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First Nations Infrastructure Resilience Toolkit (FN-IRT)

"Integrating Climate Risks into Asset Management"

AFN National Housing & Infrastructure Forum

March 10 - 12, 2020

Toronto, Ontario

Presenter Introduction

Elmer Lickers

Senior O&M Advisor, OFNTSC

Guy Félio

Senior Advisor, Asset Management Solutions, Stantec

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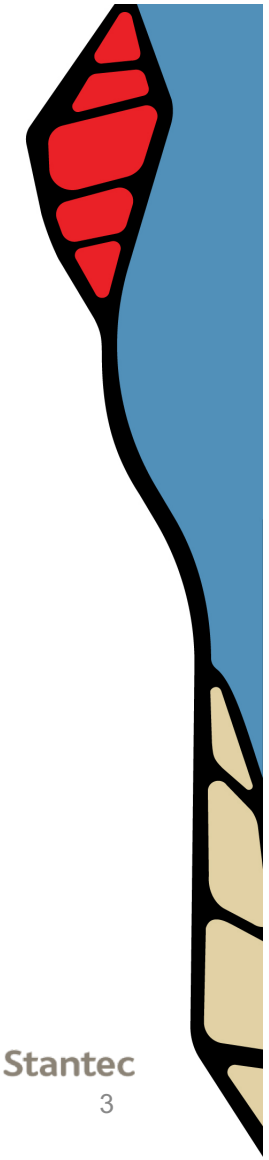
Presentation to provide an overview on:

- First Nations Infrastructure Resilience Toolkit (FN-IRT),
- How climate and climate change projection impacts community infrastructure,
- Defining climate risk assessment processes as they pertain to infrastructure response to climate change,
- Information on climate risk & asset management funding,
- Linking climate risk assessments to Asset Management.



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Delegate Introductions:

In (3) breaths tells us:

- Your name & where are you from?
- Are you familiar with Asset Management as it pertains to Climate Change?

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First Nations Infrastructure Resilience Toolkit (FN-IRT)

Overview

The toolkit was develop to assess the vulnerability of infrastructure to extreme weather and future climate uncertainty over their service life in an asset management context.

- Build on Engineers Canada's PIEVC Protocol for the climate vulnerability and risks assessment and conforms to ISO (31000 and 14090) standards,
- Built using existing FN information data (ACRS), including local and traditional knowledge on infrastructure and climate,
- Based using industry best practices for asset management planning that aligns ISO 5500x standard.

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First Nations Infrastructure Resilience Toolkit (FN-IRT)

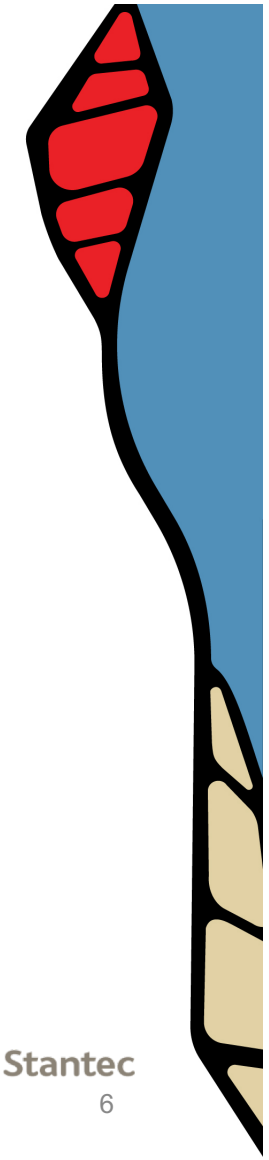
Development

September 2016

OFNTSC received funding for a two-phase project to provide First Nations in Ontario with a tailored Risk Assessment Toolkit that allows communities to assess infrastructure vulnerability to climate change.

Phase 1

Using the recognized and well documented Engineers Canada's PIEVC Protocol, conduct an Infrastructure Vulnerability and Risk Assessment on the Mohawk Council of Akwesasne's Water & Wastewater infrastructure.



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First Nations Infrastructure Resilience Toolkit (FN-IRT)

Development

Phase 2

- Test the FN AM Toolkit in two First Nations Communities.
  - Moose Cree First Nation: water and wastewater infrastructure.
  - Oneida Nation of the Thames: housing & school infrastructure
- Development of the First Nations Infrastructure Resilience Toolkit (FN-IRT) & the training material to deliver future training workshops
- Delivered (2) Regional training & awareness workshops across Ontario to over 30 First Nation communities and (4) Tribal Councils.

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First Nations Infrastructure Resilience Toolkit (FN-IRT)

Development

Phase 3

- Capacity Development thru (10) 2 ½ day training workshops across Ontario
  - reaching 80 First Nations and 10 Tribal Councils
- Climate Risks Assessments:
  - Completed - Kasabonika Lake FN (ON); Yellow Quill FN (SK)
  - In progress - Cree Nations of Nemaska and Chisasibi (QC)
- Asset Management Plans completed for (3) Ontario First Nations:
  - Moose Cree FN, Kasabonika Lake FN and Curve Lake FN
- Toolkit improvements including: climate data models, conformity with ISO standards, AM enhancement based on recent pilot projects (in progress)

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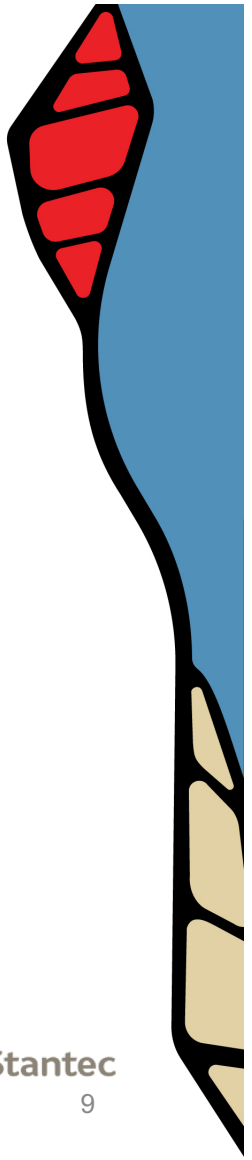
FN-IRT Modules

Module 1	Module 2	Module 3
TCA Reporting (PS3150)	**Risk Management** (FN PIEVC)	**Asset Management** (ICMS/ACRS)
Inventory	Inventory	Inventory
Condition Assessment (Physical Condition)	Condition Assessment (Physical Condition, Capacity, Functionality)	Condition Assessment (Physical Condition, Capacity, Functionality)
Residual Life Prediction	Residual Life Prediction	Residual Life Prediction
Valuation (Historical)	Valuation (Historical)	Valuation (Replacement)
	Analysis: • Threats, Exposure, Vulnerability • Risks	Analysis: • Needs – Capacity, Physical, Condition, O&M • Cost Benefits
		Life-Cycle Management Plans Additions and Upgrades Replacements & Refurbishments Operation & Maintenance Risk Management
TCA Reports	Risk Management Plans	Investment Plans (Capital & O&M)
	Monitor, Report, Revise	Monitor, Report Revise

ACRS
ICMS
PS 3150



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ONTARIO CONSULTING ENGINEERING AWARDS

2019 OCEA

A TOOLKIT for CLIMATE CHANGE ASSISTS FIRST NATIONS

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[redacted]

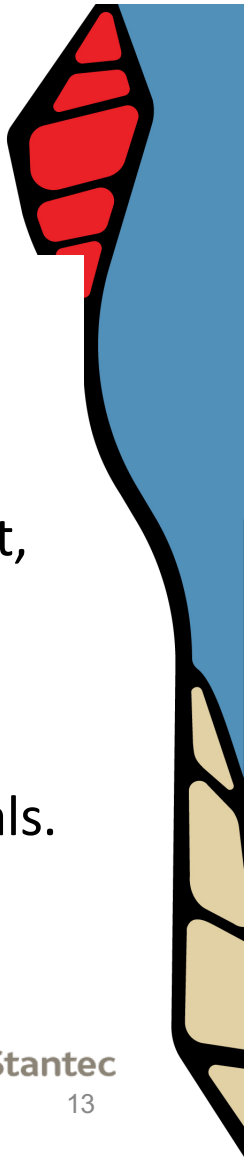
With the support of:

In collaboration with:

Funded by:

FN-IRT/Asset Management Training Workshops:

- Improve knowledge on how climate and climate change projections may impact community infrastructure,
- Review risk assessment processes as they pertain to infrastructure response to climate change and incorporate into Asset Management,
- Provide information on how to improve climate data and initiate a climate change risk assessment in their community,
- Improve knowledge on Asset Management principles & fundamentals.



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FN-IRT Workshops – *Sample Agenda*

Day 1

- Overview of Asset Management
- Define infrastructure to be assessed
- Review current & future climate trends
- Identify climate hazards, risks and thresholds

Day 2

- Identify infrastructure vulnerability to climate
- Conduct risk assessment using the Risk Matrix
- Identify risk for climate-infrastructure interactions
- Identify and tabulate low-medium-high risks

Day 3

- Prepare risk mitigation and adaptation measures
- Link adaptation measures to Asset Management

Day 1	
Time	**Activity**
7:30 - 8:30	Registration & Breakfast
8:30 - 9:00	Welcome, Opening Remarks and Introductions
9:00 - 10:15	Principles of Asset Management
10:15 - 10:30	Health Break and Networking
10:30 - 10:45	Overview of Workshop Exercises
10:45 - 11:30	Exercise 1: Defining Infrastructure Components
11:30 - 12:15	Exercise 2: Identifying Climate Hazards
12:15 - 1:15	Lunch and Networking
1:15 - 2:30	Current & Future Climate Trends and Impacts on Infrastructure
2:30 - 3:15	Exercise 3: Impacts of Climate Hazards on Infrastructure
3:15 - 3:30	Health Break and Networking
3:30 - 4:30	First Nations PIEVC: Akwesasne Case Study (Presentation)
4:30 - 4:45	Day 1 Recap & Day 2 Overview
4:45	Day 1 Adjourned
Day 2	
Time	**Activity**
7:30 - 8:30	Breakfast
8:30 - 9:15	Day 1 Recap & Day 2 Overview
9:15 - 10:15	Infrastructure Exposure, Vulnerability and Risk Assessment – the FN PIEVC process
10:15 - 10:30	Health Break and Networking
10:30 - 12:15	Exercise 4: Preparing Risk Assessment, Climate Intensity and Impacts
12:15 - 1:15	Lunch and Networking
1:15 - 2:15	First Nations PIEVC: Oneida Case Study (Presentation)
2:15 - 3:15	Exercise 5: Creating the infrastructure Risk Profile: the FN PIEVC Risk Matrix
3:15 - 3:30	Health Break and Networking
3:30 - 4:30	Exercise 5: Creating the Infrastructure Risk Profile: the FN PIEVC Risk Matrix (Continued)
4:30 - 4:45	Day 2 Recap & Day 3 Overview
4:45	Day 2 Adjourned
Day 3	
Time	**Activity**
7:30 - 8:30	Breakfast
8:30 - 9:30	Day 2 Recap & Day 3 Overview
9:30 - 10:15	First Nations PIEVC: Moose Factory Case Study (Presentation)
10:15 - 10:30	Health Break and Networking
10:30 - 11:30	Exercise 6: Risk Mitigation and Adaptation Measures
11:30 - 12:00	Integrating Risks in the Infrastructure Life-Cycle and Management (Presentation)
12:00 - 12:30	Group Question & Answer Period / Closing Remarks
12:30 - 1:30	Lunch and Networking
1:30	Workshop Closure

