

**USER MANUAL:
SIMPLIFIED LEVELS OF SERVICE (LOS) TOOLKIT**

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About the Toolkit

The simplified Levels of Service (LOS) Toolkit has been developed to support municipalities that are early in their asset management journey. This toolkit will support users in identifying and documenting current and proposed LOS and performance targets, in compliance with Ontario's *Asset Management Planning for Municipal Infrastructure* regulation (O.Reg.588/17).

This toolkit is a complement to our more detailed, class specific LOS Toolkits, which are available upon request.

Note: because facilities are particularly complex, a separate Simplified Toolkit has been created specifically for Facilities. The use instructions are the same, though the specific tab numbers will be different. Refer to Tab 0 in the Facilities Toolkit for tab numbers.

Key Terms & Definitions

Levels of Service (LOS): a defined amount of output for a particular activity, service area or asset against which performance may be measured. In the context of O. Reg. 588/17, LOS define services to the community and the asset technical and financial requirements to provide the services.

Customer/Community Levels of Service (CLOS): are statements describing customer/residents' service expectations. They are non-technical qualitative measures.

Technical Levels of Service (TLOS): are attributes and measures of the asset condition, asset performance, and related maintenance activities required to deliver CLOS and reduce the inherent risk associated with meeting CLOS expectations.

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 and are further described as follows:

- **Condition ALOS:** measures the physical health of an asset to determine if they are in adequate condition to function properly.
- **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.
- **O&M Levels of Service:** measures the operating requirements and activities for proper operations, functioning and maintenance of the assets to meet the CLOS.

Current TLOS reflect the current state of the assets and the current operating activities to maintain the assets. Current ALOS are determined based on the average ALOS rating of all the assets in the asset class.

Proposed TLOS (also referred to as target LOS) are the ALOS and O&M LOS targets selected by the municipality to ensure safe, adequate, efficient, effective, and accessible services.

Key Performance Indicators: measure trends to determine if conformance to the TLOS are leading to desired outcomes.

Intro to Technical Levels of Service (TLOS)

Levels of service are the cornerstone of asset management decision-making and planning. The focus of this toolkit is to aid municipalities in developing proposed TLOS measures and targets.

Proposed TLOS are measures and targets of asset condition, performance, and operational requirements to provide, sustain services and minimize undue risk to providing safe, efficient, reliable and accessible community services. TLOS enhance an organization's understanding of how their assets support the services, and how effectively and sustainably services are being delivered.

O. Reg. 588/17 requires that municipalities establish proposed TLOS for all of the assets that provide services to their communities. The regulation also requires municipalities develop a fully costed 10-year financial plan for all assets, including capital investments and significant annual operating costs. To meet these requirements, it is essential to understand what the proposed TLOS should be to achieve a desired level of community service (e.g., how nice is the finished appearance of the building, how many amenities are available in a park, at what point should a rough road be resurfaced) and be able to compare it to the current level of service. Once understood, an organization is able to identify, discuss, and decide on the kinds of asset investments (renovations to existing buildings; design standards for parks; capital and operating procedures to extend the life of a road surface, such as resurfacing and crack sealing) required to achieve proposed service targets.

To facilitate understanding of an asset's full lifecycle, and the asset management strategies and costing required to achieve that lifecycle, AMONTario has developed this simplified toolkit. It will help set and document TLOS targets, and identify and document assets not meeting the targets to guide decision-making going forward. The principles underpinning this toolkit include:

- Aligning TLOS with the municipality's strategic service objectives
- Maintaining line-of-sight between service levels to the community and the TLOS required of the assets
- TLOS targets should maximize asset value (i.e., desired service levels at least cost and risk)
- TLOS have multifunctional uses for planning and decision-making
- TLOS are simple, outcome-based, and few as possible
- Use industry precedent as much as possible in determining TLOS measures and targets

Proposed Levels of Service

Proposed Technical LOS set a consistent target against which *all* assets in the asset class can be consistently measured and deficient asset identified, asset risks measured, and lifecycle actions recommended.

Overview of the Toolkit

This section provides an orientation to what is included in the excel-based Simplified LOS toolkit.

Note: there are 2 versions of the Toolkit available: a general version for all asset classes except facilities and a facility specific version. The instructions below refer to the tab numbers in the general version. For facility specific tab references, refer to Tab 0 – General Instructions in the facilities toolkit.

Once completed, the information in your facilities LOS template (Tab 1) can be inserted into the LOS template (Tab 1) of the generic toolkit with your other asset, if desired.

Tab 0 – General Instructions: This tab provides an additional high-level overview of the toolkit and acts as a quick-reference.

Tab 1 – Levels of Service (LOS) Template: This is your primary working sheet within the toolkit. This template is where you will document your municipality’s community levels of service and current and proposed (target) Technical LOS, including condition asset levels of service (ALOS), performance ALOS, and operating maintenance LOS. On this sheet and throughout the workbook, the following colour coding is used to help users quickly identify where to document each type of LOS:

Condition ALOS
Performance ALOS
Operating Maintenance LOS

Row 2 (in light green) provides additional instructions about what to include in each column, and when to refer to other tabs for examples.

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 service or infrastructure group (in this case, the example is for water).

Tabs 3-7 – Example (EG) Condition ALOS Ratings: These tabs provide examples of asset condition measures, ratings, and proposed ALOS targets for assessing the condition of specific asset class types. Each tab provides examples for a different service area: roads, water, wastewater, stormwater, and fleet. The facilities toolkit includes a tab for facility condition ratings.

Sources are noted in the footnotes of each tab, when applicable, and additional sources and information are included in Appendices B, C, and D.

Note: Information to assess current Condition ALOS is sourced from the municipality’s own data.

The examples in Tabs 3-7 will help users fill out the blue cells in Tab 1.

Tab 8 – EG Asset Performance Ratings: This tab provides asset performance ratings that are applicable to all service areas and asset types. Column A lists ALOS categories (AMONTario only uses four performance ALOS), and columns B-F provide descriptions for each performance

rating so that staff can assess the performance of their assets and select a suitable performance ALOS target (typically 'Good or 'Fair').

Users can refer to this tab when completing columns F-J in Tab 9, the working performance evaluation sheet.

(For addition information about how to map ALOS categories to Customer LOS, see Appendix A)

Tab 9 – Performance Evaluation: This tab is your secondary working sheet within the toolkit, and is intended to support the user in scoring the current performance ALOS for each asset class.

