Levels of Service Strategy

Levels of service are the cornerstone of asset management decision-making and planning. The outcomes of a levels of service strategy should ensure that levels of service:

- Align with strategic service objectives
- Have line-of-sight between service levels to the community and asset service level requirements
- Targets maximize asset value
- Have multifunctional uses for planning and decision-making
- Are simple, outcome-based and few as possible
- Use industry precedent as much as possible

Figure 1 – The Role of Levels of Service in Asset Management

Levels of Service Types

Levels of Service can be summarized as follows:

Community Levels of Service

Community Levels of Service (CLOS) are non-technical measures describing the residents' service experience.

Technical Levels of Service

Technical Levels of Service (TLOS) are technical measures that outline the asset-related requirements to provide community levels of service.

Since O. Reg 588/17 requires full lifecycle costs for the life of the 10-year asset management plan, both operating and capital costs need to be identified. Therefore, to facilitate full lifecycle asset management strategies and costing, AMONTario divides TLOS into two categories: Asset Levels of Service (ALOS) for capital planning and Operations and Maintenance (O&M) Levels of Service for operational planning.

1. Asset Levels of Service

ALOS are measures of the assets' condition and performance required to provide adequate CLOS. ALOS targets are set to measure the state of the assets and to determine whether capital projects are needed to restore or replace assets so that CLOS can be maintained. ALOS measures, criteria and targets should be informed as much as possible by available industry best practices, regulations, design guidelines or Council directives.

AMONTario utilizes two types of ALOS to measure the assets' ability to provide adequate quality, quantity, safety, reliability, efficiency, and accessibility of community services:

Condition Asset Levels of Service

Condition ALOS measure the physical "health" of the assets to determine if they are in adequate condition to properly function.

Performance Asset Levels of Service

Performance ALOS measure the assets' ability to provide sufficient service quality, quantity, reliability, accessibility and/or resiliency. To minimize the number of ALOS measures, AMONTario uses only four: Operational Functionality, Capacity to Meet Demands, Operational Resiliency and Environmental Resiliency, each of which are underpinned by measurement criteria unique to each asset type.

AMONTario's ALOS measures, attributes and community service outcomes are summarized on Table 1 and Table 2.

Table 1 – Asset Levels of Service Attributes

| AMONTario ALOS	AMONTario ALOS Measurement Attributes Using Industry Measures, Ministry Design Guidelines, Regulations & Other Precedents
Condition Levels of Service	Physical state of the asset measured by condition rating systems: PCI, BCI, FCI, PACP,, Very Good to Very Poor etc.
Operational Functionality	- Efficiency and effectiveness of service delivery - Ability to meet minimum current design and/or safety requirements - Level of operational problems experienced and whether they affect community services. - Compliance with current Regulations and/or Standards (including the level of "grandfathering") - Whether all required elements are present. - Relevance and effectiveness of technology - Efficiency of resource consumption including a focus on reduction of greenhouse gas emissions
Capacity to Meet Demands	- To what degree capacity meets current demands and minimum community service levels - Level of operational problems experienced. - Are there noticeable negative affects on community service levels or stakeholders (residents and businesses)
Operational Resiliency	- To what degree minimum service requirements are maintained/protected with back-up systems, spare capacity or alternative supply. - To what extent the assets are secure from acts of vandalism, trespassing, theft, assault or terrorism.
Environmental Resiliency	- To what extent the assets are resilient to environmental stresses including climate change; e.g., impacts from wind, fire, flooding, excessive rainfall/snowfall etc.. - The extent to which assets have been specifically protected or adapted for climate change where such actions have been identified.

Table 2 – Community Service Outcomes

AMONTario ALOS	Predominant Community Service Outcomes					
	Health & Safety	Reliability	Quality	Quantity	Efficiency	Accessibility
Condition Levels of Service	X	X	X	X	X	
Operational Functionality	X	X	X		X	X
Capacity to Meet Demands	X	X	X	X	X	X
Operational Resiliency	X	X				
Environmental Resiliency	X	X				X

2. Operations and Maintenance Levels of Service

O&M LOS measures the operating requirements and activities for proper operations, functioning and maintenance of the assets to cost effectively maximize asset use and lifespan. O&M LOS measures and targets are generally established by available industry best practices, warranties and regulations.

