Years
Retaining Walls	60 Years
Overhead Sign Support Structures	60 Years

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The estimates for renewals in this AM Plan were based on the register method which utilizes the detailed listing of The City's asset inventory and all available lifecycle information to determine the optimal timing for renewals.

RENEWAL RANKING CRITERIA

Asset renewal is typically undertaken to either:

- Ensure the reliability of the existing infrastructure to deliver the service it was constructed to facilitate (e.g. replacing a bridge that has a load limit); or,
- To ensure the infrastructure is of sufficient quality to meet the service requirements (e.g. condition of a culvert).[12]

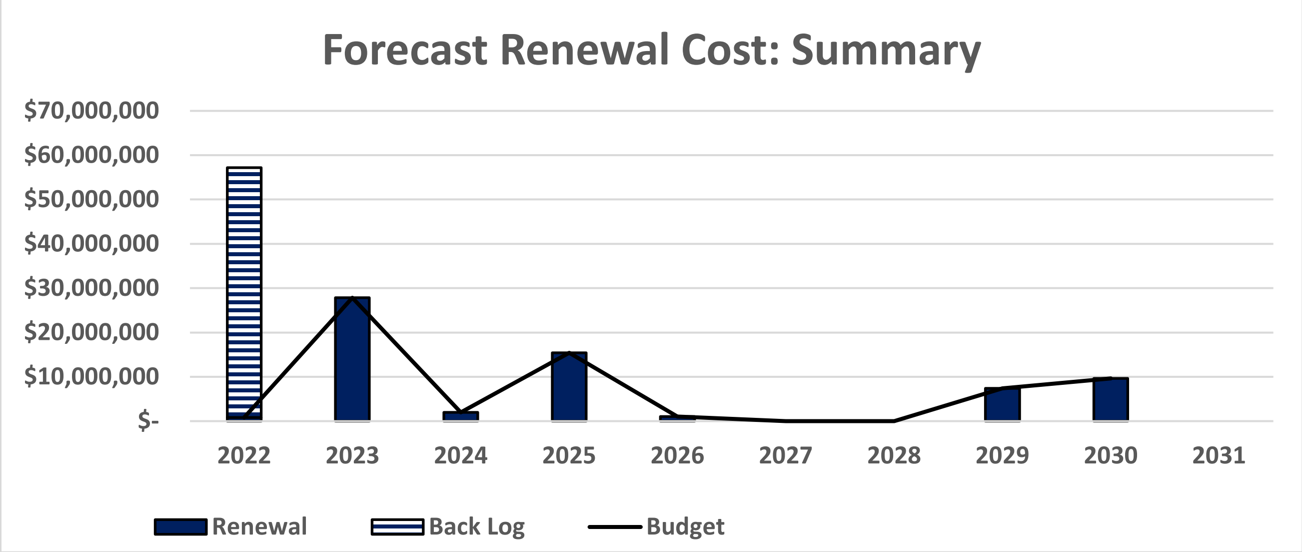
It is possible to prioritize renewals by identifying assets or asset groups that:

- Have a high consequence of failure;
- Have high use and subsequent impact on users would be significant;
- Have higher than expected operational or maintenance costs; and,
- Have potential to reduce life cycle costs by replacement with a modern equivalent asset that would provide the equivalent service.[13]

SUMMARY OF FUTURE RENEWAL COSTS

Forecast renewal costs are projected to increase over time if the asset inventory increases. The forecast costs associated with renewals are shown relative to the proposed renewal budget in Figure 26.

Figure 26: Forecast Renewal Costs
All Figure Values Are Shown In 2021 Dollars.



[12] IPWEA, 2015, IIMM, Sec 3.4.4, p 3|91.
[13] Based on IPWEA, 2015, IIMM, Sec 3.4.5, p 3|97.

3.0 ENGINEERED STRUCTURES

The forecasted renewal costs are age based for this iteration of the AM Plan and as such there is a significant backlog of renewal work listed. For the next AM Plan, the City will be moving to a condition-based approach for its renewal planning as it provides a more accurate picture to manage these assets.

Deferring renewals create risks of higher financial costs, decreased availability, and decreased satisfaction with asset performance. Ultimately, continuously deferring renewals works ensures The City will not achieve intergenerational equality. If the City continues to push out necessary renewals, there is a high risk that future generations will be unable to maintain the level of service the customers currently enjoy. It will burden future generations with such significant costs that inevitably they will be unable to sustain them.

Properly funded and timely renewals will ensure the assets perform as expected and it is recommended to continue to analyze asset renewals based on criticality and availability of funds for future AM Plans.

3.2.4 Disposal Plan

Disposal includes any activity associated with the disposal of a decommissioned asset including sale, possible closure of service, decommissioning, disposal of asset materials, or relocation. Disposals will occur when an engineered structure reaches the end of its useful life. The end of its useful life can be determined by factors such as excessive operation and maintenance costs, regulatory changes, obsolesce or demand for the structure has fallen.

Assets identified for possible decommissioning and disposal are shown in Table 38. A summary of the disposal costs and estimated reductions in annual operations and maintenance of disposing of the assets are also outlined in Table 38. Any costs or revenue gained from asset disposals is included in future iterations of the plan and the long-term financial plan.

At this time there are three (3) disposals planned over the ten-year planning horizon for bridges and major culverts, and nine (9) disposals are planned for OSSS. Bridge 33 will change ownership and as such alleviates the City from the responsibilities of ongoing lifecycle costs. Bridge 476 will be programed for disposal over the planning period and will also eliminate many ongoing operational and maintenance costs along with the significant renewal costs required to keep the bridge in working condition.

Table 38: Assets Identified for Disposal

ASSET	REASON FOR DISPOSAL	TIMING	DISPOSAL COSTS	OPERATIONS & MAINTENANCE ANNUAL SAVINGS
Bridge 033 Foxden Rd	Change of Ownership	By 2025	$50,000	$4,000

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Table 38: Assets Identified for Disposal

ASSET	REASON FOR DISPOSAL	TIMING	DISPOSAL COSTS	OPERATIONS & MAINTENANCE ANNUAL SAVINGS
Bridge 476 Formerly Hall Rd	Bridge at end of useful life and it is not essential	By 2031	$200,000	$4,500
Bridge 331 Birch Ave	Retired CPR asset which was purchased and will be disposed.	By 2024	$135,000	$3,100
9 OSSS (ARL) structures along the Linc	Asset Deficiencies require removal	By 2023	$425,000	$35,000

