



MORRISON HERSHFIELD



# WATER TREATMENT PLANT – CLIMATE ACTION PLANNING

November 9, 2022

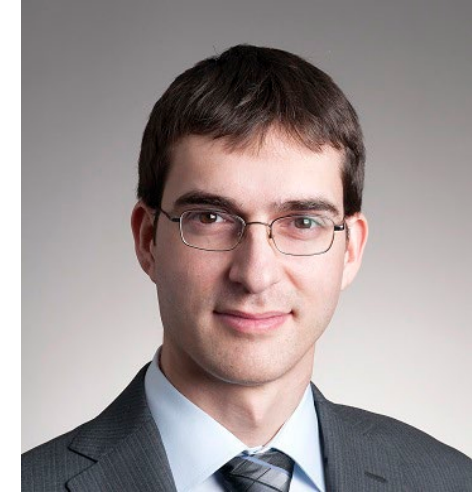
# TODAY'S SPEAKERS



**Joelle Doubrough**  
Climate Risk Analyst / Sr.  
Environmental Planner  
Morrison Hershfield



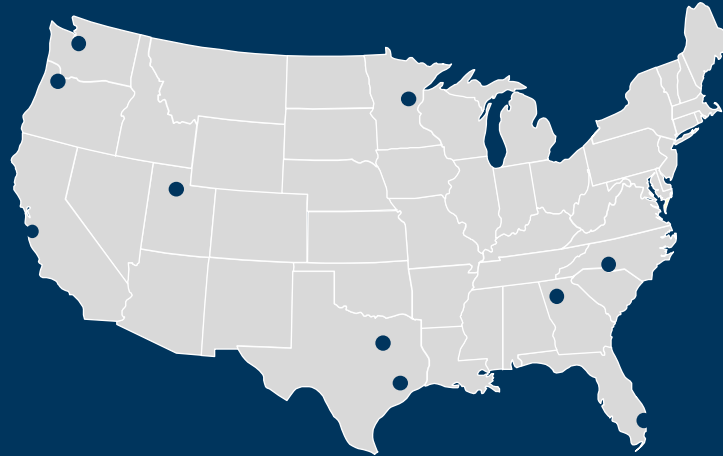
**Kalum Galle**  
Principal  
Senior Sustainability Specialist  
Morrison Hershfield



**Matt Doiron**  
Principal  
Building Energy Consultant  
Morrison Hershfield



Canadian Office Locations



USA Office Locations



India Office Location

# About Morrison Hershfield

- **Mission:** To be the first call for engineering solutions that make a difference.
- North American based with international reach.
- Over 70 years of success as a market-orientated, client focused firm.
- Employee-owned firm with annual revenues over \$150M.
- Focused on our people, culture and capabilities to provide highly specialized multidisciplinary engineering solutions.