Using the roads service as an example, Figure 2 illustrates, how the levels of service strategy creates an integrated 'line-of-sight' between corporate service goals and the asset management requirements needed to achieve those goals.

Figure 2 – The Levels of Service Hierarchy
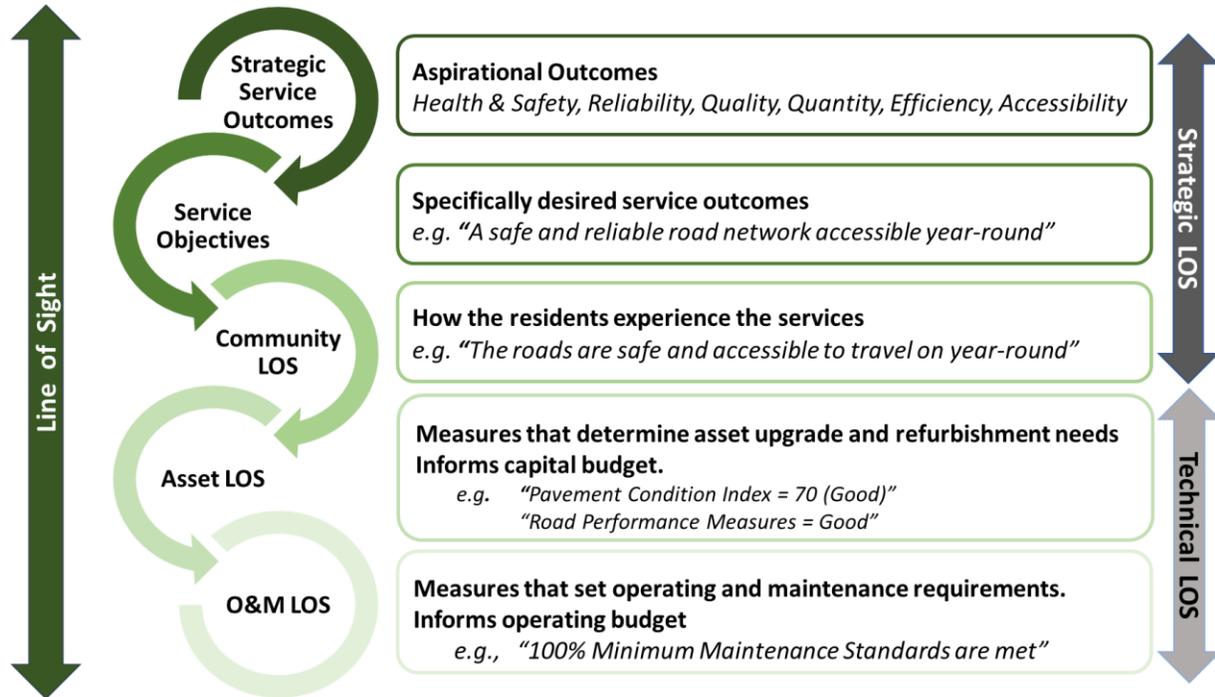
Milestone #2 Materials

There are six (6) levels of service packages; one each for roads and bridges, water, wastewater, stormwater, facilities, fleet and equipment. Each package contains the following tabs:

Tab 1 – Levels of Service Template. This is a blank template that is to be completed for Milestone #2. This template will document your municipality's current and proposed (target) ALOS and O&M LOS for your selected infrastructure group. If you are unable to list all of your current O&M activities and their current and target levels of service, try to provide a few examples. These will factor in as part of the lifecycle strategies and costs.

Tab 2 – Level of Service Example. This sheet provides an example of how the levels of service and asset information is entered for a selected infrastructure group.

Tab 3 – Service Objectives and Community Level of Service Statements. These are example statements that can be used for defining Service Objectives and Community Levels of Service if such measures have not already been defined by your municipality by the strategic plan or service plans.

