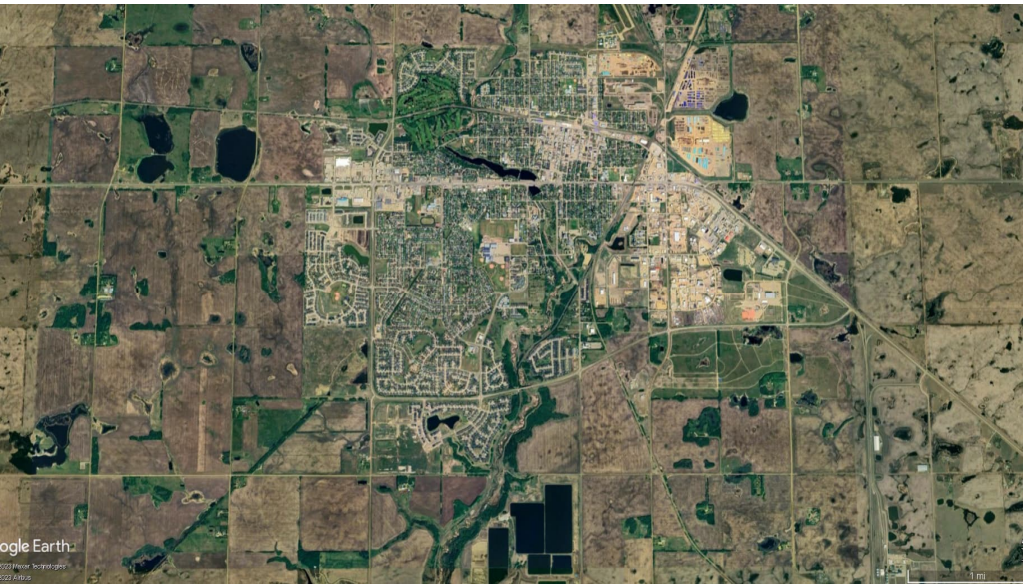
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

All One Sky FOUNDATION

REPORT

City of Camrose

Climate Vulnerability and Risk Assessment



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USE OF THIS REPORT

The intent of this report is to:

1. Provide specific details of the assessment relevant to each City of Camrose department; and
2. Deliver an overall summary that can be communicated at a high level with City Council and Managers.

The report is prepared in the following sections:

- The Executive Summary provides an overview that can be used to communicate at a high level the purpose and the findings of the report. Detailed information is available within the report itself for reference.
- The main body of the report contains the details of the risk assessment and adaptation action planning. The report is organized as follows:
    - Section 2 - Methods Used in the Risk Assessment.
    - Section 3 - Climate Projections with Likelihood Scoring.
    - Section 4 - Risk Assessment Results and Detailed Discussions.
    - Section 5 - Adaptation Actions Discussion.
    - Section 6 - Recommendations Providing Next Steps for the City to Consider.

Each Section in the Table of Contents has an active link that the reader can use to jump forward to a specific Section.

EXECUTIVE SUMMARY

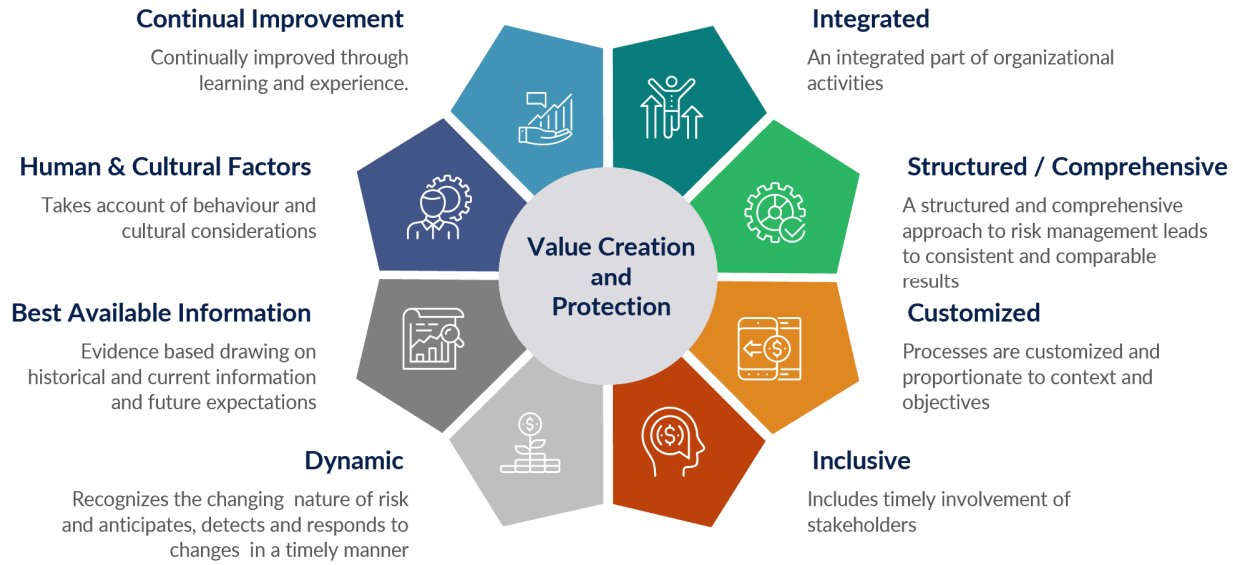
The scope of this project is to develop an understanding of climate vulnerabilities and risks to the City of Camrose's (the City) infrastructure using the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol, developed by Engineers Canada; specifically, the High-Level Screening Tool. A social and local economy risk and vulnerability assessment was also conducted to identify and prioritize risks facing the broader community and local economy. The results of this risk assessment will guide critical action planning to ensure the City remains resilient to future climate change impacts.

The study includes:

- Review the City's key infrastructure assets;
- Identify a set of relevant climate hazards, stressors and trends based on present and future climate parameters that are specific to the City of Camrose;
- Evaluate the level of risk facing infrastructure and the users/public;
- Evaluate the level of risks to vulnerable populations and businesses; and
- Identify a list of high-level adaptation measures to address key risks.

The overall process that this project adopted for the risk assessment is based on the ISO 31000's principles of risk management. The principles follow a systematic cycle of actions to create and protect the value of the community as shown on **Figure ES-1**. In this project, the risk assessment is conducted on the basis that the City will improve, communicate, and implement actions to protect and create value for the community.

Figure ES-1 Principals of Risk Management (ISO3100)



Another ISO guideline that has been used in this assessment is ISO 14092. Our approach to the climate risk assessment employed a 'best practice' methodology, which is based on the "*Climate Resilience Express – Community Climate Adaptation Planning Guide*" (https://mccac.ca/app/uploads/CRE_Planning-Guide_Final.pdf), which was developed by All One Sky Foundation for the Municipal Climate Change Action Centre and the Climate Resilience Capacity Building Program.

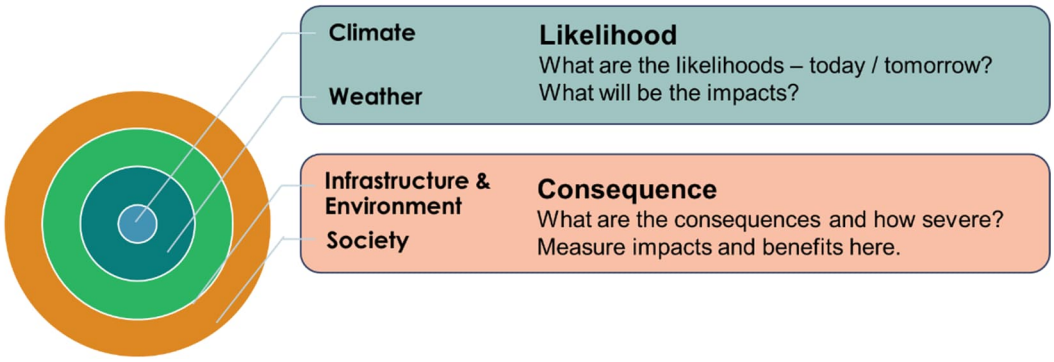
This project was led by Associated Engineering with input from All One Sky Foundation on the climate risk assessment and adaptation planning to the community and local economy.

METHODOLOGY

Risk is generally discussed as a product of likelihood and consequence. Likelihood is described as the change that hazards, events or conditions could occur. Consequence is the result of the event occurring in varying levels of negative or positive impacts or effects.

In terms of climate risk, we begin to understand how the variability of climate patterns impact the built environment and environment, and in turn, how this impacts the society. This is illustrated in **Figure ES-2** below.

Figure ES-2 Risk Inputs



The time horizons for assessment were chosen to align with the design life/expected lifecycle of the infrastructure, or period of time before a planned retrofit or reassessment of climate impacts. This assessment considered the following climate periods:

- 2020s (2020 – 2040) *i.e., current conditions*
- 2050s (2041 – 2070)
- 2080s (2071 – 2100)

Parameters were selected based on potential ongoing and future impacts to the physical infrastructure, as well as impacts to operation and maintenance. In all cases, the Representative Concentration Pathway 8.5 (RCP8.5, i.e. business as usual) scenario was chosen to reflect a worst-case scenario for the infrastructure. Climate parameters investigated in this assessment include the following **Table ES-1**.

Table ES-1 Climate Parameters

Climate Parameters	Climate Sub-Parameters
Temperature	• High Average Summer Temperature • Low Average Winter Temperature • Extreme High Summer Temperature • Extreme Low Winter Temperature • Freeze/Thaw Events
Precipitation	• Drought • Extreme Rainfall • Persistent Precipitation • Extreme Snowfall • Hail Days • Average Precipitation
Maximum Wind Gust	NA
River Flooding	• Stoney Creek
Ice Accretion	• Extreme Ice Accretion (Freezing Rain)
Wildfire	NA
Tornado	NA

The climate risk assessment was conducted for the following City's assets (built infrastructure):

- Stormwater;
- Water;
- Wastewater;
- Waste Management;
- Municipal facilities;
- Fleet, Roads, Airport, and Transit;
- Emergency Management;
- Environment and Parks; and
- Community (social aspect) and Local Economy.

The PIEVC High Level Screening (HLS) Tool was used to identify risks to the City's infrastructure resulting from climate change. As part of this discussion, **operators and public users** are also included in the risk assessment. Subsequently, preliminary adaptation actions were identified for the City to consider in future land use planning, engineering standards for design and construction, infrastructure assessment, asset management, and human resource planning and programming. Bolstering the PIEVC HLS assessment, a climate risk assessment was completed focused on the impacts of climate change on the social aspect of the community and local economy in City of Camrose. This portion of the assessment was led by All One Sky Foundation.

The HLS tool has five main steps, as shown in **Figure ES-3**:

- Step 1: Define Infrastructure
- Step 2: Evaluate Climate Changes
- Step 3: Conduct Risk Assessment
- Step 4: Conduct Risk Reduction/Mitigation (Adaptation)
- Step 5: Conclusions and Recommendations

Figure ES-3 Project Process Overview

The **Project Definition** was conducted in **Workshop 1A** and **1B**. **Workshop 1A** was conducted to define the infrastructure; the following was discussed:

- Climate change principles and parameters;
- The PIEVC tools and process; and
- Information required from the City.

In **Workshop 1B, Tell Us About Your System**, the City presented information on the assets, specifically the components of each asset. For an example, the Stormwater components would be outfall, stormwater ponds, culverts, ditch, and catch basins.

The **Risk Analysis (Identification and Scoring)** was conducted in **Workshop 2** in the following five separate sessions:

- **Workshop 2A**: Water, Wastewater, Stormwater;
- **Workshop 2B**: Roads, Transit, Fleet, Airport;
- **Workshop 2C**: Facilities;
- **Workshop 2D**: Waste Management, Environment/Parks; and
- **Workshop 2E**: Community (social aspect) and Local Economy.

The **Adaptation Action Planning** was conducted in **Workshop 3** in the following sessions:

- **Workshop 3A**: Water, Wastewater, Stormwater;
- **Workshop 3B**: Road, Fleet, Transit and Airport;
- **Workshop 3C**: Waste Management, Environment/Parks;
- **Workshop 3D**: Facilities and Properties; and
- **Workshop 3E**: Community (social aspect) and Local Economy.

Risk Assessment Results

In presenting the risk assessment results, we sought to answer the following **four key points of information**:

1. **Which infrastructure components are the most vulnerable?** Based on the total risk score above average for each component.
2. **Which climate hazards have the highest impacts on the overall infrastructure?** Based on total risk score above average for each climate hazard.
3. **What are the other individual infrastructure components with high-risk scores that are noteworthy?**
4. **What is the climate risk score trend from current to 2080s timescale?**

The **first two key points of information** showed which climate hazards the assets may be most impacted.

The **third key point of information** identified other individual asset components with high-risk scores (over 20) that should also be noted.

The **fourth key point of information** showed the interactions of the assets with climate hazards based on the likelihood trend from current to 2080s. The results generally showed low score in current timescale, and it was not until the 2050s where medium risk scores began to show and increased to high-risk scores in the 2080s as climate change impacts are estimated to become more severe. However, some climate hazards showed a downward trend impact on the assets.

In addition to the infrastructure components, **building staff, operators, and public users** were also included in the discussion in terms of how climate hazards could impact them as operators and users of the infrastructure. The discussion included accessibility, health and safety, and level of service. Emergency services (police, first responders) were discussed based on how the service could be impacted by the climate hazards. For example, heavy and persistent rainfall could cause flooding in major arterial roads, preventing emergency vehicles access.

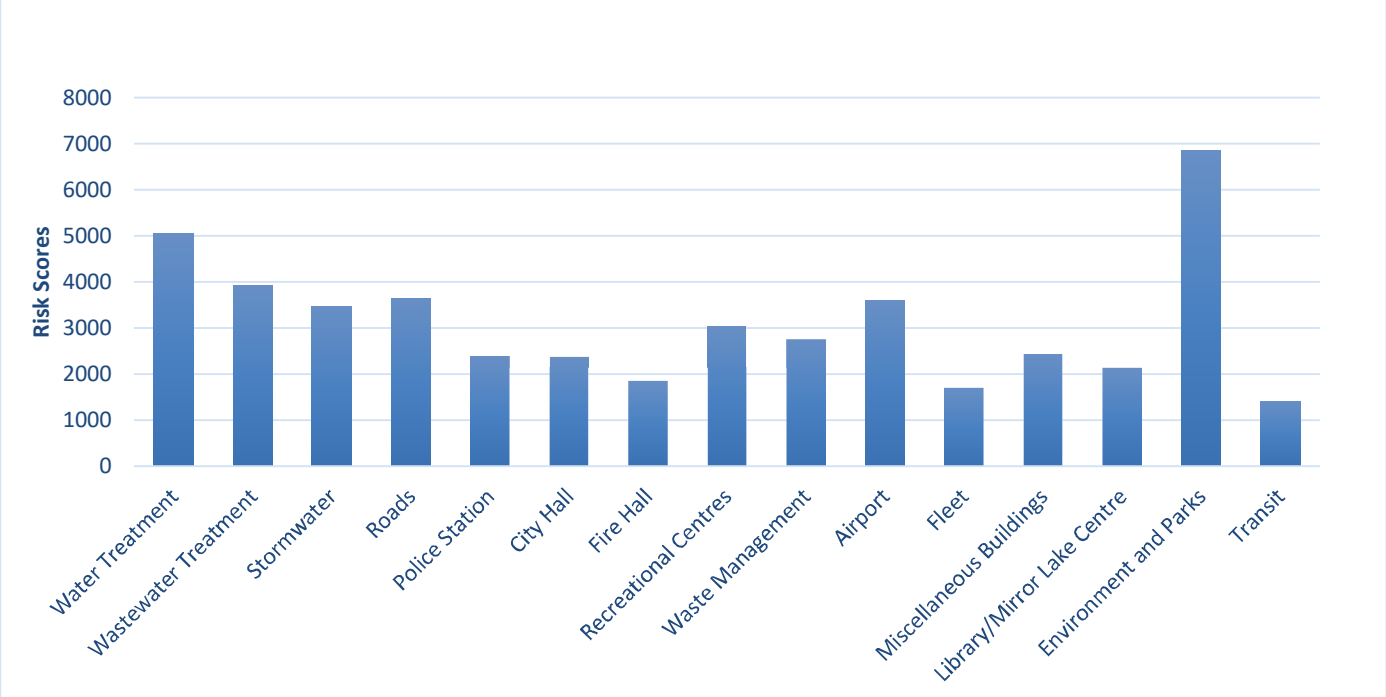
Details of the risk results are presented in **Sections 4.1** to **4.10** for each asset listed above. **Section 4.11** focused on the community (social aspects) and local economy discussion led by All One Sky Foundation. The following summarizes the risk assessment results and analysis:

1. Impacts on Built Infrastructure

Each asset has several infrastructure components (e.g., catch basins, culverts, ponds, dams, etc.) that were assessed individually, and each component has a risk score that identifies its level of vulnerability. The risk scores were dependent on the number of components being exposed to climate hazards. The total risk scores were calculated to show which components have the most risks and which climate hazards have significant impact.

Using this data, **Figure ES-4** compares the total risk scores for all of City's assets. The Figure shows that **Environment and Parks** is the most vulnerable asset when compared to the other infrastructure. **Water Treatment Systems** and **Wastewater Treatment Systems** are the next two most vulnerable assets in comparison; however, the risk scores are nearly half of the Environment and Parks as there are fewer components exposed to climate hazards. Built infrastructure including buildings, roads, bridges, and underground utilities often have lower risk scores as these structures were designed to engineering standards that consider varying historical climate impacts. These designed structures are therefore more robust compared to natural vegetation.

Figure ES-4 Overall Asset Comparison



2. Impacts on Staff, Public, and Emergency Services

Various types of climate impacts on the City staff, public and emergency services were also assessed. These three groups often showed high-risk scores and are vulnerable to the climate hazards.

- **Operations and Maintenance Staff** who work outdoors will be impacted by climate hazards. This will impact their ability to conduct tasks and expose them to various types of health and safety hazards.
- **Public Users** will be exposed to climate hazards while using the services and facilities. Examples of risks include freezing rain causing icy roads, overland flooding, fallen objects from heavy winds, cooling system unable to keep up with hot temperatures, reduction in water consumption due to drought conditions. These risks could result in adverse health impacts, bodily harm, or lost of revenue and/or property damage. Vulnerable populations may be more at risk to the adverse effects of climate hazards.
- **Emergency Services**, similar to the operations and maintenance staff, will be exposed to the various types of climate hazards while conducting their tasks. Their working conditions could be more hazardous, as they are the first respondence to any emergencies. With extreme climate events, their exposure to high level of hazards will be elevated.

3. Impacts on Community (social aspects) and Local Economy

In addition to the impacts discussed in Item 2, the highest climate impacts to the population are extended heat wave, followed by prolonged drought, high wind, hail, increase cooling and heating cost. Particularly with senior and low-income populations, they do not have the resources to guard against these climate hazards. Damage to the basic services such as utilities, communication systems, transportation disruption, property, can also have a cascading impact on people's health and well being, as well as financial impacts. Examples of consequences discussed include:

- Health impacts;
- Loss of culture;

- Loss of recreation opportunities;
- Increases costs of living;
- Increases insurance costs; and
- Lost revenues/business.

There were also outcomes noted with increasing warming trends that may provide opportunities for businesses, assets, and social aspects. These include:

- Warmer winters;
- Longer shoulder seasons; and
- Less freeze/thaw events.

Adaptation Planning

The Community Climate Adaptation Planning Guide developed by All One Sky Foundation was used in guiding the discussion. The recommended options for adaptation actions were listed in the following:

1. **No Action** – no additional actions required; business as usual.
2. **Conduct Research, Studies, or Assessments** to obtain further information on the nature of the risk to better inform the decision-making process.
3. **Update Policies, Plans, Standards, Guidelines or Bylaws** that considered climate risks and opportunities.
4. **Modify Operations and/or Maintenance Schedules, and Activities** that considered climate impacts.
5. **Build New or Upgrade Existing Infrastructure** to provide protection against climate risks.
6. **Increase Awareness and Education** to help community better understand risks and adaptation actions.
7. **Incorporate Emergency Management** such as response and evacuation planning, hazard mapping, and early warning or alert systems.
8. **Consider Human Resourcing** options and evaluate the need for additional staff time allocated to climate adaptation planning, implementation and establishing task force.

Associated Engineering facilitated the discussions during **Workshops 3A** to **3D** which identified the adaptation actions for each asset. These actions were examined for the medium to high-risk climate impacts. The discussions were summarized and tabulated in **Appendix B** for each asset. Each summary table highlights the following:

- Recommended adaptation actions;
- Time frame of implementation; and
- Climate hazards scores (medium to high-risk).

The time frames were grouped into:

- 0 to 5 years as immediate to short-term; and
- 5 to 10 years for longer term implementation.

For Socio-Economic discussion, **Table 5-1** in the main body of the report (**Section 5.2**), provided 23 recommended actions to be implemented by the City to manage high priority climate change risks affecting the local economy and community. For each recommended action, time frames were provided for implementation.