Use one copy of the performance evaluation sheet per asset class. To add an additional asset class, duplicate the sheet. There are additional instructions for the user at the top of the sheet.

Once the performance evaluation is completed for each asset class, copy the scoring that is totaled at the bottom of each performance ALOS to Tab 1. For example, copy the individual ratings from the row labeled "Average Operational Functionality ALOS Ratings" to columns I through M on Tab 1 under "Operational Functionality" and copy the overall rating from the row labeled "ALOS Rating - Operational Functionality" to column H of Tab 1 under "Operational Functionality" for each asset class.

Tabs 10-14 – EG Performance Criteria by Service Area: These tabs are a reference for the user when completing Tab 9 and provide specific performance criteria to consider by asset class types, for each of the four performance ALOS categories. Not all asset class types require all four of the performance ALOS types.

Using the toolkit

This toolkit is intended to support municipalities that are working to develop and document their current and proposed Technical Levels of Service (TLOS).

Before using this toolkit, the municipality will require their assets to be segmented into asset classes (Groups of like assets providing a distinct role in providing services and governed/measured by common Technical Levels of Service targets). For reference, see AMONTario's [Asset Information Management Toolkit](#).

Before working with the toolkit, it is also recommended that users define their Customer/Community Levels of Service (CLOS). It is possible to work with the toolkit without this information, but it is not recommended.

The instructions below will guide users through entering existing information and then using the toolkit to support you in developing and documenting your TLOS. Tab 2 provides an example of what the completed template looks like using the Water service and Tab 0 includes general instructions to refer back to during the process (as a complement to the more detailed overview in this User Manual).

Tab 1 – Levels of Service Template

The screenshot shows a spreadsheet template with columns labeled A through P. Columns A-E are grouped under 'Part 1'. Columns F-P are grouped under 'Part 4'. The 'Technical Levels of Service' section (columns F-P) is further divided into 'Capital Requirements' (columns F-G) and 'Operating Requirements' (columns H-P). The 'Capital Requirements' section includes 'Proposed Asset Levels of Service' (columns F-G) and 'Current Asset Levels of Service' (columns H-I). The 'Operating Requirements' section includes 'Operating Maintenance Levels of Service' (columns J-P). The 'Current Asset Levels of Service' section includes 'Condition' (column H), 'Asset Class Average' (column I), and 'Performance' (column J). The 'Operating Maintenance Levels of Service' section includes 'Assets' (column J), 'Current Levels of Service' (column K), and 'Proposed Levels of Service' (column L). The 'Condition' column (H) has a color-coded scale from green to red. The 'Performance' column (J) has a color-coded scale from green to red. The 'Assets' column (J) has a color-coded scale from green to red. The 'Current Levels of Service' column (K) has a color-coded scale from green to red. The 'Proposed Levels of Service' column (L) has a color-coded scale from green to red. The 'Supporting Asset Classes' section (rows 6-8) is divided into 'Part 2' (rows 6-7) and 'Part 3' (row 8). The 'Supporting Asset Classes' section includes 'Description' (column F), 'Performance' (column G), 'Operational Possibility' (column H), 'Operational Level of Service' (column I), 'Operational Condition' (column J), and 'Operational Availability' (column K).

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. To add additional services, copy rows (starting with row 7) and paste them at the bottom of the sheet.
2. Enter the “Program Service Objectives” in Column B. These objectives are high level statements describing the desired service outcomes to the community. Ideally these should be rooted in your municipality’s strategic plan or other strategic planning documents. The title “Program Service Objectives” may be retitled to suit the terms used in your municipality’s strategic plan.
3. Enter your municipality’s “Community Levels of Service” in Column C. The CLOS will be non-technical statements describing how the community experiences the service and/or how the community expects the service to operate. These statements should be rooted in your municipality’s planning documents and if available, public surveys.
4. Referring to your asset hierarchy, enter your asset “Service Divisions” in Column D and the “Asset Classes” in Column E. For reference, see AMONTario's [Asset Information Management Toolkit](#).

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

In Part 2, you are working on condition, so you are working in the light blue cells only.

1. For selecting the Condition ALOS Ratings refer to the reference tabs 3 - 7 and select the tab corresponding to the service being evaluated. In Column F enter a description of

what is to be measured (e.g. pavement condition, number of watermain breaks per kilometre, building condition, etc.)

Asset Class Types	Proposed ALOS Target ¹	Asset Condition Ratings ²				
		Very Good	Good	Fair	Poor	Very Poor
- Transmission mains - Feeder mains	Good	Use for pipes with an ERUSL greater than 20 years ERUSL estimated by any of the following: - pipe age and material - number and projected number of breaks/km of pipe - hours and projected hours of unplanned service interruptions per service - electromagnetic pipe assessments on concrete pressure pipe	Use for pipes with an ERUSL = 11 to 20 years. ERUSL estimated by any of the following: - pipe age and material - number and projected number of breaks/km of pipe - hours and projected hours of unplanned service interruptions per service - electromagnetic pipe assessments on concrete pressure pipe	Use for pipes with an ERUSL = 6 to 10 years. ERUSL estimated by any of the following: - pipe age and material - number and projected number of breaks/km of pipe - hours and projected hours of unplanned service interruptions per service - electromagnetic pipe assessments on concrete pressure pipe	Use for pipes with an ERUSL = 1 to 5 years. ERUSL estimated by any of the following: - pipe age and material - number and projected number of breaks/km of pipe - hours and projected hours of unplanned service interruptions per service - electromagnetic pipe assessments on concrete pressure pipe	Use for pipes with an ERUSL less than year or beyond ERUSL or are currently failing acceptable service requirements. ERUSL estimated by any of the following: - pipe age and material - number and projected number of breaks/km of pipe - hours and projected hours of unplanned service interruptions per service connection - electromagnetic pipe assessments on concrete pressure pipe

- In Column G, enter the proposed Condition ALOS targets. Proposed ALOS targets have been suggested for each asset class, but in general targets should equate to “Good” or “Fair” depending on asset criticality to services, safety considerations, typical industry practices (if applicable), and municipal risk tolerance. Each municipality will select proposed TLOS targets that suits their service requirements.
- In Column H, enter your asset class average Condition ALOS. This target 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.
- In Columns I to M, enter the percentage of assets/asset quantities within each asset class matching the condition ranges suggested on reference Tabs 3 - 7. Condition ratings, ranges, and descriptions may be adjusted or replaced by the municipality's own asset ratings system.