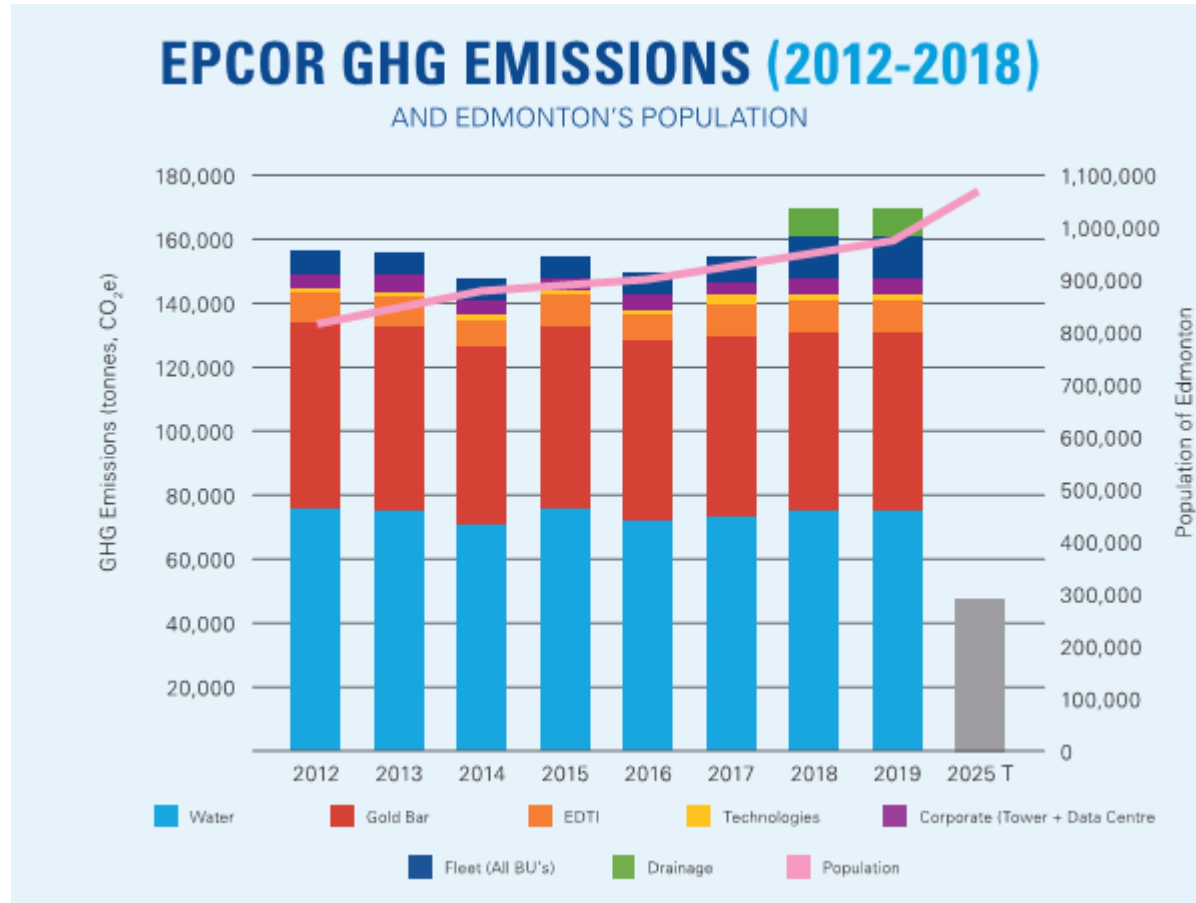


# PRESENTATION OVERVIEW

- Work we did
- Energy Audit
- Climate Risk Assessment
- Findings
- Recommendations -  
Integrated Climate Action  
Planning



# EPCOR 2018 WORK REVIEW



- EPCOR Water Services – Edmonton Water Integrated Resource Plan – 2020
- EPCOR Climate Adaptation Strategy – Discussion Paper and Recommendations

- Reduce GHG Footprint 70% by 2025
- Reduction of 85% by 2035

# WHAT IS NET-ZERO?

- Net emissions refers to the balance of source emissions and emission mitigation actions and offsets.
- If the balance of emissions and mitigation actions and offsets within a project scope equates to zero the project is said to be Net-Zero.