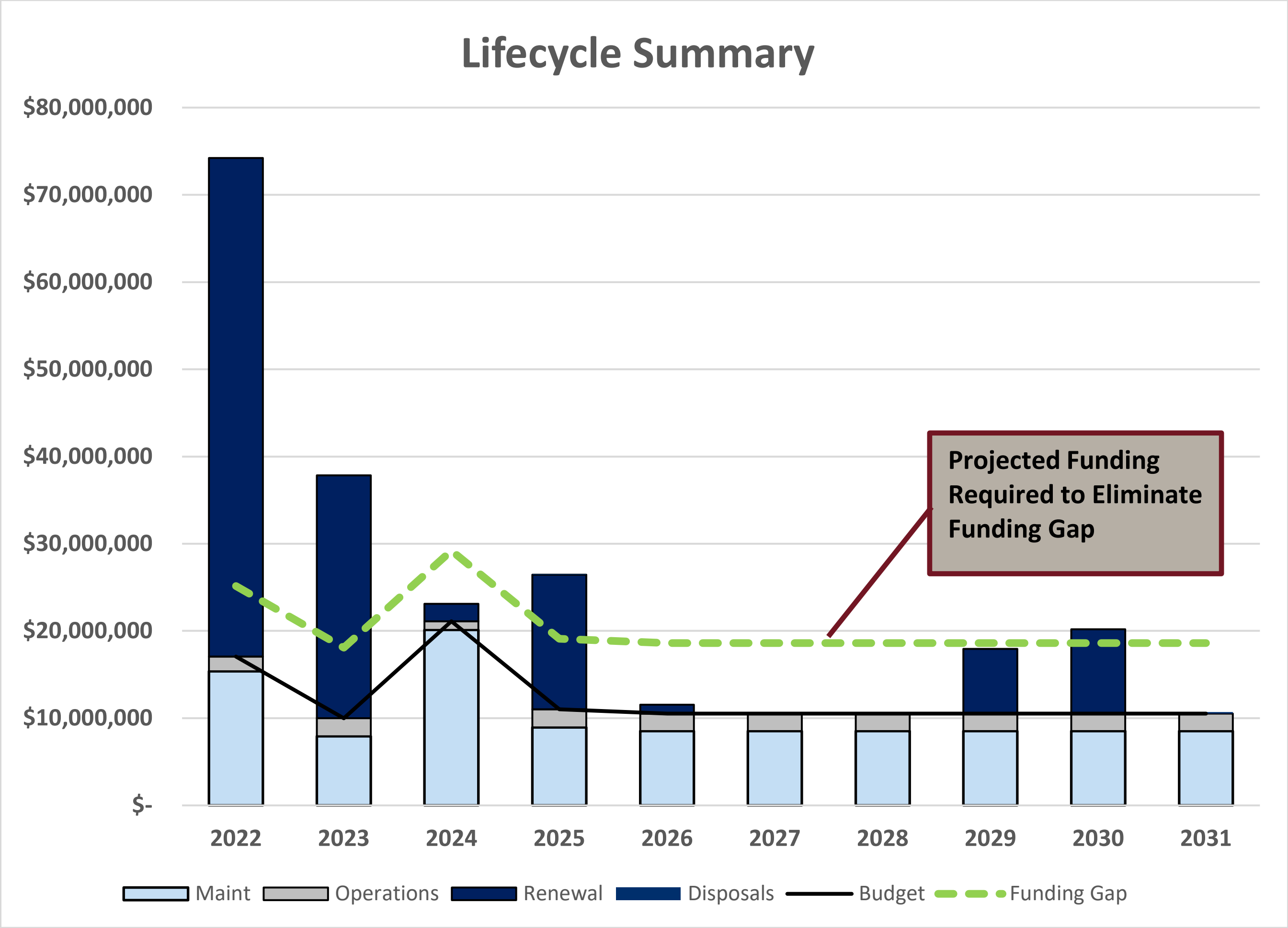
SUMMARY OF ASSET FORECAST COSTS

The financial projections from this asset plan are shown in Figure 27. These projections include forecast costs for acquisition, operation, maintenance, renewal, and disposal. These forecast costs are shown relative to the proposed budget.

The bars in the graph represent the forecast costs needed to minimize the life cycle costs associated with the service provision. The proposed budget line indicates the estimate of available funding. The gap between the forecast work and the proposed budget is the basis of the discussion on achieving balance between costs, levels of service and risk to achieve the best value outcome.

3.0 ENGINEERED STRUCTURES

Figure 27: Lifecycle Summary
All figure values are shown in 2021 dollars.



The City has allocated budget planned for operational and maintenance activities requirements over the 10-year planning horizon however there is insufficient budget to complete the necessary renewal works nor is there sufficient budget to complete all the recommended operational and maintenance works. When deferring either operations, maintenance or renewal works occur, the City runs the risk of significantly higher reactive costs, service interruptions, decreased satisfaction, harm to its reputation along with other risk costs such as legal fees.

Without sufficient funding the City has little option but to defer these necessary lifecycle activities. Deferring important lifecycle activities is never recommended. The City will benefit from allocating sufficient resources to developing its long-term financial plan to ensure that over time the City can fully fund the necessary lifecycle activities. Funding these activities helps to ensure the assets are compliant, safe, and effectively deliver the service the customers need and desire.

The lack of funding allocated for the backlog of renewals and the necessary lifecycle activities creates an additional issue which is intergenerational equity. Each year the City defers necessary lifecycle activities it pushes the ever-increasing financial burden on to future generations. It is imperative the City begin addressing the lack of consistent and necessary funding to ensure that intergenerational equity will be achieved. Over time, allocating sufficient funding on a consistent basis ensures that future generations will be able to enjoy the same standards being enjoyed today.

Over time the City will continue to improve its lifecycle data and this will allow for informed choices as how best to mitigate those impacts and how to address the funding gap itself. This gap in funding in future plans will be refined over the next 3 years and improve the confidence and accuracy of the forecasts.

3.3 MANDATORY BRIDGE & CULVERT LEVELS OF SERVICE

As previously mentioned, the City is developing this AM Plan to be in accordance with O.Reg. 588/17 requirements. Table 5 in O.Reg. 588/17 identifies specific metrics that must be reported in the AM Plan for Bridges and Culverts. These metrics are divided into community and technical levels of service. Since core assets only encompass bridges and culverts, there are not mandatory O.Reg. 588/17 levels of service for OSSS or retaining walls.

3.3.1 O.Reg. 588/17 Community Levels of Service

Per Table 5 in O.Reg. 588/17, there are community levels of service that the City is required to report on in order to meet the provincial level of service requirement. These qualitative metrics are reported below.

SCOPE

1. Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).

City bridges are designed in accordance with the standard and requirements of the Bridge Design Code at the time of construction. The City owns three (3) types of bridges: Vehicular, Railway, and Pedestrian bridges.

- Vehicular bridges or culverts have been designed to carry heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, mobility aids, and cyclists wherever possible;
- Railway bridges have been designed for railway usage only and do not support other vehicular types. However, some previous rail bridges have been converted to pedestrian (e.g. Rail Trail); and,
- Pedestrian bridges or culverts have been designed to carry pedestrians, mobility aids, cyclists, and maintenance vehicles.

The City is actively pursuing opportunities to offer multi-modal transportation options and continues to invest in pedestrian and cycling connectivity through the rehabilitation and new construction of pedestrian bridges as explained in Section 3.2.3.

QUALITY

2. *Description or images of the condition of bridges and how this would affect use of the bridges.*

Photos of bridges within the indicated BCI range are shown in Figure 28. Bridge assets range in BCI from 43 to 100. The description of each BCI range can be found in Table 32. High criticality bridges show cracking, delamination, railing issues, scaling and other deficiencies which can pose vehicle/pedestrian hazards, and affect load carrying capacity.

Typically, if a bridge is in Very Good to Poor condition the asset continues to operate and provide service to the public with operations and maintenance activities being completed on the asset in accordance with the OSIM findings. Depending on the findings of an inspection the usage may be modified such as changing a vehicular bridge into a pedestrian bridge. If the bridge is deemed unsafe for pedestrian and vehicular access, the structure will be closed with clear signage prohibiting the use of the bridge and the asset will be evaluated for renewal or disposal.