Part 3 – Entry of Performance Asset Levels of Service

In Part 3, you are working on performance, so you are working in the light gold cells only.

On Tab 1, the Performance LOS descriptions have been prepopulated in Column F. AMONTario uses four Performance ALOS types (Operational Functionality, Capacity to Meet Demands, Operational Resiliency, and Environmental Resiliency) all of which are underpinned by criteria included on reference tabs 10 – 14. How many of the four Performance ALOS will be used will vary by asset class, as included in reference tabs 10 – 14. The user will be selecting criteria for their selected service from the corresponding reference tab and pasting the criteria for each Performance ALOS into Tab 9. The reference tabs 10 – 14 will guide the user to select the applicable Performance ALOS targets for their service in Column G. Targets should equate to “Good” or “Fair” depending on asset criticality to services, safety considerations, typical industry practices (if applicable), and municipal risk tolerance.

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 rating. **Use one sheet per asset class.** Replicate as many sheets as necessary to cover all of the asset classes for your selected infrastructure type. Do not delete unused rows as this may affect the formulas (hide or leave blank).

Tab 9 – Asset Class Performance Analysis

Note: Use one copy of the performance evaluation sheet per asset class. To add an additional asset class, duplicate this sheet. Information on inserting additional rows can be found at the bottom of the sheet.

1. Select the applicable service being evaluated from reference tabs 10-14. Then, from each Performance ALOS type, select the examples of applicable criteria for each asset class within the service area. Select only the criteria that you feel are important to providing services and for assessing the performance of your selected asset classes. Paste the selected criteria into Column D on Tab 9 under each of the related Performance ALOS types.
2. Weight each of the criteria from 1 to 5 (using the dropdown options) 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 on Tab 9, enter the approximate percentage of assets within the asset class that meet the various criteria from “Very Good” to “Very Poor” per the “Criteria Ratings” descriptions provided on the spreadsheets (see the example below). Where entries for each of the criteria exceed or fall short of 100%, the cells in Column L will turn pink indicating an error.

A Asset Classes/Types ⁷	B ALOS	C Context for Evaluating Performance Criteria ³	D Select Criteria to Support Proposed ALOS Target ^{1,2} (where information is available)	E Weightings based on importance to ALOS ^{4,5} (Optional)	F G H I J K L Distribution of Asset Ratings for each ALOS ^{2,3}						
					% Very Good	% Good	% Fair	% Poor	% Very Poor	% N/A	TOTAL
Urban Road Sections	Operational Functionality	<ul style="list-style-type: none"> - 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	4	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.

The bottom-line numbers for each ALOS (rows highlighted in light gold 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 ALOS 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.

A	B	C	D	E	F	G	H	I	J	K	L					
Asset Classes/Types ⁷	ALOS	Context for Evaluating Performance Criteria ³	Select Criteria to Support Proposed ALOS Tar (where information is available)	Technical Levels of Service												
				Target Asset Levels of Service (by Asset Class)				Current Asset Levels of Service								
Urban Road Sections	Operational Functionality	<ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - Sufficient road platform widths (through lanes) to accommodate traffic volumes, posted speeds and road classification - Adequate road structure (pavement and base) capacity to traffic volumes and loading - Appropriate geometric designs and sightlines for posted and horizontal alignments) - Adequate elevation, grades and drainage to prevent sea recurring flooding. - Adequate drainage and drainage design of the road base prevent structural failure of the road base and pavement - Adequacy of roadside safety device protection - Adequate condition and regulatory compliance of existing roadside safety devices - Other 	Condition		Condition		Distribution by Asset Rating								
				HCB pavements, PCI = 70		PCI = 60		Asset Class Average								
								%	%	%	%	%	%			
										40	50	10				
								Performance		Performance						
								Operational Functionality = Good		Good		18	42	37	3	0
								Capacity = Good		Good		18	50	20	12	0
								Environmental Resiliency = Good		Fair		20	15	60	5	0
								Roadside safety								
								3		100						100
				Average Operational Functionality ALOS Ratings		21		18	42	37	3	0				
				ALOS Rating - Operational Functionality		2		Good								

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

In Part 4, you are working on Operations and Maintenance activities, so you are working in the tan cells only.

Operating Requirements		
Operating Maintenance Levels of Service		
Activity	Current Levels of Service	Proposed Levels of Service
<p>Enter a description of the current and proposed maintenance activities required to maintain asset operations and/or maximize service life.</p> <p>Avoid using operating costs that have no effect on ensuring asset operability or preservation but are simply costs associated with using the assets or providing services (e.g. overhead costs such as electricity, natural gas, internet, phone, wages and other overhead costs).</p>	<p>Enter the current measure for the maintenance activity (avoid financial measures since it is the cost of the OMLOS that is being evaluated).</p> <p>OMLOS measures include::</p> <ul style="list-style-type: none"> - length/year - units/per year - % of system per year - units/length - hours/year - # times per year - every # of years - asset condition rating - meeting a regulatory requirement (describe regulation) 	<p>Enter the proposed measure for the maintenance activity (avoid financial measures since it is the cost of the OMLOS that is being evaluated).</p> <p>OMLOS measures include::</p> <ul style="list-style-type: none"> - length/year - units/per year - % of system per year - units/length - hours/year - # times per year - every # of years - asset condition rating - meeting a regulatory requirement (describe regulation)

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 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 descriptions for 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 in Columns N and O 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.