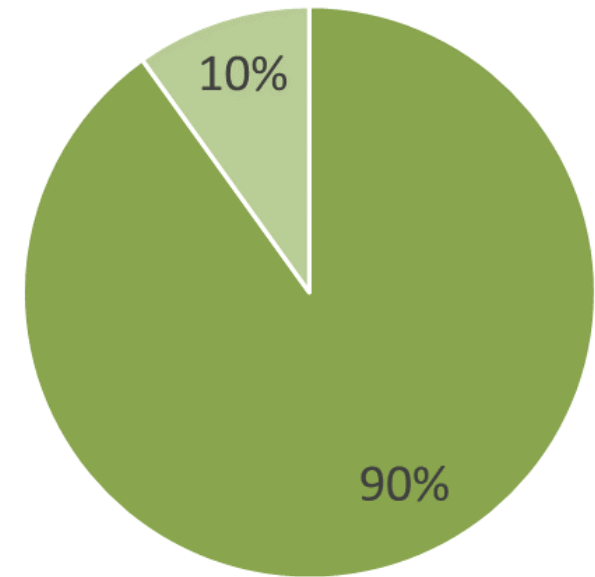
# ENERGY AND CARBON AUDIT

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- Water treatment plants serving greater Edmonton area
  - Offices, administration, maintenance and control room spaces
- Large focus on process, but admin/support spaces are important
- GHG and climate change analysis are not the norm – buildings are as important as process

# CHALLENGES

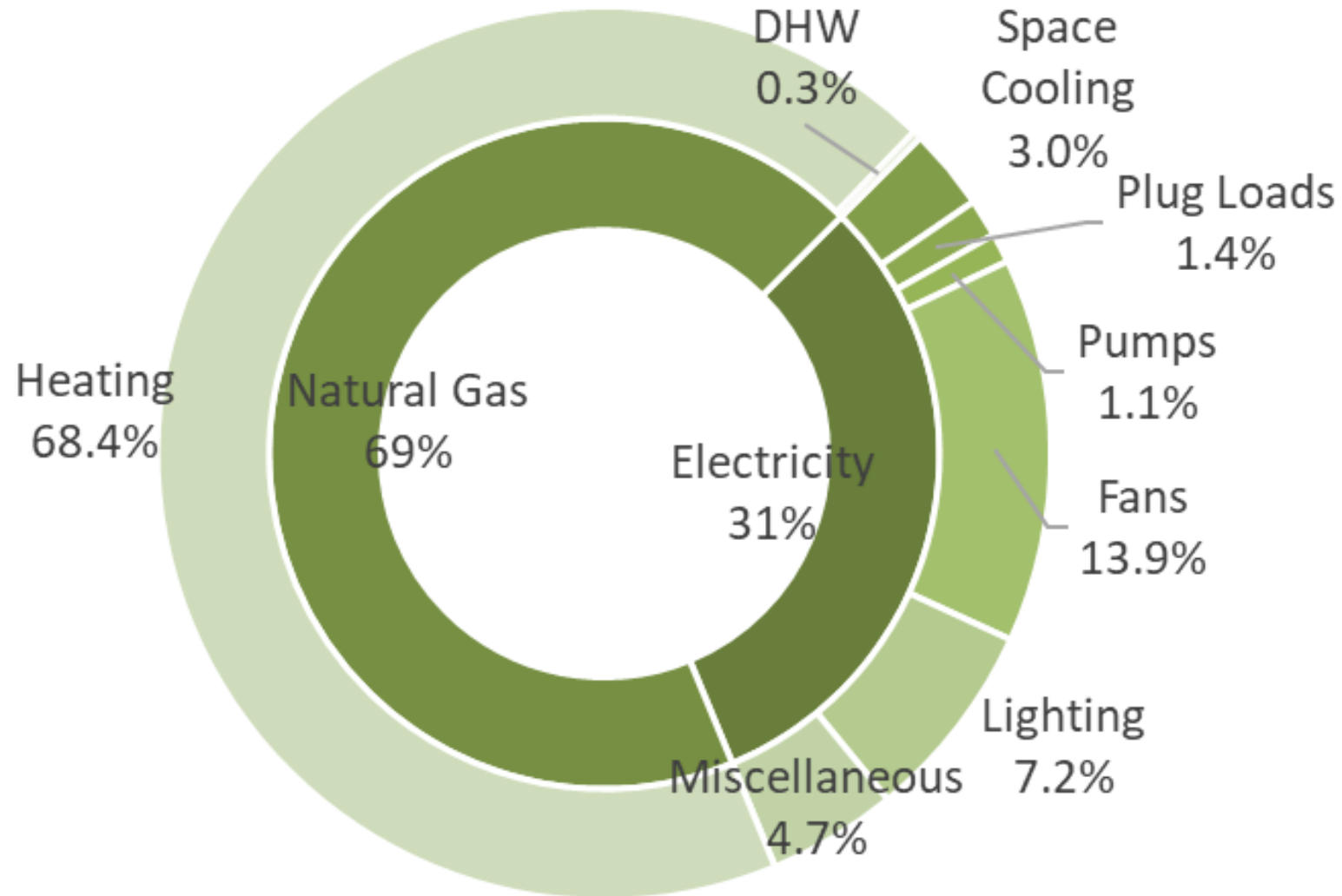
- Spread out facilities
  - Lots of low-grade heat, few ways to connect them/share
- Small loads compared to process
- Evolving fuel mix of the grid
- Emissions factors of electricity vs gas
- Aging infrastructure
- Seasonal variations