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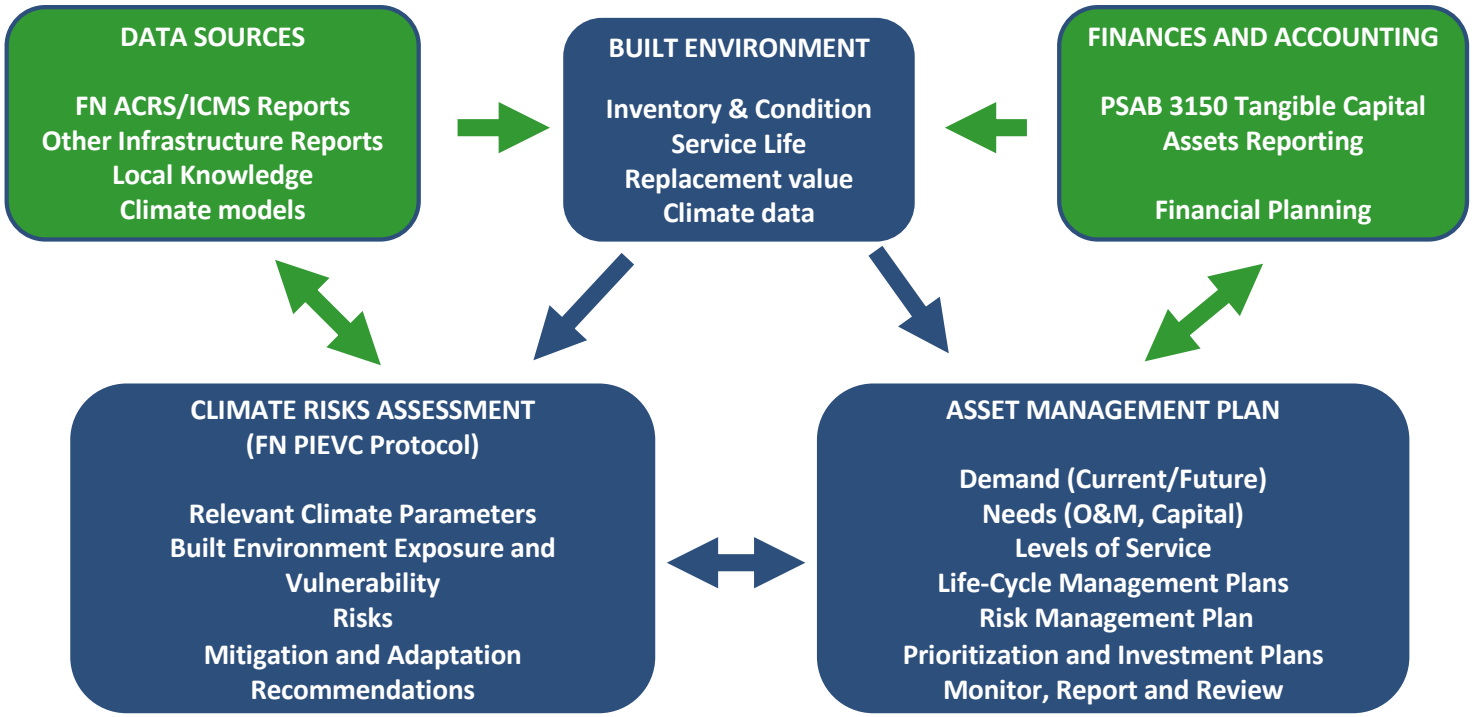
FN Infrastructure Resilience Toolkit - Framework



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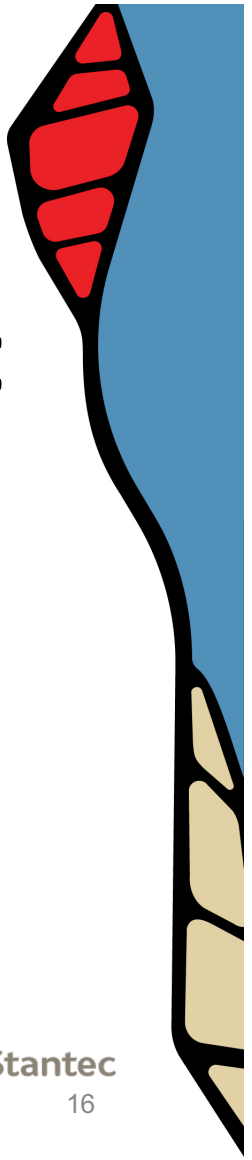
FN-Infrastructure Resilience Toolkit

Module 1

“Built Environment”



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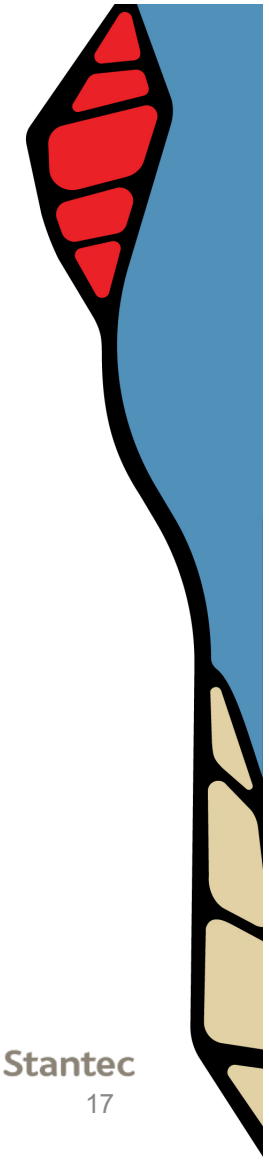
FN-IRT Module 1 – Built Environment

First Nation communities have access to abundant inventory, condition, maintenance and financial data relating to their community infrastructure assets, including housing.

This data, combined with other valuable processes for risk assessments and is the cornerstone to develop and implement effective Risk & Asset Management Plans (AMP).



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FN-IRT Module 1 - Built Environment (under revision)

- The project team gathers the relevant information on the infrastructure and the climate that will be used in the risks assessment or an asset management plan.
- Module 1 serves as the foundation for the two other modules.
- Sources of data include: ACRS reports and ICMS database, local and Traditional Knowledge, meteorological stations data and climate models, etc.

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FN-IRT Module 1 – Built Environment

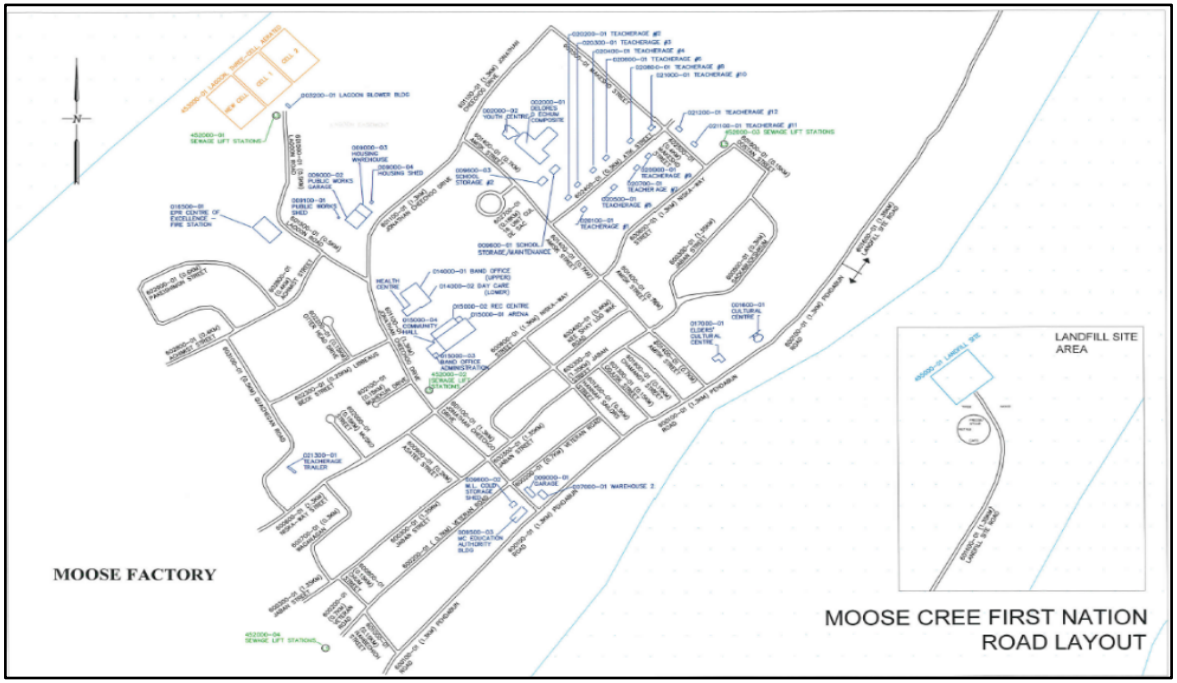
Examples of relevant asset information that can be extracted from an ACRS report.

Courtesy: Moose Cree First Nation

TABLE OF CONTENTS

Moose Cree First Nation

ASSET CONDITION REPORT		
SECTION	**SUBSECTION**	**ASSET NAME**
WATER		
WATER	31	WATER MAINS
	32	WATERMAINS SOUTH
	33	WATERMAINS CENTRAL
	34	WATERMAINS NORTH
	35	WATERMAINS WEST
	36	UNDERGROUND STORAGE RESERVIOR #1
	37	ABOVE GROUND STORAGE RESERVOIR #2
	38	LOW LEVEL LIFTSTATION
	39	WATER TREATMENT SYSTEM
WASTE WATER		
WASTE WATER	40	SANITARY MAINS SOUTH
	41	SANITARY MAINS CENTRAL
	42	SANITARY MAINS NORTH
	43	SANITARY MAINS WEST
	44	SEWAGE LIFT STATIONS
	45	SEWAGE LIFT STATIONS #2
	46	SEWAGE LIFT STATIONS
	47	SEWAGE LIFT STATIONS
	48	LAGOON,THREE-CELL,AERATED
ELECTRICAL		
	49	STREET LIGHTS
SOLID WASTE		
	50	LANDFILL SITE
ROADS		
ROADS	51	PEHDABUN ROAD
	52	VETERAN ROAD
	53	JABAN STREET
	54	KEE SHAY LOO WAK ROAD
	55	SACKABUCKSHKUM
	56	NISKA-WAY STREET
	57	WAGANAGAN
	58	CHUM STREET
	59	ASATEE STREET
	60	NAHBEMCHICH STREET
	61	JONATHAN CHEECHOO DRIVE
	62	HANNAH SAILORS STREET
	63	OOJUSK STREET
	64	AMISK STREET
	65	LAGOON ROAD
	66	LANDFILL SITE ROAD
	67	QOSTAN STREET
	68	CHAMANDY STREET
	69	MUSKO STREET
	70	MUHEKUN DRIVE



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FN-IRT Module 1 – Built Environment

Examples of relevant asset information that can be extracted from an ACRS report.