APPENDICES

Appendix A – ALOS to CLOS Mapping

ALOS Categories	General ALOS Measurement Criteria	Predominant Community Service Outcomes					
		Health & Safety	Reliability	Quality	Quantity	Efficiency	Accessibility
Condition	Physical state of the asset measured by condition rating systems (PCI, BCI, FCI, PACP, Number of Breaks, Very Good to Very Poor etc.)	X	X	X	X	X	X
Operational Functionality	<ul style="list-style-type: none"> 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 	X	X	X		X	X
Capacity to Meet Demands	<ul style="list-style-type: none"> To what degree capacity satisfies current demands and minimum community service levels Level of operational problems experienced. Are there noticeable negative effects on community service levels or stakeholders (residents and businesses) 	X	X	X	X	X	X
Operational Resiliency	<ul style="list-style-type: none"> To what degree minimum service requirements are maintained/protected with back-up systems, spare capacity or alternative supply or access. To what extent the assets are secure from acts of vandalism, trespassing, theft, assault or terrorism. 	X	X				X
Environmental Resiliency	<ul style="list-style-type: none"> To what extent the assets are resilient to environmental stresses; e.g., impacts from wind, fire, flooding, excessive rainfall/snowfall etc. To what extent are the assets resilient to the effects of climate change. 	X	X				X

Appendix B – References: Ontario Ministry of Transportation (MTO) Condition Ratings and Triggers

The following is provided as reference material that supports the condition ALOS ratings for roads and bridges.

MTO Bridge Condition Index	
Rating	Maintenance Schedule
Good: BCI Range 70 - 100	Maintenance is not usually required within the next five years
Fair: BCI Range 60 -70	Maintenance work is usually scheduled within the next five years. This is the ideal time to schedule major bridge repairs to get the most out of bridge spending.
Poor: BCI Less than 60	Maintenance work is usually scheduled within one year.

MTO Ride Condition Ratings		
Ride Comfort Rating	Uniform Description of Ride Condition at Posted Speed	Guidelines
8 – 10	Excellent.	Very smooth
6 – 8	Good.	Smooth with a few bumps or depressions
4 – 6	Fair	Comfortable with intermittent bumps or depressions
2 – 4	Poor	Uncomfortable with frequent bumps or depressions
0 – 2	Very Poor	Uncomfortable with constant bumps or depressions

*Source: SP-024 MTO Manual for Condition Ratings for Flexible Pavements

MTO PCI Performance Ratings and Trigger Levels

Class	Good	Fair	Poor (Trigger Value)	
			PCI	RCI
Freeways	75	74-66	65	6
Arterial	75	64-56	55	5.8
Collector	70	64-51	50	5.1
Local	65	59-46	45	5.1

*Source: MTO Pavement Design & Rehabilitation Manual, March 2013

PCI Decision Matrix

TIME OF IMPROVEMENT	FREEWAY	ARTERIAL	COLLECTOR	LOCAL
Adequate	>85	>85	>80	>80
6 to 10 years	76 to 85	76 to 85	71 to 80	66 to 80
1 to 5 years	66 to 75	56 to 75	51 to 70	46 to 65
NOW Rehabilitate	60 to 65	50 to 55	45 to 50	40 to 45
NOW Reconstruct	<60	<50	<45	<40

Source: Good Roads (formerly Ontario Good Roads Association)

Table 3.3.1 Service Life Experienced

	Typical Service Lives
New Construction:	
Asphalt Pavement	14-18
Rehabilitation:	
Hot mix overlay (1 lift)	6-10
Mill + hot mix overlay (1 lift)	7-11
Mill + hot mix overlay (2 lifts)	10-14
Mill + hot mix overlay (3 lifts)	12-17
FDR* + hot mix overlay (1 lift)	9-12
FDR* + hot mix overlay (2 lifts)	12-16
FDR* + hot mix overlay (3 lifts)	14-17
HIR*	9
HIR* + overlay (1 lift)	12
CIR* + hot mix overlay (1 lift)	10-15
CIR* + hot mix overlay (2 lifts)	13-17
EAS* + hot mix overlay (1 lift)	9-13
EAS* + hot mix overlay (2 lifts)	11-14
Microsurfacing	8
Single Surface Treatment	4-8
Double Surface Treatment	5-9

* FDR – Full Depth Reclamation; HIR – Hot In-place Recycling; CIR – Cold In-place Recycling; EAS – Expanded Asphalt Stabilization

Appendix C – References: Ontario Ministry of Transportation (MTO) Highway Design Standards (for roads under Ministry jurisdiction).

The following is provided as reference material that supports the performance ratings for roads.

Highway Drainage Design Standards		
Design Flow for Minor System and Major System		
Functional Road Classifications	Drainage System Type	Design Flow
Freeway Arterial (Urban)	Minor System	10-year
	Major System	100-year
Arterial (Rural) Collector (Urban and Rural)	Minor System	10-year
	Major System	100-year
Local Road (Urban and Rural)	Minor System	5-year
	Major System	NA
Depressed Roadways	Minor System	25-year
	Major System	100-year

Highway Drainage Design Standards			
Design Flow Return Period for Bridges and Culverts			
Functional Road Classification	Return Period Design Flows		Check Flow for Scour
	Total Span Less than or Equal to 6.0m	Total Span greater than 6.0m	
Urban Arterial	50	100	130% of 100 year
Rural Arterial, Collector Roads	25	50	115% of 100 year
Local Roads	10	25	100% of 100 year

1. The listed design flows apply to roads under the jurisdiction of the Ministry of Transportation.
2. Design may vary on regulated watercourses.

Highway Drainage Design Standards	
Roadside Ditch Design Parameters	
Maximum Side Slope (1):	2H:1V
Minimum Longitudinal Slope	0.3 percent
Base Width - Desirable Standard - Minimum Standard	1.0 metre Zero (V-ditch)
Minimum Ditch Depth for Minor System Design Flow: • Normal Ditch (road at grade or in cut) • Ditch at toe of Fill Slope	0.50 metres 0.25 metres
Distance that roadside ditch invert shall be below the road subgrade elevation • Desirable Standard • Minimum Standard	0.5 metres 0.3 metres
Note (1): Flatter side slopes may be incorporated into the design in accordance with the Roadside Design Manual (formerly the Roadside Safety Manual) and geotechnical characteristics.	

Highway Drainage Design Standards		
Design Flow Return Period for Bridges on Low Volume Roads		
Road Function	Return Period of Design Flow (Years)	
	Total Span less than or equal to 6.0 m	Total Span greater than 6.0 m
Arterial and Collector	25	50
Local	10	25
The listed design flows apply to roads under the jurisdiction of the Ministry of Transportation.		