If the asset reaches Very Poor status, the bridge is closed immediately while the City assesses the safety of the structure, and determines what reactive repair, rehabilitation or disposal actions to take. If a bridge is closed, it is considered a service performance deficiency. Current service performance deficiencies are identified in Section 3.1.6. An image of a bridge in the 5 condition categories are shown below in Figure 28.

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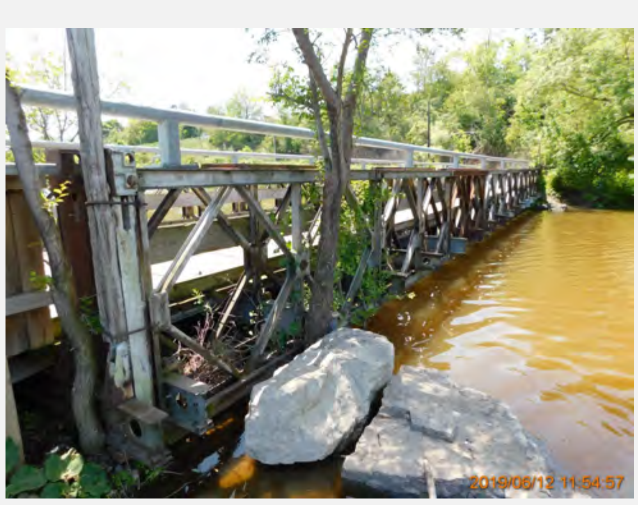
Figure 28: Bridge Conditions

CONDITION	ELEVATION	UNDERSIDE (SOFFIT)
Very Good		
Good		
Fair		
Poor		
Very Poor		

6.0 ENGINEERED STRUCTURES

3. *Description or images of the condition of culverts and how this would affect use of the culverts.*

Photos of culverts within the indicated BCI range are shown in Figure 29. Major culvert assets range in BCI from 11 to 100. The description of each BCI range can be found in Table 32. High criticality culverts have deficiencies such as undermining foundation, corrosion, spalling and delamination.

Typically, if a culvert is in Very Good to Poor condition the asset continues to operate and provide service to the public with operations and maintenance activities being completed on the asset in accordance with the OSIM findings. Depending on the findings of an inspection the usage may be modified such as changing a vehicular culvert into a pedestrian culvert. If the culvert is deemed unsafe for pedestrian and vehicular access, the structure will be closed with clear signage prohibiting the use of the culvert and the asset will be evaluated for renewal or disposal.

If the asset reaches Very Poor status, the culvert is closed immediately while the City assesses the safety of the structure and determines what reactive repair, rehabilitation or disposal actions to take and is considered a service performance deficiency. Current service performance deficiencies are identified in Section 3.1.6.

Images of culverts from very good *to very poor condition* based on the BCI value is shown in Figure 29.

Figure 29: Major Culvert Conditions

Condition	Elevation	Inside (Barrel)
Very Good		
Good		
Fair		
Poor		
Very Poor		

3.3.2 O.Reg. 588/17 Technical Levels of Service

In addition, there are technical levels of service that the City is required to report on in order to meet the provincial level of service requirement. These quantitative metrics are reported in Table 39.

Table 39: Technical Levels of Service

SERVICE ATTRIBUTE	TECHNICAL LEVELS OF SERVICE	MEASURE
Scope	Percentage of bridges in the municipality with loading or dimensional restrictions.	2.4%
Quality	1. For bridges in the municipality, the average bridge condition index value.	74.7
	2. For structural culverts in the municipality, the average bridge condition index value.	71.2

The Scope service attribute contains information related to loading or dimensional restrictions. Currently four (4) bridges have loading restrictions which are included under service performance deficiencies in Table 34.

The quality service attribute contains information related to the Bridge Condition Index (BCI) which is explained in Section 3.1.2.

3.4 MUNICIPALLY DEFINED LEVELS OF SERVICE

Levels of service are measures for what the City provides to its customers, residents, and visitors. Service levels are best described as the link between providing the outcomes the community desires, and the way that The City provides those services. Service levels defined in three ways, customer values, customer levels of service and technical levels of service which are outlined in this section. An explanation for how these were developed is provided in Section 7.5 of the AMP Overview.

3.4.1 Customer Values

Customer values are what the customer can expect from their tax dollar in “customer speak” which outline what is important to the customer, whether they see value in the service, and the expected trend based on the 10-year budget. These values are used to develop the level of service statements.

To develop these customer values, as stated in the AMP Overview, a Customer Engagement Survey was released in January 2022 on the Engage Hamilton platform. The survey received 279 submissions and contained 6 questions related to bridge and major culvert service delivery. The survey results can be found in Appendix A in the AMP Overview. While these surveys were used to establish customer values and customer performance measures, it’s important to note that the number of survey respondents only represents a small portion of the population.

The future intent is to release this survey on a regular basis to measure the trends in customer satisfaction and ensure that the City is providing the agreed level of service as well as improve the marketing strategy to receive more responses. This has been noted in Table 50 in the Continuous Improvement section.

Table 40: Customer Values

CUSTOMER VALUES	CUSTOMER SATISFACTION MEASURE	CURRENT FEEDBACK	EXPECTED TREND BASED ON PLANNED BUDGET (10-YEAR HORIZON)
Bridges feel safe to cross	Annual Customer Engagement Survey	Survey respondents generally feel that bridges are safe to travel over. There are some comments with respect to increasing maintenance on bridges/culverts.	Expected to maintain trend
Bridge is open when they want to use it	Annual Customer Engagement Survey	Survey respondents generally feel that bridges are open when they want to use them, however, there were a few comments on the Dundas Hwy 8 bridge being closed.	Expected to maintain trend

3.0 ENGINEERED STRUCTURES

Table 40: Customer Values			
CUSTOMER VALUES	CUSTOMER SATISFACTION MEASURE	CURRENT FEEDBACK	EXPECTED TREND BASED ON PLANNED BUDGET (10-YEAR HORIZON)
Culverts operate appropriately and are free from blockages	Annual Customer Engagement Survey	Survey respondents generally feel that there aren't culverts that are frequently blocked.	Expected to maintain trend

3.4.2 Customer Levels of Service

Ultimately customer performance measures are the measures that the City will use to assess whether it is delivering the level of service the customers desire. Customer level of service measurements relate to how the customer feels about the City's engineered structures in terms of their quality, reliability, accessibility, responsiveness, sustainability and over course, their cost. The City will continue to measure these customer levels of service to ensure a clear understanding on how the customers feel about the services and the value for their tax dollars.

The Customer Levels of Service are considered in terms of:

Condition	How good is the service? What is the condition or quality of the service?
Function	Is it suitable for its intended purpose? Is it the right service?
Capacity/Use	Is the service over or under used? Do we need more or less of these assets?

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In Table 41 under each of the service measures types (Condition, Function, Capacity/Use) there is a summary of the performance measure being used, the current performance, and the expected performance based on the current budget allocation.