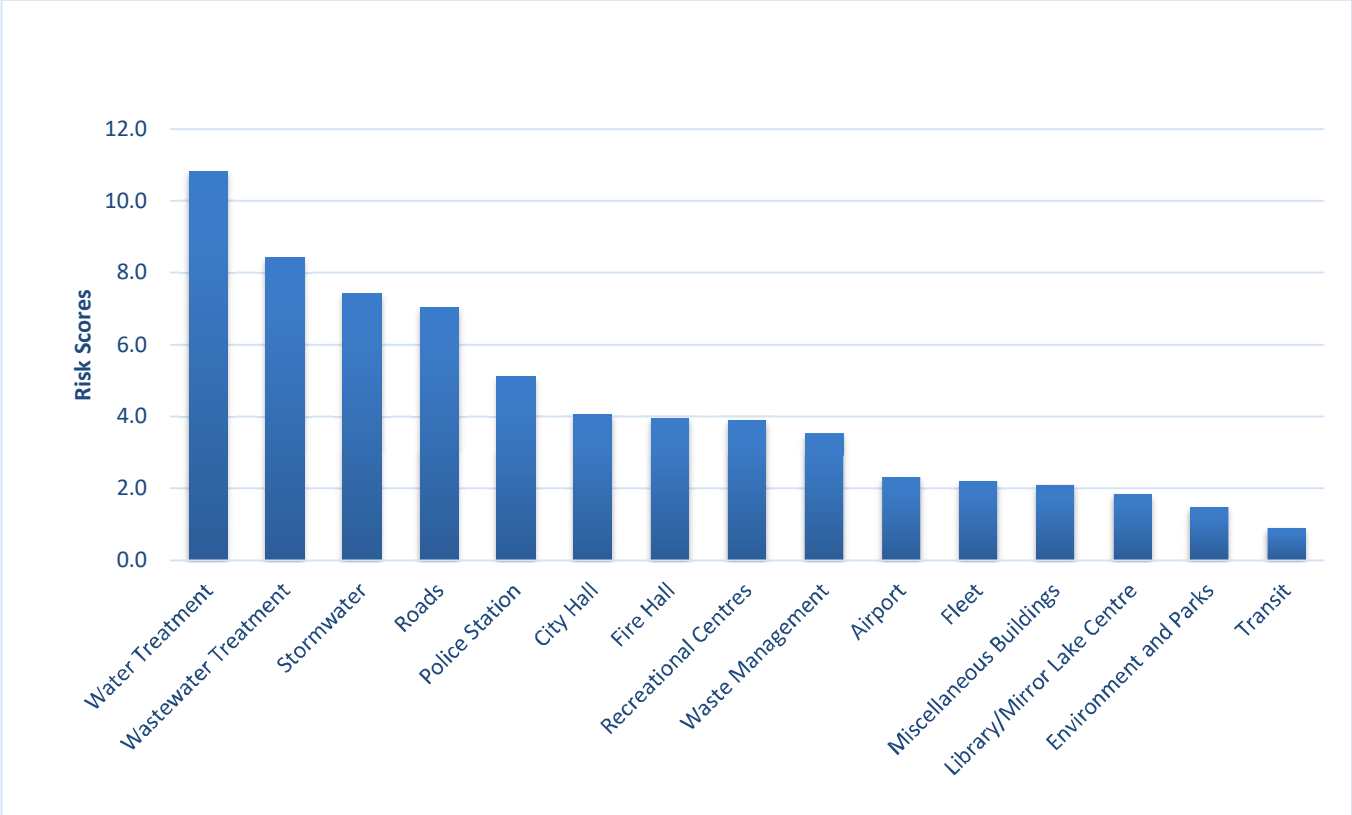
The assessment showed that out of the 23 recommended actions, 12 were relevant to Heat Management. Five of the actions have listed all climate impacts with strategies to have cross cutting effort to inform, improve communications and coordination between local organizations for more efficient response to risk reduction.

Recommendations

The risk assessments and adaptation actions provided an overview of the risk and vulnerabilities of the built infrastructure and the socio-economic aspects for the City. The assessment enabled the City to identify high-risk areas and allocate resources to take actions in preventing, reducing or eliminating potential risks. The assessment focused on the City's current condition and how the assets fared with future projected climate hazards. The following recommendations for consideration as **Next Steps**:

1. **Prioritize Actions**. The risk assessment results showed high-risk assets, and these can be priority items to address and implement risk treatment actions. When criticality scoring was applied, it showed that a high risk for one asset category becomes a lower priority. Priority rankings based on criticality of the infrastructure to the City are shown on **Figure ES-5**. A list of recommended actions has been provided for the City to consider and implement. City can consider starting with low cots actions and those that can be implemented along with planned policy or bylaw updates, and/or mainstreamed into the infrastructure renewal, community planning and development projects.

Figure ES-5 Critical Infrastructure Ranking



2. **Cross Cutting Discussion and Information Sharing.** The City is encouraged to share this information with other relevant departments and inform asset managers for future planning. Furthermore, the cross-departmental discussion can help to identify, assess, and address common problematic areas to protect assets.

Table ES-2 Cross Cutting Adaptation Actions Applicable to All Departments/Corporations

All Departments/Corporation
Increase public engagement and community awareness of climate change impacts and adaptations through public open houses, schools and other discussion forums.
Increase cross-departmental collaboration and information sharing to improve management of climate change risks and opportunities.
Increase education and public awareness of the health and safety impacts of climate change.
Create and disseminate climate related risk maps across City departments, and to residents, businesses and other organizations to support more resilient development and planning.
Develop an education and awareness program to increase understanding of the benefits of local food production, and appreciation of local food.
Employ an adaptive management approach to climate adaptation planning.
Increase staff training on climate change impacts and adaptations across all departments.

All Departments/Corporation
Increase the resilience of City buildings to climate hazards and extreme weather, for example through updates to the City's development process, including zoning, planning and permitting.
Integrate climate change science and concepts into school curriculums.
Promote densification in all City planning and developments.
Promote sharing of City maps and emergency information to improve emergency response.
Promote the use of renewable energy sources in homes and buildings.
Avoid flood prone areas through zoning, planning and development restrictions.

3. **Monitor, Assess, and Update Risk Scores and Adaptation Actions.** The City is encouraged to identify performance or tolerance threshold (e.g., temperature, precipitation) of the asset so that it provides a baseline for monitoring. As the City improves or make modifications to reduce the risks and vulnerabilities to the assets, the adaptation plans can be updated. This encourages improvements and furthering the reduction and removal of risks.
4. **Continual Review of Climate Data.** The City, overtime, should also monitor the ongoing evolution of climate projections. This will allow the City to update the risk score and evaluate its vulnerabilities and exposure based on current and science-based information. Adaptation actions will be adjusted accordingly while staying flexible and adaptable to the potential market fluctuations.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Project Background

The City of Camrose (the 'City') would like to develop an understanding of the high-risk climate vulnerabilities and risks. The results of this risk assessment will guide critical action planning for a resilient community and reducing the impacts of climate change. The City is conducting this work with funding from Municipal Climate Change Action Centre (MCCAC) Climate Resilience Capacity Building Program.

Municipal Climate Change Action Centre

A series of risk identification and assessment workshops was conducted with the City using the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol, developed by Engineers Canada. The assessment was conducted on the following assets and areas:

- Stormwater;
- Water;
- Wastewater;
- Waste Management;
- Municipal facilities;
- Fleet, Roads, Airport, and Transit;
- Emergency Management;
- Environment and Parks; and
- Community (social aspects) and Local Economy.

Further to the above list of assets, operational staff, building staff, and public users were also included in the assessment. A socio-economic risk assessment was conducted on a qualitative basis as part of the project.

1.2 Purpose

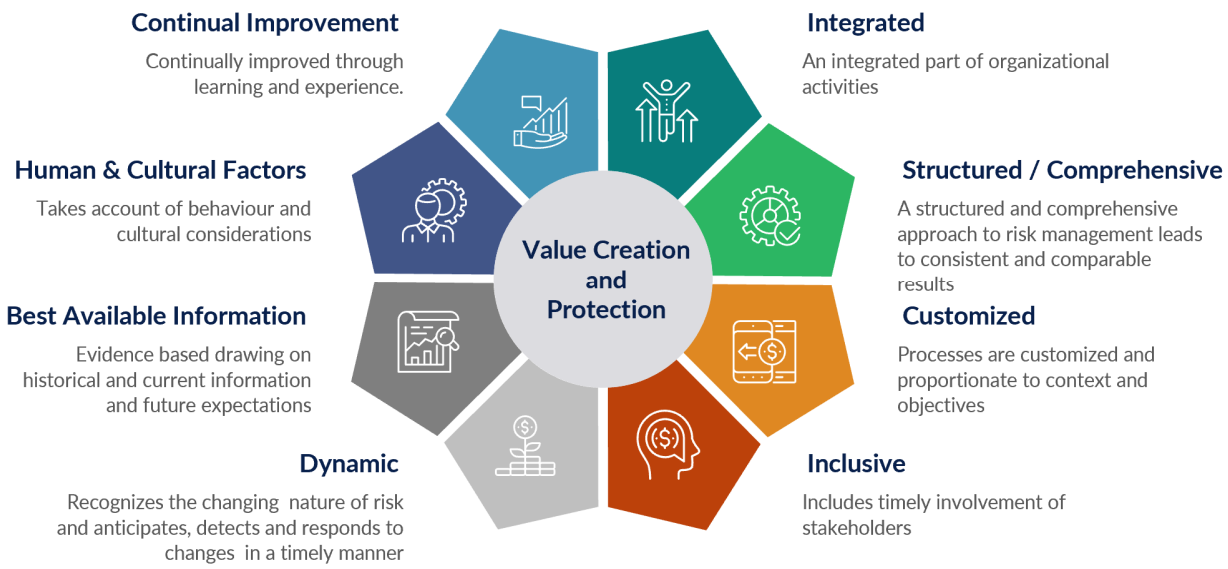
The purpose of this assessment is to conduct a climate-based risk analysis and provide an overall climate risk map for the City's key infrastructure, as noted above. The assessment is within the City's boundary as shown on **Figure 1-2**. The results of this study will assist the City to incorporate climate risks discussion and adaptive measures into future land use planning, engineering design standards, operational practices, infrastructure assessment, and human resource programming. The assessment included:

- Reviewing City's key infrastructure assets;
- Identifying a set of relevant climate hazards, stressors and trends based on present and future climate parameters that are specific to the City of Camrose;
- Evaluating the level of risk facing each infrastructure; and
- Identifying a list of high-level adaptation measures to address key risks.

1.3 International Standard Guidelines (ISO)

The risk assessment process that this project adopted is based on the ISO 31000's principles of risk management. The principles follow a systematic cycle of actions to create and protect the value of the community. **Figure 1-1** illustrates the process starting from integration of organizational activities that requires the collaboration of all departments, using a structured approach to assess risk that is customized for the appropriate context. The discussion is also inclusive and dynamic, drawing from evidence-based information. Finally, the risk management process identifies a continual improvement through leaning and experience.

Figure 1-1 Principals of Risk Management (ISO 31000)



Another ISO guideline that was consulted is ISO 14092. Our approach to the climate risk assessment employed a 'best practice' methodology, which is based on the "*Climate Resilience Express – Community Climate Adaptation Planning Guide*" (https://mccac.ca/app/uploads/CRE_Planning-Guide_Final.pdf), which was developed by All One Sky Foundation for the Municipal Climate Change Action Centre and the Climate Resilience Capacity Building Program. Our work is also aligned with the recently published International Standards Organization (ISO) guideline 14092: Adaptation to Climate Change—Requirements and guidance on adaptation planning for local governments and communities, and with the Intergovernmental Panel on Climate Change's (IPCC) latest conceptualization of climate risk assessment methods.

1.4 Assessment Limitation

Risk is defined as the product of the likelihood of the "impact" and the consequence of the "impact" on the system. The "impact" in this discussion referred to the climate change impacts or climate hazards. **Vulnerability** is defined as how the system fares against the climate hazards when exposed. It can also be viewed as the ability of the system to absorb the inundation of the climate hazards. In other words, vulnerability is the inability of a system to cope with the adverse effects of climate change and the climate variability. The sensitivity of the system when exposed to the climate change is often evaluated based on level of use, service life/age, maintenance/operations costs, and replacement costs. Adaptive capacity is assessed based on time and cost for the system to resume to its original service.

In this report, vulnerability was not assessed in detail as noted above, but only qualitatively within the consequence scoring. During consequence scoring, which took place in workshops, the City of Camrose staff were asked how their systems (infrastructure) will behave when exposed to the various climate hazards at their current conditions. Their qualitative assessment was based on their engineering/technical experience and their understanding of their assets/infrastructure. This **Qualitative Vulnerability** discussion, coupled with the risk assessment, provides an overall understanding of the current status of the City's infrastructure. This initial mapping of risk will allow the City to formulate a more focused and detailed risk and vulnerability assessment of each infrastructure components beyond this report.

The **Community (social aspects) and Local Economy** discussion in the report is qualitative in nature. The quantitative assessment is outside the scope of this project. However, the results of discussion can inform future assessment if the City chooses to assess the impacts on a monetary basis.

The **Adaptation** measures identified in this report will provide the City will potential activities to consider, plan and implement. The international standard for risk management, ISO 31000 shows the progression from Risk assessment to treatment that will require monitoring, review, consultation, and communication (**Figure 1-2**). In this project, we have taken the first step to identify risk reduction and treatment. Beyond this project, the City would then need to take the future steps to identify the site specific risk reduction strategies and activities in future details.

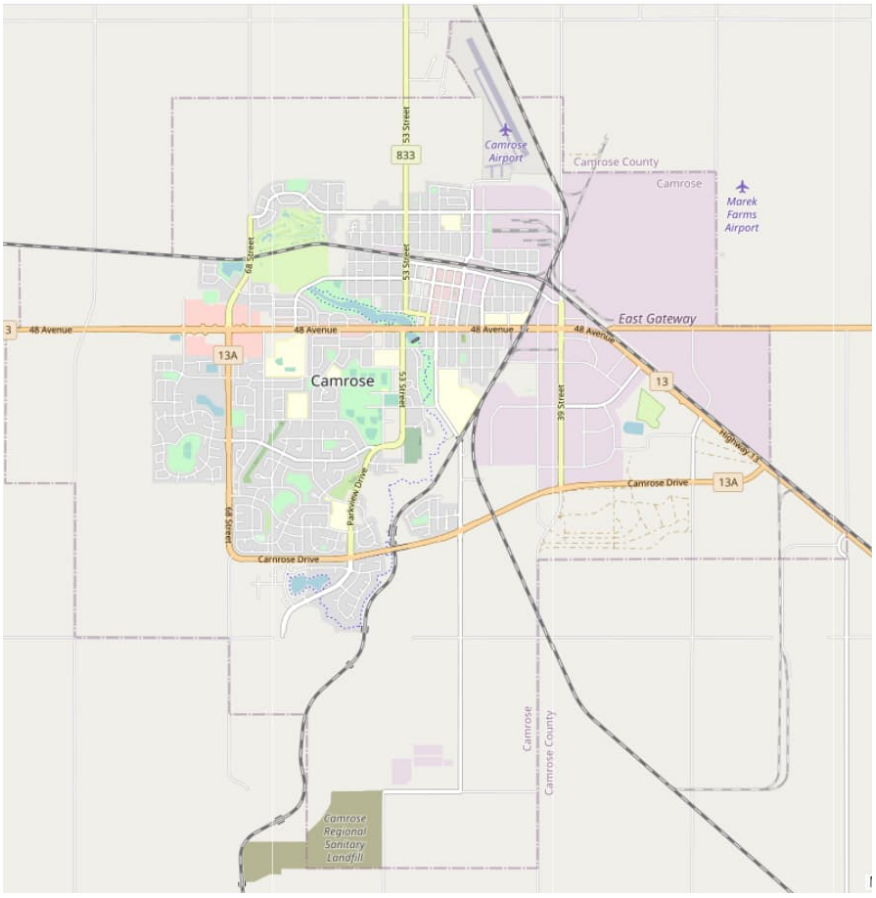
Figure 1-2 ISO 31000 Risk Management Process (High Level Screening)

1.5 Organization of the Report

This report is organized in the following way:

- **Section 2**: Provides an overview of the process undertaken for the Resilience Assessment, including the PIEVC High Level Screening (HLS) process overview and an overview of the risk analysis.
- **Section 3**: Reviews the climate trends and projections.
- **Section 4**: Outlines the assets for each infrastructure category, the risk assessment and resulting potential impacts.
- **Section 5**: Presents a preliminary list of adaptation actions.
- **Section 6**: Reviews the work completed and provides recommendations for next steps.

Figure 1-3 City of Camrose Study Boundary



1.6 Use of Report

This report is written such that the reader will only have to read the asset that is relevant to their work or operations or the risk assessment and results. The City has two uses for the report:

- Departmental with details of the assessment;
- Corporate summary that can communicated at a high level with Council and managers.

Based on this request, the following sections are as follows:

- The results and detailed discussions are found in **Section 4**. In Section 4, each asset has its own risk discussion that include the following:
  - Description of the asset components.
  - Risk assessment results based on the PIEVC HLS Tool conducted in **Workshops Series 2**. The results are presented to answer four separate questions listed in **Section 3** of this report.
- For adaptation, **Section 5**, the report shows commonality of actions and provide short, medium and long-term as the initial priority consideration.
- Lastly, **Section 6** provides recommendations for next steps for City to consider.

2 METHODOLOGY

The project was conducted in the phases shown in **Figure 2-1** below.

Figure 2-1 Project Overview

During **Project Definition, Workshop 1A**, Associated Engineering provided a discussion of climate change principles and parameters, the PIEVC High Level Screen (HLS) tools and process, and information gathering requirements. The information gathering process was mainly to understand the major components and function of City's assets. The City presented the information of the assets in **Workshop 1B**, Tell Us About Your System, which informed the subsequent **Risk Assessments, Workshop 2**.

Workshop 2 Series, Risk Assessment, consisted of five separate sessions:

- **Workshop 2A:** Water, Wastewater, Stormwater;
- **Workshop 2B:** Roads, Transit, Fleet, Airport;
- **Workshop 2C:** Facilities and Properties;
- **Workshop 2D:** Waste Management, Environment/Parks; and
- **Workshop 2E:** Community (social aspects) and Local Economy.

Workshop 3 Series, Risk Reduction/Treatment (Adaptation), was conducted in the following sessions:

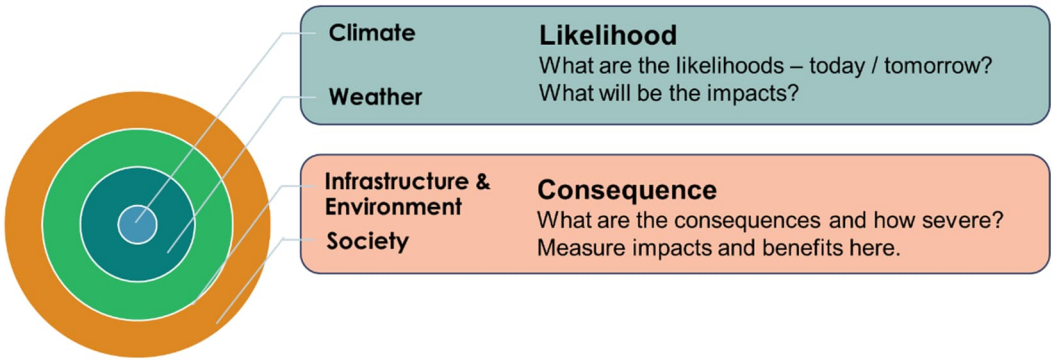
- **Workshop 3A**: Water, Wastewater, Stormwater;
- **Workshop 3B**: Road, Fleet, Transit and Airport;
- **Workshop 3C**: Waste Management, Environment/Parks;
- **Workshop 3D**: Facilities and Properties; and
- **Workshop 3E**: Community (social aspects) and Local Economy.

2.1 Risk Identification and Assessment

Risk, in general, is discussed in terms of likelihood and consequences. The likelihood is described as the hazards, events or conditions that could occur, and consequence as the result occurring in varying levels of negative or positive impacts or effects. In quantitative terms, risk is evaluated as the product of the likelihood and consequence.

In terms of climate risk, we begin to understand how the variability of climate patterns impact the built environment and environment, and in turn, how this impacts the society. This can be illustrated in **Figure 2-2** below.

Figure 2-2 Risk Inputs



For this project, the PIEVC HLS tool was used in assessing the built infrastructure. The socio-economic risk assessment used the same risk concept, but the PIEVC Tool was not used. The methods are discussed in the following sections.

2.2 Assets Identification

The municipal owned assets that were assessed are:

- Water;
- Wastewater;
- Stormwater;
- Waste Management;
- Municipal facilities;
- Fleet, Roads, and Transit;
- Airports;
- Environment;
- Emergency management;
- Public users; and
- Operational staff.

While **Emergency Management** is not a "built" asset, this service is are critical to the function of the City. During the workshops, Emergency Services were included in all categories and assessed for risks. Similarly, **operational staff, and public users** are included in the risk assessment.

2.3 Climate Likelihood Scoring

The likelihood scoring in PIEVC High Level Screening was based on the climate projections. The climate parameter trends and projections were translated into likelihood scores (L), with increasing/decreasing values reflecting increasing/decreasing occurrence over the specified time horizon. Translation into likelihood scores normalized the various climate change trend measures into a common numerical ranking. For each climate parameter, an appropriate likelihood score was applied to determine the direction-of-change for potential impact. **Table 2-1** lists the method for determining climate likelihood scores. For the City of Camrose assessment, we have used the PIEVC Middle Baseline Approach for likelihood scoring.

Table 2-1 PIEVC Likelihood Scoring

Likelihood Score (L)	Middle Baseline Approach - Establish Base	Method
1 2	▲	Likely to occur less frequently than current climate
3	Establish Current Climate Baseline Per Parameter	Likely to occur as frequently as current climate
4 5	▼	Likely to occur more frequently than current climate

2.4 Consequence Scoring

Using the defined infrastructure and climate parameters, this assessment was completed by evaluating the consequences of an interaction between each climate parameter and infrastructure component. The determination of consequence was guided by a simplified PIEVC technique shown in Table 2-2.