Tab 4 –Condition ALOS Ratings. This sheet outlines condition ALOS measures and suggested targets for many asset class types.

Tab 5 – General Performance Ratings. This sheet outlines the descriptions of what each of the Performance ALOS ratings look like for the assets.

Tab 6 (and Tab 8 for the Facilities LOS Package) – Performance ALOS Ratings – Asset Class. This sheet is intended as a desktop scoring exercise to rate the current Performance ALOS for each asset class. Use one sheet per asset class, hide the rows not being used, and replicate as many sheets as necessary to cover all of the asset classes for your selected infrastructure type.

Tab 7 (and Tab 9 for the Facilities LOS Package) – Performance ALOS Ratings – Assets. This sheet can be used to score and compare the Performance ALOS for each asset within the same asset class. This is provided for information only and not a requirement for Milestone #2. These sheets are designed to cover up to four assets within the same asset class. Additional assets (columns) can be added if desired. Use one sheet per asset class, hide the rows not being used, and replicate as many sheets as necessary.

Tabs 8 and 9 (Tabs 10 and 11 for the Facilities package) – Generic Asset Class and Asset Performance Evaluation. If preferred, or where assets cannot be readily scored per the Asset Performance Criteria on Tabs 6 and 7 (and Tabs 8 and 9 in the Facilities LOS package), these sheets can be used to score the current Performance ALOS based on a generic set of Performance ALOS criteria. These sheets should be replicated as necessary to evaluate each of the selected asset classes and assets. Again, this is provided for information and not a requirement for Milestone #2.

Tab 10 (Tab 12 for the Facilities LOS package) – Climate Change Vulnerability Assessment. This sheet is a tool to assess the asset classes and Performance ALOS criteria that are potentially exposed and sensitive to climate change. This tool is intended for municipalities that have not completed climate change adaptation studies or strategies. For such municipalities, this activity is to be completed for Milestone #2.

The packages also include Appendices that provide additional information summarizing the levels of service and ratings, the levels of service frameworks and setting levels of service targets.

The Connection between ALOS and Risk

ALOS provide a measure of the assets' likelihood of failure to meet service requirements. Tabs 4 to 9 (4 to 11 in the Facilities LOS package) link the asset conditions to likelihood of failure. Table 3 summarizes the relationship between Condition and Performance ALOS and likelihood of failure per the AMONTario levels of service framework.

Table 3 – AMONTario ALOS and Corresponding Likelihood of Failure.

	Condition Levels of Service (Tab 4)				Performance Levels of Service (Tabs 5-9 or 5-11)			
ALOS Measures	Corresponding Likelihood of Failure Measures				ALOS Measures	Corresponding Likelihood of Failure Measures		
Varies by asset type and rating method	Risk Ratings	Estimated Timeframe	% Likelihood of Failure	1. Operational Functionality	ALOS Rating	Risk Ratings	% Likelihood of Failure	
Very Good to Good	Very Unlikely	>20 yrs.	<10%	2. Capacity to Meet Demands	Very Good	Very Unlikely	<10%	
Good to Fair	Unlikely	11-20 yrs.	10% - 30%		Good	Unlikely	10% - 30%	
Fair to Poor	Possible	6-10 yrs.	30% - 60%	3. Operational Resiliency	Fair	Possible	30% - 60%	
Poor to Very Poor	Likely	1-5 yrs.	60% - 90%		Poor	Likely	60% - 90%	
Very Poor to Failed	Very Likely or Certain	<1 yr.	>90%	4. Environmental Resiliency	Very Poor	Very Likely or Certain	>90%	

Completing the Milestone #2 Activities

The first activity is to complete the Level of Service Template on Tab 1.

TAB 1 – Levels of Service Template

Part 1 – Enter Asset Hierarchy Information and Community Levels of Service

1. Enter the title of the service benefiting from the selected infrastructure type in Column A.

2. Enter the "Program Service Objectives" in Column B. These are high level statements describing the desired service outcomes to the community. It is preferred that your municipality's strategic plan or other strategic planning documents be used; however, the examples provided on Tab 3 can also be used.