MTO Drainage Design Standards	
Minimum Culvert Size for Maintenance Purposes	
Road Type	Minimum Culvert Size
Freeways, Urban Arterials and Highway Ramps	800 mm minimum diameter for circular culverts
	800 mm minimum rise for elliptical or arch culverts
	900 mm minimum rise for box culverts
Rural Arterials, Collector Roads	600 mm minimum diameter for culverts
	600 mm minimum rise for elliptical or arch culverts
	900 mm minimum rise for box culverts
Local Roads and Private Entrances	500 mm minimum diameter or culvert rise if length > 10 m
	400 mm minimum diameter or culvert rise if length ≤ 10 m

Highway Drainage Design Standards	
Freeboard for Bridges	
Road Type	Freeboard
Arterials and Collectors	≥ 1.0 m
Local Roads	≥ 0.3 m
Low Volume Roads	No Freeboard Requirements

Highway Drainage Design Standards	
Freeboard for Minor Culverts on a Watercourse	
Road Type	Freeboard
Arterials and Collectors	≥ 1.0 m
Local Roads including Private Entrances	≥ 0.3 m

Minimum Design Cross-fall (m/m) for Three Lanes or less draining in one direction	
Travel Lanes	
Concrete or Bituminous pavement	0.02
Gravel or crushed stone	0.03 to 0.04
Shoulders	
Paved or treated	0.04
Gravel or crushed stone	0.06
Earth or turf	0.08
Grassed Areas	
	0.04

Appendix D – References: Notes on Rating Watermains

Condition ALOS Rating Method	Calculation Methodology	Advantages	Disadvantages
<p>Rating = Pipe Age</p> <p>Proposed ALOS Target = Maximum Age</p>	<p>Pipes are normalized by age</p> <p>Pipe age and material (if available) is used a proxy to rate current and future pipe conditions.</p>	<ul style="list-style-type: none"> • Most simple to use and rate. • Most municipalities have available data • Provides the ability to plan the approximate level of watermain replacements and costs required to sustain the proposed condition ALOS target 	<ul style="list-style-type: none"> • Least supportable measure for understanding current and future pipe conditions. • Age is an inaccurate proxy for actual pipe condition which can vary widely by age, pipe material, ground conditions and construction practices. • Not transferable to O.Reg 588/17 reporting requirements.
<p>Rating = Number of lifetime breaks/km of pipe</p> <p>Proposed ALOS Target = Maximum lifetime pipe breaks/km of pipe</p>	<p>Pipe are normalized by lifetime breaks/km</p> <p>Current pipe condition rating = Number of lifetime breaks/km of main</p> <p>Estimated remaining useful service life = The average rate at which a watermain of a certain material breaks over its lifetime/km which is then used to estimate the number of years an average watermain lasts before reaching its target number of breaks.</p> <ol style="list-style-type: none"> 1. Calculate the average rate at which a watermain of a certain material breaks over its lifetime. 2. Based on the current number of breaks for each watermain section, calculate the equivalent age of the watermain section and use that to estimate the remaining service life. If there are no breaks for a given watermain section, then estimate the remaining service life based on current age of the watermain and average time it takes to reach the target number of breaks. 3. Allocate annual envelopes of funds in the capital budget and forecast accordingly to address the anticipated rate of watermain replacements due to occur. 	<ul style="list-style-type: none"> • Better, more data driven predictor of pipe condition and estimated remaining useful service life than just pipe age alone • A more tangible measure of adequacy for service delivery • Provides the ability to plan the approximate level of watermain replacements and costs required to sustain the proposed condition ALOS target 	<ul style="list-style-type: none"> • Uses average historical break data which is still a proxy indicator of actual pipe conditions and remaining useful service life. • Requires more data and time to track pipe breaks and to correlate breaks with pipe age to extrapolate an estimated remaining useful service • It can take many years to assemble the data and history • Not transferable O.Reg 588/17 reporting requirements.

Condition ALOS Rating Method	Calculation Methodology	Advantages	Disadvantages
<p>Rating = Hours of unplanned service interruptions/ section of pipe*</p> <p>Proposed ALOS Target = Maximum hours of unplanned service interruptions/section of pipe*</p> <p>*Hours of interruption = number of service connections affected by the pipe out of service (directly or indirectly connected) multiplied by the number of hours the pipe was out of service.</p>	<p>Pipes are normalized by number of affected services (directly or indirectly connected) per pipe section.</p> <p>Current pipe condition rating = Total number of hours a pipe section has been out of service multiplied by the number of services affected by the pipe interruption.</p> <p>Estimated remaining useful service life:</p> <ol style="list-style-type: none"> 1. Calculate the average rate at which a watermain of a certain material breaks over its lifetime multiplied by the number of average hours to restore a broken watermain multiplied by the number of services affected by the watermain. 2. Based on the current number of breaks for each watermain section, calculate the equivalent age of the watermain section and estimate the remaining service life (the time at which the target for hours of interrupted service will be met). If there are no breaks for a given watermain section, then estimate the remaining service life based on current age of the watermain and average time it takes to reach the target hours of interrupted service base on number of breaks and number of affected service connections. 3. Allocate annual envelopes of funds in the capital budget and forecast accordingly to address the anticipated rate of watermain replacements due to occur. <p>Notes:</p> <ol style="list-style-type: none"> 1. Affected connections can include services not directly connected to the pipe section i.e. connections affected "downstream" of a section break. 2. Pipe sections would be defined as node to node between controlling valve points 3. Km of pipe could be used in lieu of pipe sections but would not necessarily directly pinpoint more critical watermain sections. 	<ul style="list-style-type: none"> • Better, more data driven predictor of pipe conditions, estimated remaining useful service life and service consequences than just pipe age • Can be used a measure of each pipe section's criticality: i.e. feeder mains would potentially have many more hours of service interruption per pipe loss than a local watermain; thus, feeder mains would naturally be more critical than local water mains and some sections of feeder mains would be more critical than others. • The most tangible measure of service delivery • Easier to transfer to the O.Reg 588/17 reporting requirements. 	<ul style="list-style-type: none"> • A more complicated data intensive measure of current and future pipe conditions than pipe age or number of pipe breaks • Requires a detailed inventory of the water system, locations of connections and valves and "downstream" modelling of services affected by pipe interruptions. • Uses average historical break and repair time data which is still a proxy indicator of actual pipe conditions and remaining useful service life. • It may take many years to assemble the data and history

Appendix E – Asset Condition Ratings and Corresponding Likelihood of Failure

ALOS provide a measure of the assets’ likelihood of failure to meet service requirements. The table below shows the connection between asset condition ratings and the likelihood of asset failure, and is presented here as a reference to support users who are moving on to the risk assessment.