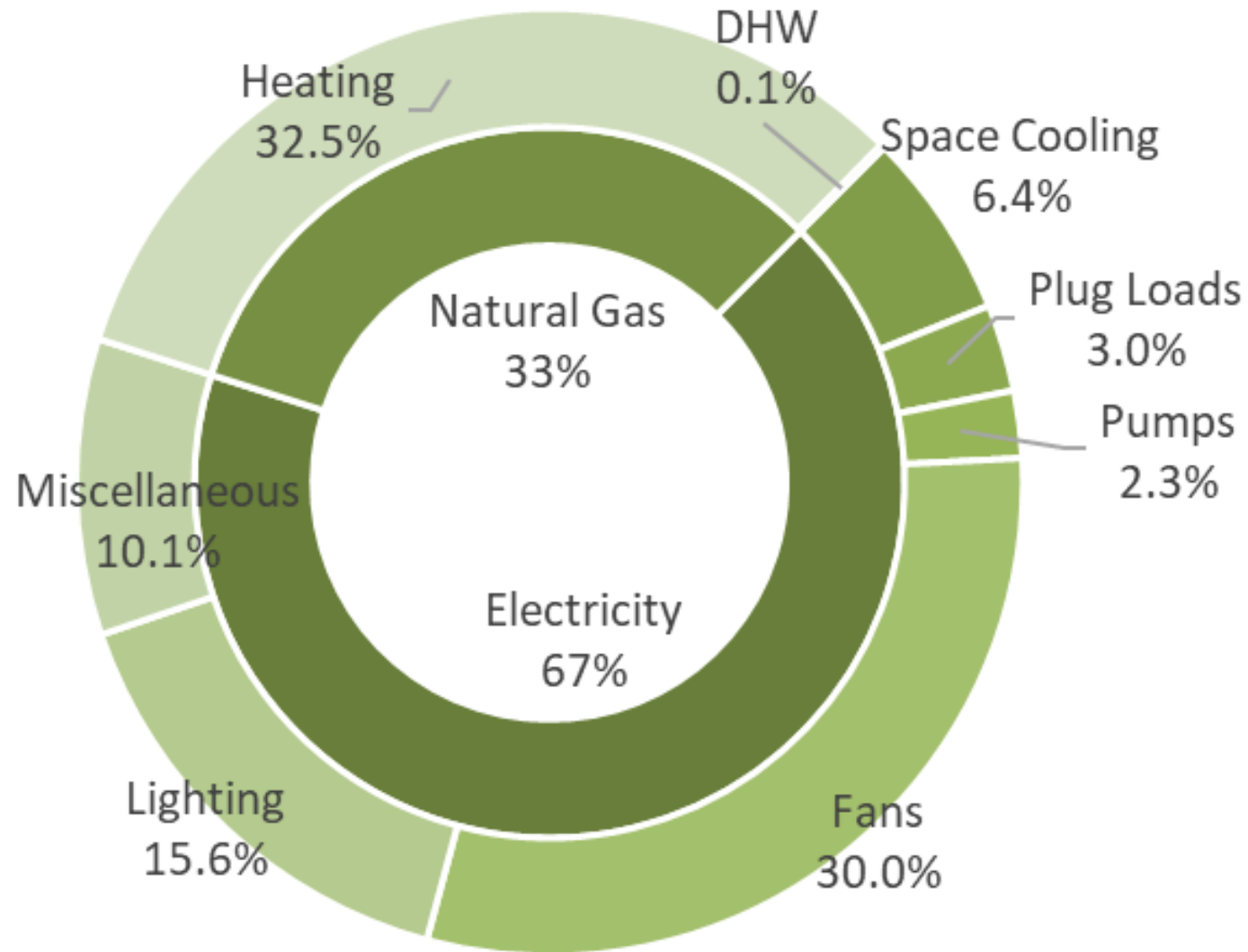
■ Process ■ Non-Process



# ANNUAL COST END-USE BREAKDOWN



# ANNUAL ENERGY END-USE BREAKDOWN



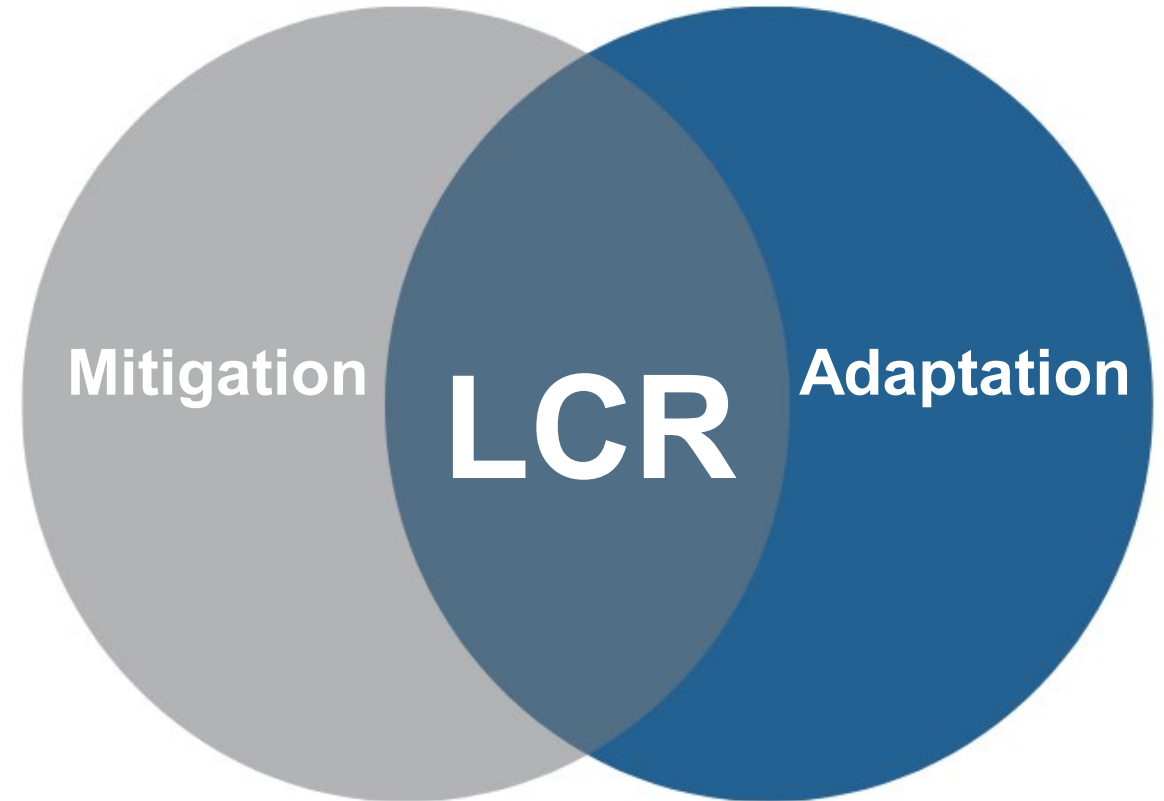
# RECOMMENDATIONS

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- Findings
  - Low-hanging fruit:
    - Don't forget controls, scheduling, maintenance
    - Lighting
    - Relace aging infrastructure with new, efficient versions
  - Design for 24/7, but not everywhere
  - Interconnect to process heat recovery if it makes sense
  - Future on-site generation (PV)
- Mitigation / Adaptation are more than just Energy / GHG

# CLIMATE ACTION PLANNING

- Climate Change Mitigation
  - GHG / net zero etc.
- Climate Change Resilience
  - Addressing Climate Change Risks
- Low Carbon Resilience (LCR)
  - Balancing the need for resilience with GHG conscious solutions