Table 2-2 PIEVC Consequence Scoring Method

Score	Consequence
0	No effect
1	Insignificant
2	Minor
3	Moderate
4	Major
5	Catastrophic

2.5 Risk Scoring

Using the likelihood and consequence scoring, the final risk score for each infrastructure component falls on a scale between **0 and 25** (refer to **Figure 2-3**):

- **Between 0 and 9** are considered **low risk**;
- **Between 10 and 19** are considered **medium risk** (yellow); and
- **Between 20 and 25** are considered **high-risk** (**red**) items.

Upon completion of the risk assessment, the **risk scores** across all climate-infrastructure interactions were assessed.

This review was completed to establish confidence in the professional judgement employed in the process, as well as to identify any unexpected or surprising results in terms of risk. Unexpected results were not necessarily erroneous, as they highlighted where climate changes were anticipated to introduce new issues and challenges.

The results of the assessment for each infrastructure category were compiled on a master worksheet, along with comments on the rationale for individual component consequence scoring as shown the example Figure below. **Section 4** describes the results of the assessment

	CONSEQUENCE							
5		Catastrophic	0	5	10	15	20	25
4		Major	0	4	8	12	16	20
3		Moderate	0	3	6	9	12	15
2		Minor	0	2	4	6	8	10
1		Insignificant	0	1	2	3	4	5
0		No Effect	0	0	0	0	0	0
			Negligible Not Applicable	Highly Unlikely Improbable	Remotely Possible	Possible Occasional	Somewhat Likely Normal	Likely Frequent
			LIKELIHOOD					
			0	1	2	3	4	5

Figure 2-3 Risk Assessment Matrix Example Scoring

Figure 2-4 Example – Risk Assessment Worksheet

CITY OF Camrose

Risk Assessment Worksheet

Consequence Score
0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

			Temperature																	
			Summer Mean Daily Temp (°C)				Winter Mean Daily Temp (°C)				Days above +30°C				Warmest Maximum Temperature (°C)					
			Summer Mean				Winter Mean				Very Hot Days				Hottest Day					
Climate Projections (RCP 8.5)		Baseline	15.7	3			-12	3			4	3			31.2	3				
		2050	17.7	4			-9.4	2			12	4			33.6	4				
		2080	19.9	5			-7	2			27	5			36.2	5				
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R		
3	Landfill (O&M considerations) (contracted)	Baseline		3		0		3		0		3		9		3		9		
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		
		2080		5		0		2		0		5		15		5		15		
4	Recycling Facility (contracted)	Baseline		3		0		3		0		3		6		3		6		
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8		
		2080		5		0		2		0		5		10		5		10		
4	Public / Customers	Baseline		3		0		3		0		3		9		3		9		
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		
		2080		5		0		2		0		5		15		5		15		
6	Future Transfer Station - Indoor	Baseline		3		0		3		0		3		9		3		9		
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		
		2080		5		0		2		0		5		15		5		15		
6	Future Transfer Station - Outdoor	Baseline		3		0		3		0		3		9		3		9		
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		
		2080		5		0		2		0		5		15		5		15		

2.6 Community (Social) and Local Economy Assessment

For this category, the PIEVC High Level Screen (HLS) tool was not used as it is more suited for built infrastructure. All One Sky Foundation, our sub-consultant, conducted a qualitative risk assessment with the City that considered climate related events and trends that could result in direct and indirect impacts to the people. Similar to the PIEVC HLS tool, this process also used the basic concept of **Risk is a product of Likelihood and Consequence**. Note the assessment was limited to:

- Impacts arising from projected climate changes to the **2060s (2051-2080)** time period, under a **high greenhouse gas emissions scenario** (RCP 8.5)[1].
- Impacts within the geographic boundaries of the City of Camrose.
- **Impacts related to changes in the climate**. The assessment did not consider impacts related to, for example, provincial policy or legislative changes, broad economic impacts, or impacts related to demographic or population changes that might affect the workforce, etc.
- **Impacts on the City of today.** While climate projections were considered out to the 2060's, the changes were considered in terms of the City today, in terms of exiting development, land use patterns and resource capacity. The goal was to overlay the future climate on the Camrose of today. Doing so, allowed the climate adaptations to be determined and implemented within the City's timeline.
- **Impacts that are worsening (becoming more frequent or severe) as a result of climate change**. Climate change impacts that are improving with climate change, such as extreme cold events, snowstorms, and freeze-thaw cycles, were not included within this scope. Climate change may also provide some benefits, in terms of increased opportunities for recreation or agriculture. These potential benefits were also excluded.

[1] RCP (Representative Concentration Pathway) 8.5 is a "business as usual" scenario and assumes that world greenhouse gas emissions continue to increase at current rates through the end of the century.

The **Climate Risk Assessment Method** involved:

1. Identifying potential climate change impacts. These are the 'climate impact scenarios' outlined in **Section 3**.
2. Assigning a likelihood score to each climate impact scenario using the scale at **Table 2-3**. Likelihood scores were calculated for each climate impact scenario based on modelled climate change projections for the City, historic event occurrence, published research/studies, and/or professional judgement of the project team.
3. Assigning a consequence score to each climate impact scenario using the scale at **Table 2-4**. The consequences of each climate impact scenario were discussed, and a score assigned, at the Workshop on October 6, 2022.
4. Combining the likelihood and consequence scores to produce an overall risk score for each climate impact scenario.

Table 2-3 Likelihood Scale

Score	Descriptor	Likelihood/Probability
1	Rare	Impact scenario is expected to happen less than once every 100 years (annual chance < 1% in 2050)
2	Unlikely	Impact scenario is expected to happen about once every 51-100 year (1% ≤ annual chance < 2% in 2050)
3	Possible	Impact scenario is expected to happen about once every 11-50 years (2% ≤ annual chance < 10% in 2050)
4	Likely	Impact scenario is expected to happen about once every 3-10 years (10% ≤ annual chance < 50% in 2050)
5	Almost Certain	Impact scenario is expected to happen once every two years or more frequently (annual chance ≥ 50% in 2050)

Table 2-4 Consequence Scale

Score	Descriptor	Description
(1)	**Very low**	• Negligible impact on health & safety and quality of life for residents. • Very minimal impact on local economy. • Financial loss equal to <1% tax impact. • Negligible impact on vulnerable groups (low income, seniors, rants, older adults, children, vulnerable occupations, persons with disabilities and persons with pre-existing chronic medical conditions) and on existing disparities, inequalities and deprivation.
(2)	**Low**	• Low impact on health & safety and quality of life for residents. • Minimal impact on local economy. • Financial loss equal to >1% tax impact. • Minimal impact on vulnerable groups (low income, seniors, rants, older adults, children, vulnerable occupations, persons with disabilities and persons with pre-existing chronic medical conditions) and on existing disparities, inequalities and deprivation.
(3)	**Medium**	• Some injuries, or modest temporary impact on quality of life for some residents. • Temporary impact on income and employment for a few businesses, or modest costs and disruption to a few businesses. • Financial loss of between 3% and 5% tax impact. • Some vulnerable groups are disproportionately affected, exacerbating existing disparities, inequalities and deprivation. • Short-term community interruption and/or localized evacuations.
(4)	**High**	• Serious injuries or illnesses, some fatalities, or long-term impact on quality of life for most residents. • Mid to long-term impact on businesses and economic sectors, major economic costs or disruption. • Financial loss equal to >5% tax impact. • Numerous vulnerable groups are significantly affected resulting in long-term increases in existing disparities, inequalities and deprivation. • Mid to long-term community interruption and/or widespread evacuations.
(5)	**Very high**	• Many serious injuries or illnesses, some fatalities, or long-term impact on quality of life for most residents. • Long-term impact on businesses and economic sectors, major economic costs or disruption. • Financial loss equal to >10% tax impact. • Large vulnerable groups are significantly affected resulting in long-term increases in existing disparities, inequalities and deprivation. • Long-term community interruption and/or widespread evacuations.

The end result of the risk assessment was a climate risk matrix (**Table 2-5**), which delineated between risks that pose an unacceptable threat to the City, and those that do not. The results of the climate risk assessment are provided in **Section 4**.

Table 2-5 Risk Matrix

CONSEQUENCE						
	Very High	MEDIUM	MEDIUM	HIGH	VERY HIGH	VERY HIGH
	High	MEDIUM	MEDIUM	HIGH	HIGH	VERY HIGH
	Medium	LOW	MEDIUM	MEDIUM	HIGH	HIGH
	Low	VERY LOW	LOW	LOW	MEDIUM	MEDIUM
	Very Low	VERY LOW	VERY LOW	LOW	LOW	LOW
		Rare	Unlikely	Possible	Likely	Almost Certain
		LIKELIHOOD				

3 CLIMATE PROJECTIONS

3.1 Climate Data

The climate data availability within Canada has rapidly evolved and access to datasets are now more readily available and organized for use; Canada has several data sources where historical climate data and future climate projections can be obtained. The PIEVC High Level Screen (HLS) Guideline indicated that although Climate data are now available in higher spatial and temporal resolution, there are remaining differences in availability of historical climate data sets may lead to gaps in overall understanding of baseline climate information for some climate parameters and geographic areas. When this occurs, it is possible to use proxy datasets and modelled data to cover the gaps. Complex parameters include wind gusts, extreme and complex precipitation events, snowfall. **Table 3-1** lists the climate data sources available. For this Assessment, the Climate Atlas of Canada and Climate Data Canada were used to obtain data and projections.

Table 3-1 Climate Data Sources

Climate Portal Name	Source	Link
Climate Atlas of Canada	Prairie Climate Centre	https://climateatlas.ca
Climate Data Canada	Environment and Climate Change Canada/ OURANOS/ CRIM/ PCIC/ Prairie Climate Centre	https://climatedata.ca
Downscaled Climate Scenarios	Environment and Climate Change Canada	https://climate-change.canada.ca/climate-data/#/
PCIC Plan 2 Adapt	Pacific Climate Impacts Consortium	https://www.pacificclimate.org/analysis-tools/plan2adapt
PCIC Climate Explorer	Pacific Climate Impacts Consortium	https://www.pacificclimate.org/analysis-tools/pcic-climate-explorer
Ouranos Climate Portraits	Ouranos Consortium	https://www.ouranos.ca/climate-portraits

3.2 Timescale and Parameters

The infrastructure assessed have varying lifecycles ranging from 15 to 100 years from present. **Table 3-2** shows the typical lifecycle of assets as a starting point for risk assessment.

Table 3-2 Typical Lifecycle

Elements	Expected Lifecycle
• Dams/Water Supply	• Base system 50-100 yrs. • Refurbishment 20-30 yrs. • Reconstruction 50 yrs.
• Storm/Sanitary Sewer	• Base system 100 yrs. • Major upgrade 50 yrs. • Components 25-50 yrs.
• Roads/Bridges	• Road surface 10 -20 yrs. • Bridges 50-100 yrs. • Maintenance annually • Resurface concrete 20-25 yrs. • Reconstruction 50-100 yrs.
• Houses/Buildings	• Retrofit/alterations 15-20 yrs. • Demolition 50-100 yrs.

For this project, the time horizons for assessment were chosen to align with the design life/expected lifecycle of the infrastructure, or period of time before a planned retrofit or reassessment of climate impacts. This assessment considered the following climate periods:

- 2020s (2020 – 2040) i.e., current conditions
- 2050s (2041 – 2070)
- 2080s (2071 – 2100)

Parameters were selected based on potential ongoing and future impacts to the physical infrastructure, as well as impacts to operation and maintenance. In all cases, the Representative Concentration Pathway 8.5 (RCP8.5, i.e. upper-end, business as usual) scenario was chosen to reflect a worse-case scenario for the infrastructure. Climate parameters investigated in this assessment are noted in **Table 3-3** below:

Table 3-3 Climate Parameters

Climate Parameters	Climate Sub-Parameters
Temperature	• Summer Mean Daily Temp (◦C) • Winter Mean Daily Temp (◦C) • Days above +30°C • Warmest Maximum Temperature (◦C) • Days below -30°C • Coldest Minimum Temperature (◦C) • # Freeze/Thaw Events
Precipitation	• Annual Total Precipitation (mm) • Maximum 5-day Consecutive Precipitation (mm) • Maximum One-Day Precipitation (mm)

Climate Parameters	Climate Sub-Parameters
	• Winter Precipitation • Severe Summer Hail Days (% Change Relative to Present) • Years >/= 1 Freezing Rain Warnings • Drought - Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)
River Flooding	• River Flooding • Creek Flow
Wildfire	• Wildfire Risk - Climate Moisture Deficit • Wildfire Smoke - Climate Moisture Deficit
Heavy Winds	• Mean # days/year with Daily Peak Wind >70 km/h
Tornado	• Tornado
Lightning	• Lightning
Biodiversity	• Insect, invasive plants and disease

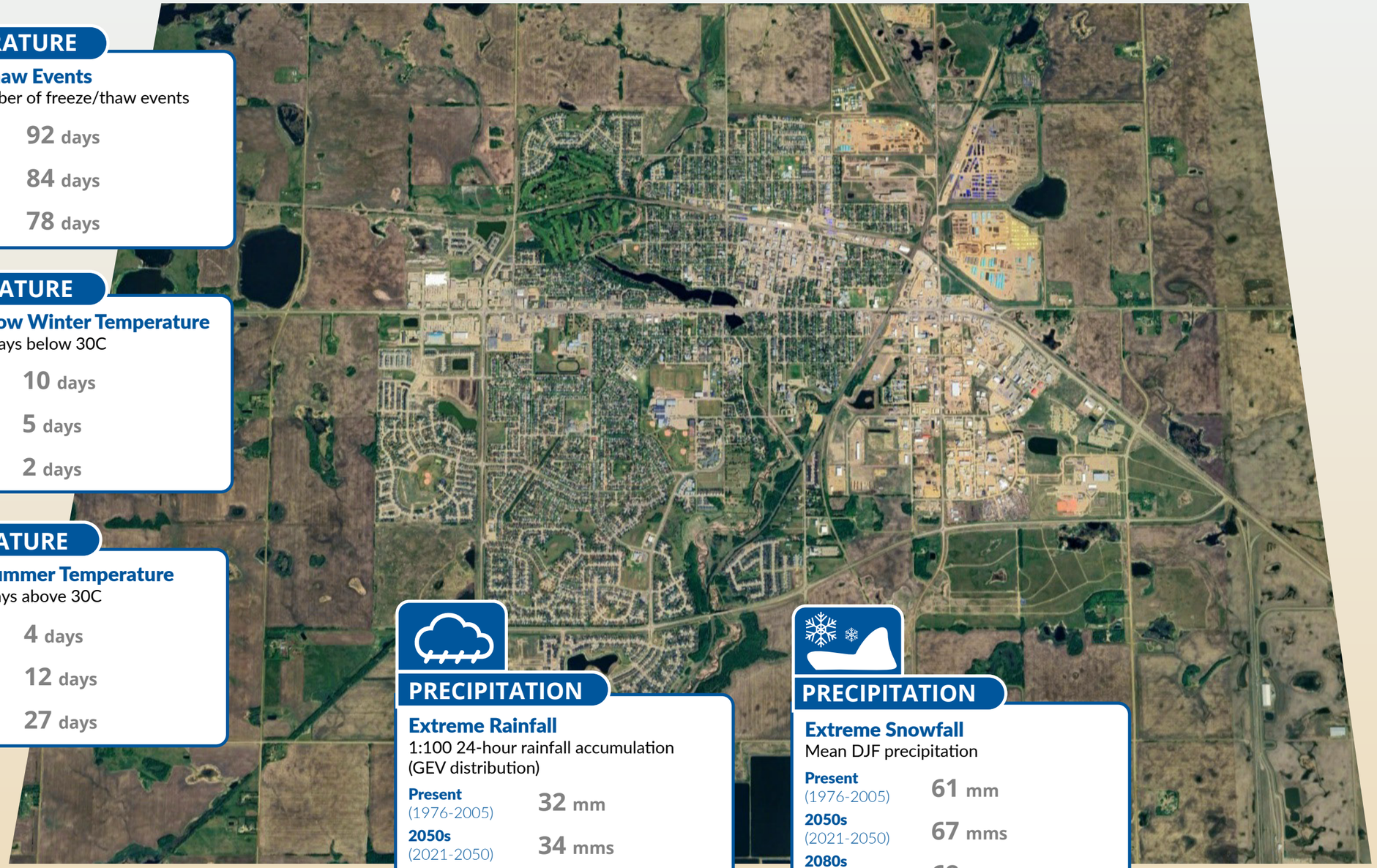
For all parameters, quantitative present and future values were determined from reputable and widely used national climate data sources, and peer-reviewed scientific literature. Datasets were sourced to be as relevant as possible to identified infrastructure vulnerabilities. The most proximal data and was used, and a consistent approach with gridded data extraction was maintained. Estimates of future changes to climate parameters that have potential to impact the City come with varying levels of uncertainty. Details climate data and projections for each Climate parameter for each timeframe are included in the risk assessment worksheets. See **Appendix A**.

3.3 Climate Project Assumptions

The following assumptions should be noted with respect to the climate assessment:

- The temporal and spatial scale of global climate models can only simulate patterns on very large scales, resulting in a need for site specific downscaling studies that were not completed for the assessment.
- There is the potential for individual models to produce baseline values that are possibly inaccurate (e.g., too warm or cold, too wet or dry, or have difficulty reproducing specific parameters).
    - Note: This inaccuracy was reduced through the creation of a spread of projected values from the accumulation of many climate models.
- The climate downscaling procedure implemented in the Climate Atlas of Canada, and other sources noted, may under- or over-estimate climate parameters have used in this project.
- The Assessment did not account for cumulative effects of multiple climate events occurring concurrently.
- The Assessment should be updated based on new specific climate projections when they are available.

City of Camrose
Climate Projections



TEMPERATURE

Freeze/Thaw Events

Annual number of freeze/thaw events

Present (1976-2005)	92 days
2050s (2021-2050)	84 days
2080s (2051-2080)	78 days

TEMPERATURE

Extreme Low Winter Temperature

Number of days below 30C

Present (1976-2005)	10 days
2050s (2021-2050)	5 days
2080s (2051-2080)	2 days

TEMPERATURE

Extreme Summer Temperature

Number of days above 30C

Present (1976-2005)	4 days
2050s (2021-2050)	12 days
2080s (2051-2080)	27 days

PRECIPITATION

Extreme Rainfall

1:100 24-hour rainfall accumulation (GEV distribution)

Present (1976-2005)	32 mm
2050s (2021-2050)	34 mms
2080s (2051-2080)	35 mm

PRECIPITATION

Extreme Snowfall

Mean DJF precipitation

Present (1976-2005)	61 mm
2050s (2021-2050)	67 mms
2080s (2051-2080)	68 mm

4 RISK ASSESSMENT RESULTS

The risk assessment workshops were conducted in-person by Associated Engineering (Workshop 2A to 2D series) between October 5 and 6, 2022. The community (social aspect) and local economy risk assessment (Workshop 2E) was facilitated by our sub-consultant, All One Sky Foundation, with City's representatives.

Specific to the built infrastructure, the results for each infrastructure components aimed to answer the following **four key questions**:

1. ***Which infrastructure components are the most vulnerable?*** Based on above average total risk score of the components (calculated by averaging total risk scores from Present Day to 2080s).
2. ***Which climate hazards have the highest impacts on the infrastructure?*** Based on high total risk score above average.
3. ***What are the other individual infrastructure components with high-risk scores that are noteworthy?***
4. ***What is the climate risk score trend from current to 2080s timescale?***

The **first two key questions** illustrate which climate hazards may impact the asset the most and where efforts should be allocated. These were identified using average risk scores.

The **third key question** identified other individual asset components of high-risk scores (over 20) that were noteworthy.

The **last key question** showed that the interactions of the assets with climate hazards were generally low score for the current timescale, and it was not until the 2050s where medium risk scores began to show and increase to high-risk scores in the 2080s as climate change impacts were estimated to become more severe. However, some climate hazards showed a downward trend impact on the assets.

Sections 4.1 to **4.10** provide the risk assessment results for the built infrastructure with figures and tables to present the information. The socio-economics discussion is in **Section 4.11**. A summary is provided at the end of this Section.