Courtesy: Moose Cree First Nation

ASSET CONDITION REPORTING SYSTEM
COMPONENT CHECK-LIST

Page 1 of 3

[X] BUILDINGS [ ] ROADS [ ] BRIDGES [ ] WATER [ ] WASTEWATER [ ] SOLID WASTE [ ] VEHICLES

Region Name: Ontario | Site No.: 06261 | Site Name (Reserve): Moose Cree

F.N. No.: 144 | First Nation Name: Moose Cree First Nation

Asset No.: 003200 | Ext. No.: 01 | Asset Code: A5B | Asset Name: LAGOON BLOWER BLDG | Inspected By: T Bruyere, D Bethune

Component Code	N/A (Does not apply)	No Deficiencies (component inspected)	Deficiencies identified *
Grounds			
A 1.1 Landscaping			x
A 1.2 Fences/Gates/Railings	x		
A 1.3 Retaining Walls	x		
A 1.4 Pedestrian Surfaces	x		
A 1.5 Parking Areas	x		
A 1.6 Drainage		x	
A 1.7 Playground Equipment	x		
A 1.8 Paved Play Areas	x		
A 1.9 Play Area Surface	x		
A 1.10 Other		x	
Building Exterior			
A 2.1 Steps/Platforms/Ramps		x	
A 2.2 Structure		x	
A 2.3 Foundations/Basement		x	
A 2.4 Exterior Walls		x	
A 2.5 Caulking		x	
A 2.6 Chimney and Stacks	x		
A 2.7 Painting			x
A 2.8 Doors		x	
A 2.9 Windows	x		
A 2.10 Handicapped Access	x		
A 2.11 Other		x	
Roof			
A 3.1 Surface		x	
A 3.2 Flashing		x	
A 3.3 Drains			x
A 3.4 Skylights	x		
A 3.5 Vents		x	
A 3.6 Roof Mounted Equipment	x		
A 3.7 Insulation		x	
A 3.8 Other		x	
Building Interior			
A 4.1 Ceilings		x	
A 4.2 Floor Covering		x	
A 4.3 Painting		x	
A 4.4 Fitments		x	
A 4.5 Walls		x	
A 4.6 Doors		x	
A 4.7 Fire Exits		x	
A 4.8 Stairs	x		
A 4.9 Signage		x	
A 4.10 Garbage Hand/Storage	x		
A 4.11 Handicapped Access	x		
A 4.12 Other		x	

*For all identified needs details to be described on Needs Identification Form with comments

ASSET CONDITION REPORTING SYSTEM
PHOTOS

Page 5 of 9

[X] BUILDINGS [ ] ROADS [ ] BRIDGES [ ] WATER [ ] WASTEWATER [ ] SOLID WASTE [ ] VEHICLES

Region Name: Ontario | Site No.: 06261 | Site Name (Reserve): Moose Cree

F.N. No.: 144 | First Nation Name: Moose Cree First Nation

Asset No.: 003200 | Ext. No.: 01 | Asset Code: A5B | Asset Name: LAGOON BLOWER BLDG | Inspected By: T Bruyere, D Bethune

Inspection Date (Y Y M M D D): 16-08-08 | Year of Construction: 1986 | Est. Remaining Life (years): 20

Condition Rating (0 - 10): [7] 0 = Closed; 1 - 3 = Poor; 4 - 6 = Fair; 7 - 9 = Good; 10 = New

O & M Rating (0 - 3): [2] 0 = Non-existent; 1 = Substandard; 2 = Acceptable; 3 = Exemplary

Quantity: 50.76 | [X] square meters [ ] Kilometres [ ] each

Photo No.: 1
Description:
Exterior view of building.
1. Grade around building.
2. Repaint exterior door.
3. Replace missing downspouts.

Photo No.: 2
Description:
Exterior view of building.
1. Grade around building.
2. Repaint exterior door.
3. Replace missing downspouts.

ASSET CONDITION REPORTING SYSTEM
PHOTOS

Page 6 of 9

[X] BUILDINGS [ ] ROADS [ ] BRIDGES [ ] WATER [ ] WASTEWATER [ ] SOLID WASTE [ ] VEHICLES

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Quantity: 50.76 | [X] square meters [ ] Kilometres [ ] each

Photo No.: 3
Description:
Interior view of building.

Photo No.: 4
Description:
Interior view of building.
4. Repair the intake control exhaust fan.
5. Provide fire extinguisher.

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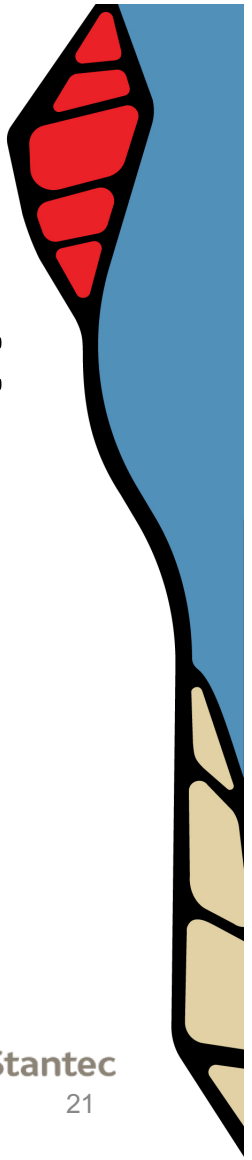
FN-Infrastructure Resilience Toolkit

Module 2

“Climate Risk Assessment”



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The difference between Weather vs Climate

VS.

* Image from Pixabay
\+ Images by Heiko Stein from Pixabay

Weather (*what you get*):

- Conditions today and over the next few days;
- "We *operate* infrastructure day-to-day on the basis of weather"

Climate (*what you typically expect*):

- Weather over time;
- "We *plan* and *design* for the longer
- term on the basis of climate" (*includes local to global scales*)

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Weather, Climate and Roads

Weather: can change in minutes (*operations*)

vs

Climate: changes over seasons to decades+ (*design*)

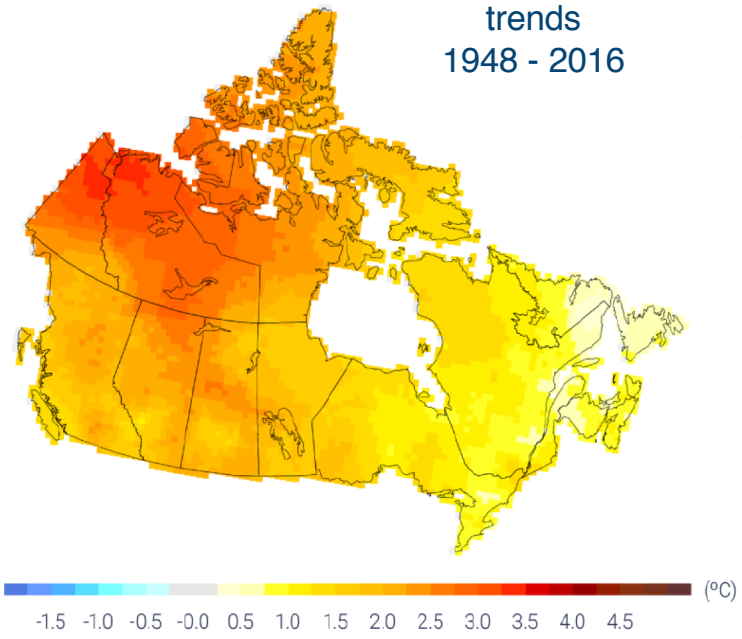
Winter road maintenance

Road/bridge design and rehabilitation

* http://www.mto.gov.on.ca
+ https://mymuskopkanow.com

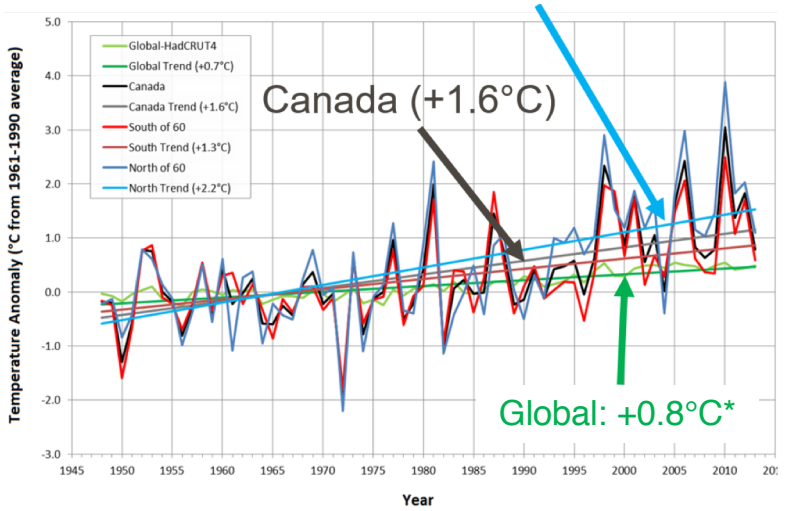
Some current climate trends are clear; other less so

Annual Temperature trends
1948 - 2016



Canada's warming, compared to the world
Canada = ~2X Global; North = ~ 3X Global

North of 60°N: +2.3°C*



*temperature change over the 1948-2016 time period
(from Canada's Changing Climate Report, 2019)

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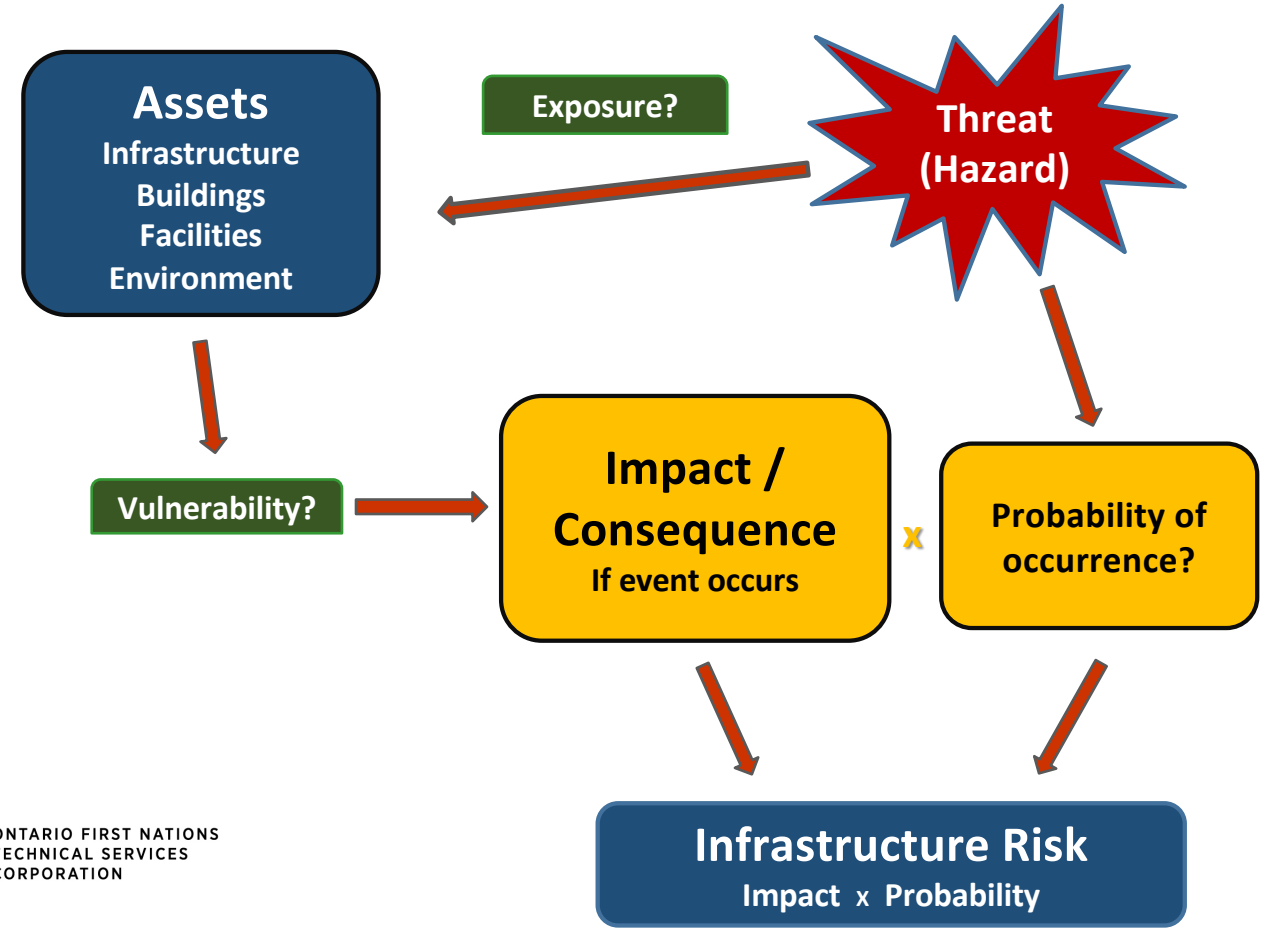
FN-IRT Module 2 – Climate Risk Assessment Process