3. Enter the "Community Levels of Service" in Column C. These will be non-technical statements describing how the community experiences the service and/or how the community expects the service to operate. Again, refer to available planning documents and public surveys within your organization or use the examples provided on Tab 3.

4. Referring to your service to asset hierarchy completed in Milestone #1, enter your asset "Service Divisions" in Column D and the "Asset Classes" in Column E.

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AMONTario
ASSET MANAGEMENT ONTARIO

Part 2 – Enter Proposed (Target) and Current Condition Asset Levels of Service

TAB 4

Likelihood of Failure **Very Unlikely** Estimated beyond 20 yrs. OR Estimated less than 10%	Likelihood of Failure **Unlikely** Estimated 11 - 20 yrs. OR Estimated 10% -30%	Likelihood of Failure **Possible** Estimated 6 - 10 yrs. OR Estimated 30% - 60%	Likelihood of Failure **Likely** Estimated 1 - 5 yrs. OR Estimated 60% - 90%	Likelihood of Failure **Very Likely or Certain** Estimated within 1 yr. or Now OR Estimated greater than 90%
The assets are rated **'Very Good'**. **For all asset types:** - Fit for the future. - Well maintained, in good condition, new or recently rehabilitated. **AND/OR** - No or insignificant defects and/or wear. **AND/OR** For assets with a estimated useful service life of 25 years or greater: **ERUSL >20 years** **OR** For assets with a useful service life of 20 years or less: **ERUSL >80%**	The assets are rated **'Good'**. **For all asset types:** - Adequate for now. **AND/OR** - Minor defects/deficiencies and/or wear. **AND/OR** For assets with a estimated useful service life of 25 years or greater: **ERUSL = 11 to 20 years** **OR** For assets with a useful service life of 20 years or less: **ERUSL = 80% to 55%**	The assets are rated **'Fair'**. **For all asset types:** - Shows signs of deterioration and some elements exhibit deficiencies. - May require attention. **AND/OR** - Moderate defects/deficiencies and/or wear. **AND/OR** For assets with a estimated useful service life of 25 years or greater: **ERUSL= 6 to 10 years** **OR** For assets with a useful service life of 20 years or less: **ERUSL = 54% to 30%**	The assets are rated **'Poor'**. **For all asset types:** - An increasing potential for asset conditions to affect the services it (or they) provides. - Approaching the end of service life. - The condition is below the standard and a large portion of the system (or asset) exhibits significant deterioration. **AND/OR** - Significant defects/deficiencies and/or wear. **AND/OR** For assets with a estimated useful service life of 25 years or greater: **ERUSL = 1 to 5 years** **OR** For assets with a useful service life of 20 years or less: **ERUSL = 30% to 5%**	The assets are rated **'Very Poor'**. **For all asset types:** - Unfit for sustained service. - Near or beyond its expected service life and shows widespread signs of advanced deterioration. - The asset or some assets may be unusable. **AND/OR** - Severe defects/deficiencies and/or wear **AND/OR** For assets with a estimated useful service life of 25 years or greater: **ERUSL <1 year or beyond EURSL** **OR** For assets with a useful service life of 20 years or less: **ERUSL <5%**

1. Using Tab 4 (Condition ALOS Ratings) select ALOS targets to be entered in Column F. In most cases (minimally for the critical and/or more complex assets), the condition ALOS targets should equate to the ratings listed under the green headings (Likelihood of Failure = Unlikely: 11 – 20 years or 10% - 30%). Less critical assets and/or simpler assets that can be repaired or replaced quickly (say within 1-3 years) may be suitable for the ratings under the yellow heading (Likelihood of Failure = Possible: 6 – 10 years or 30% - 60%). Notes for determining target ALOS are provided for each asset class in Column B of Tab 4. Each municipality will select their ALOS targets based on community service expectations, cost effectiveness and risk tolerances. Additionally, the Condition ALOS Ratings and ranges may vary somewhat from some municipalities pre-established ratings and ranges. In such cases, the municipality should select and/or adjust the ratings and ranges that best suit the municipality.