4.1 Water Treatment System

The water treatment system provided by the City is as follows:

Components	Description
Raw Water Intake and Pump Station	Commissioned in 2016
Raw Water Distribution Main	14.5 km of 500 mm PVC, service Life of 80 years
Water Treatment Plant	Commissioned in 1988, service life of 50 years
High Lift Pump Station #2/Reservoir	1966, service life of 60 years
High Lift Pump Station #3/Reservoir	1983 (north), 1922 (south), service life of 60 years
Duggan Park Booster Station	1987, service life of 60 years
Water Mains (includes hydrants and valves)	170 km, service life of 75 years for AC, over 100 years for PVC pipes

For the purpose of the assessment, the following components were also included:

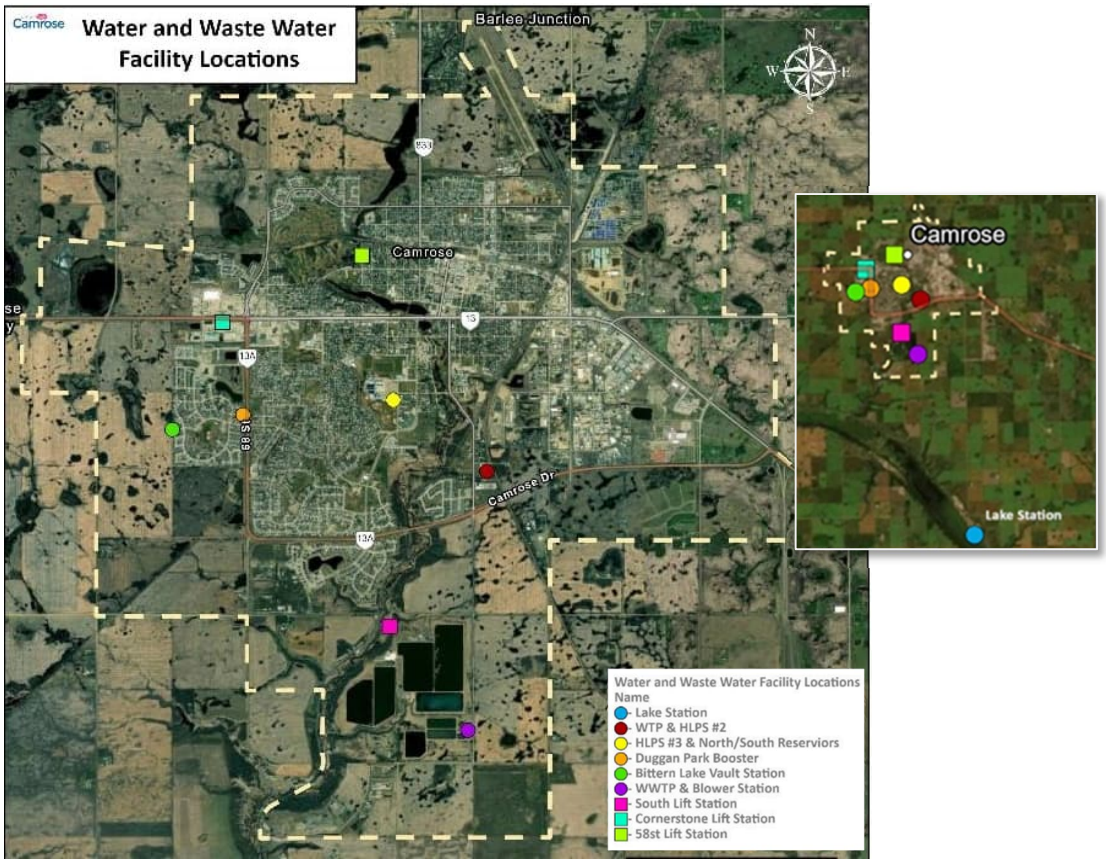
- Driedmeat Lake;
- Communication/SCADA;
- Building/HVAC;
- Operations and Maintenance staff;
- Public/customers; and
- Emergency services.

The City also identified the following potential changes that would affect the Water system:

- Population growth – increased demands, accelerate timing of treatment / pumping upgrades;
- Land use development – unplanned demands, supply issues, license limitations;
- Changes to standards and regulations triggering upgrades – anticipated and unanticipated;
- Water treatment plant component capacity upgrades; and
- Potential shift to a regional water supply.

Figure 4-1 shows the overall site location of the Water systems

Figure 4-1 Overall Water and Wastewater Facility Locations



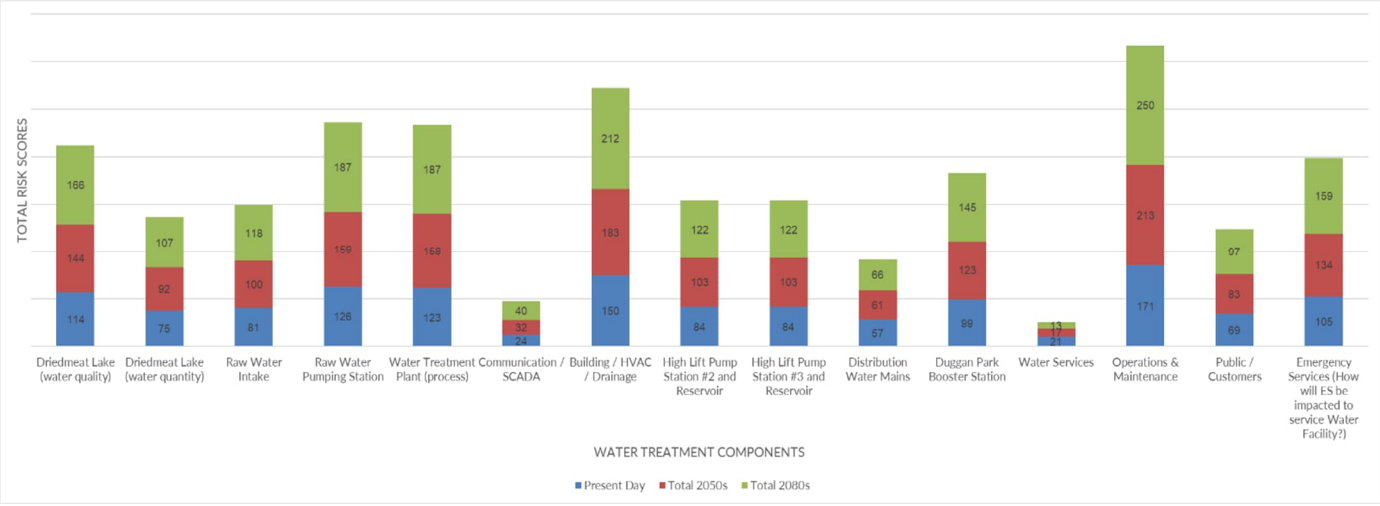
The Master Risk Assessment for Water system is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable?*** The Average Total Risk Score from Present Day to 2080s is 336. The vulnerable components that scored above are 336 is listed in **Table 4-1** and illustrated on **Figure 4-2**.

Table 4-1 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Operations and Maintenance (Staff)	171	213	250	**634**
Building/HVAC/Site Drainage	150	183	212	**545**
Raw Water Pump Station	126	159	187	**472**
Water Treatment Plant (Process)	120	154	182	**456**
Driedmeat Lake (Water Quality)	114	144	166	**424**
Duggan Park Booster Station	99	123	145	**367**

Figure 4-2 Water System Components Overall Risk Score



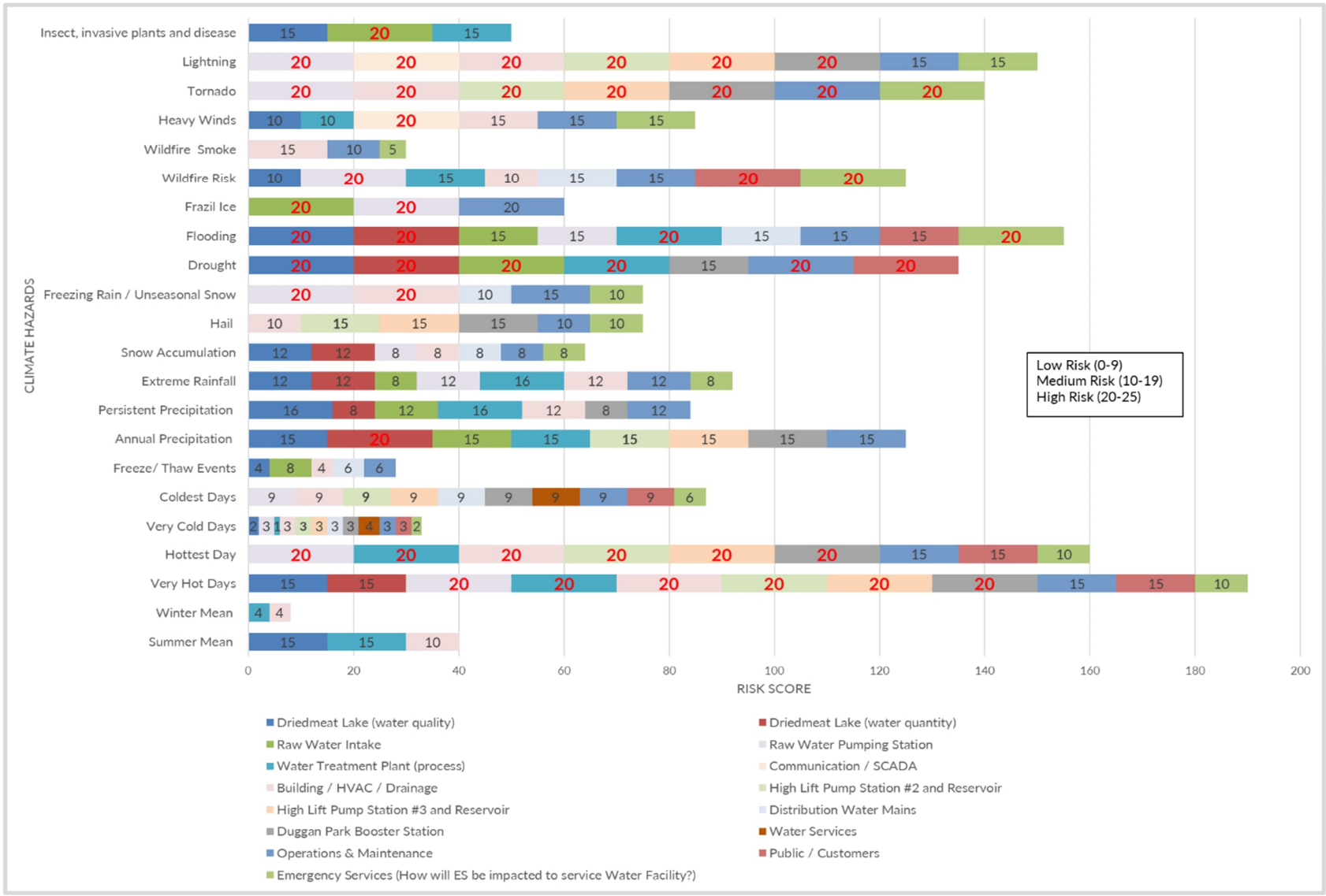
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** The top climate hazards that have total risk scores above the calculated average are identified on **Table 4-2** and illustrated on **Figure 4-3** with Water Systems components and risk scores identified. **Table 4-2** also described the discussed impacts due to the climate hazards.

Table 4-2 Top Climate Hazards

Climate Hazards	Water System Component Impact	Impacts
Very Hot Days (Days above +30C)	• Driedmeat Lake (Water Quality and Quantity) • Raw Water Pumping Station • Water Treatment Plant (process) • Building/HVAC/Site Drainage • High Lift Pump Station 2/Reservoir • High Lift Pump Station 3/Reservoir • Duggan Park Booster Station • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• Poor water quality impacting treatment system. • Equipment failure from overheating. • Increased ventilation and cooling system for buildings, thus increased use of energy. • Staff are stressed under severe working conditions. Reduction in efficiency and time. • Increase demand resulting in water conservation/restriction of water use.
Hottest Days Warmest Max. Temp.	• Raw Water Pumping Station • Water Treatment Plant (process) • Building/HVAC/Site Drainage • High Lift Pump Station 2/Reservoir • High Lift Pump Station 3/Reservoir • Duggan Park Booster Station • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• Similar impacts to Very Hot Days.
Flooding	• Driedmeat Lake (Water Quality and Quantity) • Raw Water Pumping Station • Water Treatment Plant (process) • Raw Water Intake • Distribution Water Mains • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• Impact water quality and disrupt treatment system. • Damage infrastructure or temporary shut-downs (e.g. roads, water distribution, etc.) • Impede/shut down of services until infrastructure is restored. • Staff will be required to attend to emergency response system to restore the water systems for public use. Staff resource may be stressed. • Financial cost of restoring the infrastructure.
Lightning	• Water Treatment Plant (process) • Communications/SCADA • Building/HVAC/Site Drainage • High Lift Pump Station 2/Reservoir • High Lift Pump Station 3/Reservoir • Duggan Park Booster Station • Operations & Maintenance (staff) • Emergency Services	• Potentially impact all electrical systems or damage to the sensitive systems. • Damage to infrastructure resulting in temporary shut down until the service is restored. • Financial cost of restoring the infrastructure • Increase need of emergency services.

Climate Hazards	Water System Component Impact	Impacts
Tornado	• Raw Water Pumping Station • Building/HVAC/Site Drainage • High Lift Pump Station 2/Reservoir • High Lift Pump Station 3/Reservoir • Duggan Park Booster Station • Operations & Maintenance (staff) • Emergency Services	• Severe damage to infrastructure and prolonged period of restoration and reconstruction. • Large financial cost of restoring and reconstruction the infrastructure. • Emergency Service and O&M staff main effort are to restore public safety and services.
Drought	• Driedmeat Lake (Water Quality and Quantity) • Water Treatment Plant (process) • Raw Water Intake • Duggan Park Booster Station • Operations & Maintenance (staff) • Public/Customers	• Impact on water quantity and quality which will impact the treatment process. • Reduced available water for consumption – impact public health. • Water level drops impacts the efficiency of pumps or render pumps unusable. • Public would need to observe water conservation policies.
Annual Total Precipitation (increasing)	• Driedmeat Lake (Water Quality and Quantity) • Raw Water Intake • Water Treatment Process • High Lift Pump Station 2/Reservoir • High Lift Pump Station 3/Reservoir • Duggan Park Booster Station • Operations & Maintenance (staff)	• Impact water quantity and quality which in turn will impact water treatment system, pumping system and water intake. • Increase operations and maintenance needs.
Wildfire Risk	• Raw Water pumping Station • Water Treatment Plant • Distribution water mains • Operations & Maintenance (staff) • Emergency Services	• Interruption to water treatment system with distribution lines need to be serviced to bring back to service (e.g. chlorination, flushing). • Emergency Service and O&M staff main effort are to restore public safety and services. • Financial cost of restoring and reconstruction the infrastructure.

Figure 4-3 Risk Score Based on Climate Hazards for 2080s

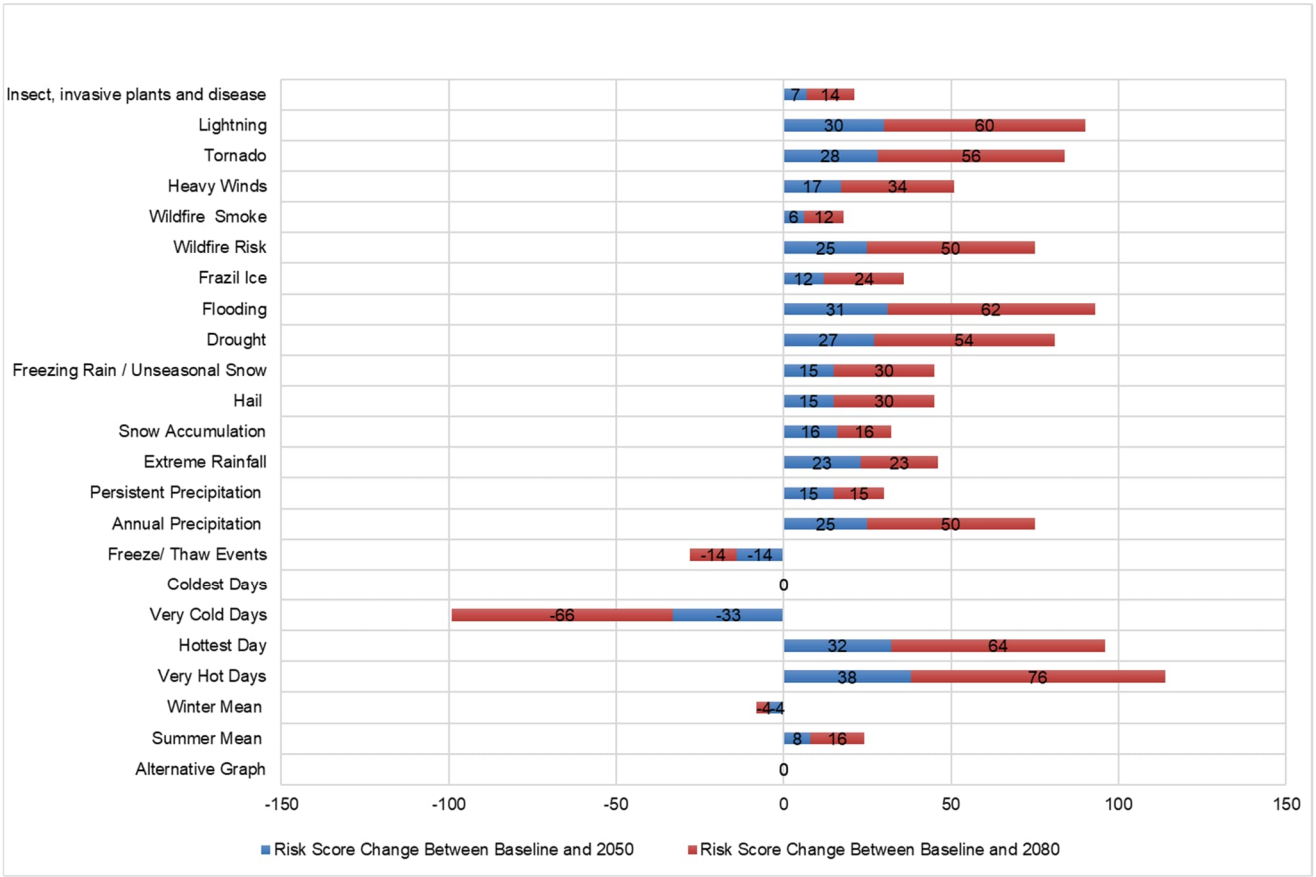


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure
Wildfire Risk	Raw Water Pumping Station
Frazil Ice	Raw Water Intake Raw Water Pumping Station
Freezing Rain/Unseasonal Snow	Raw Water Pumping Station Building HVAC/Site Drainage
Invasive species	Raw Water Intake

4. ***What is the climate trend from current to 2080s timescale?*** **Figure 4-4** shows the current as the baseline, and the 2050s and 2080s are noted as delta or change from the baseline. The Figure shows the top climate hazards will continue to impact the infrastructure with an increasing risk score. On the contrary, climate hazards such as Freeze/thaw Events, Very Cold Days, Winter Mean are showing downward trend as the climate is warming. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-4 Climate Trends (Deltas)



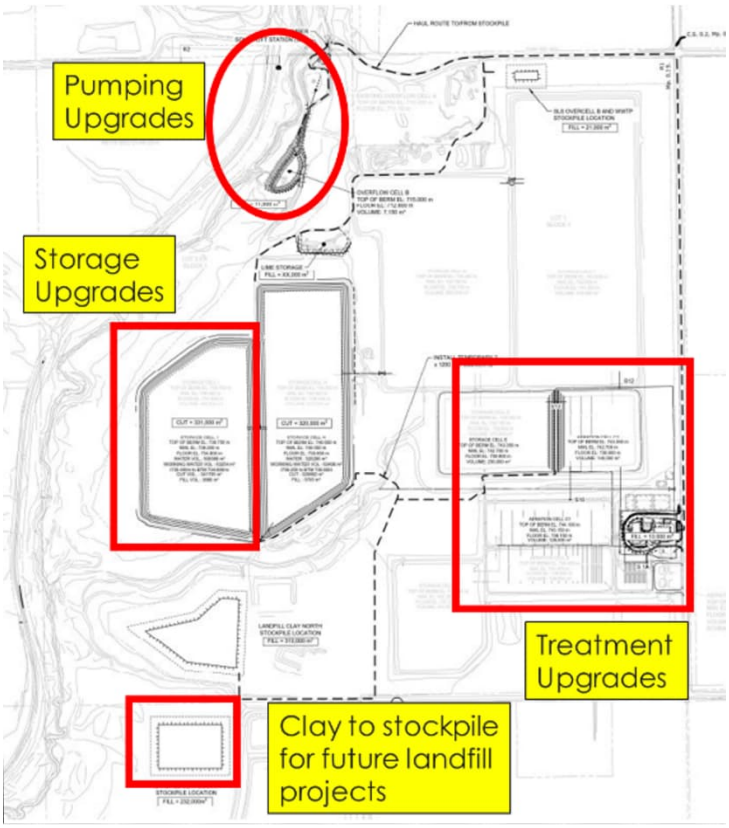
4.2 Wastewater System

The City provided the following information for the wastewater system:

Components	Description
Collection Mains	145 km
Forcemains	3 km, Service Life of 50 years
59 Street/50 Avenue Lift Station	Constructed in 1056; rebuilt in 2006
Cornerstone Lift Station	Constructed in 2000
South Lift Station (emergency overflow)	Constructed in 1991
Wastewater Treatment Facility • Aeration System • MBBR Tanks • Storage Cells	 Constructed early 1990s, replacements in 2022 and 2023 Commissioning in 2023 and 2024 Constructed 1960s to 1992, over 2M m^3

Treatment facilities are shown in **Figure 4-5**.

Figure 4-5 Planned Upgrades at the Wastewater Treatment Facilities



The City has also identified the following potential changes that would affect the wastewater system, including:

- Population growth and increased land use development will result in increased flows and loads to the treatment;
- Changes to standards and regulations triggering upgrades – future requirements for treatment and management of solids and treated effluent will be more stringent; and
- Future upgrade of the system to a fully mechanical treatment plant will have new challenges.