Service	Asset Class Types	Proposed LOS Targets	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%
Roads	High Class Bituminous Pavement - Arterial Roads All roadside types Option 1: LoF estimated as a %	PCI = 75 (Good)	PCI >85	PCI = 75 - 85	PCI = 56 - 74	PCI = 50 - 55	PCI <50
	High Class Bituminous Pavement - Arterial Roads All roadside types Option 2: LoF by RUSL in years (based on typical lifecycle estimates)		NA	PCI > 85	PCI = 56 - 74	PCI = 50 - 55	PCI <50
	High Class Bituminous Pavement - Collector Roads All roadside types Option 1: LoF estimated as a %	PCI = 70 (Good)	PCI >80	PCI = 70 - 80	PCI = 51 - 69	PCI = 45 - 50	PCI <45
	High Class Bituminous Pavement - Collector Roads All roadside types Option 2: LoF by RUSL in years (based on typical lifecycle estimates)		PCI >90	PCI = 70 - 90	PCI = 51 - 70	PCI = 45 - 51	PCI <46

Service	Asset Class Types	Proposed LOS Targets	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%
	High Class Bituminous Pavement - Local Roads All roadside types	PCI = 65 - 70 (Good)	PCI >80	PCI = 65 - 80	PCI = 46 - 64	PCI = 40 - 45	PCI <40
	Low Class Bituminous Pavement - Collector Roads Option 2: LoF by RUSL in years (based on typical lifecycle estimates)	PCI = 70 (Good)	NA	PCI >80	PCI = 51 - 69	PCI = 45 - 50	PCI <45
	Low Class Bituminous Pavement - Collector Roads Option 2: LoF by RUSL in years (based on typical lifecycle estimates)			PCI = 70 - 80			
	Low Class Bituminous Pavement - Local Roads Option 1: LoF estimated as a %	PCI = 65 - 70 (Good)	PCI >80	PCI = 65 - 80	PCI = 46 - 64	PCI = 40 - 45	PCI <40
	Low Class Bituminous Pavement - Local Roads Option 2: LoF by RUSL in years (based on typical lifecycle estimates)		NA	PCI >80	PCI = 46 - 64	PCI = 40 - 45	PCI <40
	Gravel Road Surfaces <400 AADT Option 1: LoF estimated as a %	PCI = 65 (Good)	PCI >80	PCI = 65 - 80	PCI = 46 - 64	PCI = 40 - 45	PCI <40
	Gravel Road Surfaces		NA	PCI >80	PCI = 46 - 64	PCI = 40 - 45	PCI <40

Service	Asset Class Types	Proposed LOS Targets	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%
	<400 AADT Option 2: LoF by RUSL in years (based on typical lifecycle estimates)			PCI = 65 – 80			
	<ul style="list-style-type: none"> Bridges Major Culverts 	BCI = 70 (Good)	BCI >90	BCI = 70 - 90	BCI = 69 - 60	BCI = 40 - 59	BCI <40
	Minor Culverts < 3.0 metres width/diameter	Good - Fair	Very Good	Good	Fair	Poor	Very Poor
	Ditches	Good - Fair	Very Good	Good	Fair	Poor	Very Poor
	<ul style="list-style-type: none"> Sidewalks Street Lights 	Good - Fair	Very Good	Good	Fair	Poor	Very Poor
	Retaining Walls	Good	Very Good	Good	Fair	Poor	Very Poor
	Guiderails/Roads Safety Devices	Good	Very Good	Good	Fair	Poor	Very Poor
Water	<ul style="list-style-type: none"> Transmission mains Feeder mains 	Good	Very Good	Good	Fair	Poor	Very Poor
	Local Watermains	Good - Fair	Very Good	Good	Fair	Poor	Very Poor
	Water treatment and distribution mechanical and electrical assets such as pumps, motors, motor control centres, centrifuges, conveyors, skimmers, scrapers, bridges, generator units etc. as part of: <ul style="list-style-type: none"> Pumping Stations/Pumping Systems Pre-Treatment Systems 	Good	Very Good	Good	Fair	Poor	Very Poor

Service	Asset Class Types	Proposed LOS Targets	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%
	<ul style="list-style-type: none"> Primary Treatment Systems/ Disinfection Systems/Filtration Systems Water Storage Systems Standby Power 						
	Water treatment, distribution and storage civil assets such as: <ul style="list-style-type: none"> In-ground reservoirs Elevated storage, Process treatment tanks/channels, Surge protection systems/tanks Pumping Station gallery areas/substructures (Excluding building envelope (see Building ALOS)) 	Good	Very Good	Good	Fair	Poor	Very Poor
Wastewater	Trunk Sewers	PACP = 3 (Fair)	PACP = 1	PACP = 3	PACP = 4	PACP = 5 (Functional 1 - 5 years)	PACP = 5 (Failed, Non-Functional)
			PACP = 2				
	Local Collection Sewers	PACP = 3 (Fair)	PACP = 1	PACP = 3	PACP = 4	PACP = 5 (Functional 1 - 5 years)	PACP = 5 (Failed, Non-Functional)
			PACP = 2				
Forcemains	PACP = 3 (Fair)	PACP = 1	PACP = 3	PACP = 4	PACP = 5 (Functional 1 - 5 years)	PACP = 5 (Failed, Non-Functional)	
		PACP = 2					
	Wastewater treatment and collection mechanical and electrical assets such as pumps, motors, motor control centres, centrifuges,	Good	Very Good	Good	Fair	Poor	Very Poor

Service	Asset Class Types	Proposed LOS Targets	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%
	conveyors, skimmers, scrapers, bridges, generator units etc. as part of: <ul style="list-style-type: none"> • Pumping Stations/Pumping Systems • Pre-Treatment/Pre-Treatment Systems • Primary Treatment/ Primary Treatment Systems • Secondary Treatment/Secondary Treatment Systems • Aeration and Disinfection Systems • Biosolids Treatment/Biosolids Treatment Systems • Standby Power • Combined sewer overflow systems • Lagoon systems 						
	Wastewater treatment, collection and storage civil assets such as: <ul style="list-style-type: none"> • Process treatment tanks/channels, chambers • Wet and dry Wells (Excluding building envelope (see Building ALOS)), • Combined sewer overflow system • Lagoons 	Good	Very Good	Good	Fair	Poor	Very Poor
Stormwater	Storm sewer pipes		PACP = 1	PACP = 3	PACP = 4		