2. Enter your asset class average Condition ALOS in Column G. This is based on the average current condition of all the assets in the asset class which may be weighted by asset lengths or areas. The average current condition ALOS for each asset class is necessary to understand the current state of the assets and to meet the O. Reg 588/17 reporting requirements.

3. In Columns H to L of Tab 1, enter the percentage of assets/asset quantities within each asset class matching the condition ranges on Tab 4. Again, the ranges indicated on Tab 4 may vary from condition and likelihood of failure ranges being used by your

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municipality. In such circumstances, use the ranges most suitable to your municipality's assets.

Part 3 – Entry of Performance Asset Levels of Service

Enter the Performance LOS descriptions and targets in Column F of Tab 1. How many of the four Performance ALOS that will be used will vary by asset class according to Tab 6 (Performance LOS Evaluation – Asset Class). In most cases, the Performance ALOS target should equate to "Good" (Likelihood of Failure = Unlikely: 10% - 30%).

The asset class performance analysis is intended as a desktop exercise to rate how well the asset classes are meeting the various performance criteria and to determine the overall Performance ALOS. Use one sheet per asset class. Replicate as many sheets as necessary to cover all of the asset classes for your selected infrastructure type and "hide" the rows and asset classes not being used. Do not delete rows as this may affect the formulas.

Asset Class Performance Analysis Tab 6 (and 8 in the Facilities LOS package))

TAB 6

Asset Classes/Types[7]	ALOS	Context for Evaluating Performance Criteria[1]	Select Criteria to Support Proposed ALOS Target[1,2] (where information is available)	Weightings based on importance to ALOS[4,5] (Optional)	% Very Good	% Good	% Fair	% Poor	% Very Poor	% NA	TOTAL
Urban Road Sections	Operational Functionality	- Efficiency and effectiveness of service delivery - Ability to meet minimum current design and/or safety requirements - Level of operational problems experienced and whether they affect community services. - Compliance with current Regulations and/or Standards (including the level of "grandfathering") - Whether all required elements are present. - Relevance and effectiveness of technology	- Sufficient road platform widths (through lanes) to accommodate current traffic volumes, posted speeds and road classification	3		90	10				100
			- Adequate road structure (pavement and base) capacity to accommodate traffic volumes and loading		20	80					100
			- Appropriate geometric designs and sightlines for posted speeds (vertical and horizontal alignments)	5			100				100
			- Adequate elevation, grades and drainage to prevent seasonal and/or reoccurring flooding	3		50	50				100
			- Adequate drainage and drainage design of the road base and sub-base to prevent structural failure of the road base and pavement	3		50	30	20			100
			- Adequacy of roadside safety device protection	2						100	N/A
			- Adequate condition and regulatory compliance of existing roadside safety devices	3	100						100
			- Other								
			Average Operational Functionality ALOS Ratings	21	18	42	37	3	0	14	100
			ALOS Rating - Operational Functionality	2	Good						

Criteria Ratings	
Very Good	Fully meets or exceeds criteria.
Good	Meets criteria.
Fair	Meets criteria with some limitations, exceptions or minor deficiencies.
Poor	Only partially or somewhat meets criteria or only meets criteria in some circumstances.
Very Poor	Mostly or fully does not meet criteria.

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Referring to the "Criteria Ratings" table in the footnotes and pasted at locations on the spreadsheet, rate the performance of the asset classes on Tab 6 as follows:

1. Select the asset class performance criteria in Column D that you feel is important to providing services and for assessing the performance of your selected asset classes.

2. Weight each of the criteria from 1 to 5 (a dropdown) in Column E according to the importance of the criteria to the asset class performance (1 = Unimportant, 2 = Relatively Unimportant, 3 = Relatively Important, 4 = Important, 5 = Very Important). Again, the "Criteria Weightings" table can be found in the footnotes and is pasted at locations on the spreadsheet.