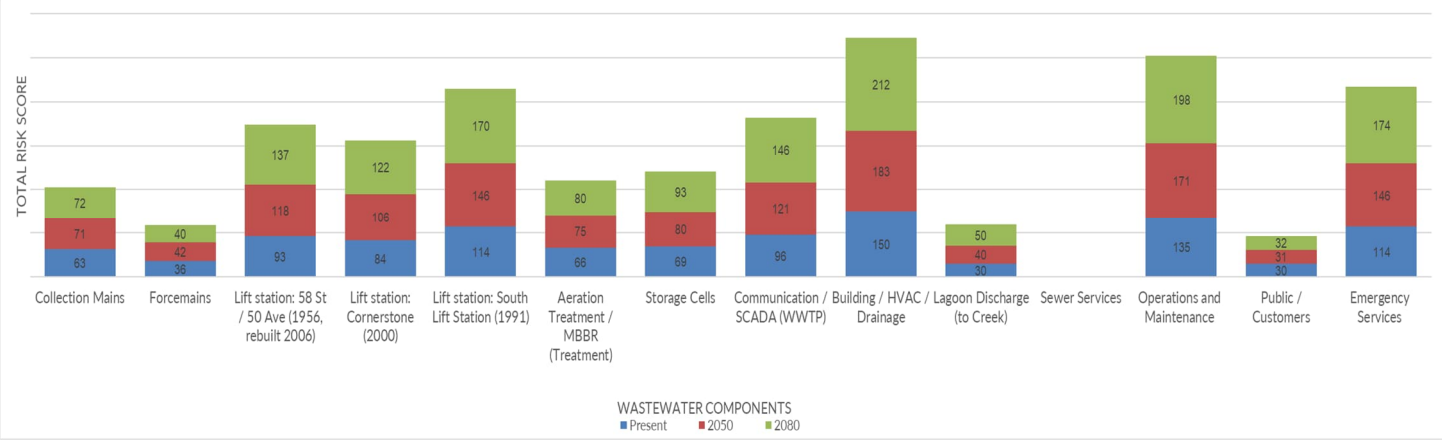
The Master Risk Assessment for Wastewater system is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable*?** The average total risk score from Present Day to 2080s is 302. The vulnerable components scored above 302 are identified in **Table 4-3** and illustrated on **Figure 4-6**.

Table 4-3 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Building/HVAC/Site Drainage	150	183	212	**545**
Operations and Maintenance (Staff)	135	171	198	**504**
Emergency Services	114	146	174	**434**
South Lift Station	114	146	170	**430**
Communication/SCADA	96	121	146	**363**

Figure 4-6 Wastewater System Components Overall Risk Score



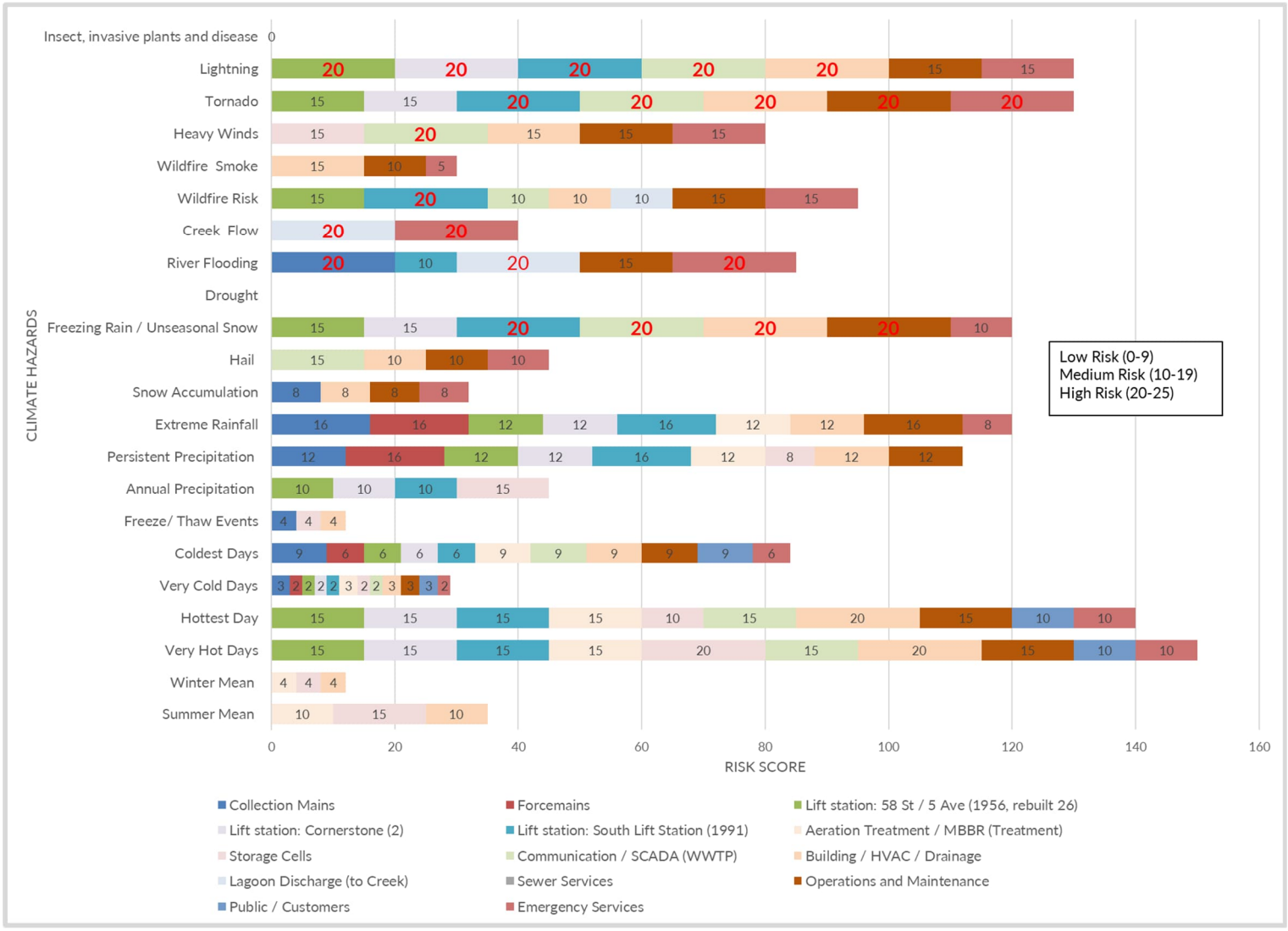
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Top climate hazards that have total risk scores above the calculated average are identified on **Table 4-4** and illustrated on **Figure 4-7** with wastewater components and risk scores identified. **Table 4-4** also describes the discussed impacts due to the climate hazards.

Table 4-4 Top Climate Hazards

Climate Hazards	Wastewater System Component	Impacts
Very Hot Days (Days above +30C)	• 58 St/50 Ave Lift Station • Cornerstone Lift Station • South Lift Station • Aeration/MBBR treatment • Storage Cells • Communication/SCADA • Building/HVAC • Operations and Maintenance (staff) • Public/Customers • Emergency Services	• Reduce efficiency of mechanical system in treatment. • Equipment and electronic systems overheat result in failure. • Increased ventilation and cooling system for buildings, thus increase use of energy. • Staff are stressed under severe working conditions. Reduction in efficiency and time.
Hottest Days Warmest Max. Temp.	• Similar to Very Hot Days	• Similar impacts as Very Hot Days
Lightning	• 58 St/50 Ave Lift Station • Cornerstone Lift Station • South Lift Station • Communication/SCADA • Building/HVAC • Operations and Maintenance (staff) • Emergency Services	• Potentially impact all electrical systems or damage to the sensitive systems. • Damage to infrastructure resulting in temporary shut down until the service is restored. • Financial cost of restoring the infrastructure.
Tornado	• Similar to Lightning	• Severe damage to infrastructure and prolonged period of restoration and reconstruction. • Large financial cost of restoring and reconstruction the infrastructure.
Extreme Rainfall	• Collection Mains • Forcemains • 58 St/50 Ave Lift Station • Cornerstone Lift Station • South Lift Station • Aeration/MBBR treatment • Storage Cells • Building/HVAC • Operations & Maintenance (staff) • Emergency Services	• Disrupt treatment system. • Increase accumulation of water in storage pond that reduce storage capacity for wastewater. • Overland flooding and saturated grounds result in subsidence. • Concerns with higher incoming volume of water to treat, more peak wet weather flow events. • Building envelope failure (e.g. leakages). • Financial cost of restoring the infrastructure.
Freezing Rain/Unseasonal Snow	• 58 St/50 Ave Lift Station • Cornerstone Lift Station • South Lift Station • Building/HVAC	• Damage exposed equipment and electronic systems causing damage or temporary shut down.

Climate Hazards	Wastewater System Component	Impacts
	• Communication/SCADA • Operations & Maintenance (staff) • Emergency Services	• Iced roads causing facility/site to be inaccessible.
Wildfire Risk	• 58 St/50 Ave Lift Station • South Lift Station • Operations & Maintenance (staff) • Emergency Services	• Damage equipment and electronic systems causing damage or temporary shut-downs. • Service restoration required. • Financial cost of restoring the infrastructure.
River Flooding	• Collection Mains • Lagoon Discharge to the Creek • Operations & Maintenance (staff) • Emergency Services	• Back flows into the systems. • Inundation of the lagoon. • Effluent cannot be discharged. • Increased emergency effort. • Financial cost of restoring the infrastructure. Service restoration and potential reconstruction.
Heavy Winds	• Storage Cells • Communication/ SCADA • Building/HVAC • Operations & Maintenance (staff) • Emergency Services	• Damage exposed systems resulting in increase replacement and maintenance costs. • Wave action causing erosion on berms. • Wave action causing water overtopping berms. • Financial cost of restoring the infrastructure.

Figure 4-7 Risk Score Based on Climate Hazards for 2080s

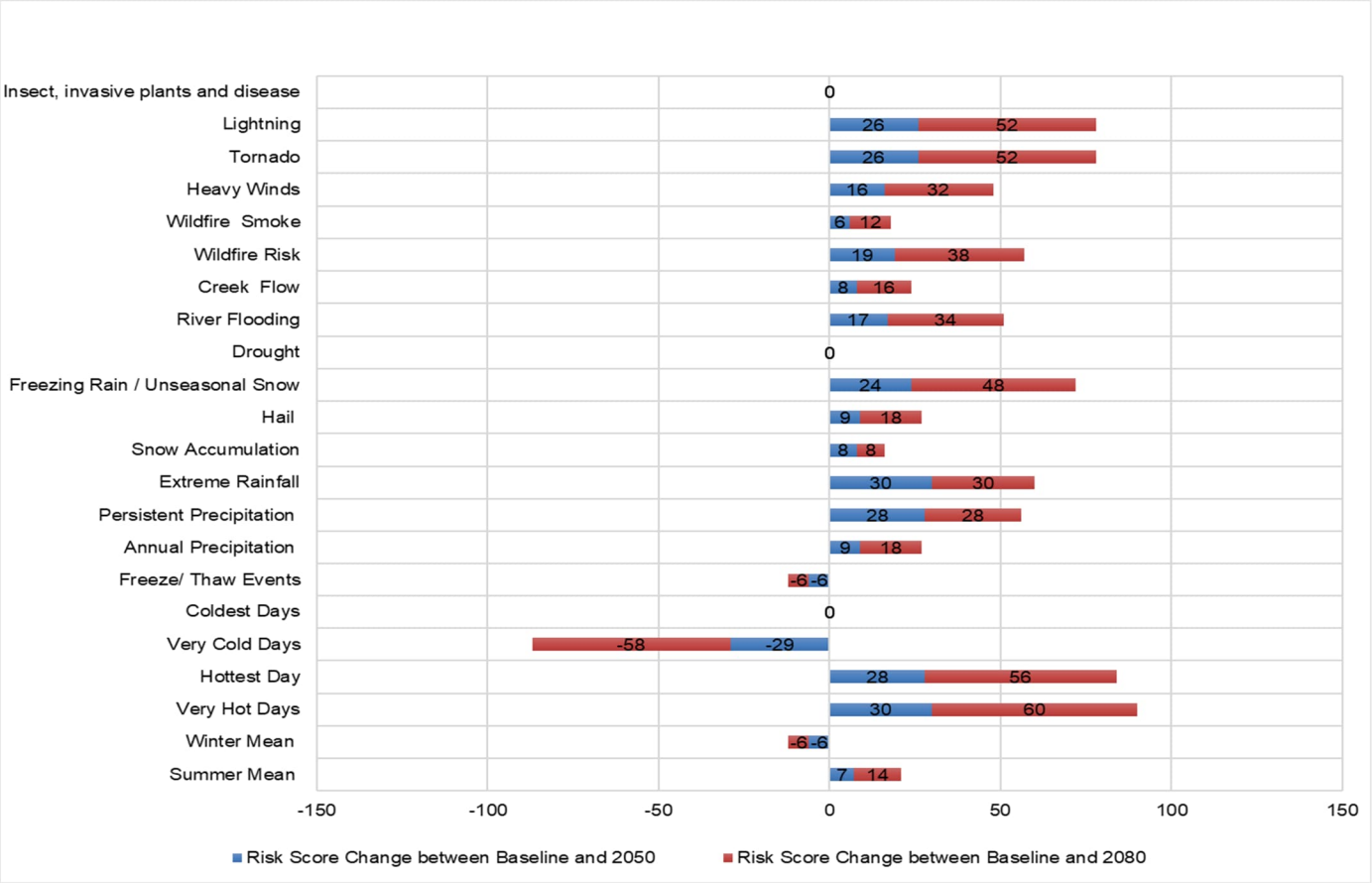


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure & Services
Wildfires	South Lift Station
Heavy Winds	Communication/SCADA (WWTP)
Creek Flow	Lagoon Discharge (to Creek) Emergency Services
River Flooding	Collection Mains Lagoon Discharge Emergency Services

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-8** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days, Winter Mean are showing downward trend as the climate is warming. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-8 Climate Trends and Risk Score (Deltas)



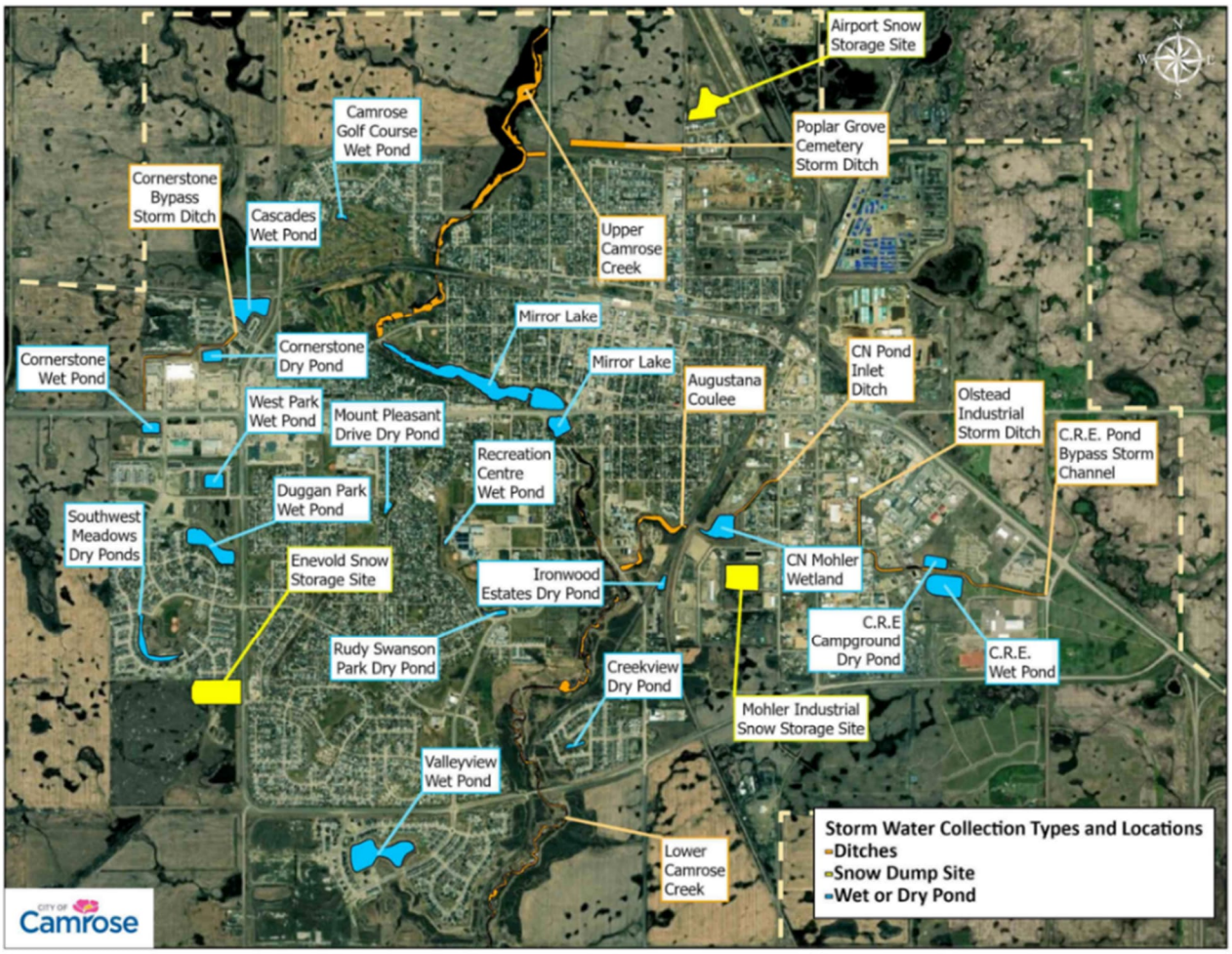
4.3 Stormwater System

The City provided the following information for the stormwater system:

Components	Description
Storm Sewer Mains	110 km consisting of 200 mm dia. to 1,500 mm dia. pipes sizes
Catch Basins	Approximately 1,300 units
Cornerstone Storm Pump Station	Pump Station
Stormwater Ponds	• 8 wet ponds • 1 constructed wetland • 7 dry ponds • Mirror Lake
Drainage ditches and Culverts	Five alignments
Stoney Creek and Outfalls	Various outfalls
Snow Dump Sites	Three facilities
Dams	• Mirror Lake • Valleyview

Figure 4-9 provided by the City identified the key components listed above.

Figure 4-9 Stormwater Components



The City has also identified the following potential changes that would affect the stormwater system:

- Population growth and increased land use development will result in increased flows and loads to the treatment; and
- Changes to standards and regulations on snow dumps.

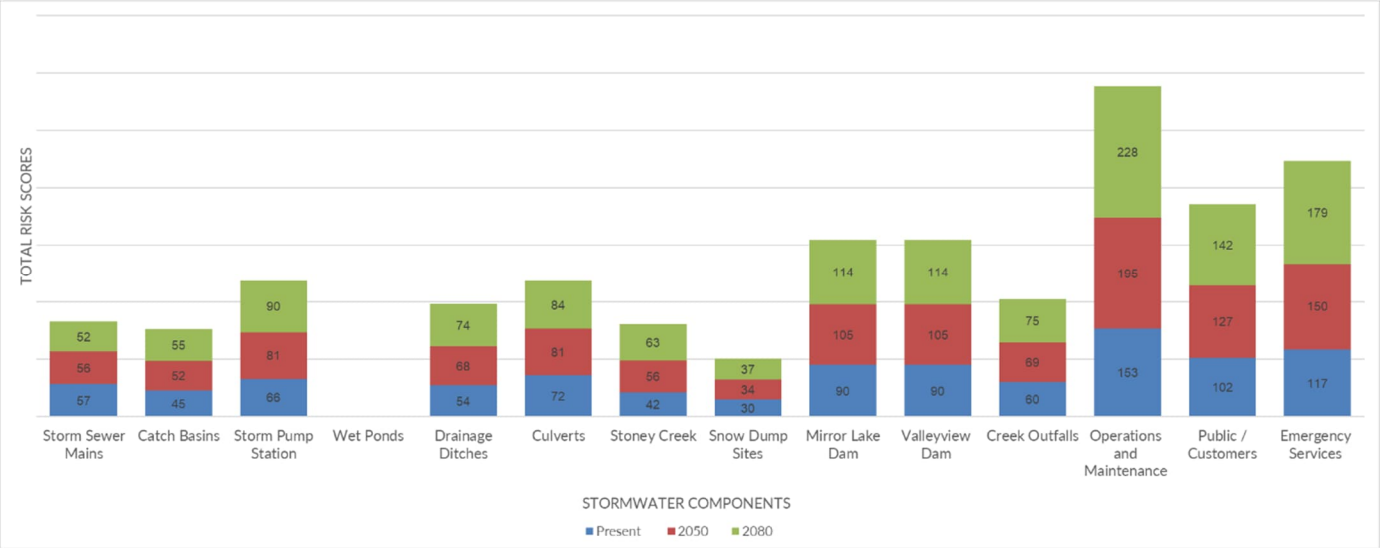
The Master Risk Assessment for Stormwater system is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 247. The vulnerable components that scored above 247 are identified in **Table 4-5** and illustrated on **Figure 4-10**.