Table 41: Customer Levels of Service

TYPE OF MEASURE	LEVEL OF SERVICE	SOURCE	PERFORMANCE MEASURE	CURRENT PERFORMANCE	EXPECTED TREND BASED ON PLANNED BUDGET
Condition	Ensure engineered structures are kept in safe and good repair.	Annual Customer Engagement Survey	97.4% of survey respondents feel bridges are generally in Fair condition or better.	Satisfied	Maintain Satisfied
			85% of survey respondents feel bridges and culverts are somewhat safe to very safe to travel over.	Fairly Satisfied	Maintain Fairly Satisfied
			Confidence levels	Medium	
		OSIM Inspection Report	Average Condition of Bridges	Good	Slight Decrease
			Average Condition of Major Culverts	Good	Slight Decrease
			Average Condition of Retaining Walls	Fair	Slight Decrease
			Confidence levels	High	
		SSIG Report	Average Condition of Overhead Sign Support Structures	Good	Maintain Good
			Confidence levels	High	
Function	Ensure engineered structures are meeting program needs.	Annual Customer Engagement Survey	76.5% of survey respondents don't know of any culverts that are partially or completely blocked.	Fairly Satisfied	Maintain Fairly Satisfied
			90.8% of survey respondents indicate there are no bridges that are currently closed they would typically use.	Very Satisfied	Maintain Very Satisfied
			Confidence levels	Medium	
		Staff Input	Bridges along major transportation routes are generally open.	Good	Slight Decrease
		Staff Input	Overhead Sign Support Structures along major transportation routes are in service.	Good	Maintain Good
			Confidence levels	Low	
Capacity	Ensure engineered structures' usage is within design capacity.	Annual Customer Engagement Survey	98.5% of survey respondents don't have concerns with bridges' height or weight restrictions.	Very Satisfied	Maintain Very Satisfied
			66.2% of survey respondents generally feel traffic levels leading up to bridges are acceptable.	Satisfied	Slight Decrease
			Confidence levels	Medium	
		Staff Input	Open bridges are used frequently.	Unknown	
			Confidence levels	Low	

3.4.3 Technical Levels of Service

Technical levels of service are operational or technical measures of performance, which measure how the City plans to achieve the desired customer outcomes and demonstrate effective performance, compliance and management. The metrics should demonstrate how effectively The City delivers its services in alignment with its customer values; and should be viewed as possible levers to impact and influence the Customer Levels of Service. The City will measure specific lifecycle activities to demonstrate how the City is performing on delivering the desired level of service as well as to influence how customers perceive the services they receive from the assets.

Technical service measures are linked to the activities and annual budgets covering Acquisition, Operation, Maintenance, and Renewal. Asset owners and managers create, implement and control technical service levels to influence the service outcomes

Table 42 shows the activities expected to be provided under the current plan with targets and recommended performance.

Table 42: Technical Levels of Service

LIFECYCLE ACTIVITY	PURPOSE OF ACTIVITY	ACTIVITY MEASURE	CURRENT PERFORMANCE *	TARGET **	RECOMMENDED PERFORMANCE ***
Acquisition	Ensure engineered structures are meeting program needs.	Number of planned pedestrian bridge new or improvement projects	1	N/A	N/A
Operation	Ensure engineered structures are kept in safe and good repair.	Percentage of legislated inspections completed for bridges > 3m	110	190	N/A
		Number of bridges with loading restrictions	4	4	4
Maintenance		% of bridge deck spalls repaired to	100%	100%	100%

3.0 ENGINEERED STRUCTURES

Table 42: Technical Levels of Service					
LIFECYCLE ACTIVITY	**PURPOSE OF ACTIVITY**	**ACTIVITY MEASURE**	**CURRENT PERFORMANCE ***	**TARGET ****	**RECOMMENDED PERFORMANCE *****
		MMS standards			
		Number of culverts with known flooding/channel blockage issues	24	0	0
		Number of bridges in Very Poor condition	2	0	0
		Number of culverts in Very Poor condition	2	0	0

It is important to monitor the service levels regularly as circumstances can and do change. Current performance is based on existing resource provision and work efficiencies. It is acknowledged changing circumstances such as technology and customer priorities will change over time.

3.4.4 Level of Service Summary

At this time, the City's technical metrics for the engineered structures service area is based on OSIM and MMS requirements. It is evident per Table 42 that the City is typically meeting these standards. The explanation below is intended to explain how the customer and technical levels of service relate to each other.

CONDITION

Based on the customer performance measures, survey respondents felt that bridges and culverts were in Fair or better condition which was deemed to be considered satisfied. The majority also felt that bridges were a minimum of somewhat safe to cross. When comparing this to the technical levels of service, the City has completed 100% of MMS requirements and has completed the legislated inspections. This suggests that the activities that the City is performing meets the customer expectations of the service.

3.0 ENGINEERED STRUCTURES

FUNCTION

Survey respondents appeared to be satisfied with the function of bridges and culverts. The majority of survey respondents were not aware of any blocked culverts and most did not find that there were bridges that were closed that they typically used. Those who identified that there was a bridge they wanted to use that was closed, were typically referring to bridges which were closed due to construction and are temporary service deficiencies. This suggests that the activities that the City is performing meets the customer expectations of the service.

CAPACITY

Most survey respondents did not have any concerns with bridge height or weight restrictions, and many felt traffic levels leading up to a bridge were acceptable. Currently there are four (4) bridges with weight restrictions, but since currently most survey respondents are not concerned with these restrictions it suggests the level of service for those bridges meets program needs.

3.5 FUTURE DEMAND

The ability for the City to be able to predict future demand for services enables the City to plan ahead and identify the best way of meeting that demand while being responsive to changes in demand. Demand will inevitably change over time and will impact the needs and desires of the community in terms of the quantity of services (more bridges to growing communities) and types of service required (larger bridges for increased traffic volumes).

Demand is defined as the desire customers have for assets or services and that they are willing to pay for. These desires are for either new assets/services or current assets.

Since demand is not yet an extensive requirement in O.Reg. 588/17 for the July 1st, 2022 deadline, this section is not as robust as some other sections of the report, but is an obligation for the report by July 1st, 2025, and will be expanded on in future iterations of the report.

3.5.1 Demand Drivers

For the engineered structures service area, the key drivers are population change, climate change, and customer preferences and expectations. A future continuous improvement item is to identify additional demand drivers since this was not the focus of this AM Plan.

3.5.2 Demand Forecasts

The high level present position and projections for demand drivers that may impact future service delivery and use of assets have been identified and documented in Table 43. These projections are based on the Greater Golden Horseshoe projections and the Development Charges Background Study.

Growth projections have been shown in the AMP Overview.

3.5.3 Demand Impact and Demand Management Plan

The impact of demand drivers that may affect future service delivery and use of assets are shown in Table 43.

Demand for new services will be managed through a combination of managing and/or upgrading of existing assets and providing new assets to meet demand and demand management. Demand management practices can include non-asset solutions, management of risks and failure mitigation.

Opportunities identified to date for demand management are shown in Table 43. Climate change adaptation is included in Table 44. Further opportunities will be developed in future revisions of this AM Plan, as identified in Table 50 in the Continuous Improvement Section.

Table 43: Demand Management Plan

DEMAND DRIVER	CURRENT POSITION	PROJECTION	IMPACT ON SERVICES	DEMAND MANAGEMENT PLAN
Customer preferences and expectations	Bridges prioritize vehicular traffic.	Bridges will need to begin to prioritize multi-modal traffic as well as LRT.	Ensure enough space in the bridge ROW to accommodate multi-modal traffic.	Complete Transportation Master Plans: Plan for redesign or upgrade of bridges and culverts to accommodate additional space required.
Population Change	573,000 (2021)	636,080 (2031)	Increased population will increase demand on transportation network.	Complete Transportation Master Plans; Redesign or upgrade bridges and culverts to accommodate increased traffic; Invest in sustainable transportation so that the increase in transportation demand will not be predominately single use occupancy vehicles.
Employment Population Change	192,704 (2019 - Excluding Work from Home)	244,839 (2031 – Excluding Work from Home)	Increased commuters may increase demand on transportation network.	Complete Transportation Master Plans; Plan for redesign or upgrade bridges and culverts to accommodate increased traffic; Invest in sustainable transportation so that the increase in transportation demand will not be predominately single use occupancy vehicles.