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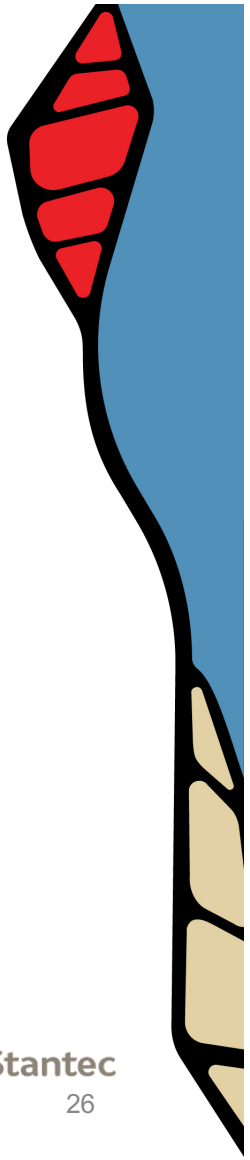
Definition of Risks

- What is Risk? Varying definitions
- Depending on their focus, different organizations and associations define risk differently
- In general, all definitions reference uncertainty

Risk = Uncertainty

- Uncertainty about the outcomes that can be either positive or negative.



Risk Management Environment

- A holistic view of risk:
  - Risks are varied and can arise in ways not easily foreseen
  - All risks must be managed
- Four main categories of risk:

Hazard (Pure risk)	Operational Risks
Financial Risks	Strategic Risks

- Four main categories could be further reduced to sub-categories:
  - Project risk: Constraints such as time, cost and quality
  - Financing reporting risk: Liability exposures, Regulatory oversight
  - Process risk: Failure to follow business process

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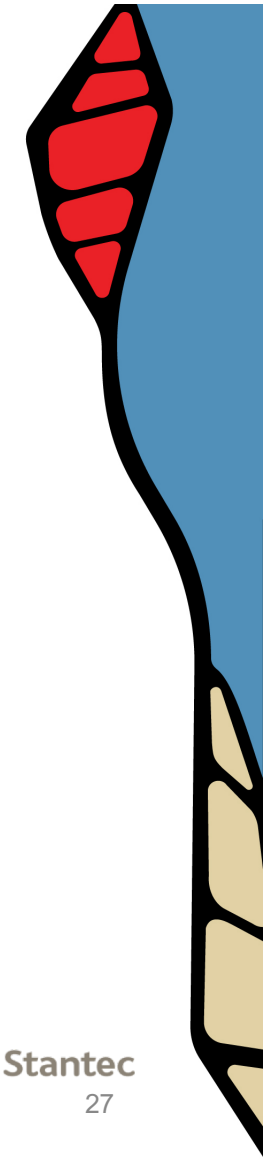

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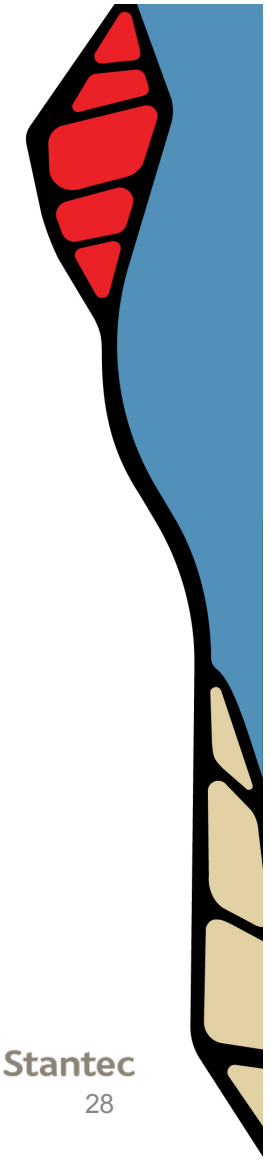
The Essence of Risk Management

"The essence of risk management lies in maximizing the areas where we have some control over the outcome while minimizing the areas where we have absolutely no control over the outcome and the linkage between effect and cause is hidden from us".

Peter Bernstein, The Remarkable Story of Risk



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The Benefits for an Organization

- Reduce cost of hazard risk
- Reduce deterrence effects of hazard risks
- Reduce downside risk
- Manage the downside of risk
- Intelligent risk taking
- Maximize profitability
- Holistic risk management
- Legal regulatory requirements

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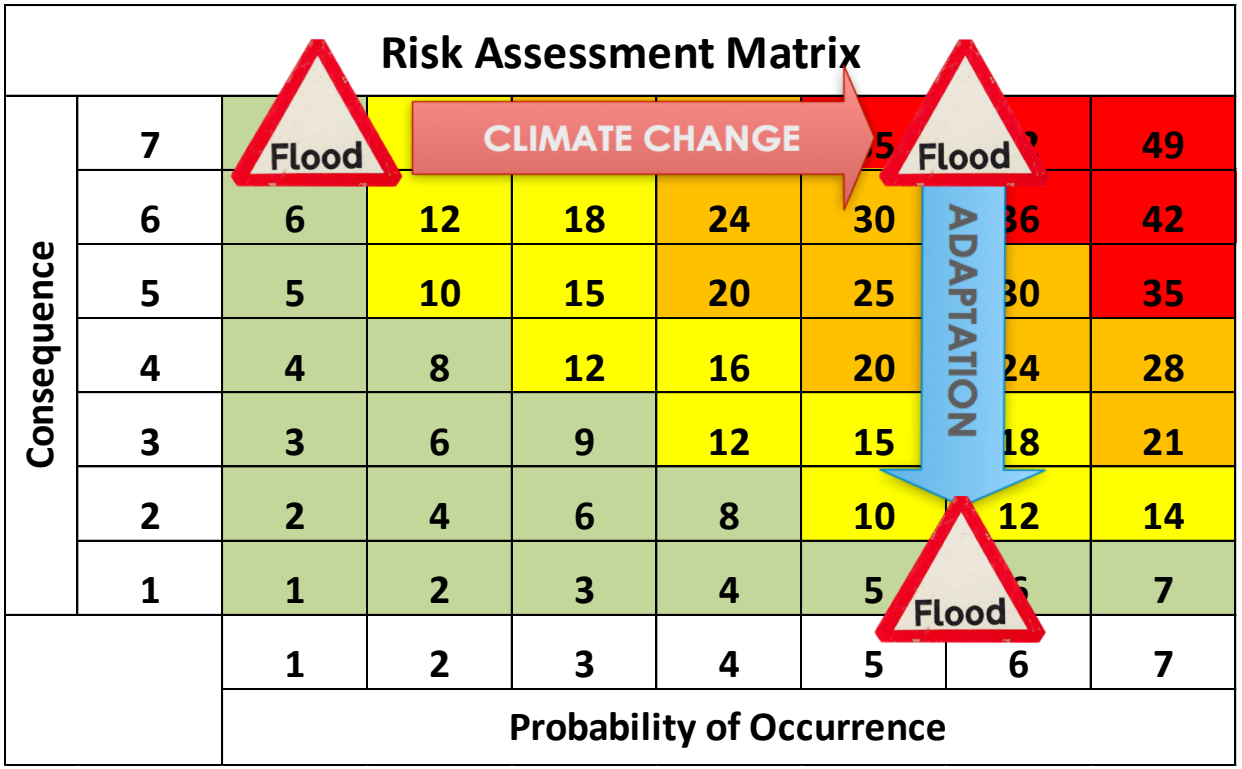
Focus on Climate Change Risks Component



engineerscanada ingénieurscanada
Public Infrastructure Engineering Vulnerability Committee (PIEVC)

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FN-IRT Module 2 – Climate Risk Assessment *(under revisions)*

- Based on the infrastructure information, the project team identifies past climate events that have caused disruptions, malfunctions or failure, and establishes a risk profile of the infrastructure under present climate and projected future climate conditions.

- Climate related risks can be incorporated in the life-cycle analysis of the asset management plan.

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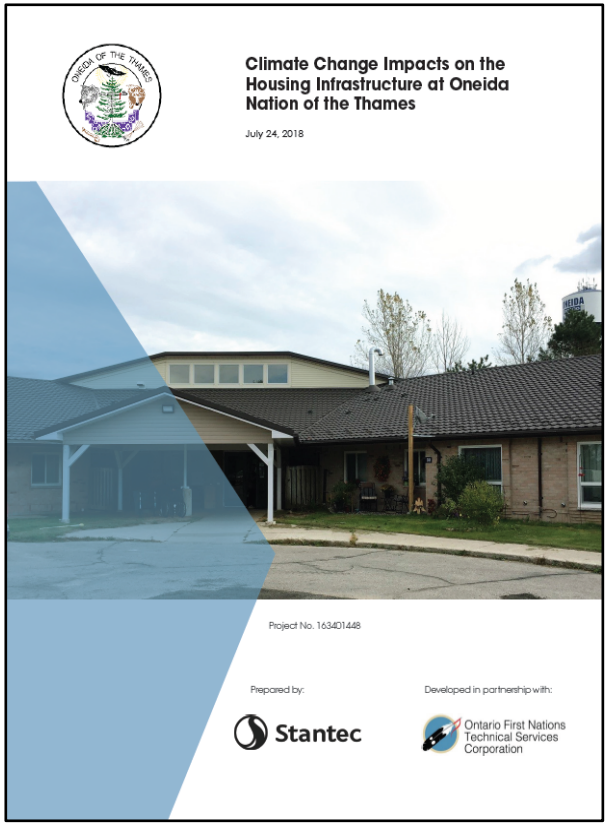
FN-IRT Module 2 – First Nations Case Study

FN-PIEVC Climate Change Vulnerability Assessment of the Oneida Housing Assets and Support Infrastructure



www.PIEVC.ca/assessments

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Infrastructure Data and Climate Consideration

- Description of the housing assets and related infrastructure in the community and past weather-related performance issues and concerns
- Definition of the global project parameters and boundary conditions for the vulnerability assessment.
  - Which assets and infrastructure is being assessed; locations
  - General climatic, geographic considerations;
  - Uses of the infrastructure (levels of Service).