Table 4-5 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Operations and Maintenance (Staff)	153	195	228	**576**
Emergency Services	117	150	179	**446**
Public/Customers	102	127	142	**371**
Mirror Lake Dam	90	105	114	**309**
Valleyview Dam				

Figure 4-10 Stormwater System Components Overall Risk Score



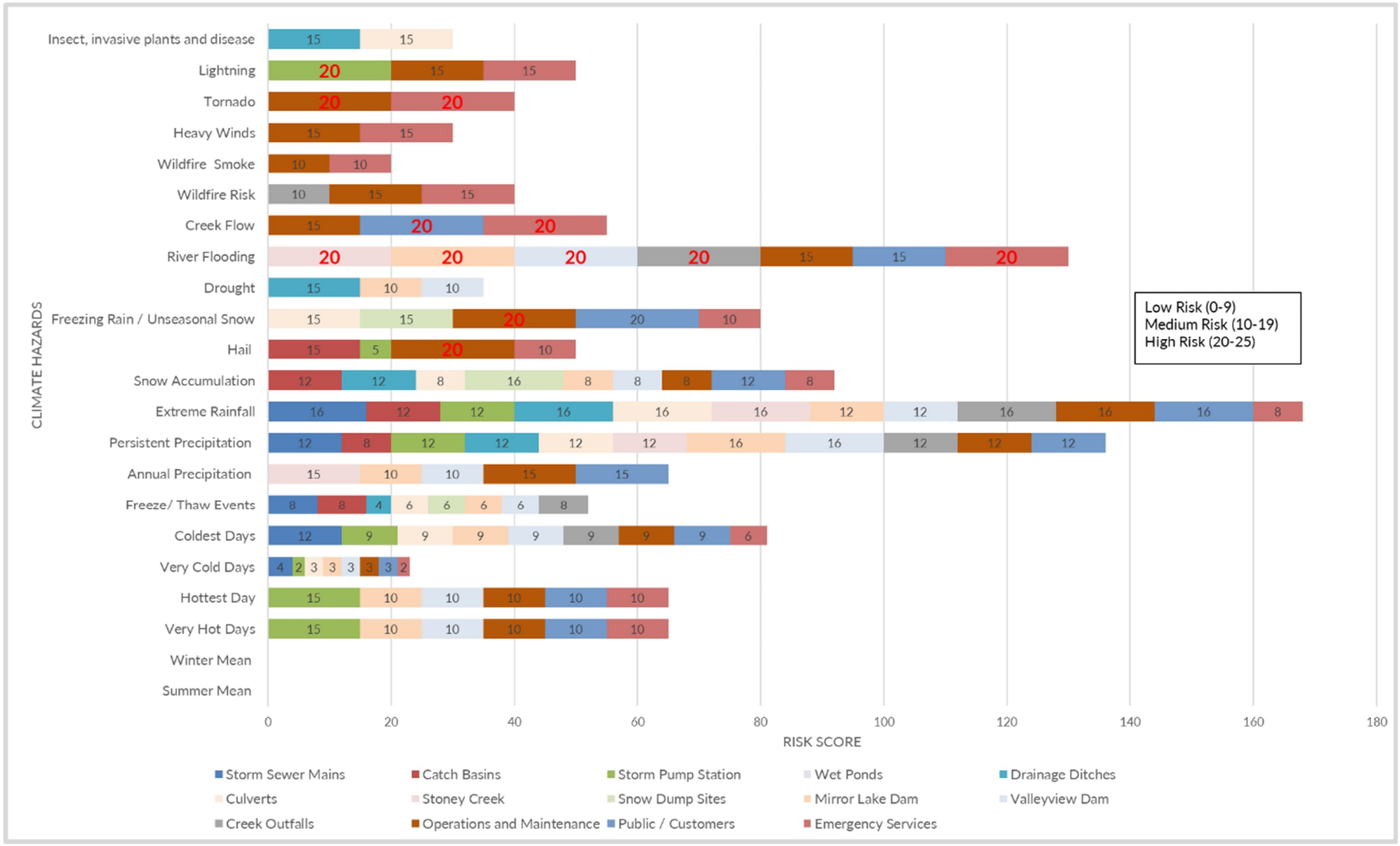
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** The top climate hazards that have total risk scores above the calculated average are identified on **Table 4-6** and illustrated on **Figure 4-11** with Stormwater components and risk scores identified. **Table 4-6** also describes the discusses impacts due to the climate hazards.

Table 4-6 Top Climate Hazards

Climate Hazards	Stormwater System Component	Impacts
Extreme Rainfall	• Stormwater Sewer Mains • Catch Basins • Storm Pump Station • Drainage Ditches and Culverts • Stoney Creek • Mirror Lake Dam • Valleyview Dam • Creek Outfalls • Operations and Maintenance (staff) • Emergency Services	• Overwhelming the capacity of the systems causing overflows, spills, overland flooding, pipe/manholes surcharging and backdoor flooding. • Temporary shut down of services (e.g. roads) and access to facilities or sites. • Erosion of ditches and washouts due to overland flows. • Financial cost of repairs/replacements, operations, and maintenance.
Persistent Precipitation	• Stormwater Sewer Mains • Catch Basins • Storm Pump Station • Drainage Ditches and Culverts • Stoney Creek • Mirror Lake Dam • Valleyview Dam • Creek Outfalls • Operations and Maintenance (staff)	• Accumulation of surface runoff result in capacity issues similar to extreme rainfall. • Soil saturation result in subsidence.
River Flooding	• Stoney Creek and outfalls • Mirror Lake Dam • Valleyview Dam • Operations and Maintenance (staff) • Public/Customers • Emergency Services	• River bank erosion and washouts. • Overspills dams and high hydraulic forces on the structure. • Limited or impeded access. • Danger to public in close proximity. • Financial cost of restoring the infrastructure.
Snow Accumulation	• Catch Basins • Drainage Ditches and Culverts • Snow Dump Sites • Mirror Lake Dam • Valleyview Dam • Operations and Maintenance (staff) • Public/Customers • Emergency Services	• Increased need to remove and manage snow and melt water. • Clog drainage system during snow melt. • Increase flow and accumulation of meltwater impacting capacity. • Limit or impeded access. • Financial impact to accommodate more snow removal.
Freezing Rain/ Unseasonal Snow	• Culverts • Snow Dump Sites • Operations and Maintenance (staff) • Public/Customers	• Freezing up culverts. • Slippery roads and sidewalks conditions. • Increase service to apply salt/sand for public access.

Note that Coldest Days has a score of 81, but all stormwater assets were noted as low risk.

Figure 4-11 Risk Score Based on Climate Hazards for 2080s

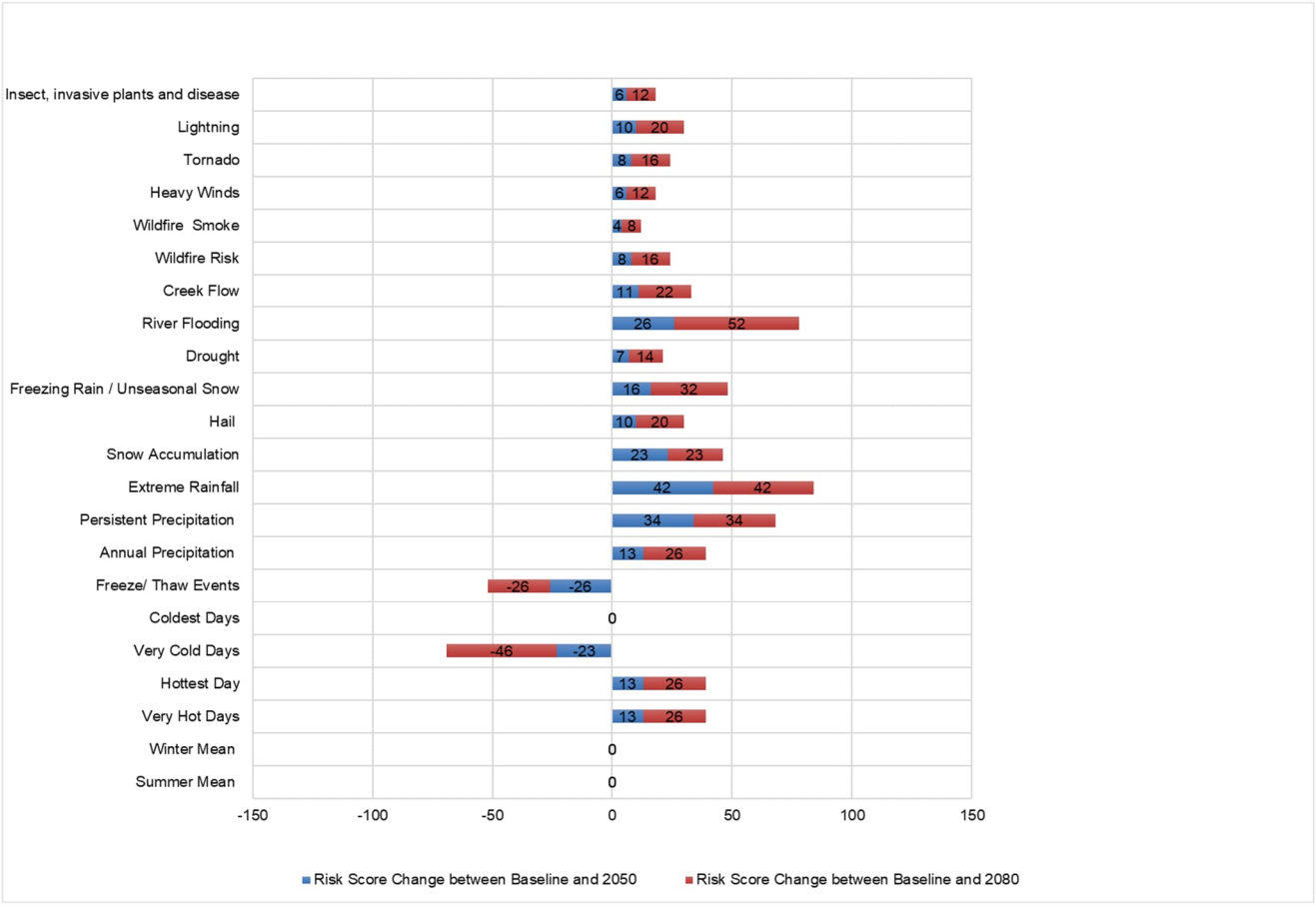


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure & Services
Lightning	Storm Pump Station
Tornado	Public, Emergency Services
Creek Flow	Public
Hail	Operations and Maintenance Staff
Freezing Rain/Unseasonal Snow	Operations and Maintenance Staff

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-12** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events and Very Cold Days are showing downward trend as the climate is warming. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-12 Climate Trends and Risk Score (Deltas)



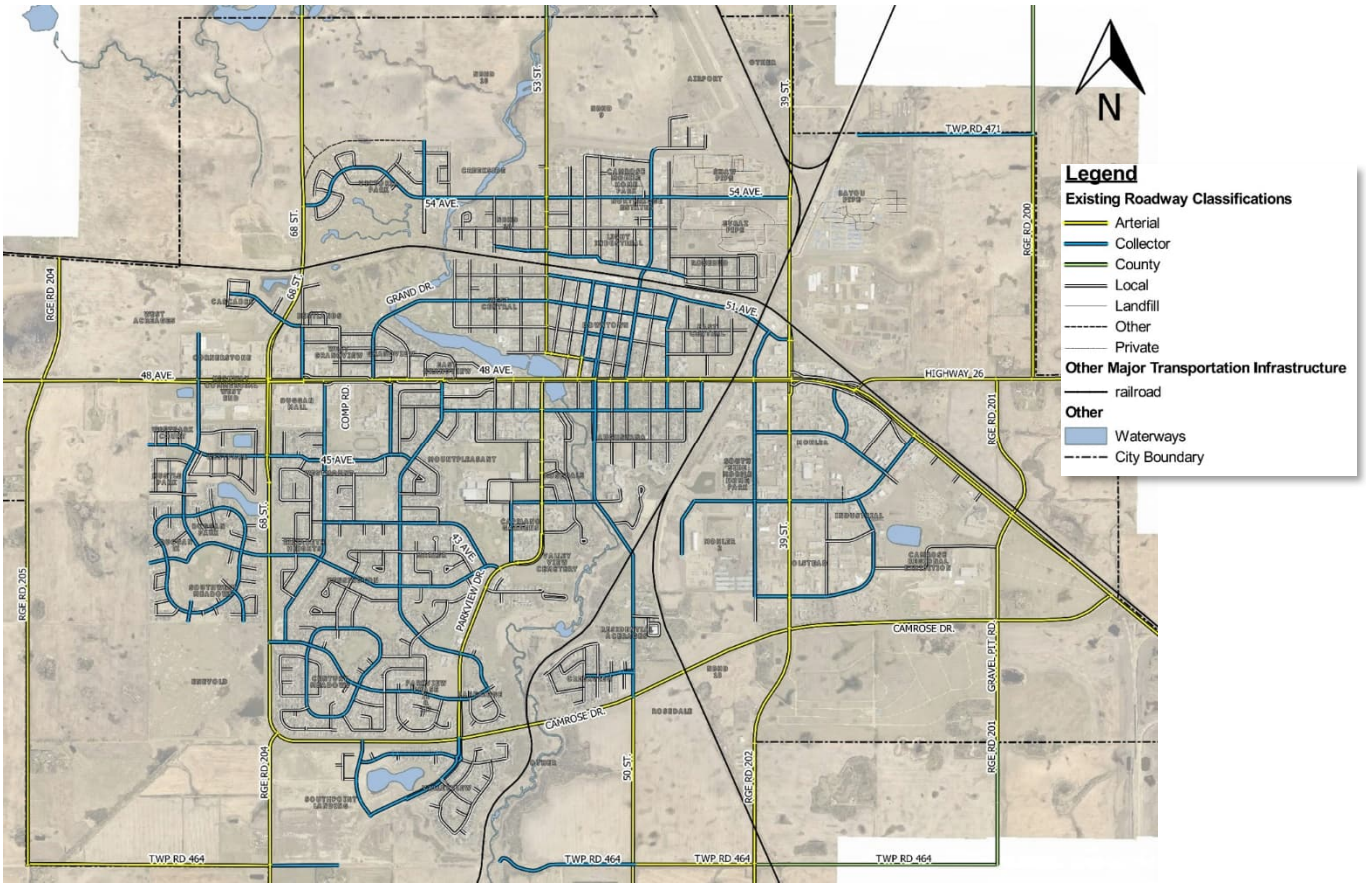
4.4 Roads

The Roads Components provided by the City are as follows:

Components	Description
Arterial/Collector/Local Roads	200 km
Laneways	62 km
Sidewalks	300 km
Road Signs	3,300
Signalized Intersections	14 full signals and 5 half signals
Pedestrian Crossing Flashers	11 locations
Bridges (not including trail crossing at Stoney Creek and Mirror Lake)	8 - Constructed between 1962 and 2018

In addition to the above components, the roads are also distinguished between asphalt and gravel surfaces for the risk assessment. **Figure 4-13** provided by the City identified the key components listed above.

Figure 4-13 Transportation Components



The City has also identified the following potential changes that would affect the transportation system:

- Population growth and increased land use development will result in increased road maintenance, traffic, congestion and signalization to keep up with the level of service.

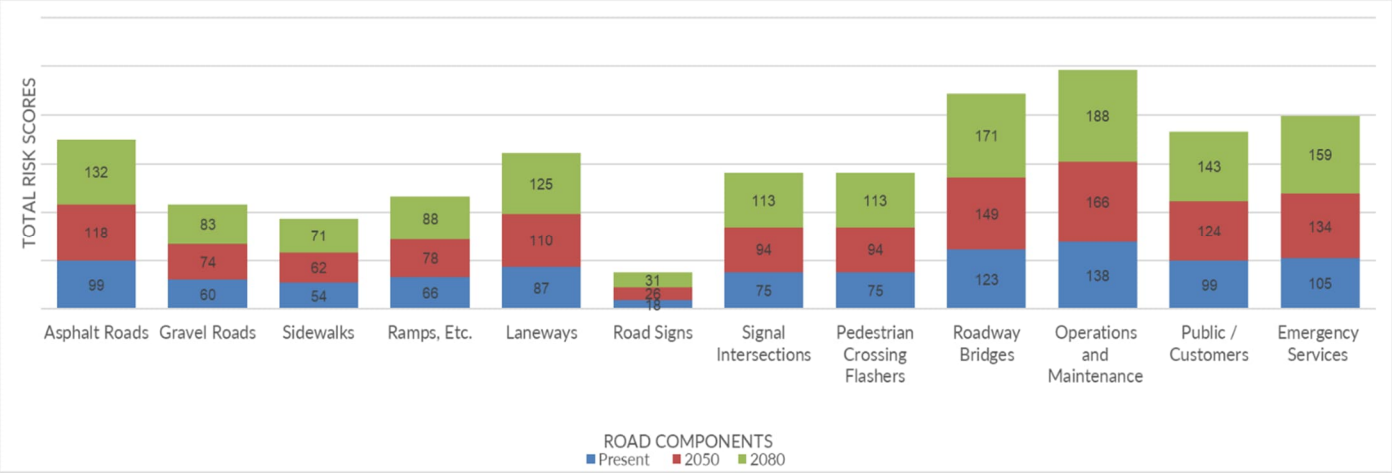
The Master Risk Assessment for Road Systems is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable?*** The Average Total Risk Score from Present Day to 2080s is 303. The vulnerable components that scored above 303 are identified in **Table 4-7** and illustrated on **Figure 4-14**.

Table 4-7 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Operations and Maintenance (Staff)	138	166	188	**492**
Roadway Bridges	123	149	171	**443**
Emergency Services	105	134	159	**398**
Public/Customers	99	124	143	**366**
Asphalt Roads	99	118	132	**349**
Laneways	87	110	125	**322**

Figure 4-14 Stormwater System Components Overall Risk Score



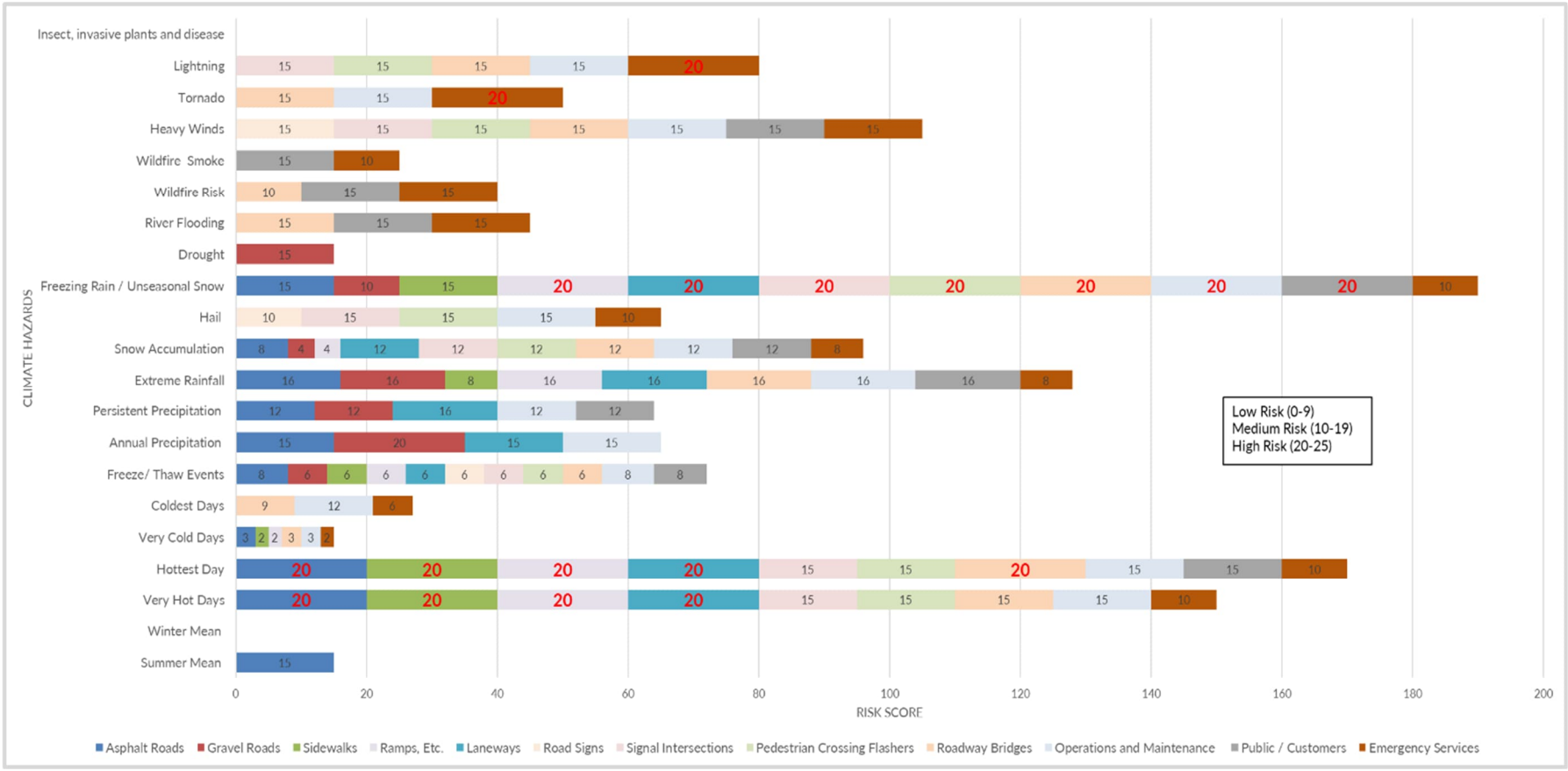
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** The top climate hazards that have total risk scores above the calculated average are identified on **Table 4-8** and illustrated on **Figure 4-15** with Road components and risk scores identified. **Table 4-8** also describes the discussed impacts due to the climate hazards.