3.5.4 Asset Programs to Meet Demand

The new assets required to meet demand may be acquired, donated or constructed. At this time there are no plans for new assets over the ten (10) - year planning horizon. Acquiring new assets would commit the City to ongoing operations, maintenance and renewal costs for the period that the service provided from the assets is required.

3.5.5 Climate Change Adaptation

The impacts of climate change may have a significant impact on the assets we manage and the services they provide. In the context of the asset management planning process, climate change can be considered as both a future demand and a risk.

Climate change impacts on assets will vary depending on the location and the type of services provided, as will the way in which those impacts are responded to and managed.[14]

As a minimum the City must consider how to manage our existing assets given potential climate change impacts for our region.

Risk and opportunities identified to date are shown in Table 44. This is a continuous process and will be updated in the 2025 AM Plans per the timelines outlined in the AMP Overview.

Table 44: Managing the Impact of Climate Change on Assets and Services

CLIMATE CHANGE DESCRIPTION	PROJECTED CHANGE	POTENTIAL IMPACT ON ASSETS AND SERVICES	MANAGEMENT
Storm Events	Increased frequency of large storm events which may overwhelm the stormwater system.	Deck height of bridges may need to be raised requiring a redesign. Culverts may need to be resized. Delays in transportation network may occur if road asset is flooded in large storm event or if damage occurs to bridge/culvert asset requiring repairs.	Draft culvert standards policy: Redesign or upsize existing culverts and bridges when renewals occur; Prioritize replacements; Planning for sufficient funds to implement plans; Model stormwater network to ensure capacity; Investigate problem areas.
GHG Emissions	Increased GHG emissions due to increased demand for transportation.	Increased GHG emissions contribute to climate change	Investigate opportunities to change the modal split; Invest in sustainable transportation so that the increase in transportation demand will not be predominately single use occupancy vehicles.

[14] IPWEA Practice Note 12.1 Climate Change Impacts on the Useful Life of Infrastructure

7.0 ENGINEERED STRUCTURES

Additionally, the way in which the City constructs new assets should recognize that there is opportunity to build in resilience to climate change impacts. Building resilience can have the following benefits:

- Assets will withstand the impacts of climate change;
- Services can be sustained; and,
- Assets that can endure may potentially lower the lifecycle cost and reduce their carbon footprint.

Table 45 summarizes some asset climate change resilience projects the City is currently pursuing.

Table 45: Building Asset Resilience to Climate Change

PROJECT	PROJECT DESCRIPTION	CLIMATE CHANGE IMPACT	BUILD RESILIENCE IN NEW WORKS
Strathcona Pedestrian Bridge	Installation of multi-use trail connecting crossing over CN lands to connect Locke St. to the Waterfront Trail.	Due to increased demand for transportation infrastructure, it is anticipated there will be more vehicles in the road network. If these vehicles are mostly single occupancy vehicles, GHG emissions will increase in the City.	To change the modal split and investigate strategies so that more trips are taken by active and sustainable transportation than single use occupancy vehicles.
Pedestrian Bridge Replacement & Repair Program	Repair or replace pedestrian bridges within our parks that are in poor condition.	Due to increased demand for transportation infrastructure, it is anticipated there will be more vehicles in the road network. If these vehicles are mostly single occupancy vehicles, GHG emissions will increase in the City.	To change the modal split and investigate strategies so that more trips are taken by active and sustainable transportation than single use occupancy vehicles.
Stormwater Infrastructure Upgrades	Ongoing work on upgrading stormwater infrastructure (e.g. bridges, culverts, etc.) to increase capacity	It is anticipated that larger storm events will happen more frequently affect water levels under bridges and capacity levels of culverts.	To improve the City's climate resiliency by designing future assets to mitigate their vulnerability to extreme weather, minimizing future damages, and take advantage of opportunities i.e. grants.

The impact of climate change on assets is a new and complex discussion and further opportunities will be developed in future revisions of this AM Plan.

3.6 RISK MANAGEMENT

The purpose of infrastructure risk management is to document the findings and recommendations resulting from the periodic identification, assessment and treatment of risks associated with providing services from infrastructure, using the fundamentals of International Standard ISO 31000:2018 Risk management – Principles and guidelines.

Risk Management is defined in ISO 31000:2018 as: ‘coordinated activities to direct and control with regard to risk’[15].

The City is developing and implementing a formalized risk assessment process to identify risk associated with service delivery and to implement proactive strategies to mitigate risk to tolerable levels. The risk assessment process identifies credible risks associated with service delivery and will identify risks that will result in loss or reduction in service, personal injury, environmental impacts, a ‘financial shock’, reputational impacts, or other consequences.

The risk assessment process identifies credible risks, the likelihood of those risks occurring, and the consequences should the event occur. For its bridge and culvert assets, the City utilizes two risk assessment methods to determine risk along with subject matter expert opinion to inform the prioritization.

Since the City is further developing its risk assessment maturity with the inclusion of a risk rating, evaluation of the risks and development of a risk treatment plan for those risks that are deemed to be non-acceptable in the next iteration of the plan.

Risk Assessment is not yet an extensive requirement in O.Reg. 588/17 for the July 1st, 2022 deadline. As a result, this section is not as robust as some other sections of the report, but is an obligation for the report by July 1st, 2025, and will be expanded on in future iterations of the report.

3.6.1 Critical Assets

Critical assets are defined as those which have a high consequence of failure causing significant loss or reduction of service. Critical assets have been identified and along with their typical failure mode, and the impact on service delivery, are summarized in Table 46. Failure modes may include physical failure, collapse or essential service interruption.

[15] ISO 31000:2009, p 2

Table 46: Critical Assets		
CRITICAL ASSET(S)	**FAILURE MODE**	**IMPACT**
High Criticality Bridges/Major Culverts	Collapse	Injury Service Interruption Financial Reputational Environmental
High Criticality Bridges/ Major Culverts	Major Blockage	Service Interruption Financial Injury Reputational Environmental

By identifying critical assets and failure modes, an organization can ensure that investigative activities, condition inspection programs, maintenance and capital expenditure plans are targeted at critical assets.

3.6.2 Risk Assessment

The risk assessment process identifies credible risks, the likelihood of the risk event occurring, the consequences should the event occur, development of a risk rating, evaluation of the risk and development of a risk treatment plan for non-acceptable risks.

An assessment of risks associated with service delivery will identify risks that will result in loss or reduction in service, personal injury, environmental impacts, a ‘financial shock’, reputational impacts, or other consequences.

Critical risks are those assessed with ‘Very High’ (requiring immediate corrective action) and ‘High’ (requiring corrective action) risk ratings and will be identified in the Infrastructure Risk Management Plan in future iterations. The residual risk and treatment costs (if available) of implementing the selected treatment plan is shown in Table 47. It is essential that these critical risks and costs are reported to management. Additional risks will be developed in future iterations of the plan and is identified in Table 50 in the Continuous Improvement Section the plan.