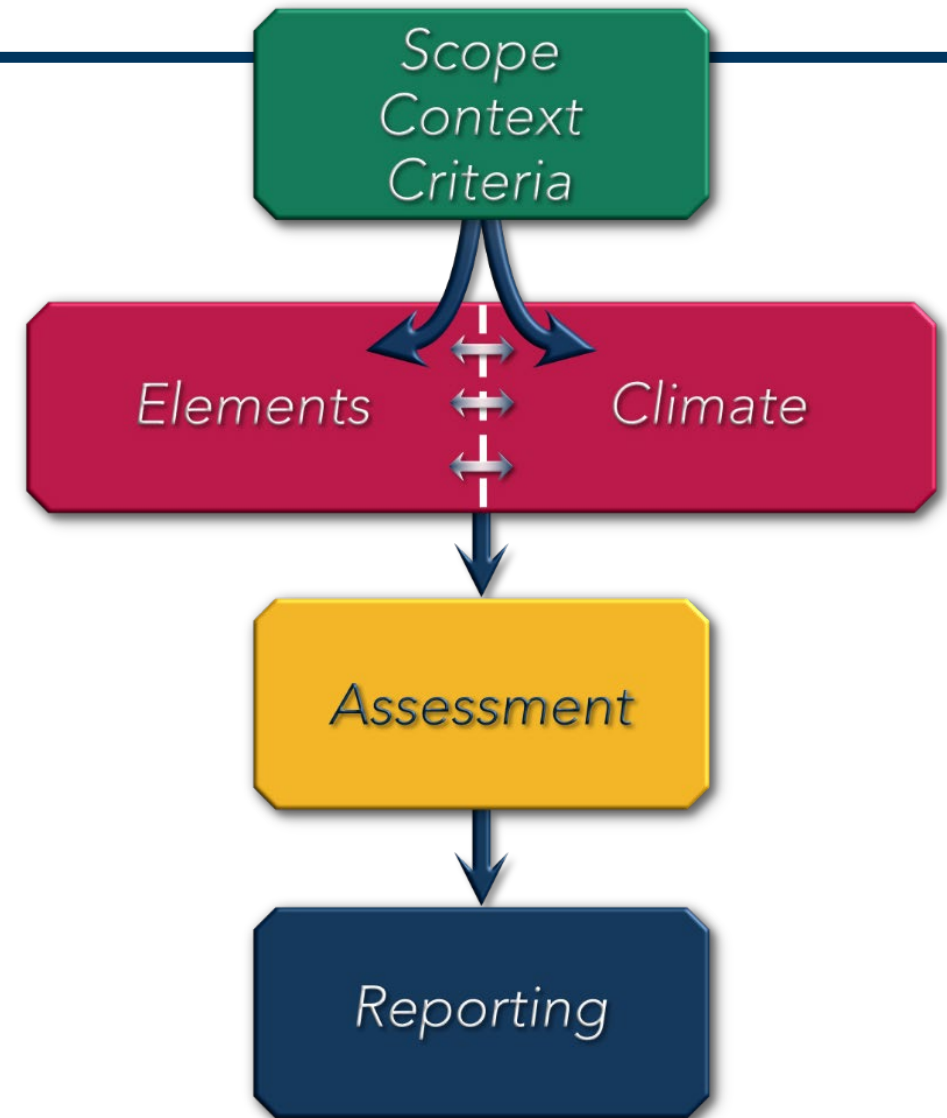


# EPCOR CLIMATE ADAPTATION STRATEGY

- Outlines potential climate change risks to EPCOR's water, wastewater, and drainage systems in Edmonton
- Identifies and describes measures that EWC is currently taking to plan for climate change, and to identify gaps make recommendations for developing a climate change adaptation and resiliency plan.
- The impact of climate change on EPCOR's operations in Edmonton was compared to the U.S. Environmental Protection Agency's (US EPA) "Adaptation Strategy Guide for Water Utilities".
- DW Treatment and Distribution Focused
  - Water conservation
  - Emergency response planning
  - Repairs and retrofits
  - Drought related contingency planning
  - Planning and policy including consideration of mutual aid agreements
  - Flood planning for the WTPs
  - Establishing alternative on-site water supply

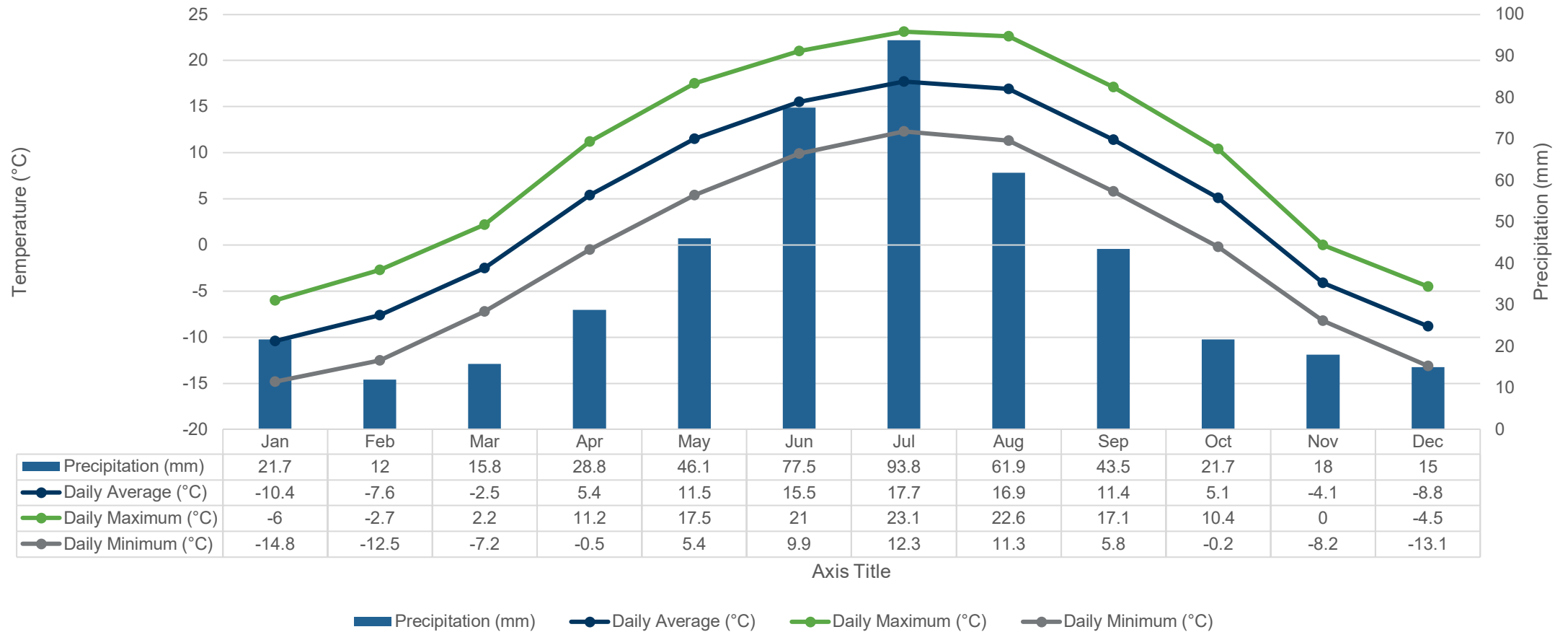
## PIEVC High Level Screening Guide

- The core PIEVC Process
- Streamlined
- Aligns with Climate Lens
- ISO 31000 compliant
- Recommended approach for this assessment