Table 4-8 Climate Hazards

Climate Hazards	Roads Component	Impacts
Freezing Rain/Unseasonal Snow	• Asphalt Roads • Gravel Roads • Sidewalks • Ramps • Laneways • Signal Intersections • Pedestrian Crossing Flashers • Bridges • Operations & Maintenance (Staff) • Public/Customers • Emergency Services	• Slippery surfaces impeding access and drivability. • Increase need to salt and sanding. • Safety hazard for public and staff.
Hottest Days	• Asphalt Roads • Sidewalks • Ramps • Laneways • Signal Intersections • Pedestrian Crossing Flashers • Bridges • Operations & Maintenance (Staff) • Public/Customers • Emergency Services	• Heating of pavement structure impacting service life. • Overheat of equipment and replacements. • Stress on bridge expansion joints and other structural elements. • Increase resources for road maintenance. • Increase financial cost for replacements.
Very Hot Days	• Asphalt Roads • Sidewalks • Ramps • Laneways • Signal Intersections • Pedestrian Crossing Flashers • Bridges • Operations & Maintenance (Staff) • Emergency Services	• Similar to Hottest Days.
Extreme Rainfall	• Asphalt Roads • Gravel Roads • Sidewalks • Ramps • Laneways • Bridges • Operations & Maintenance (Staff) • Public/Customers • Emergency Services	• Erosion/washout of subgrades or gravel surfaces. • Temporary shut down of services (e.g. roads) and access to facilities or sites. • Increase financial cost of repairs/replacements. • Overland floods and ponding result in closure of roads and bridges. • Financial cost of restoring the infrastructure.

Climate Hazards	Roads Component	Impacts
Heavy Winds	• Road Signs • Signal Intersections • Pedestrian Crossing Flashers • Bridges • Operations & Maintenance (Staff) • Public/Customers • Emergency Services	• Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public. • Fallen objects obstructing access. • Driving safety concerns.
Snow Accumulation	• Asphalt Roads • Gravel Roads, Ramps	• Snow accumulation impedes accessibility result in more frequent operational services to remove snow from asphalt, gravel roads and ramps.

Figure 4-15 Risk Score Based on Climate Hazards for 2080s

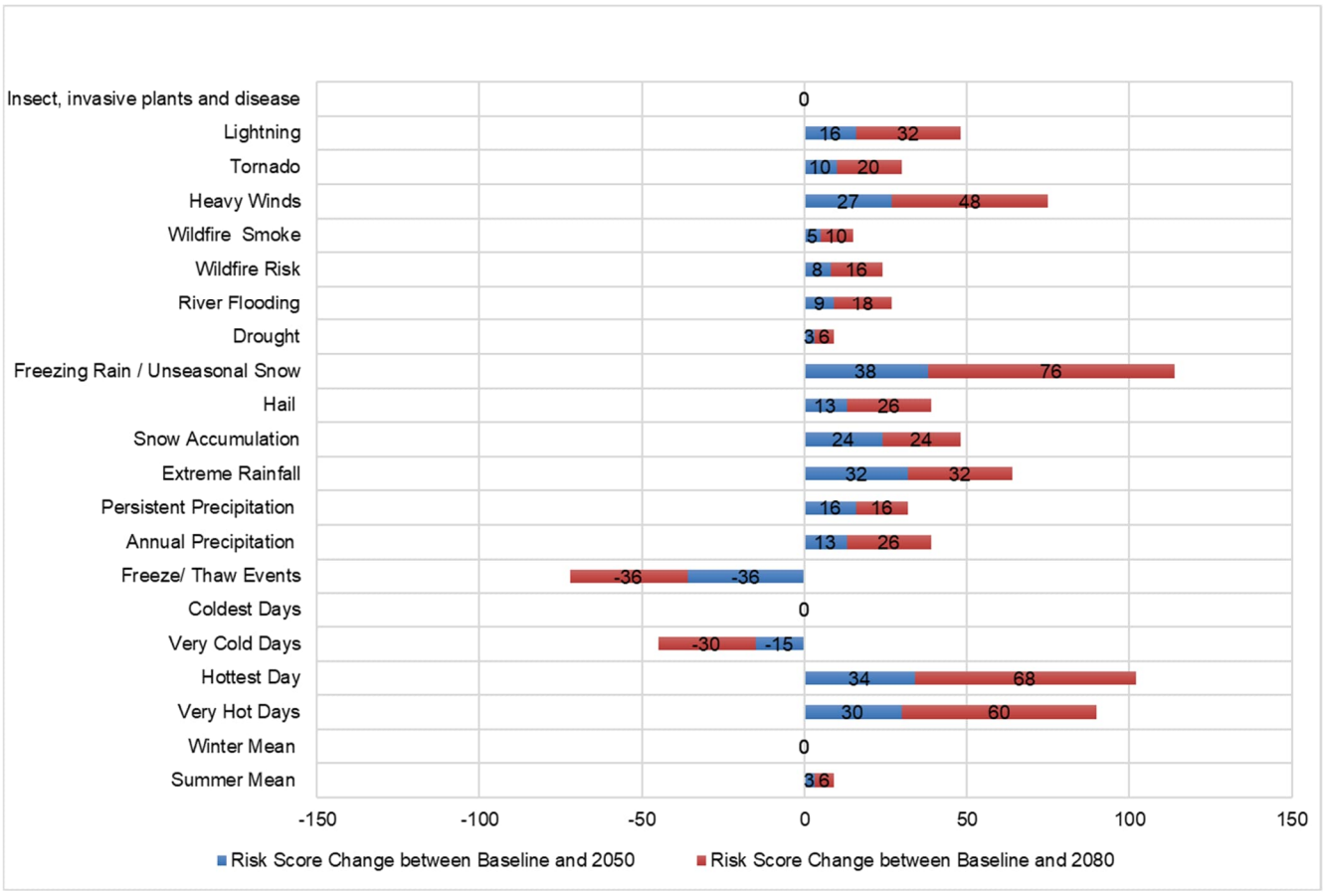


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure and Services
Lightning	Emergency Services
Tornado	Emergency Services

4. ***What is the Climate Risk Score trend from current to 2080s timescale?*** **Figure 4-16** shows that climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/Thaw Events and Very Cold Days are showing downward trend as the climate is warming. Persistent precipitation and Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-16 Climate Trends and Risk Score (Deltas)



4.5 Fleet

The City provided information on fleet components:

Components	Description
161 pieces of equipment	• 47 light vehicles (pickup trucks and SUVs) • 26 Commercial vehicles (trucks over 1 ton) • 46 off road equipment (graders, loaders, backhoes, etc.) • 29 Grounds and trail maintenance (mowers, skid steer loader, UTVs) • 13 misc. road maintenance and support equipment (spray patcher, tar kettle, hotbox, loader-mounted snowblower, mobile air compressors)
	Service life range between 5 to 20 years
Emergency Services (fleet)	NA
Communication Systems	Radios, towers, repeaters

The City has also identified the following potential changes that would affect the fleet components:

- Population growth – more parks, roads, underground infrastructure to maintain.
- Land use development – low population density, larger footprint, more sites to maintain.
- Increased service loads – increase in equipment maintenance required.
- Changes to standards and regulations triggering upgrades – may be forced to switch to electric sooner than planned.
- Long lead times and increase costs for equipment replacements.

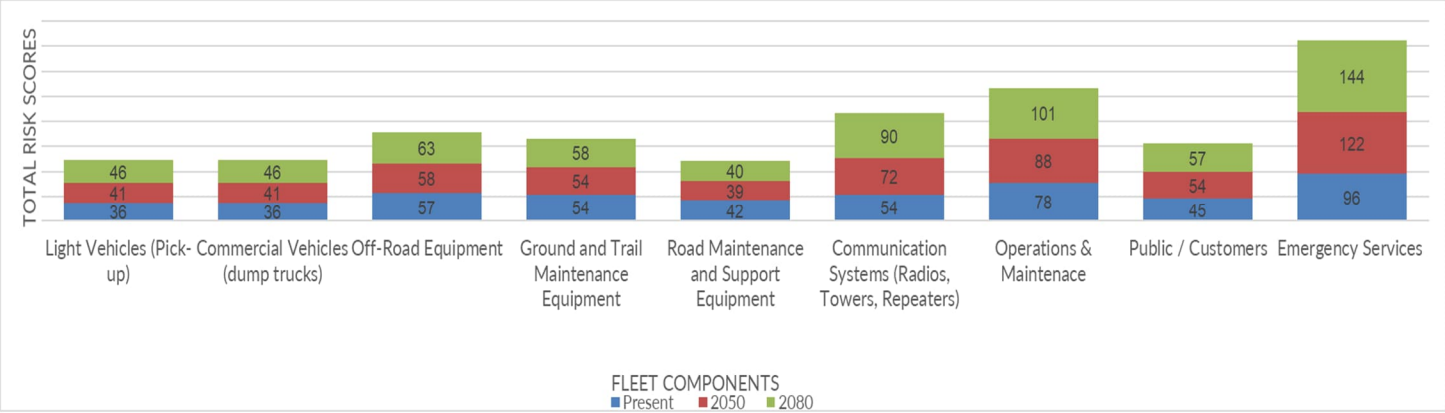
The Master Risk Assessment for Fleet system is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure/asset components are the most vulnerable?*** The Average Total Risk Score from Present Day to 2080s is 190. The vulnerable components that scored above 190 are identified in **Table 4-9** and illustrated on **Figure 4-17**.

Table 4-9 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Emergency Services	96	122	144	**362**
Operations and Maintenance (Staff)	78	88	101	**267**
Communication Systems (Radios, Towers, Repeaters)	54	72	90	**216**

Figure 4-17 Fleet System Components Overall Risk Score



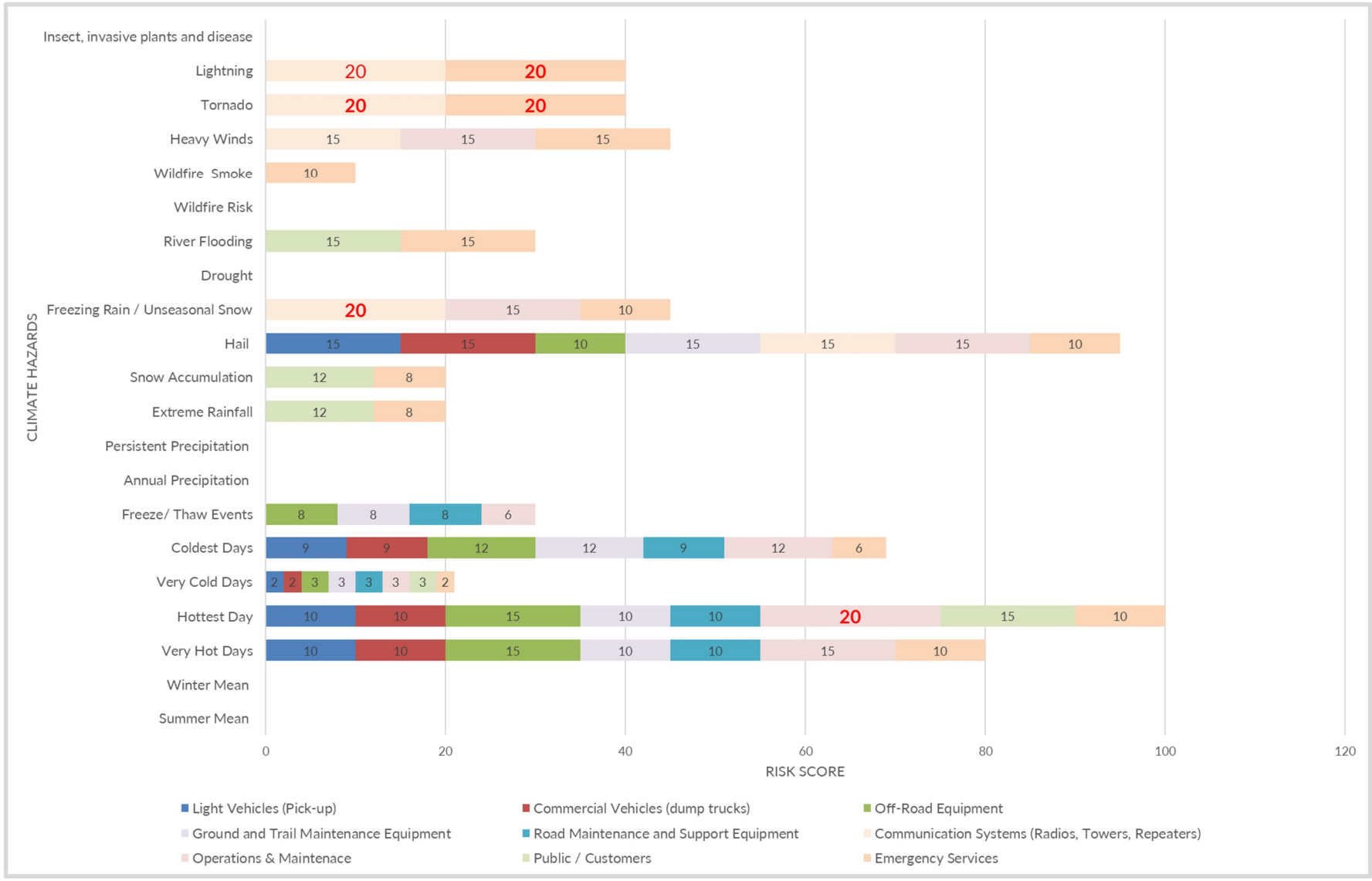
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above average are identified on **Table 4-10** and illustrated on **Figure 4-18** with Road components and risk scores identified. **Table 4-10** also described the discussed impacts due to the climate hazards.

Table 4-10 Climate Hazards

Climate Hazards	Fleet Component	Impacts
Hottest Day	• Light Vehicles • Commercial Vehicles • Off Road Equipment • Ground and Trail Maintenance Equipment • Road Maintenance and Support Equipment • Operations & Maintenance (Staff) • Public/Customers • Emergency Services	• Equipment failure and resulting in shorter service life and frequent replacement. • Potentially reducing resource impacting level of service to the public.
Hail	• Light Vehicles • Commercial Vehicles • Off Road Equipment • Ground and Trail Maintenance Equipment • Communication Systems • Operations & Maintenance (Staff) • Emergency Services	• Damage to communication systems thus requiring alternative communication means. • Equipment damage and resulting in shorter service life and frequent replacement.
Very Hot Days	• Light Vehicles • Commercial Vehicles • Off Road Equipment • Ground and Trail Maintenance Equipment • Road Maintenance and Support Equipment • Operations & Maintenance (Staff) • Emergency Services	• Similar to Hottest Days.

Climate Hazards	Fleet Component	Impacts
Coldest Days	• Light Vehicles • Commercial Vehicles • Off Road Equipment • Ground and Trail Maintenance Equipment • Road Maintenance and Support Equipment • Operations & Maintenance (Staff) • Emergency Services Emergency Services	• Similar to Hottest Days.
Freezing Rain/ Unseasonal Snow	• Communication Systems • Operations & Maintenance (Staff) • Emergency Services	• More frequent usage resulting in shorter service life and frequent replacement.
Heavy Winds	• Communication Systems • Operations & Maintenance (Staff) • Emergency Services Emergency Services	• Damage to communication systems thus requiring alternative communication means. • Equipment damage and resulting in shorter service life and frequent replacement.

Figure 4-18 Risk Score Based on Climate Hazards for 2080s

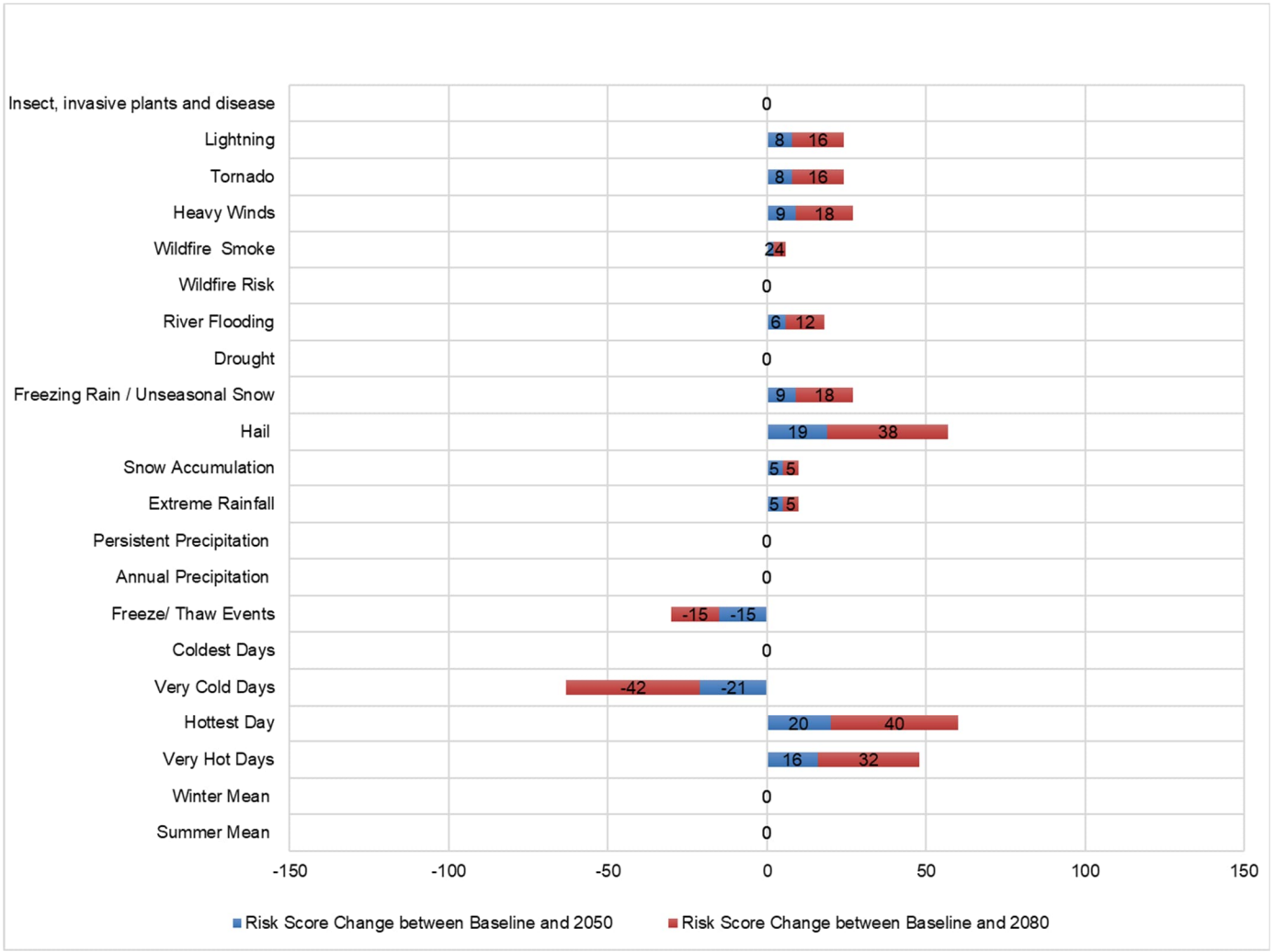


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure & Services
Lightning	Communication Systems
Tornado	Emergency Services

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-19** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Very Cold Days and Freeze/Thaw Events are showing downward trends. Risk scores that are not shown on the **Figure 4-19** indicates that the assets are not impacted by the climate hazards. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-19 Climate Trends and Risk Score (Deltas)



4.6 Transit

The Transit components provided by the City are as follows:

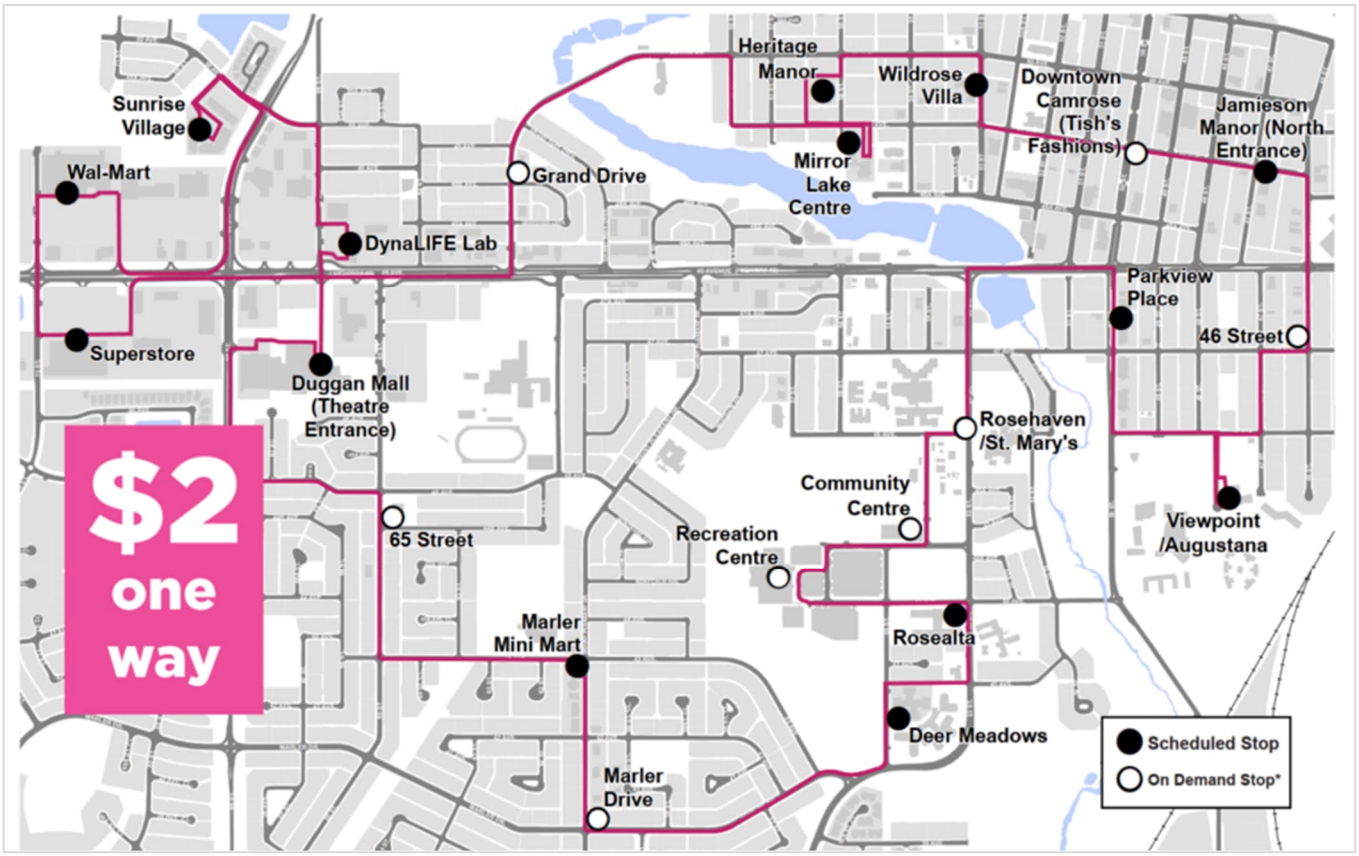
- Community Bus; and
- Bus Stops.