Service	Asset Class Types	Proposed LOS Targets	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%
		PACP = 3 (Fair)	PACP = 2			PACP = 5 (Functional 1 - 5 years)	PACP = 5 (Failed, Non-Functional)
	Force mains	PACP = 3 (Fair)	PACP = 1 PACP = 2	PACP = 3	PACP = 4	PACP = 5 (Functional 1 - 5 years)	PACP = 5 (Failed, Non-Functional)
	<ul style="list-style-type: none"> Pumping Stations/Pumping Systems Standby Power 	Good	Very Good	Good	Fair	Poor	Very Poor
	<ul style="list-style-type: none"> Overland Flow and Stormwater Detention Systems Underground stormwater retention assets (tanks/chambers) Wet and Dry Ponds Inlet/Outlet structures Low Impact Development (LID) installations 	Good	Very Good	Good	Fair	Poor	Very Poor
Buildings and Property	<ul style="list-style-type: none"> Municipal buildings and property Architectural features of treatment plants and pumping stations 	FCI = 5% - 10% Good - Fair	FCI <3%	FCI = 3% - 5%	FCI =6% - 10%	FCI = 11% - 30%	FCI >30%
Municipal Parks	<ul style="list-style-type: none"> Community Parks Recreational Areas Greenspaces 	Good - Fair	Very Good	Good	Fair	Poor	Very Poor
All	Fleet and Equipment	Good - Fair	Very Good	Good	Fair	Poor	Very Poor
	Various Assets with EUSL = 20 Years	Good - Fair	16-20 Years	11-15 Years	5-10 Years	1-4 Years	<1 Year

Service	Asset Class Types	Proposed LOS Targets	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%
	Various Assets with EUSL = 15 Years	Good - Fair	12-15 Years	8-12 Years	4-7 Years	1-3 Years	<1 Year
	Various Assets with EUSL = 10 Years	Good - Fair	8-10 Years	6-8 Years	3-5 Years	1-2 Years	<1 Year

Notes:

1. Asset failure is the point at which the assets can no longer provide desired service outcomes such as health and safety, service reliability, adequate quality and quantity of services, service efficiency and accessibility.
2. Proposed Level of Service Targets are determined according to asset criticality and organizational risk tolerance.

Appendix F – Performance Ratings & Likelihood of Failure

ALOS provide a measure of the assets' likelihood of failure to meet service requirements. The table below shows the connection between asset performance ratings and the likelihood of asset failure, and is presented here as a reference to support users who are moving on to the risk assessment.

Asset Performance Ratings and Corresponding Likelihood of Failure (LoF) (All Assets)					
LoF	Likelihood of Failure Very Unlikely Estimated less than 10%	Likelihood of Failure Unlikely Estimated 10% -30%	Likelihood of Failure Possible Estimated 30% - 60%	Likelihood of Failure Likely Estimated 60% - 90%	Likelihood of Failure Very Likely or Certain Estimated greater than 90%
Perf.	VERY GOOD	GOOD	FAIR	POOR	VERY POOR
General Description	Exceeds or fully meets performance requirements. No affect to services	Meets performance requirements. No affect to services	Just meets performance requirements with some limitations. Possible minor effects to services.	Does not meet several performance requirements. Minor to moderate and/or sporadic effects to services	Does not meet many or most performance requirements. Moderate to significant and/or ongoing effects to services.
Operational Functionality	<ul style="list-style-type: none"> Fully meets or exceeds current minimum community service level requirements in a fully efficient and effective manner. Exceeds minimum current design and/or safety requirements No operational problems experienced. No effects on community service levels or stakeholders Fully complies with current Regulations and/or Standards. No desirable elements are missing, and all required elements are present. Technology is state-of-the art/best available 	<ul style="list-style-type: none"> Meets current minimum community service level requirements in an efficient and effective manner. Meets minimum current design and/or safety requirements Occasional operational problems may be experienced. No noticeable effects on overall community service levels and/or stakeholders Complies with Regulations and/or Standards with possibly some "grandfathering" where permitted by Regulation for certain standards. 	<ul style="list-style-type: none"> Just meets/essentially satisfies the current minimum community service level requirements with possibly occasional or minor constraints, and/or some inefficiencies and ineffectiveness present. Just meets minimum current design and/or safety requirements possibly with some added monitoring, extra controls or maintenance. Operational problems may occur more frequently. 	<ul style="list-style-type: none"> A limited ability to meet current minimum community service level requirements with performance frequently below minimum service and efficiency requirements. Below minimum current design and/or safety requirements. Significant monitoring, extra controls or maintenance actions may be required to maintain community services. Significant operational problems are evident and occur frequently with perceivable and possibly moderate effects to community services 	<ul style="list-style-type: none"> Ability to meet current minimum community service level requirements is deficient and unsustainable with performance significantly and continuously below minimum service and efficiency requirements. Fails minimum current design and/or safety requirements. Active monitoring, extra controls or maintenance actions are not practical or feasible to maintain community services. Operational problems are serious and ongoing and affecting community services. Does not meet essential or critical Regulations and/or Standards, and "grandfathering" cannot be permitted either by Regulation or due to safety or practical concerns.

Asset Performance Ratings and Corresponding Likelihood of Failure (LoF) (All Assets)