# EDMONTON BASELINE CLIMATE CONDITIONS

Temperature and Precipitation Graph  
for Baseline Time Period (1981-2010)  
Canadian Climate Normals (Edmonton City Centre A)



# INFRASTRUCTURE ELEMENTS REVIEWED

## E.L. Smith WTP

Infrastructure Category	Infrastructure Sub-Components Included
Major Envelope and Structure	Opaque walls, windows, roofs, doors, structure
Major Mechanical Systems	Building heating, cooling and ventilation plant, BAS
Major Electrical and Lighting	Lighting system and lighting controls Emergency generator, emergency power distribution.
Interior and Equipment	N/A
Energy Use, Generation and Storage	N/A
Water Systems (Including Stormwater and Wastewater)	Plumbing (supply and drainage) systems Water, storm and sanitary service connections
The Site (Including Exterior Landscaping)	Hard and soft landscaping, including roadways and vegetation
Special Consideration	Antennae, water intake systems





# INFRASTRUCTURE ELEMENTS REVIEWED

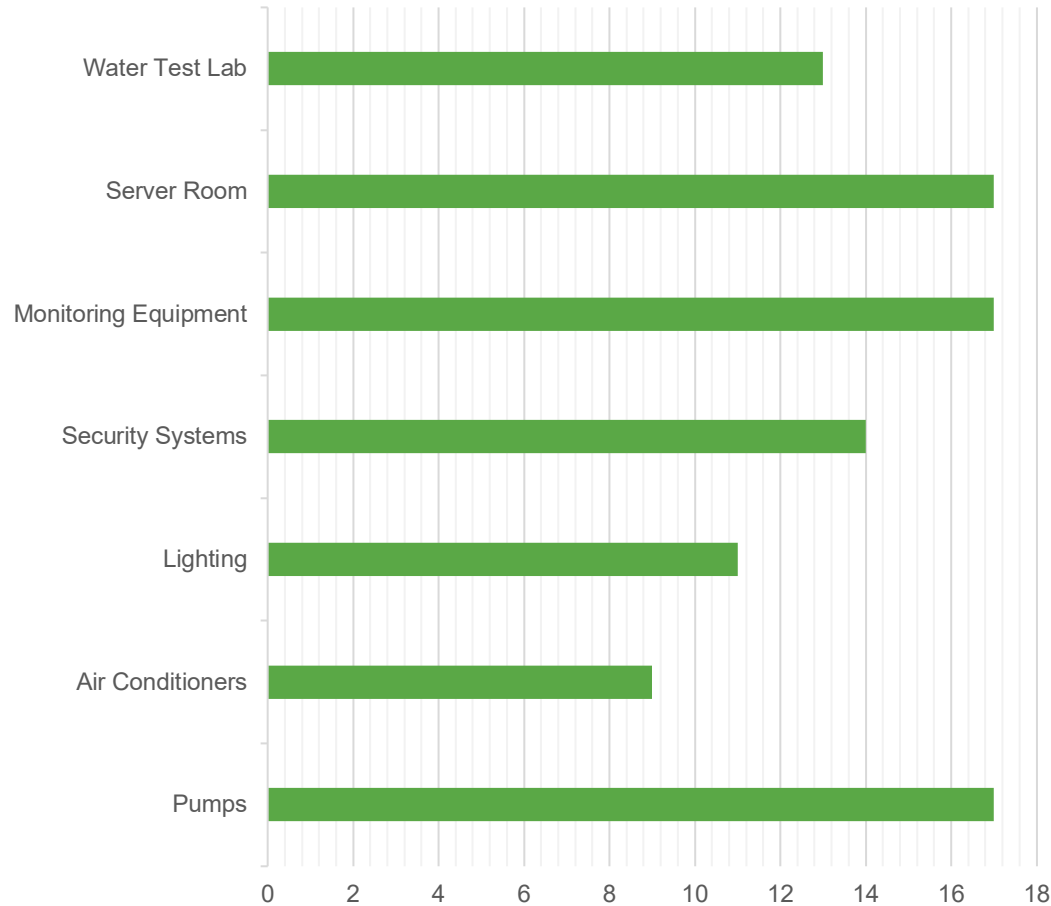
## Rossdale WTP

Infrastructure Category	Infrastructure Sub-Components Included
Major Envelope and Structure	Opaque walls, windows, roofs, doors, structure
Major Mechanical Systems	Building heating, cooling and ventilation plant, BAS
Major Electrical and Lighting	Lighting system and lighting controls Emergency generator, emergency power distribution.
Interior and Equipment	N/A
Energy Use, Generation and Storage	N/A
Water Systems (Including Stormwater and Wastewater)	Plumbing (supply and drainage) systems Water, storm and sanitary service connections
The Site (Including Exterior Landscaping)	Hard and soft landscaping, including roadways and vegetation
Special Consideration	Antennae, water intake systems