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Infrastructure Selected

Housing:

- Seniors Complex
- Quadplex
- Duplex
- Single family homes

Schools

Supporting Infrastructure

- Water
- Wastewater
- Roads

Support services

Adjacent communities' activities

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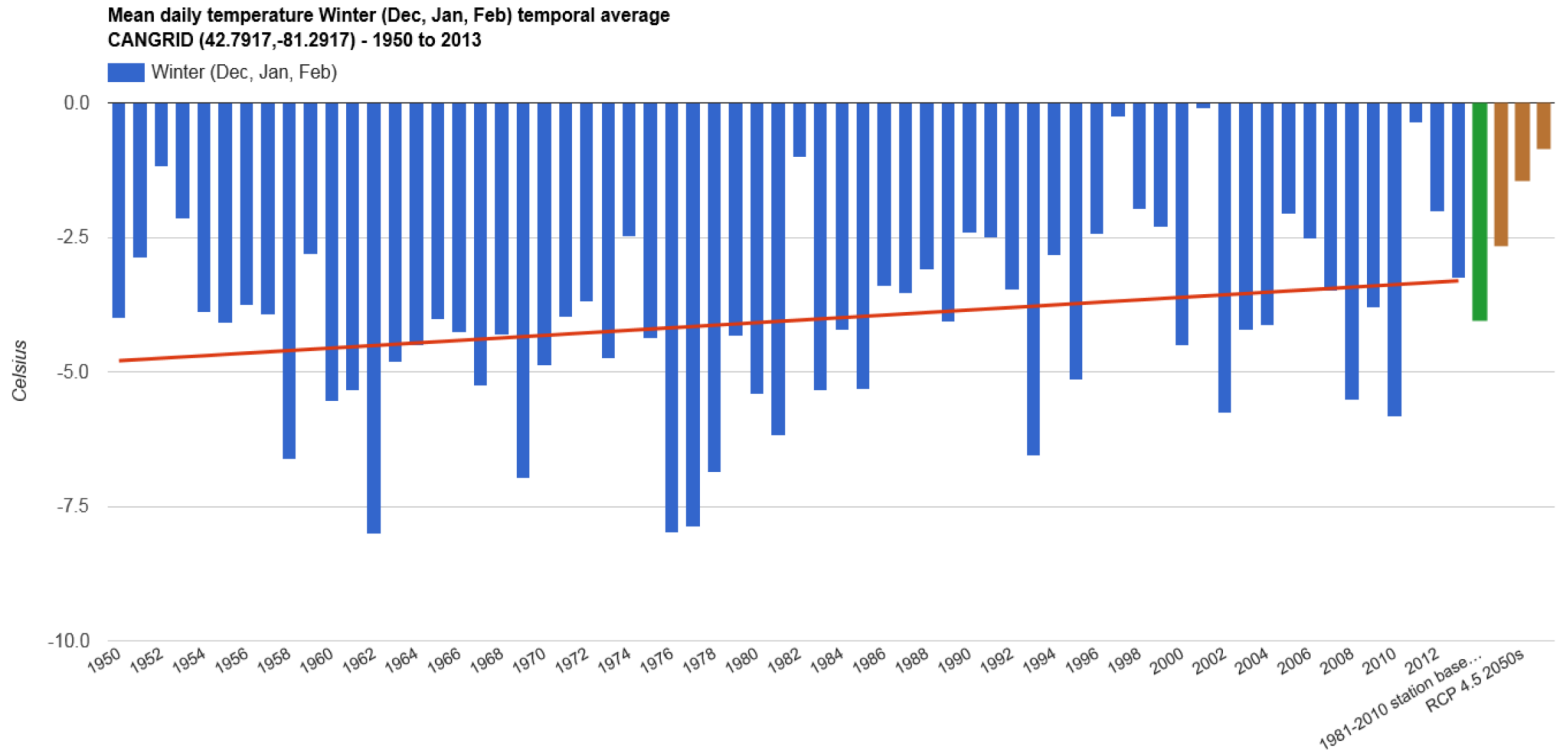
Mean Daily Temperature Winter



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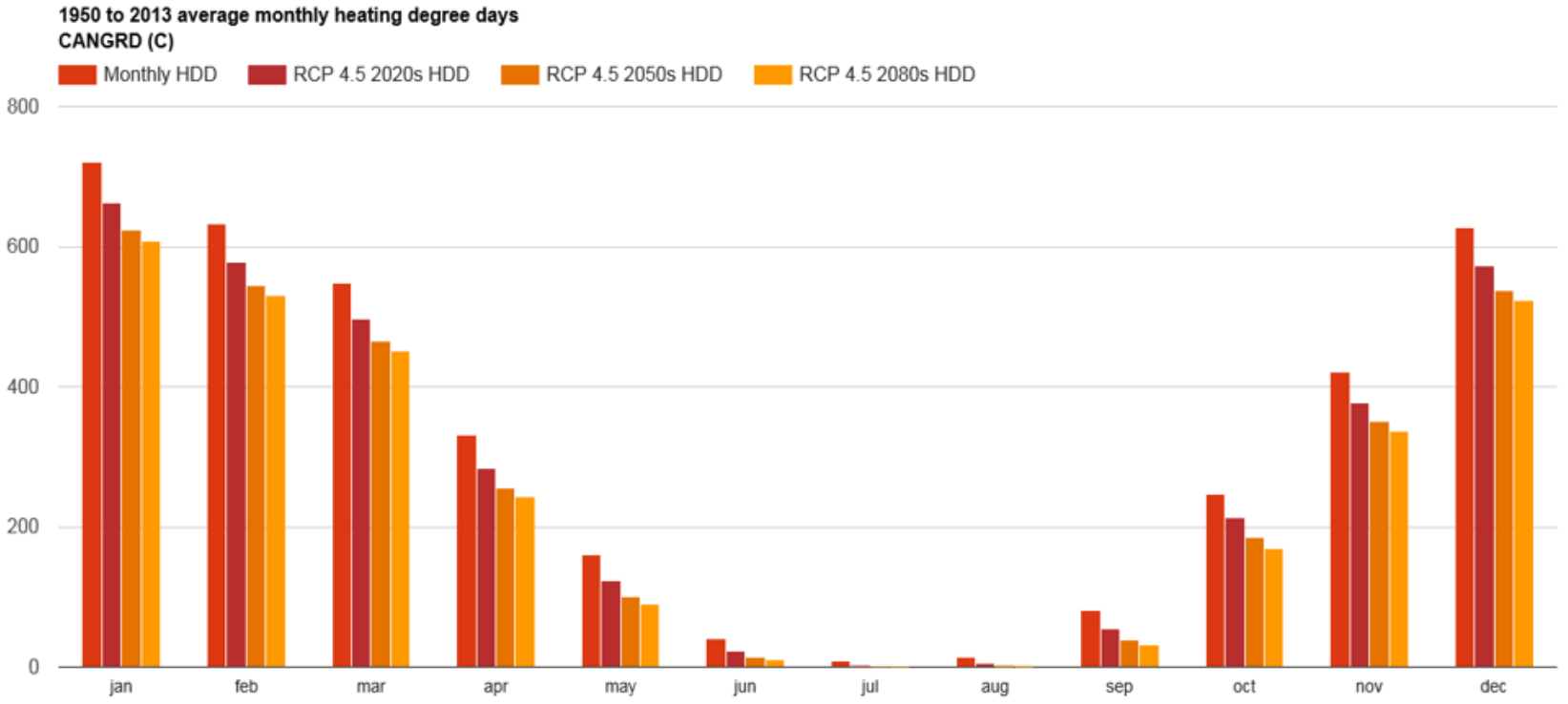
Average Monthly Heating Degree Days



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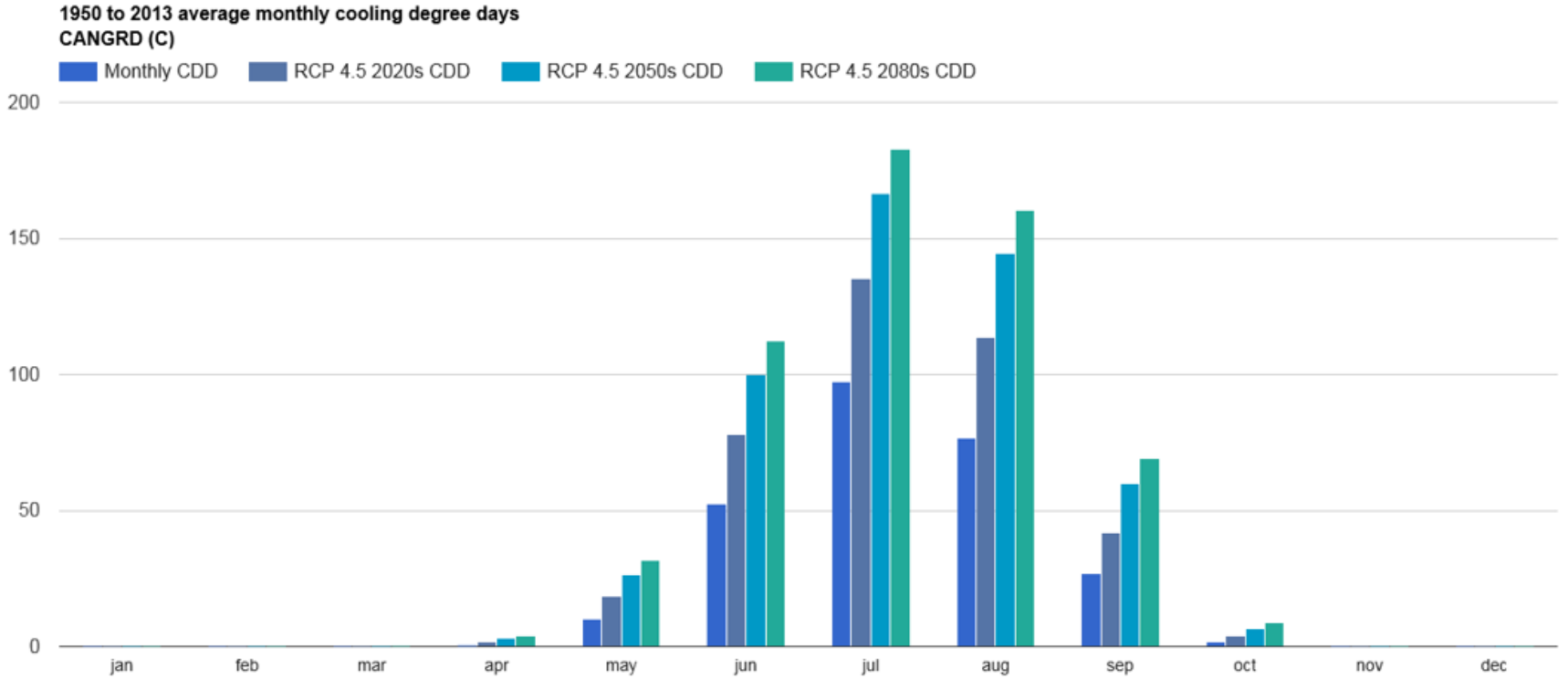
Average Monthly Cooling Degree Days