8.0 ENGINEERED STRUCTURES

Table 47: Risks and Treatment Plans
Note * The Residual Risk Is The Risk Remaining After The Selected Risk Treatment Plan Is Implemented.

SERVICE OR ASSET AT RISK	WHAT CAN HAPPEN	RISK RATING	RISK TREATMENT PLAN	RESIDUAL RISK *	TREATMENT COSTS
Bridge & Culvert	Pier damage due to vehicular collision	Very High	Installed crash attenuators, sand barrels, signage Maintain regular inspection of roadside.	High	TBD
Bridge & Culvert	Concrete deck damage due to water infiltration from potholes.	Very High	Biennial inspections; Road Patrol Inspection; Complete operational activities on bridges & culverts either internally or contractually.	Medium	$310,000 Annually
Bridge & Culvert	Collapse of bridge due to stress from overweight vehicle.	High	Coordinate overweight permits with Hamilton Police & MTO. Adequate signage. Request enforcement, weight scales.	Medium	TBD
Bridge & Culvert	Pier erosion due to drainage system not being maintained	High	Complete operational activities on bridges & culverts either internally or contractually.	Low	TBD
Unassumed Bridge & Culvert	Bridge or culvert fails due to no maintenance or inspection program, and City is liable because ownership unclear	High	Confirm ownership and responsibility of asset. Add assets to OSIM program.	Low	TBD
Unassumed Minor Retaining Wall	Retaining wall fails due to no maintenance or inspection program, and City is liable because ownership unclear	High	Create inventory of retaining walls and confirm ownership; Internal inspection program for owned assets.	Medium	TBD

3.6.3 Infrastructure Resilience Approach

The resilience of our critical infrastructure is vital to the ongoing provision of services to customers. To adapt to changing conditions the City needs to understand its capacity to 'withstand a given level of stress or demand', and to respond to possible disruptions to ensure continuity of service. An example would be how engineered structures operate during their peak usage. We do not currently measure our resilience in service delivery and this will be included in the next iteration of the AM Plan.

Resilience covers the capacity of the City to withstand any service disruptions, act appropriately and effectively in a crisis, absorb shocks and disturbances as well as adapting to ever changing conditions. Resilience is built on aspects such as response and recovery planning, financial capacity, climate change, risk assessment and crisis leadership.

3.6.4 Service and Risk Trade-Offs

The decisions made in AM Plans are based on the objective to achieve the optimum benefits from the available resources. The City does not have sufficient data to present risks and tradeoffs. This information will be presented in the 2025 AM Plans regarding Proposed Levels of Service per the timelines outlined in the AMP Overview.

3.6.5 Financial Summary

This section contains the financial requirements resulting from the information presented in the previous sections of this AM Plan. Effective asset and financial management will enable the City to ensure its engineered structures provide the appropriate level of service for the City to achieve its goals and objectives. Reporting to stakeholders on service and financial performance ensures the City is transparently fulfilling its stewardship accountabilities.

Long-Term financial planning (LTFP) is critical for the City to ensure its engineered structures lifecycle activities such as renewals, operations, maintenance, and acquisitions can happen at the optimal time. The City is under increasing pressure to meet the wants and needs of its customer while keeping costs at an affordable level and maintaining its financial sustainability.

Without funding asset activities properly for its engineered structures, the City will have difficult choices to make in the future which will include options such as higher costs reactive maintenance and operational costs, reduction of service and potential reputational damage.

The City will be seeking to incorporate its engineered structures into the LTFP. Aligning the LTFP with the AM Plan is critical to ensure the engineered structures needs will be met while the City is finalizing a clear financial strategy with measurable financial targets. The financial projections will be improved as the discussion on desired levels of service and asset performance matures.

3.6.6 Sustainability of Service Delivery

This AM Plan focuses on two key financial indicators of sustainable service delivery that are considered within the AM Plan for this service area. These indicators are used to monitor and assess financial performance over the planning period. The two indicators are the:

- asset renewal funding ratio (proposed renewal budget for the next ten (10) - years / forecast renewal costs for next ten (10) - years); and,
- medium term forecast costs/proposed budget (over 10 years of the planning period).

ASSET RENEWAL FUNDING RATIO

Asset Renewal Funding Ratio[16] **32.86%**

The Asset Renewal Funding Ratio is used to determine if the City is accommodating asset renewals in an **optimal** and **cost effective** manner from a timing perspective and relative to financial constrains, the risk the City is prepared to accept and service levels it wishes to maintain. Ideally the target renewal funding ratio should be ideally between **90% - 110%** over the entire planning period. A low indicator result generally indicates that service levels are achievable however the expenditures are below this level because the City is reluctant to fund the necessary work or prefers to maintain low levels of debt.

Over the next ten (10) years the City expects to have **32.86%** of the funds required for the optimal renewal of assets. By only having sufficient funding to renew **32.86%** of the required assets in the appropriate timing it will inevitably require difficult trade off choices that could include:

- A reduction of the level of service and availability of assets
- Increased complaints and reduced customer satisfaction
- Increased reactive maintenance and renewal costs and,
- Damage to the City's reputation and risk of fines or legal costs

The historical lack of renewal funding resources will be addressed in future AM Plan's while aligning the plan to the LTFP. This will allow staff to develop options and long-term strategies to address the renewal rate. The City will review its renewal allocations once the entire inventory has been confirmed and amalgamated.

The Asset Renewal Funding Ratio is an important indicator and illustrates that over the next 10 years we expect to have **32.86 %** of the funds required for the optimal renewal of assets.

MEDIUM TERM – TEN (10) - YEAR FINANCIAL PLANNING PERIOD

This AM Plan identifies the forecast operations, maintenance and renewal costs required to provide an agreed level of service to the community over a ten (10) – year period. This provides input into ten (10) - year financial and funding plans aimed at providing the required services in a sustainable manner.

[16] AIFMM, 2015, Version 1.0, Financial Sustainability Indicator 3, Sec 2.6, p 9.

This forecast work can be compared to the proposed budget over the first ten (10) - years of the planning period to identify any funding shortfall.

The forecast operations, maintenance and renewal costs over the ten (10) - year planning period is **$24,281,410** on average per year. Over time as improved information becomes available it is anticipated to see this number increase. In future AM Plans, staff will connect the operational and maintenance needs to the forecasts, and this will result in a significantly higher cost than is outlined here.

The proposed (budget) operations, maintenance and renewal funding is **$16,186,100** on average per year giving a ten (10) - year funding shortfall of **$8,095,310** per year or **$80,953,100** in total over the ten year planning period. This indicates that **66.66%** of the forecast costs needed to provide the services documented in this AM Plan are accommodated in the proposed budget. Note, this calculation excludes acquired assets (if any).

Providing sustainable services from infrastructure requires the management of service levels, risks, forecast outlays and financing to achieve a financial indicator of approximately one (1.0) for the first years of the AM Plan and ideally over the ten (10) - year life of the Long-Term Financial Plan.

3.6.7 Forecast Costs (Outlays) for the Long-Term Financial Plan

Table 48 shows the forecast costs (outlays) required for consideration in the ten (10)-year long-term financial plan.

Providing services in a financially sustainable manner requires a balance between the forecast outlays required to deliver the agreed service levels with the planned budget allocations in the operational and capital budget. The City will begin developing its long-term financial plan (LTFP) to incorporate both the operational and capital budget information and help align the LTFP to the AM Plan which is critical for effective asset management planning.