# RISK ASSESSMENT WORKSHOP SUMMARY

**What are the critical services that MUST remain operational?**



**Has the WTP been positively or negatively impacted by a climatic event in the past?**

Types of Events	#
Extreme Warm Temperatures	13
Extreme Precipitation	11
Riverine Flooding	10
Convective Storms	6
Total Snowfall Accumulation	3
Extreme Drought / Dry Conditions	7
Wind Gusts	1
Indirect Wildfire Impacts	7

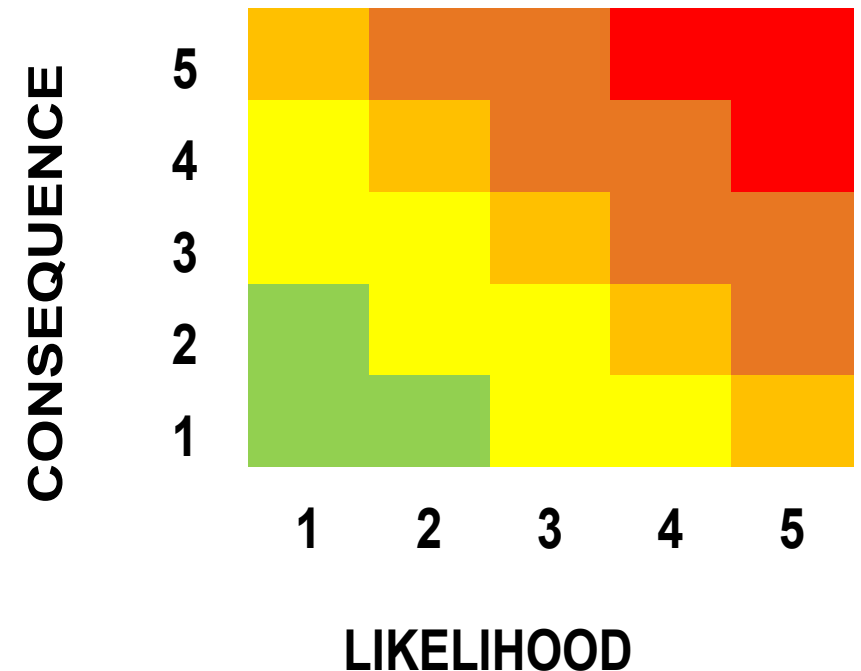
# CLIMATE CHANGE RISK ASSESSMENT - FINDINGS

## ■ Purpose

- No 'one-size fits all' approach
- Each organization / facility has to contend with specific climate change issues and unique design and condition characteristics
- The facility as well as the treatment and distribution all need to be considered in a comprehensive Climate Action Plan

## ■ Process

- PIEVC HLSG
- Workshop with 24 ESWI Representatives
- Integration with ESWI Enterprise Risk Management Matrix (5x5)
- Tailored to ESWI needs and work to-date



Risk = Exposure (E) x Likelihood (L) x Consequence (C)

# RISK EVALUATION SUMMARY

	Historical Baseline Conditions					Projected 2050s Conditions (2041-2070)					Projected 2080s Conditions (2071-2100)				
	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk	Negligible Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
Average Annual Temperatures	-	5	-	-	-	-	-	4	1	-	-	-	4	1	-
Extreme Heat	-	5	2	1	-	-	-	1	6	1	-	-	1	6	1
Supercooling of River	-	-	1	-	-	-	1	-	-	-	-	1	-	-	-
Freeze-Thaw	-	3	3	-	-	1	5	-	-	-	1	5	-	-	-
Extreme Low Precipitation (Drought / Dry Conditions)	-	4	-	-	-	-	3	1	-	-	-	-	3	1	-
Extreme Heavy Precipitation (Rain)	-	3	-	2	-	-	3	0	2	-	-	2	1	-	2
Changes to Winter Precipitation	-	4	2	-	-	-	-	4	2	-	-	-	4	2	-
Heavy / Extreme Snowfall	-	3	1	2	-	-	3	1	2	-	-	3	1	2	-
Wind Gusts	-	5	1	-	-	-	2	3	1	-	-	2	3	1	-
Convective Type Events - Tornado, Hail	-	4	1	1	-	-	4	1	1	-	-	4	1	1	-
Lightning	-	4	1	-	-	-	1	3	1	-	-	-	1	4	-
Wildfire Interface	-	1	-	5	-	-	-	-	1	5	-	-	-	1	5
Indirect Wildfire Impacts	-	3	-	-	-	-	-	-	3	-	-	-	-	3	-

# POTENTIAL RISK TREATMENT OPTIONS

	Risk	Historical Baseline	2050s	2080s	Recommendations
TEMPERATURE	T-1: Additional wear and tear resulting from annual temperature effects on building envelope sub-components.	Low	High	High	<b>O&amp;M - Annual monitoring program for sealants and joints</b>
	T-2: Additional wear and tear resulting from extreme heat events on building envelope sub-components.	Moderate	High	High	<b>O&amp;M - Consider using High Temperature self-adhesive membranes and sealants at time of renewal</b>
	T-3: Additional wear and tear on the Mechanical HVAC systems associated loads under extreme heat conditions.	High	Extreme	Extreme	<b>Capital Upgrades - Reduce heat gains to offset increasing outdoor temperatures</b>
	T-4: BMS sensors and units are affected by high/extreme heat.	Moderate	High	High	<b>Monitor Building Cooling Loads, Plan for Life Cycle Cooling Plant Upgrades</b>
	T-5: Electrical equipment risks were captured as a “special consideration” for high / extreme heat interactions.	Low	High	High	<b>O&amp;M - Increase frequency of maintenance and service of major electrical equipment, Plan and provide real time monitoring of equipment condition</b>
	T-6: Emergency power equipment (generators) are located outside. High / extreme heat reduce the efficiency of these systems.	Low	High	High	<b>Upgrade Emergency Power to Keep WTPs in Operation Upon Utility Power Outage</b>
	T-7: ESWI staff, particularly O&M Staff may be impacted by extreme heat events	Moderate	High	High	<b>Policy Related Resilience Strategies</b>
	T-8: A low consequence score for additional wear and tear, extreme heat impacts on roadways was identified.	Moderate	High	High	<b>Access Road Inspection Program for excessive wear and tear following extreme heat events</b>