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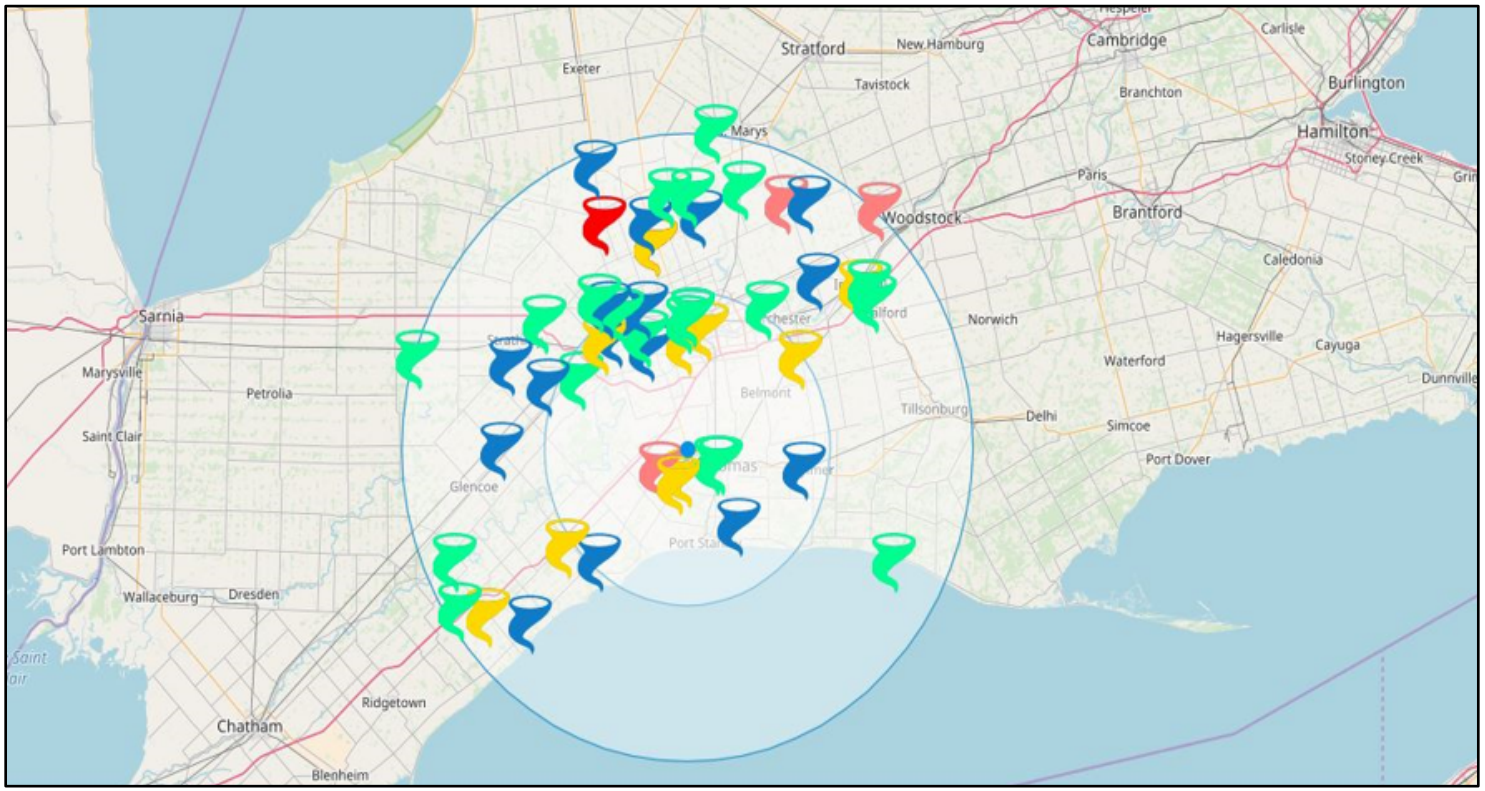
Tornados Events



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Various High Risks & Mitigation Measures

- **All Facilities:**
  - Tornado
  - Wind: loose material around properties
- **Seniors Complex**
  - Maximum Temp.: HVAC
  - Freezing rain: fuel, access road, backup generator
  - Winter rain: access road
- **Housing Units**
  - Asphalt shingles' roofs: wind
  - Freezing rain: fuel, drainage
  - Winter rain: drainage

Climate Event	Risk Mitigation and Adaptation Measures
Rain (short duration, high intensity)	Housing • Explore gravity-fed sump pumps in case of power failures. Communicate benefits to the public; explore working with suppliers. • Explore slab-on-grade construction to avoid basement flooding risks due to rain events and the high groundwater levels in the area. School (recommendations also applies to winter rain) • Maintain the drainage system of the flat roof free of debris. Inspect after each severe weather event. • Assess the capacity of the roof drainage system based on the current severe and projected more intense future rainfall events. • Inspect and possibly replace the old septic system.
Rain (consecutive days of winter rain)	Drainage • Ensure drainage system (ditches, culverts) is clear of debris and performs at its design capacity. • Conduct a stormwater management study to assess the drainage system capacity under current and projected future climate conditions.
Freezing Rain	Buildings • Inspect after freezing rain events. • Clear debris and branches that can pose safety hazards. • Use environmentally friendly de-icing salts around the Senior Citizens complex, the school and administration buildings to reduce damage to concrete and other materials. Personnel: • Provide personnel with proper safety equipment. • Apply sand and salt in working areas. • Train/refresh training staff in safe operating practices. Third party services • Include potential loss of service in emergency planning. Back-up electricity • Ensure portable back-up generators are available for essential services in case of power failure. • Maintain backup generators including fuel conditioning to ensure service when required.
Wind	Buildings: • Continue requirement of metal roofs for new residential construction. • Implement policies to protect housing against strong wind events, such as requiring hurricane ties in all new construction.

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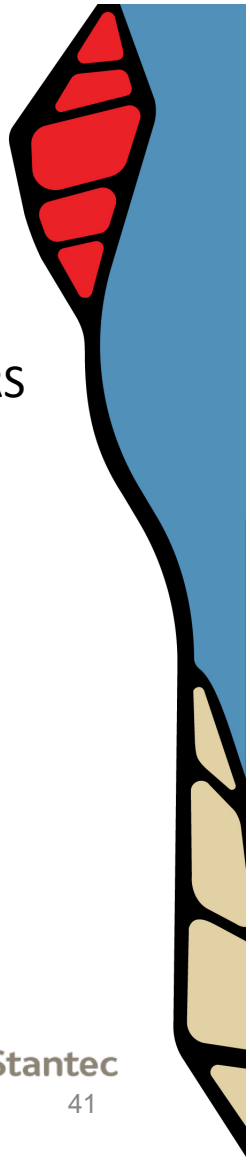
Various project teams and working sessions

Elements of the Risk Assessment Worksheet

- **Infrastructure:**
  - List of infrastructure components
  - Information on assets: attributes such as age, condition, remaining life – from ACRS
  - Performance considerations: e.g., structural, functional, operational etc.
  - Severity of impacts scale (related to performance considerations): e.g., what is catastrophic? – represents the risk tolerance of the community

- **Climate**
  - Climate parameters: from list of past climate events that have caused damages or disruptions in the past, and events that could cause impacts in the future
  - Climate events' thresholds: intensity of event that causes damages or disruptions
  - Probability/Likelihood of events: from historical data, current trends and future projections



FN Infrastructure Resilience Toolkit - Matrix

CLIMATE ASSESSMENT Select:	Climate 1							Climate 2							Climate 3							Climate 4							Climate 5						
Current Climate																																			
Future Climate																																			
	Probability:							Probability:							Probability:							Probability:							Probability:						
Asset/Infrastructure Elements	Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk		
		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F
Extreme (>= 20)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
High (10 - 16)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Moderate (8 - 9)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Low (3 - 6)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Negligible (< 3)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0

FN Infrastructure Resilience Toolkit - Matrix

Assets to be assessed

ACRS, ICMS, PS3150

CLIMATE ASSESSMENT Select: Current Climate / Future Climate	Climate 1							Climate 2							Climate 3							Climate 4							Climate 5						
	Probability:							Probability:							Probability:							Probability:							Probability:						
Asset/Infrastructure Elements	Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk		
		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F
ROADS																																			
Driving Surface (dirt)																																			
Shoulders																																			
Road Width																																			
Street Lights																																			
Signage																																			
Subsurface																																			
Ditching																																			
Culverts																																			
Railway Crossings																																			
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Lateral Clearances																																			
Intersections																																			
Drainage																																			
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Guardrails																																			
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Protection																																			
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Expansion Joints																																			
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Extreme (>= 20)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
High (10 - 16)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Moderate (8 - 9)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Low (3 - 6)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Negligible (< 3)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0

FN Infrastructure Resilience Toolkit - Matrix

CLIMATE ASSESSMENT Select: Current Climate / Future Climate	Climate 1 Wind						Climate 2 Rain/Flooding						Climate 3 Rain/Flooding						Climate 4 Winter Storm						Climate 5 Forest Fires					
	90 km/hr						50+ mm in a day						80+ mm over 3 days						Freezing Rain/Snow 25+ cm						Fire within 25 km, Smoke and Ash from further away sources					
	Probability: 5						Probability: 5						Probability: 4						Probability: 5						Probability: 4					
Asset/Infrastructure Elements	Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk		
		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F
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Extreme (>= 20)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
High (10 - 16)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Moderate (8 - 9)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Low (3 - 6)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Negligible (< 3)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0