A gap between the recommended forecast outlays and the amounts allocated in the operational and capital budgets indicates further work is required on reviewing service levels in the AM Plan.

The City will manage the 'gap' by continuing to develop this AM Plan to provide guidance on future service levels and resources required to provide these services in consultation with the community. Options to manage the gap include reduction and closure of low use assets, increased funding allocations, reduce the expected level of service, utilize debt based funding over the long term, adjustments to lifecycle activities, improved renewals and multiple other options or combinations of options.

These options will be explored in the next AM Plan and the City will provide analysis and options for Council to consider going forward.

3.0 ENGINEERED STRUCTURES

Table 48: Forecast Costs (Outlays) For the Long-Term Financial Plan Forecast Costs Are Shown In 2021-Dollar Values.					
YEAR	ACQUISITION	OPERATION	MAINTENANCE	RENEWAL	DISPOSAL
2022	0	$1,670,000	$15,377,000	$57,168,028	
2023	0	$2,050,000	$7,938,000	$27,841,490	$425,000
2024	0	$1,000,000	$20,110,000	$2,014,039	$135,000
2025	0	$2,050,000	$8,960,000	$15,442,533	$50,000
2026	0	$1,987,000	$8,526,500	$1,030,651	
2027	0	$1,987,000	$8,526,500	$0	
2028	0	$1,987,000	$8,526,500	$0	
2029	0	$1,987,000	$8,526,500	$7,416,129	
2030	0	$1,987,000	$8,526,500	$9,665,233	
2031	0	$1,987,000	$8,526,500	$0	$200,00

3.6.8 Funding Strategy

The proposed funding for assets is outlined in the City's operational budget and ten (10) - year capital budget.

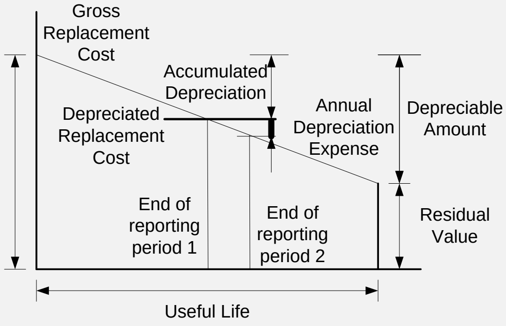
These operational and capital budgets determine how funding will be provided, whereas the AM Plan typically communicates how and when this will be spent, along with the service and risk consequences. Future iterations of the AM Plan will provide service delivery options and alternatives to optimize limited financial resources.

9.0 ENGINEERED STRUCTURES

3.6.9 Asset Valuations

The best available estimate of the value of assets included in this AM Plan are shown below. The assets are valued at estimated replacement costs:

Replacement Cost (Current/Gross)	$1,543,540,541
Depreciable Amount	$1,543,540,541
Depreciated Replacement Cost[17]	$ 775,648,704
Depreciation	$ 20,953,100



The current replacement cost is the most common valuation approach for specialized infrastructure assets such as engineered structures. The methodology includes establishing a comprehensive asset registry, assessing replacement costs (based on market pricing for the modern equivalent assets) and useful lives, determining the appropriate depreciation method, testing for impairments, and determining remaining useful life.

As the City matures its asset data, it is highly likely that these valuations will fluctuate significantly over the next 3 years and they should increase over time based on improved market equivalent costs.

3.6.10 Valuation Forecast

Asset values are forecast to increase as projections improve and can be validated as market pricing. The net valuations will increase significantly despite some assets being programmed for disposal that will be removed from the register over the 10-year planning horizon.

Any additional assets will add to the operations and maintenance needs in the longer term and would also require additional costs due to future renewals obligations. Any additional assets will also add to future depreciation forecasts. Any disposals of assets would decrease the operations and maintenance needs in the longer term and removes the high costs renewal obligations.

Currently there are bridges planned to be acquired acquired within the 10-year planning horizon however with limited availability of data it cannont be accurately projected at this point. This will be improved for the next iteration of the AM Plan.

[17] Also reported as Written Down Value, Carrying or Net Book Value.

3.6.11 Key Assumption Made in Financial Forecasts

In compiling this AM Plan, it was necessary to make some assumptions. This section details the key assumptions made in the development of this AM Plan, and should provide readers with an understanding of the level of confidence in the data behind the financial forecasts.

Key assumptions made in this AM Plan are:

- Operational forecasts are based on current budget allocations and are the basis for the 10-year horizon projections;
- Maintenance forecasts are based on current budget allocations and do not identify asset needs at this time. It is solely based on planned activities; and,
- Replacement costs were based on historical costing and engineer estimates. They were also made without costing what the asset would be replaced with in the future.

3.6.12 Forecast Reliability and Confidence

The forecast costs, proposed budgets, and valuation projections in this AM Plan are based on the best available data. For effective asset and financial management, it is critical that the information is current and accurate. Data confidence is classified on a A - E level scale[18] in accordance with Table in the AMP overview.

The estimated confidence level for and reliability of data used in this AM Plan is shown in Table 49.

Table 49: Data Confidence for Data Used in The AM Plan

DATA	CONFIDENCE ASSESSMENT	COMMENT
Demand Drivers	Low	Growth Demand Driver data is considered high confidence. Other drivers will require further investigation, and all require annual monitoring.
Growth Projections	Low	Population Data is of high confidence.
Acquisition Forecast	High	None planned within the ten (10) -Year horizon. The City will continue to monitor growth projections annually for acquisitions.
Operation Forecast	Medium	Future costs have been extrapolated from existing budget allocations and projected out by system growth modelling.
Maintenance Forecast	High	Maintenance activities are informed by the Bridge Condition Assessments.

[18] IPWEA, 2015, IIMM, Table 2.4.6, p 2|71.

Table 49: Data Confidence for Data Used in The AM Plan		
DATA	**CONFIDENCE ASSESSMENT**	**COMMENT**
Renewal Forecast - Asset Values	Low	Valuations will need to be updated to ensure the City has accurate costs to replace.
- Asset Useful Lives	Medium	Subject matter expert opinion and Bridge Condition Inspection modelling.
- Condition Modelling	Medium	Biennial Engineer Inspection informs the model. Will review modelling.
Disposal Forecast	Medium	Formalized process and priorities are being developed

The estimated confidence level for and reliability of data used in this AM Plan is considered to be a **Medium** confidence level.

3.7 PLAN IMPROVEMENT & MONITORING

3.7.1 Status of Asset Management Practices

ACCOUNTING AND FINANCIAL DATA SOURCES

This AM Plan utilizes accounting and financial data. The sources of the data are:

- 2021 Capital & Operating Budget;
- 2021 Tender Documents (various);
- Asset Management Data Collection templates;
- Audited Financial Statements and Government Reporting (FIR, TCA etc);
- Financial Exports from internal financial systems; and,
- Historical cost and estimates of budget allocation based on SME experience.

ASSET MANAGEMENT DATA SOURCES

This AM Plan also utilizes asset management data. The sources of the data are:

- Data extracts from various city applications and management software;
- Asset Management Data Collection Templates;
- Tender documents, subdivision agreements and projected growth forecasts as well as internal reports;
- Condition assessments;
- Subject matter Expert Opinion and Anecdotal Information; and,
- Reports from the mandatory biennial inspection, operational & maintenance activities internal reports.