	Risk	Historical Baseline	2050s	2080s	Recommendations
HEAVY PRECIP - RAIN	P-1: Overland flooding, and washouts of the gravel access road at E.L. Smith was determined to have a high consequence associated with potential supply chain concerns, and human health and safety.	High	High	Extreme	<b>Access Road Improvements</b>
	P-2: Captured as a special consideration, water ponding near an entrance to one of the Rossdale buildings was noted to have a high consequence.	High	High	Extreme	<b>Upgrade Access Doors at Vulnerable Locations</b>
HEAVY PRECIP - SNOW	P-3: The building envelope consequence scores are based on the historic climatic factors on which the roof design is based. Given the uncertainty in the likelihood scores and the potentially significant consequence of roof damage / failure, the workshop participants applied a high consequence score for this exposure.	High	High	High	<b>Investigative Structural Assessment (Roofs)</b>
	P-4: The mechanical (HVAC) system was noted to experience impacts from heavy and extreme snowfall events. The exposure of the system to heavy snowfall results in components freezing / “getting plugged up” from snow. This consequence was determined to be high given the potential for damage to the system.	High	High	High	<b>Implement a Roof Snow Clearing Plan</b>

	Risk	Historical Baseline	2050s	2080s	Recommendations
CHANGING PRECIP - FREEZING RAIN	P-5: Health and safety of staff, particularly related to slips, trips and falls was determined to have a moderate consequence associated with exposure to freezing-rain events.	Moderate	High	High	<b>Exterior Hardscape Management Plan</b>
	P-6: Access to the E.L. Smith WTP was noted to have historic challenges in icy, snowy conditions. A moderate consequence score was applied to roadways with consideration for access, including access related to delivery of various supplies as storage on-site is limited.	Moderate	High	High	
WIND GUSTS & STORMS	WS-1: A special consideration element was noted to be the radio antennas on-site, with some teams relying on radios for communication. Potential damage from wind gusts was noted to have a moderate consequence.	Moderate	High	High	<b>Investigative Structural Assessment</b>
	WS-2: A special consideration element was noted in relation to the potential for hail preventing drainage via storm drains. Overland flood potential related to a convective storm even, including hail was determined to have a very high potential consequence interaction.	High	High	High	
LIGHTNING	L-1: A low consequence score was applied for potential interactions with building envelope elements related to localized damage.	Moderate	Moderate	High	<b>Provide Lightning Protection System</b>
	L-2: A low consequence score was applied for potential interactions with mechanical (HVAC) systems related to localized, short-term damage.	Moderate	Moderate	High	
	L-3: A low consequence score was applied for potential interactions with networking equipment, specifically antennae on the roof and the potential for localized, short-term damage.	Moderate	Moderate	High	
	L-4: A moderate consequence score was applied for the potential interactions with staff/personnel. Given health and safety concerns associated with walking between buildings in a lightning event, this was the only lightning exposure for which a moderate consequence was applied.	Moderate	High	High	<b>Lightning Event Management Plan</b>

	Risk	Historical Baseline	2050s	2080s	Recommendations
DIRECT & INDIRECT WILDFIRE IMPACTS	WF-1: Building envelope exposure to direct wildfire interface may result in damage or have potentially catastrophic consequences.	High	Extreme	Extreme	<b>Emergency Management Plan</b>
	WF-2: Exposure of the mechanical system to direct wildfire interface may result in damage or have potentially catastrophic consequences.	High	Extreme	Extreme	
	WF-3: Landscape elements, transformers and road assets may experience damage or catastrophic loss in the event of wildfire interface. Road closures may result in supply chain consequences.	High	Extreme	Extreme	
	WF-4: Exposure of the emergency power (generator and associated fuel) to direct wildfire interface may result in potentially catastrophic consequences.	High	Extreme	Extreme	
	WF-5: If people are exposed directly to wildfire, potentially catastrophic consequences could be the result.	High	Extreme	Extreme	
	WF-6: Road closures may result in a consequence score of low as it relates to potential supply chain impacts if the road is the only element exposed.	Moderate	High	High	
	WF-7: Exposure of the building envelope to indirect wildfire impacts (air quality, ash, debris) may result in a low ranked consequence.	Moderate	High	High	<b>Wildfire Smoke Management Plan</b>
	WF-8: Exposure of the mechanical (HVAC) system poor air quality associated with indirect wildfire impact may result in a low ranked consequence associated with additional filtration / maintenance.	Moderate	High	High	
	WF-9: If people / staff are exposed to poor air quality associated with indirect wildfire impacts, a low consequence score may result. Vulnerable people with underlying health conditions were not considered separately.	Moderate	High	High	



**DISCUSSION / QUESTIONS?**



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