LoF	Likelihood of Failure Very Unlikely Estimated less than 10%	Likelihood of Failure Unlikely Estimated 10% -30%	Likelihood of Failure Possible Estimated 30% - 60%	Likelihood of Failure Likely Estimated 60% - 90%	Likelihood of Failure Very Likely or Certain Estimated greater than 90%
Perf.	VERY GOOD	GOOD	FAIR	POOR	VERY POOR
General Description	Exceeds or fully meets performance requirements. No affect to services	Meets performance requirements. No affect to services	Just meets performance requirements with some limitations. Possible minor effects to services.	Does not meet several performance requirements. Minor to moderate and/or sporadic effects to services	Does not meet many or most performance requirements. Moderate to significant and/or ongoing effects to services.
Operational Functionality (continued)	<ul style="list-style-type: none"> Resource consumption: 100% of baseline efficiency 	<ul style="list-style-type: none"> A few desirable elements may be missing, but all required elements are present. Technology is industry standard Resource consumption: 91% to 100% of baseline efficiency 	<ul style="list-style-type: none"> There may be some minor effects to community service levels and/or stakeholders Meets essential Regulations and/or Standards with "grandfathering" where permitted by Regulation for certain standards. A few desirable elements and one or two required elements are missing. Technology is adequate but may not be efficient. Resource consumption: 76 to 90% of baseline efficiency 	<ul style="list-style-type: none"> May not meet or partially meets essential Regulations and/or Standards which may not be permitted "grandfathering" by Regulation or are unsafe or impractical to continue "grandfathering" Several desirable elements and one or two required elements are missing. Technology is nearing obsolescence. May be inefficient, prone to breakdown with no vendor support or original equipment manufacturer parts available. Resource consumption: 51 to 75% of baseline efficiency 	<ul style="list-style-type: none"> Many desirable and several required elements are missing. Technology is obsolete and/or non-functional and replacement parts may be unavailable Resource consumption: Less than 50% of baseline efficiency
Capacity to Meet Demands	<ul style="list-style-type: none"> Capacity fully meets or exceeds current demands and minimum community service level requirements No operational problems experienced. 	<ul style="list-style-type: none"> Capacity meets current demands and minimum community service level requirements Minor and occasional operational problems may be experienced. 	<ul style="list-style-type: none"> Capacity just meets/essentially satisfies current demands and minimum community service level requirements, possibly with occasional or minor 	<ul style="list-style-type: none"> Capacity is frequently below demands and/or minimum community service level requirements. Significant operational problems are evident and can occur frequently. 	<ul style="list-style-type: none"> Capacity is significantly and continuously below demands and/or minimum community service level requirements. Operational problems are serious and ongoing. There are noticeable and possibly significant effects to

Asset Performance Ratings and Corresponding Likelihood of Failure (LoF) (All Assets)					
LoF	Likelihood of Failure Very Unlikely Estimated less than 10%	Likelihood of Failure Unlikely Estimated 10% -30%	Likelihood of Failure Possible Estimated 30% - 60%	Likelihood of Failure Likely Estimated 60% - 90%	Likelihood of Failure Very Likely or Certain Estimated greater than 90%
Perf.	VERY GOOD	GOOD	FAIR	POOR	VERY POOR
General Description	Exceeds or fully meets performance requirements. No affect to services	Meets performance requirements. No affect to services	Just meets performance requirements with some limitations. Possible minor effects to services.	Does not meet several performance requirements. Minor to moderate and/or sporadic effects to services	Does not meet many or most performance requirements. Moderate to significant and/or ongoing effects to services.
	<ul style="list-style-type: none"> No effects on community service levels or stakeholders 	<ul style="list-style-type: none"> No noticeable effects on overall community service levels and/or stakeholders 	<ul style="list-style-type: none"> constraints and/or reduced efficiency. Operational problems may occur more frequently. There may be some minor or modest effects to community service levels and/or stakeholders 	<ul style="list-style-type: none"> There are noticeable and possibly moderate effects to community service levels and/or stakeholders. 	<ul style="list-style-type: none"> community service levels and/or stakeholders.
Operational Resiliency	<ul style="list-style-type: none"> Fully meets or exceeds the minimum emergency or service safeguard requirements for back-up systems, spare capacity, alternative supply or system/asset security. Maximum protection or security from acts of vandalism, trespassing, theft, assault or terrorism. 	<ul style="list-style-type: none"> Meets the minimum emergency or service safeguard requirements for back-up systems, spare capacity, alternative supply or system/asset security. Adequate protection or security from acts of vandalism, trespassing, theft, assault or terrorism. 	<ul style="list-style-type: none"> Provides acceptable but limited emergency or service safeguard requirements for back-up systems, spare capacity, alternative supply or system/asset security. Reasonable but limited protection or security from acts of vandalism, trespassing, theft, assault or terrorism. 	<ul style="list-style-type: none"> Provides partial but inadequate emergency or service safeguard requirements for back-up systems, spare capacity, alternative supply or system/asset security. Partial protection or security from acts of vandalism, trespassing, theft, assault or terrorism. 	<ul style="list-style-type: none"> Provides marginal or no emergency or service safeguard requirements for back-up systems, spare capacity, alternative supply or system/asset security. Marginal or no protection or security from acts of vandalism, trespassing, theft, assault or terrorism.

Asset Performance Ratings and Corresponding Likelihood of Failure (LoF) (All Assets)

LoF	Likelihood of Failure Very Unlikely Estimated less than 10%	Likelihood of Failure Unlikely Estimated 10% -30%	Likelihood of Failure Possible Estimated 30% - 60%	Likelihood of Failure Likely Estimated 60% - 90%	Likelihood of Failure Very Likely or Certain Estimated greater than 90%
Perf.	VERY GOOD	GOOD	FAIR	POOR	VERY POOR
General Description	Exceeds or fully meets performance requirements. No affect to services	Meets performance requirements. No affect to services	Just meets performance requirements with some limitations. Possible minor effects to services.	Does not meet several performance requirements. Minor to moderate and/or sporadic effects to services	Does not meet many or most performance requirements. Moderate to significant and/or ongoing effects to services.
Environmental Resiliency	<ul style="list-style-type: none"> Assets are fully resilient to environmental stresses; e.g. impacts from wind, fire, flooding, excessive rainfall/snowfall etc. Fully meets climate change mitigation requirements. 	<ul style="list-style-type: none"> Assets are adequately resilient to environmental stresses; e.g. impacts from wind, fire, flooding, excessive rainfall/snowfall etc. Meets almost all climate change mitigation requirements. 	<ul style="list-style-type: none"> Assets are resilient with some limitations to environmental stresses; e.g. impacts from wind, fire, flooding, excessive rainfall/snowfall etc. Provides acceptable but limited protections from climate change. 	<ul style="list-style-type: none"> Asset resiliency to environmental stresses is partially lacking; e.g. impacts from wind, fire, flooding, excessive rainfall/snowfall etc.. Provides partial but inadequate protections from climate change. 	<ul style="list-style-type: none"> Asset resiliency to environmental stresses is mostly or completely lacking; e.g. impacts from wind, fire, flooding, excessive rainfall/snowfall etc. Provides marginal or no protections from climate change