Climate Elements

FN Infrastructure Resilience Toolkit - Matrix

CLIMATE ASSESSMENT Select: Current Climate / Future Climate	Climate 1 Wind						Climate 2 Rain/Flooding						Climate 3 Rain/Flooding						Climate 4 Winter Storm						Climate 5 Forest Fires					
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	Probability:			5			Probability:			5			Probability:			4			Probability:			5			Probability:			4		
Asset/Infrastructure Elements	Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk			Y/N	Severity			Risk		
		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F		S	O	F	S	O	F
ROADS																																			
Driving Surface (dirt)	Y		2	2		10	10	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	Y	2	2	2	10	10	10	N						
Shoulders	Y		2	1		10	5	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	Y	2	2	2	10	10	10	N						
Road Width	Y		1	1		5	5	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	Y	2	2	2	10	10	10	N						
Street Lights	Y	3	3	3	15	15	15	N							N							Y	2	1	1	10	5	5	Y	3	3	3	12	12	12
Signage	Y	2	2	2	10	10	10	N							N							Y	2	1	1	10	5	5	Y	3	3	3	12	12	12
Subsurface	N							Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	N							N						
Ditching	Y		2	1		10	5	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	Y	2	2	2	10	10	10	N						
Culverts	Y		2	1		10	5	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	N							N						
Railway Crossings	N							N							N							N							N						
Guardrails/Barricades	N							N							N							N							Y	3	3	3	12	12	12
Lateral Clearances	Y	1	1	1	5	5	5	N							N							Y	1	1	1	5	5	5	Y	2	2	2	8	8	8
Intersections	N							N							N							Y	1	1	1	5	5	5	N						
Drainage	Y		2	1		10	5	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	N							N						
BRIDGES																																			
Guardrails	N							N							N							N							Y	3	3	3	12	12	12
Deck	N							N							N							Y		1	1		5	5	Y	3	3	3	12	12	12
Road Surface (Wood/Metal/Concrete)	N							N							N							Y		1	1		5	5	Y	4	4	4	16	16	16
Foundation	N							Y	1			5			Y	1			4			N							N						
Protection	Y	2	2	2	10	10	10	N							Y	1	1	1	4	4	4	N							Y	3	3	3	12	12	12
Approach/Crossing	Y	1	1	1	5	5	5	Y	1	1	1	5	5	5	Y	1	1	1	4	4	4	Y		1	1		5	5	N						
Piers	N							Y	1	1	1	5	5	5	Y	1	1	1	4	4	4	Y		1	1		5	5	Y	3	3	3	12	12	12
Width	N							N							N							Y		1	1		5	5	Y	3	3	3	12	12	12
Signage/Hazard Approach	Y	1	1	1	5	5	5	N							N							Y	2	1	1	10	5	5	Y	2	2	2	8	8	8
Lighting and Signage	Y	3	3	3	15	15	15	N							N							Y	2	1	1	10	5	5	Y	3	3	3	12	12	12
Expansion Joints	Y	4	4	4	20	20	20	N							N							Y	2	2	2	10	10	10	N						
Drainage	Y		2	1		10	5	Y	1	1	1	5	5	5	Y	2	1	1	8	4	4	N							N						
Extreme (>= 20)	3				1	1	1					0	0	0					0	0	0					0	0	0					0	0	0
High (10 - 16)	9				4	10	5					0	0	0					0	0	0					9	5	5					10	10	10
Moderate (8 - 9)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0
Low (3 - 6)	12				3	4	9					11	10	10					4	11	11					2	11	11					0	0	0
Negligible (< 3)	0				0	0	0					0	0	0					0	0	0					0	0	0					0	0	0

Asset Inventory

Climate Elements

Risk Scoring

Risk Summary

Advice for a FN Climate Risk Assessment Team

- Important to have a multi-disciplinary team
  - Engineering/technical experts
  - Elders and youth
  - Climate
  - Operators and owners
- Evaluate current risks first
  - Determine relevant weather thresholds for infrastructure
- Climate numbers
  - Start with available data but augment with operations experience and community knowledge
    - Limited climate data for some variables -

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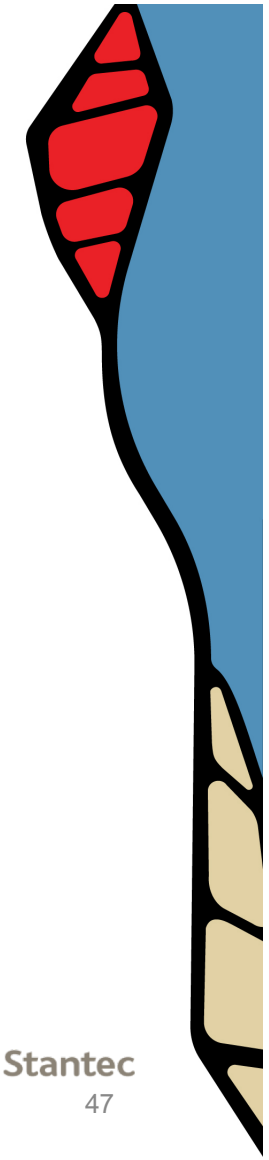
Funding Opportunities

Indigenous Services Canada (ISC) **First Nation Adapt Program** provides funding to First Nation communities to assess and respond to climate change impacts on community infrastructure and emergency management.

First Nation communities located below the 60th parallel visit:
www.First Nation Adapt Program

First Nation communities north of the 60th parallel visit:
www.Climate Change Preparedness in the North Program



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Climate Data Collections & Opportunities

Automated weather stations, snow sampling, monitoring programs and data access

Great funding opportunity for First Nations to improve local climate data:

Indigenous Community-Based Climate Monitoring Program

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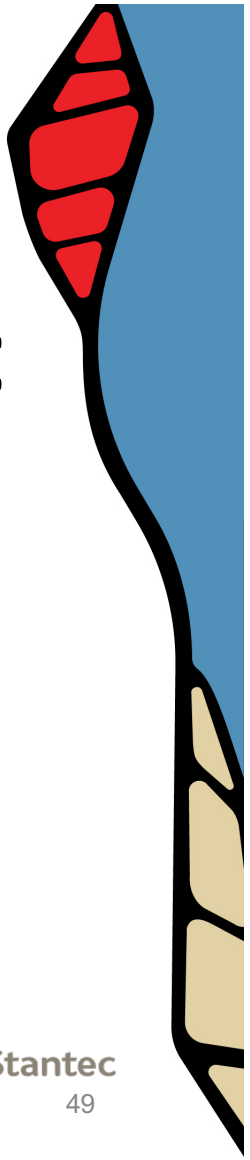
FN-Infrastructure Resilience Toolkit

Module 3

“Asset Management”



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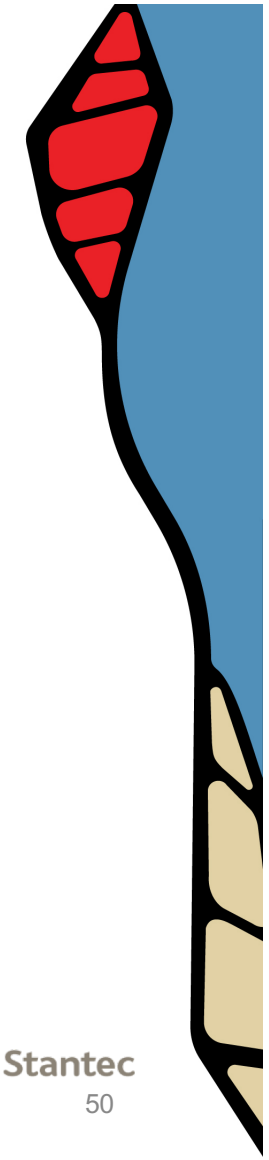
Why Asset Management?

It's all about service….

Infrastructure [assets] only exist to provide a service to the community

- **Mobility**: people and goods
- **Health and safety**
- **Protection**: of people and property, of health and the environment
- **Economic development**
- **Support well-being** of citizens
- **Cultural development**



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It's all about services…

Once the community has decided to offer the service – define its quality

"Levels of Service" (LoS) means different things to different people – beware of LoS creep !

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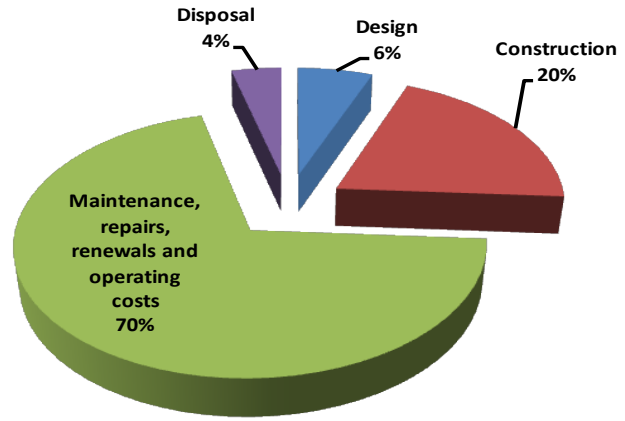
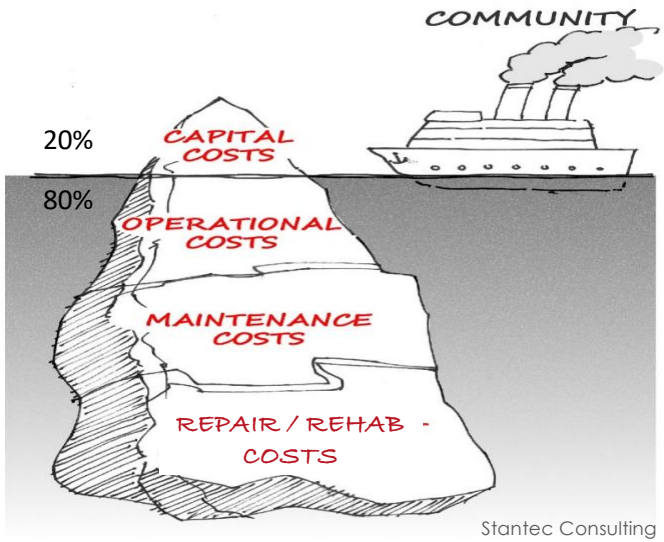
Levels of Services

With Levels of Service come Operations and Maintenance requirements over the asset life-cycle



Distribution of life-cycle costs for a typical building (Source: British Columbia Homeowner Protection Office)



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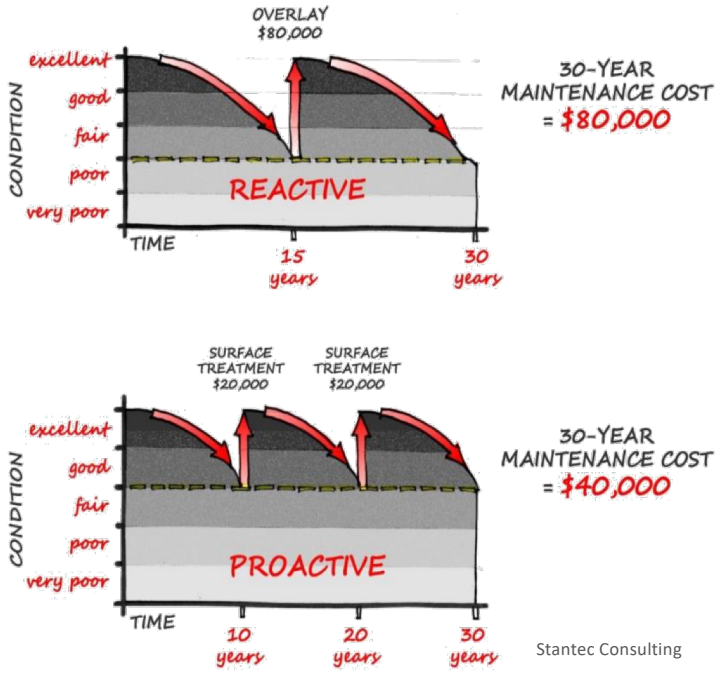
Reactive vs Proactive Management

Deferring costs until asset fails costs more …

... and has service implications!