Criteria Weightings	
1	Unimportant
2	Relatively Unimportant
3	Relatively Important
4	Important
5	Very Important

3. In Columns F to J, enter the approximate percentage of assets within the asset class meeting the various criteria from "Very Good" to "Very Poor" per the "Criteria Ratings" descriptions provided on the spreadsheets. Where information is not available or not applicable for any one of the criteria, enter "100" under "NA" in Column K so that it is not included as part of the calculations. Column K will indicate a percentage of missing or non-applicable information for the ALOS which can be used to assess the confidence in the ALOS results. Where entries for each of the criteria exceed or fall short of 100%, the cells in Column L will turn pink indicating the error.

The bottom-line numbers for each ALOS (rows highlighted in tan from Columns F to J) are then entered into Columns H to L of Tab 1 and your asset class average ALOS at the very bottom of each section is entered in Column G of Tab 1 as shown below. Note that the overall performance rating for the asset class is indicated at the very bottom of the spreadsheet.

Part 4 – Entry of O&M Activities and Current and Proposed Levels of Service

 TAB 1   **M**   **N**   **O**

O&M Levels of Service		
Activity	Current LOS	Target LOS
Road Patrols	Fully Meet Min. Maintenance Standards	Fully Meet Min. Maintenance Standards
Line Painting	100% of roads every 2 years	100% of roads every year
Sweeping	Once a year	Once a year
Snow Removal	Fully Meet Min. Maintenance Standards	Fully Meet Min. Maintenance Standards
Pavement Spot Repairs	Fully Meet Min. Maintenance Standards	Fully Meet Min. Maintenance Standards
CB/CBMH Cleaning	Every 10 years	Every 5 years

Operations and maintenance are generally the assets' highest lifecycle expenditures and need to be included as part of the lifecycle strategies and costs per O. Reg 588/17. As much as possible, enter on Tab 1 your municipality's typical O&M lifecycle activities and the LOS that trigger these activities. Enter the information into Tab 1 as follows:

1. Activity (Column M) – List both the activities currently being done and activities that should be done but are not currently able to do.

2. Current LOS (Column N) - Enter the current LOS for activities currently being done. Leave a blank for the activities not being done.

3. Proposed LOS (Column O) – Enter proposed LOS for all activities (both for those being done and not being done).

Options for defining O&M LOS targets include:
- length/year
- units/per year
- % of system per year
- units/length
- hours/year
- # times per year
- every # of years
- asset condition rating
- regulatory requirement (describe regulation)

Avoid using dollars as a LOS measure. The technical units of measure are what is used to define lifecycle strategies and support the required O&M costs.

Part 5 – Climate Change Vulnerability Assessment

The AMONTario Climate Change Vulnerability Assessment is intended as a preliminary assessment of where municipal infrastructure may be at added risk due to climate change. The assessment is best suited where there have been no previous studies on

climate change impacts and there is little or no information on the degree to which assets may be affected by climate change.

The vulnerability assessment is applied only to those asset classes that have criteria highlighted in green and where the criteria has been selected and rated by the municipality as 'Fair', 'Poor' or 'Very Poor'. This indicates that there is potentially greater climate change sensitivity to these asset and criteria if improvements are not made. This is not to say that "green criteria" rated as 'Very Good' or 'Good' are not sensitive to climate change, but without additional study, it may be difficult to determine at a preliminary stage what additional improvements might be necessary to further adapt the assets that rate 'Very Good' or 'Good'.
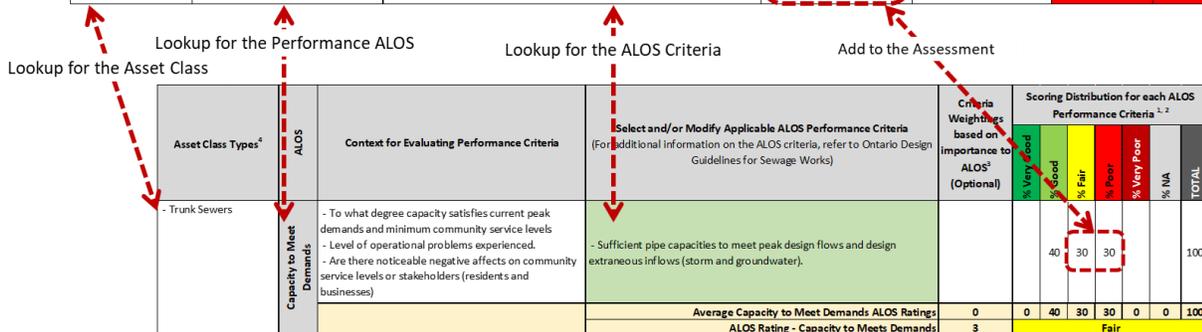
The results of the vulnerability assessment can be incorporated into asset management risk assessments and priority setting.