3.7.2 Improvement Plan

It is important that the City recognize areas of the AM Plan and planning process that require future improvements to ensure effective asset management and informed decision making. The tasks listed below are essential to improving the plans and the City's ability to make evidence based and informed decisions. These improvements span from improved lifecycle activities, improved financial planning and to plans to physically improve the assets.

The Improvement Plan Table 50 below highlights proposed improvement items that will require further discussion and analysis to determine feasibility, resource requirements and alignment to current workplans. Future iterations of this AM Plan will provide updates on these improvement plans.

9.0 ENGINEERED STRUCTURES

Table 50: Improvement Plan

#	TASK	RESPONSIBILITY	RESOURCES REQUIRED	TIMELINE
1.	Complete update of major retaining wall inventory and confirm ownership.	CAM, Engineering Services,	$80,000 per annum $240,000 Total Tender Process Internal staff time	3 Years 2022 - 2024
2.	Complete condition assessment for older aluminum supports on a two-year cycle per the OSSIM.	CAM, Engineering Services,	$40,000 per annum Total Tender Process Internal staff time	3 Years 2022 - 2023
3.	Develop a Long-Term Financial Plan to connect the budgeting process to AM planning and ensure sustainable funding is achieved.	CAM, Engineering Services, Finance	$15,000 per annum $60,000 Total Internal Staff Time	4 Years 2022-2025
4.	Complete a lifecycle needs assessment to ensure funding gap is accurate and current and ensure funding requirements are understood.	CAM, Engineering Services, Finance, TOM	$40,000 per annum $120,000 Total Internal staff time	3 Years 2022 - 2024
5.	Incorporate missing bridges, major culverts and other engineered structures from other asset classes (e.g. Parks, Cemeteries, Golf Courses) into future AM Plan. This is to ensure inventory is accurate and all regulatory obligations are being met.	CAM, Engineering Services, Finance, TOM, Parks, Cemeteries, Recreation	$20,000 per annum $60,000 Total Internal staff time	3 Years 2022 - 2024
6.	Create inventory of minor retaining walls, confirm ownership, investigate operational change, and incorporate findings into AM Plan.	CAM, Engineering Services	$125,000 (Annual) $250,000 (Total) Tender Process Internal staff time	3 Years 2022 - 2024
7.	Update Age data for Retaining Walls and OSSS.	CAM, Engineering Services	$2,000 (Annual) $6,000 Total Internal staff time	3 Years 2022-2024
8.	Review Condition Assessment deliverables for engineered structures and align with AM practices.	CAM, Engineering Services	$4,000 (Annual) $8,000 (Total) Internal staff time	2 Years 2022 - 2023
9.	Review operating & maintenance activities and procedures for bridges, and options for contracting out services.	CAM, Engineering Services	$5,000 Internal staff time	Annually
10.	Develop new process to update data when Engineered Structure assets are replaced or new assets are acquired.	CAM, Engineering Services Continuous improvement,	$2,000 (Annual) $6,000 Total Internal staff time	3 Years 2022-2024
11.	Update Replacement Costs based on Market Pricing information and O&M Costs based on actual costs.	CAM, Engineering Services, TOM	$3,500 (Annual) Internal staff time	Annually (Perpetual)
12.	Review assets recommended for renewal and ensure planned forecasts and replacement costs are updated with type of asset it would be replaced with.	CAM, Engineering Services	$3,000 p.a. $6,000 Total Internal Staff Time	2 Years 2022-2023
13.	Review and update Schedule 29 By law to capture updated bridge & culvert load restrictions.	Engineering Services, Clerks	$1,500 p.a. $3,000 Total Internal Staff Time	2 Years 2022-2023
14.	Improve annual engagement survey process to optimize engagement and respondents.	CAM, Engineering Services, Communications	$7,500 (Annual) $37,500 (Total) Internal staff time	5 Years 2022-2027
15.	Improve demand driver knowledge and identify additional drivers to be utilized within the plan.	CAM, Engineering Services, Economic Development, Environmental Services	$3,000 Internal staff time	Annually
16.	Develop and improve risk management knowledge along with supporting documentation.	CAM, Engineering Services, Continuous Improvement	$12,500 (Annual) $25,000 (Total)	2 Years 2022-2023
17.	Investigate renewal needs for bridges with boundary agreements and incorporate into budget.	CAM, Engineering Services	$3,000 p.a. $6,000 Total Internal Staff Time	2 Years 2022-2023
18.	Investigate O&M activities and funding allocation for OSSS	CAM, TOM	$3,000 per annum $6,000 Total Internal Staff Time	2 Years 2022-2023

3.7.3 Monitoring and Review Procedures

This AM Plan will be reviewed during the annual budget planning process and revised to show any material changes in service levels, risks, forecast costs and proposed budgets as a result of budget decisions.

The AM Plan will be reviewed and updated on a regular basis to ensure it represents the current service level, asset values, forecast operations, maintenance, renewals, acquisition and asset disposal costs and planned budgets. These forecast costs and proposed budget will be incorporated into the Long-Term Financial Plan once completed.

3.7.4 Performance Measures

The effectiveness of this AM Plan can be measured in the following ways:

- The degree to which the required forecast costs identified in this AM Plan are incorporated into the long-term financial plan;
- The degree to which the 1-10-year detailed works programs, budgets, business plans and corporate structures consider the ‘global’ works program trends provided by the AM Plan;
- The degree to which the existing and projected service levels and service consequences, risks and residual risks are incorporated into the Strategic Planning documents and associated plans; and,
- The Asset Renewal Funding Ratio achieving the Organisational target (this target is often 90 – 100%).

4.0 REFERENCES

- Ministry of Transportation. (2002, May 8). *Sign Support Guidelines.* Retrieved from http://www.bv.transports.gouv.qc.ca/mono/1116014.pdf
- MTO. (2015, August 18). *Bridge repairs.* Retrieved from Ministry of Transportation: http://www.mto.gov.on.ca/english/highway-bridges/ontario-bridges.shtml
- MTO. (2020). *Ontario Sign Support Inspection Manual.* St. Catharines: Ontario Ministry of Transportation.
- IPWEA, 2006, 'International Infrastructure Management Manual', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/IIMM
- IPWEA, 2015, 3rd edn., 'International Infrastructure Management Manual', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/IIMM
- IPWEA, 2008, 'NAMS.PLUS Asset Management', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/namsplus.
- IPWEA, 2015, 2nd edn., 'Australian Infrastructure Financial Management Manual', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/AIFMM.
- IPWEA, 2020 'International Infrastructure Financial Management Manual', Institute of Public Works Engineering Australasia, Sydney
- IPWEA, 2018, Practice Note 12.1, 'Climate Change Impacts on the Useful Life of Assets', Institute of Public Works Engineering Australasia, Sydney
- IPWEA, 2012, Practice Note 6 Long-Term Financial Planning, Institute of Public Works Engineering Australasia, Sydney, https://www.ipwea.org/publications/ipweabookshop/practicenotes/pn6
- IPWEA, 2014, Practice Note 8 – Levels of Service & Community Engagement, Institute of Public Works Engineering Australasia, Sydney, https://www.ipwea.org/publications/ipweabookshop/practicenotes/pn8
- ISO, 2014, ISO 55000:2014, Overview, principles and terminology
- ISO, 2018, ISO 31000:2018, Risk management – Guidelines