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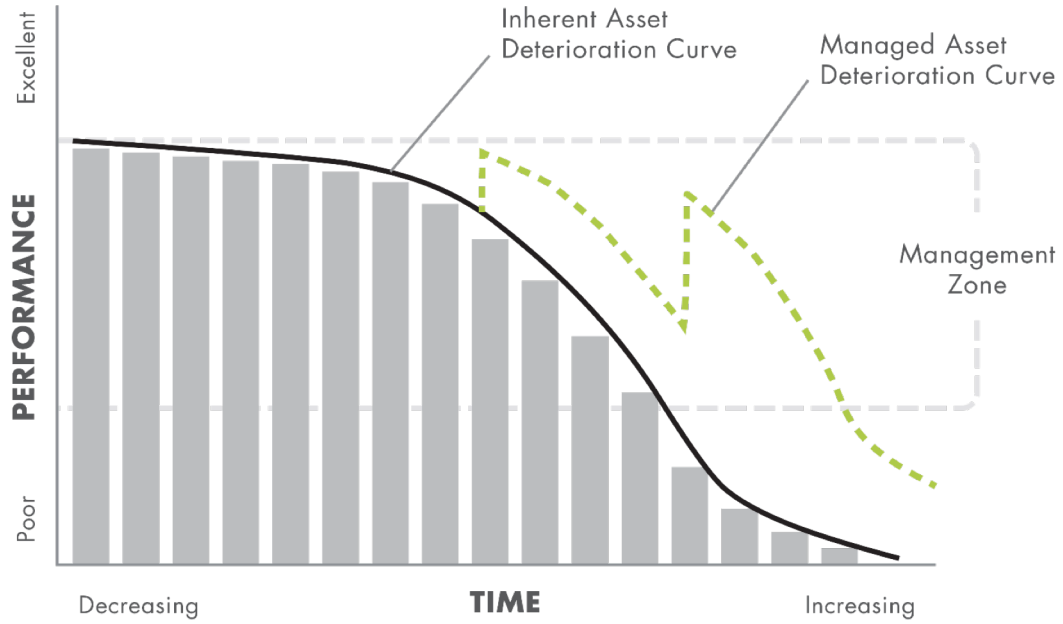
Again, Why Asset Management?

Do the right thing, to the right asset, at the right time



At the right cost!

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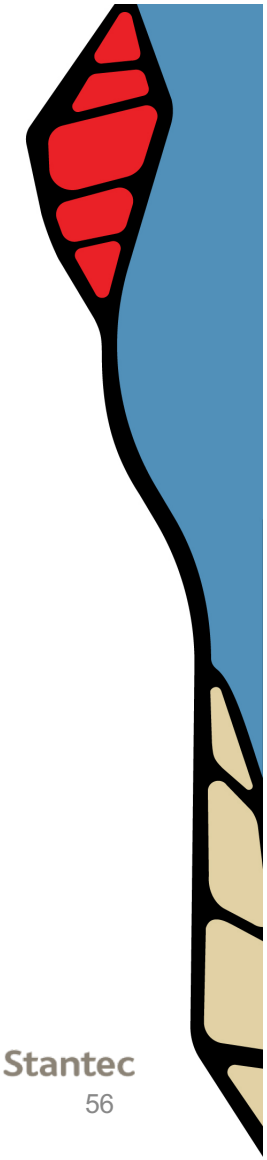
(7) Elements of Asset Management

InfraGuide – Practical Guide to Operation & Maintenance

1. What do you have and where is it?	**CAIS/ICMS/ACRS**
2. What is it worth?	**ACRS/PS3150**
3. What is its condition and expected remaining service life?	**ACRS/PS3150**
4. What is the level of service expectation and what needs to be done?	**ACRS/Condition Assessments**
5. When do you need to do it?	**ACRS/PS3150**
6. How much will it cost and what is the acceptable level of risk?	*Life Cycle Costing, Key Performance Indicators and Climate Change*
7. How do you ensure long-term affordability?	*Asset Management Plans*



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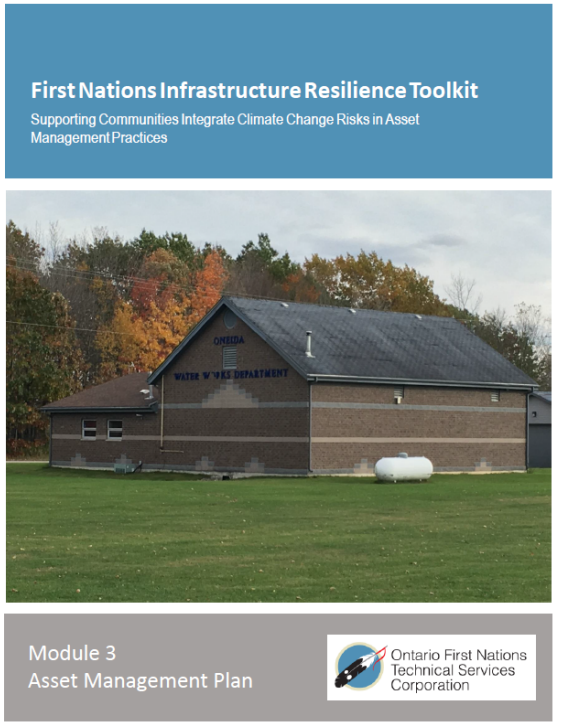
FN-IRT Module 3 – Asset Management Plans (AMP)

- Using the infrastructure information, the project team establishes the life-cycle needs (operations, maintenance, rehabilitation) to maintain the assets in a condition that meets the established levels of service based on current and future demand.

- The AMP provides the financial and other non-financial requirements to maintain and/or improve the service in a sustainable manner; it provides guidance on establishing priorities, monitoring and reporting.



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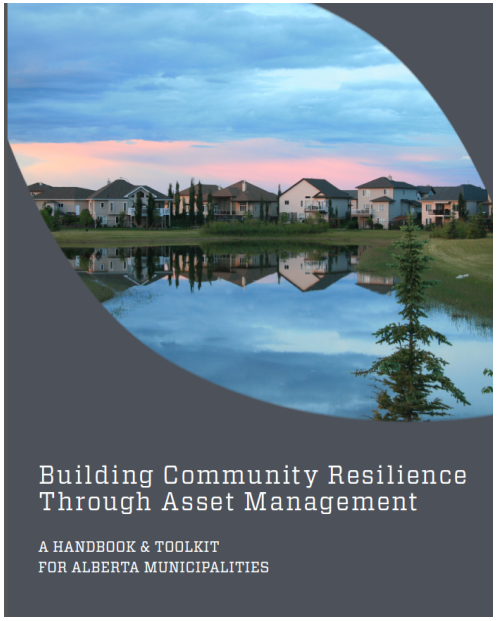
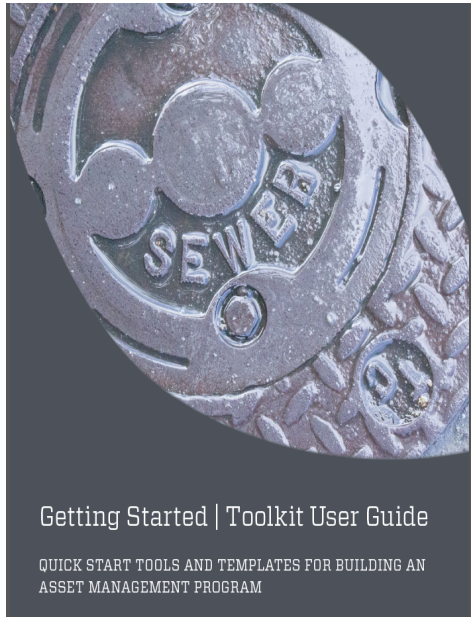
Asset Management Templates

- Not re-inventing the wheel: using AB Municipalities AM Toolkit and adapting it to FN communities
- Import data from ACRS, ICMS, PS3150, capital and O&M, etc.





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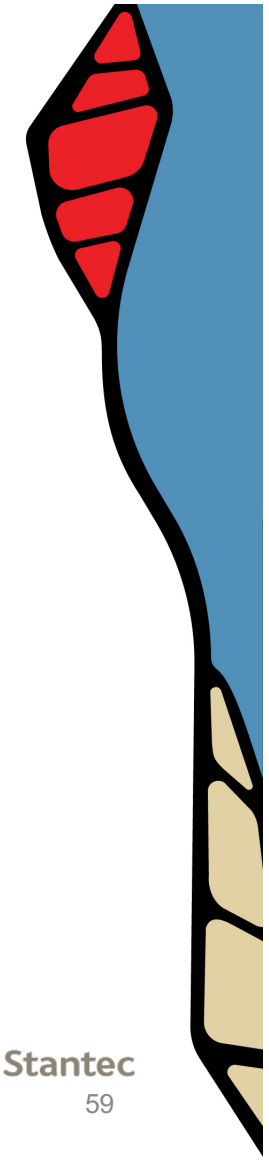
Current activities to improve Module 3 of FN-IRT

- Improve the Asset Registry and Worksheets to:
  - including links to ICMS, PS 3150, E-ACRS and CRM,
- Improve the Asset Management Policy so it can be used as a guide,
- Integrate lessons learned from the (3) FN AMP completed in Ontario,
- Update processes to the Infrastructure Needs Assessments, Financial Plans, Infrastructure Investment Priorities, and community Asset Management Plans (AMP).



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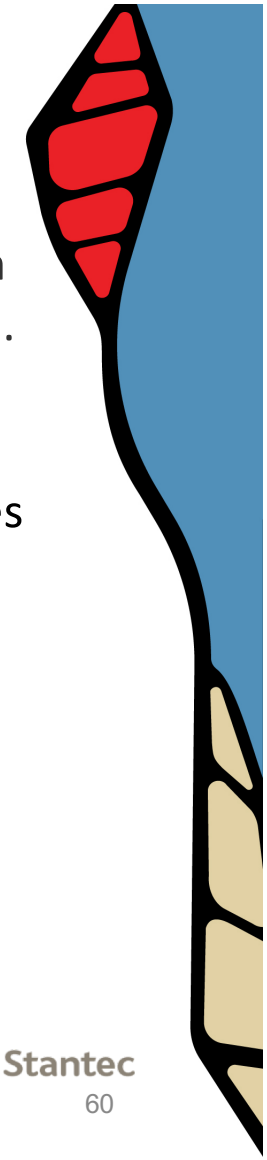
Funding Opportunities:

Indigenous Services Canada's (ISC) Capital Facilities and Maintenance Program in intended to help First Nations communities manage communities infrastructure.

ISC's new **Asset Management Program** was recently launched to help First Nations proactively manage assets, such as schools, water & wastewater facilities and buildings in a more sustainable way, and take preventative measures with improved operations and maintenance.

More information is available at [www.ISC-Asset Management Program]



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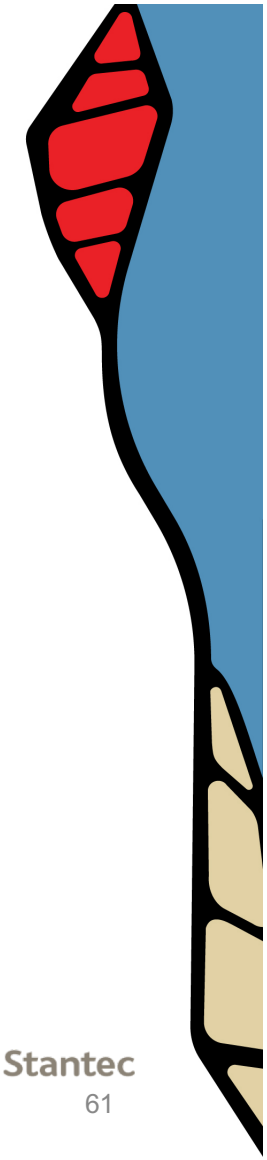
Next Steps

- AMP's tailored to help communities balance the actual levels of service with available funding and help prioritize financial decision making,
- Future infrastructure decisions should integrate long term objectives,
- Implement key performance indicators to measure asset management effectiveness,
- Review Risk Matrix against Levels of Service and use as a basis for prioritization for O&M, renewal & replacement costs and expenditures,
- Continue to provide First Nations with relevant training on Asset & Risk Management.



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Questions?

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