Figure 3 below illustrates the process of transferring the information from the Performance ALOS Ratings worksheet on Tab 6 (and 8 for Facilities LOS package) to the Climate Change Vulnerability Assessment on Tab 10 (Tab 12 for the Facilities LOS package). Appendix I provides information on how the criteria highlighted in green could potentially be affected by climate change.

Figure 3 – Climate Change Vulnerability Assessment Process

Tab 10: Climate Change Vulnerability Assessment

Tab 6: Performance ALOS Ratings – Asset Class

Note that "Adaptive Capacity" in the Climate Change Vulnerability Assessment is determined by the municipality as outlined on Table 4.

Table 4 – Municipal Capacity to Adapt Assets to Climate Change

Adaptive Capacity	
High Capacity (X1)	The municipality can readily adapt the assets to achieve a 'Very Good' or 'Good' ALOS criteria rating within the next 10 years.
Medium Capacity (X2)	With some difficulty and reallocation of resources, the municipality can adapt the assets to achieve a 'Very Good' or 'Good' ALOS criteria rating within the next 10 years.
Low Capacity (X3)	The assets are not practical to be adapted and/or the municipality currently has very limited or no ability to adapt the assets to achieve a 'Very Good' or 'Good' ALOS criteria rating within the next 10 years. Significant reprioritization of resources, changes in levels of service and/or higher risk tolerances and response planning are required.

Due Date and One-on-One Discussions

Should you wish to schedule a one-on-one meeting for additional assistance with the activities, please do not hesitate to contact Salman Zafar to arrange a coaching session.

Please submit the completed Milestone #2 activities by Friday February 3rd, 2023.

APPENDIX I

Potential Climate Change Impacts
(Courtesy: Asset Management BC's Climate Change and Asset Management: A Sustainable Service Delivery Primer)

Water
- Drought leading to loss of reliable water sources
- Reduced source water quantity and quality
- Increased water demands leading to system capacity issues and stress on water sources
- Increased need for the water system to deliver sufficient fire flows to protect properties against wildfires
- Damage to water buildings, tankage and process equipment from flooding and wildfires
- Taste/odour problems in the summer

Wastewater
- Increased inflow and infiltration leading to system capacity being more frequently exceeded which may lead discharges to surfaces, water and sources, basement flooding and water borne health affects
- Changes to wastewater effluent characteristics
- More frequent wastewater process overflows and untreated discharges/bypasses into water bodies
- Damage to wastewater buildings, tankage and housed process equipment from flooding and wildfires

Storm Water Management
- Major and minor system capacity more frequently exceeded causing overland flooding leading to property and infrastructure damage
- Increased energy costs due to increased pumping
- Water-borne health effects from flooding

Roads
- Road damage caused by erosion, landslides, and embankment failure
- Higher temperatures increasing the frequency and severity of thermal cracking and rutting
- More frequent freeze/thaw cycles causing frost heave and thaw weakening
- Road washouts caused by overflowing culverts and storm sewers
- Increased risk that low-lying roads, bridges and bridge foundations will be inundated, undermined or damaged by flooding

Buildings and Property
- Damage due to wildfires and flooding
- Increased reliance on cooling systems causing increased energy use
- Reduced service life and functionality of components and systems
- Increased odour and pests in solid waste systems during longer summer periods

Parks
- Drought leading to increased stress on vegetation and potential water restrictions for built water features
- Loss of trees due to drought, windstorms and wildfires
- Increased temperatures leading to increased demand on parks with water features (natural or constructed)
- Changes to water quality of adjacent lakes or rivers impacting recreational use
- Increased erosion and decreased slope stability