Figure 4-20 shows the bus route within the City.

The City has also identified the following potential changes that would affect the fleet components:

- Population growth – need to expand service area or level of service (more buses or routes).
- Land use development – change route to service new areas.
- Increased service loads – currently low ridership and may increase revenue with as service and ridership increases.
- Investigating option to switch to an on-demand system.
- Future discussion for a regional service from Camrose to Edmonton.

Figure 4-20 Bus Route



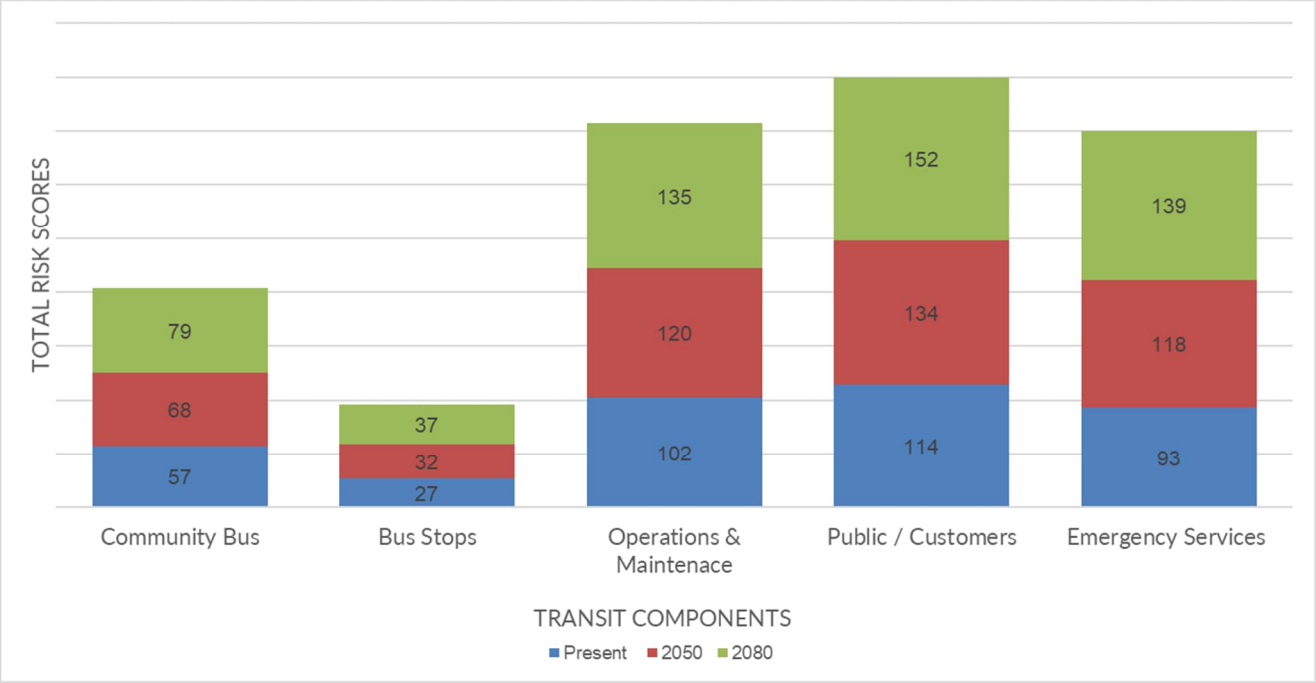
The Master Risk Assessment for Transit system is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure/asset components are the most vulnerable?*** The Average Total Risk Score from Present Day to 2080s is 281. The vulnerable components that scored above 281 are shown in **Table 4-11** and **Figure 4-21**. The results showed that it is the public, operations and maintenance staff, and emergency services that are the most vulnerable.

Table 4-11 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Public/Customers	114	134	152	**400**
Operations and Maintenance (Staff)	102	120	135	**357**
Emergency Services	93	118	139	**350**

Figure 4-21 Stormwater System Components Overall Risk Score

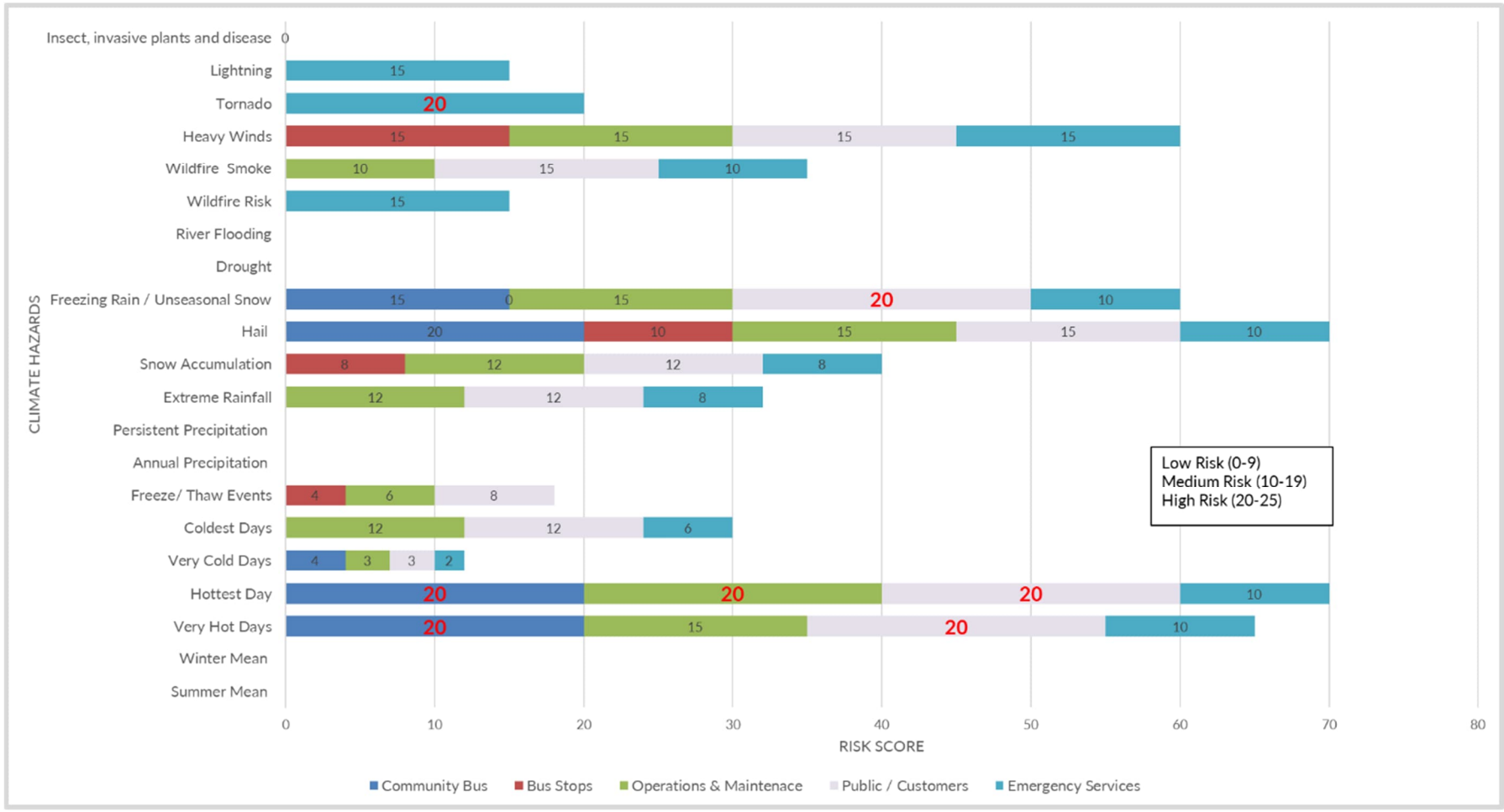


2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-12** and illustrated on **Figure 4-22** with Transit components and risk scores identified. **Table 4-12** also described the discussed impacts due to the climate hazards.

Table 4-12 Climate Hazards

Climate Hazards	Transit Component	Impacts
Hottest Day	• Community Bus • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• Equipment failure due to overheating and resulting in shorter service life and frequent replacement.
Hail	• Community Bus • Bus Stops • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• Equipment damage and resulting in shorter service life and frequent replacement. • Damaging hail resulting fallen objects obstructing access and danger to public.
Very Hot Days	• Similar to Hottest Day	• Similar to Hottest Days
Freezing Rain/ Unseasonal Snow	• Similar to Hottest Days	• Poor road conditions for buses and sidewalks for users. • More frequent sanding/salting of roads and bus stops stands.
Heavy Winds	• Bus Stops • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public. • Fallen objects obstructing access.
Snow Accumulation	• Bus Stops • Operations & Maintenance (staff) • Public/Customers • Emergency Services	• More frequent removal of snow for public safety and use.

Figure 4-22 Risk Score Based on Climate Hazards for 2080s

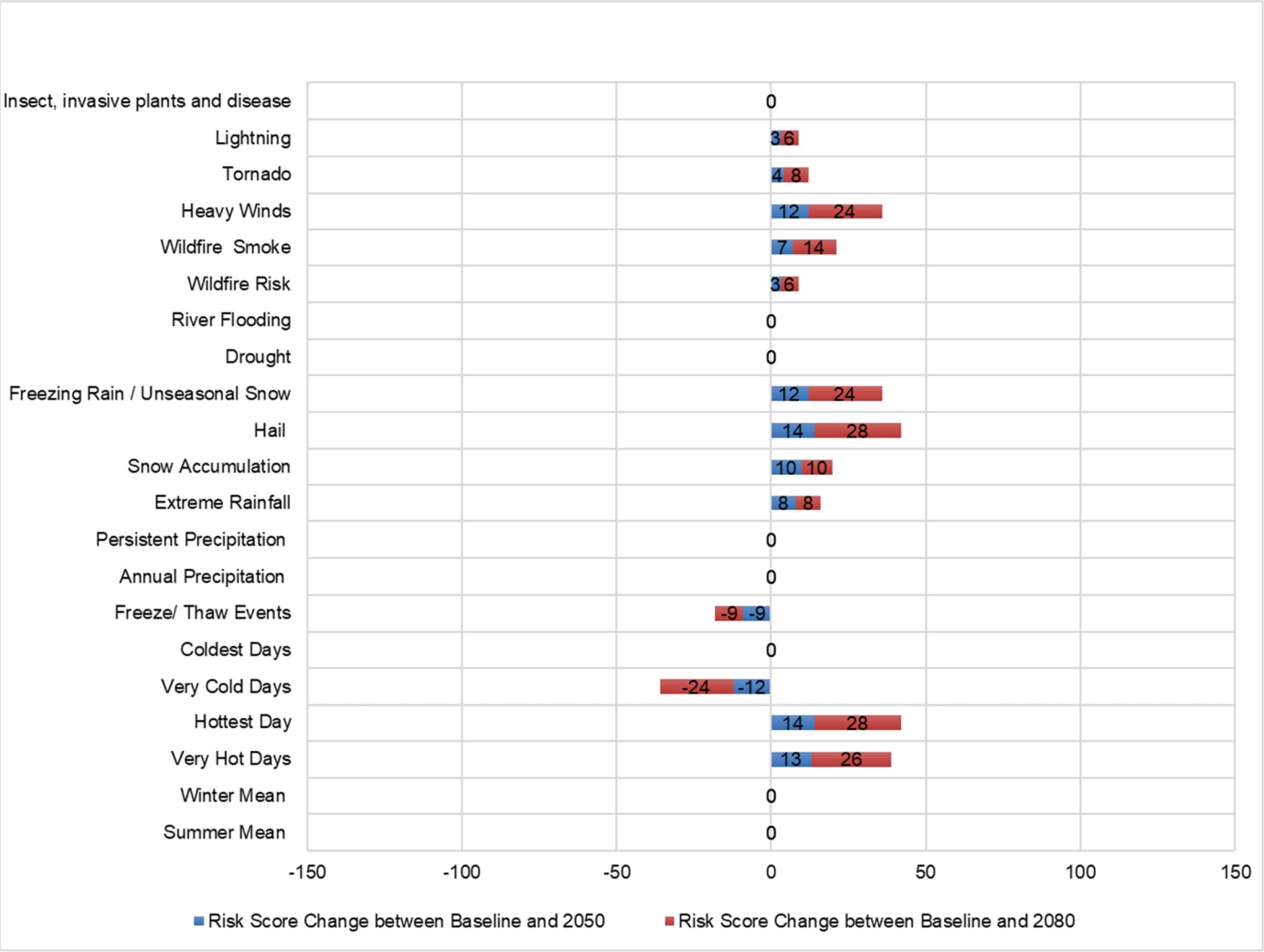


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure & Services
Tornado	Emergency Services

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-23** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/Thaw and Very Cold Days is showing downward trend as the climate is warming. Risk scores that are not shown on the **Figure 4-23** indicates that the assets are not impacted by the climate hazards. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-23 Climate Trends and Risk Score (Deltas)



4.7 Airports

The following airport components were identified by Associated Engineering and reviewed with the City. The agreed Airport components are as follows:

- Buildings (terminal);
- Lighting and Navigation, Communication;
- Runways, Taxiways;
- Parking and Sidewalks Facilities;
- Drainage Infrastructure;
- Electrical Service;
- Fuelling Service (Tank, Pumps);
- Groundside Roads (gravel);
- Operations & Maintenance;
- Public / Customers; and
- Emergency Services.

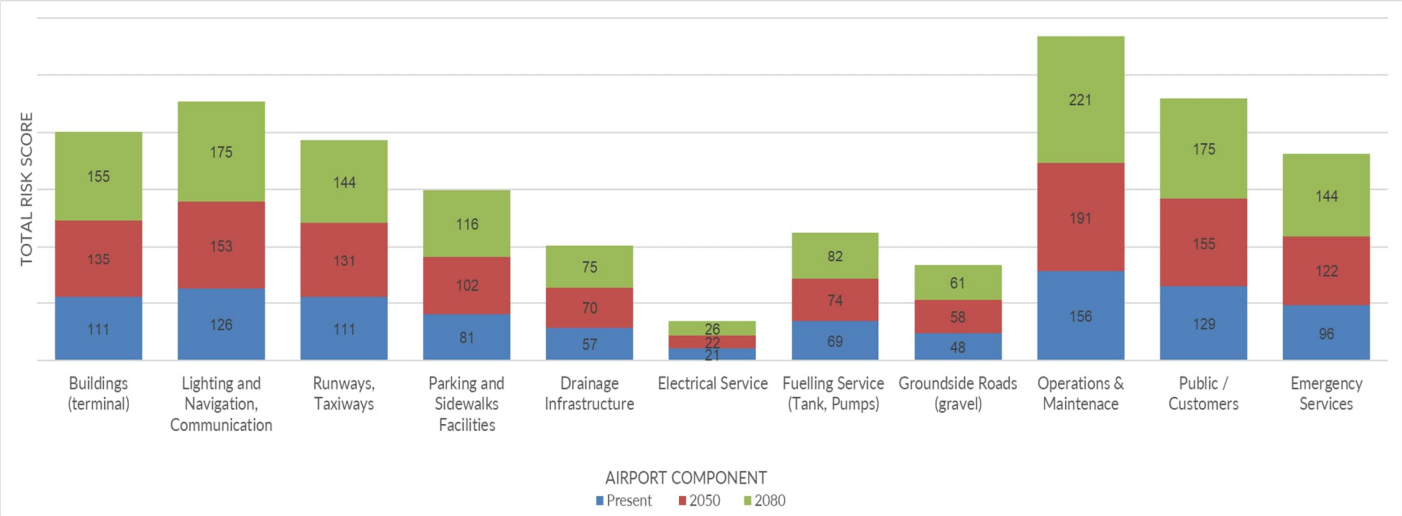
The Master Risk Assessment for Airport system is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 326. The vulnerable components that scored higher than 326 are identified in **Table 4-13** and illustrated on **Figure 4-24**.

Table 4-13 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Operations and Maintenance (Staff)	156	191	221	**568**
Public/Customers	129	155	175	**459**
Lighting, Navigation and Communication	126	153	175	**454**
Buildings (Terminal)	111	135	155	**401**
Runways, Taxiways	111	131	144	**386**
Emergency Services	96	122	144	**362**

Figure 4-24 Airports System Components Overall Risk Score



2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-14** and illustrated on **Figure 4-25** with Airport components and risk scores identified. **Table 4-14** also described the discussed impacts due to the climate hazards.

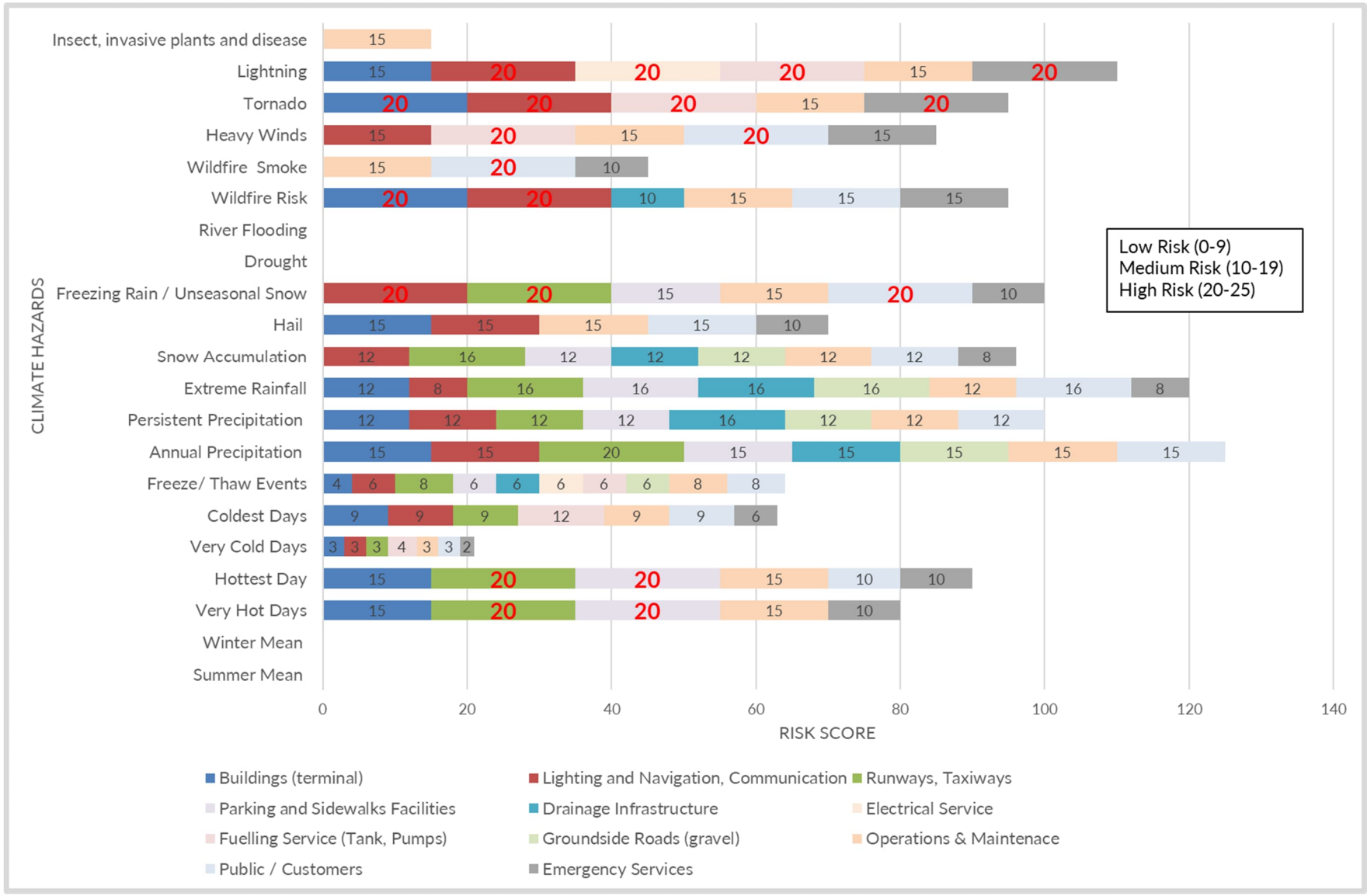
Table 4-14 Climate Hazards

Climate Hazards	Airport Component	Impacts
Annual Precipitation	• Buildings • Lighting, Navigation and Communication • Runways, Taxiways • Parking and Sidewalks • Drainage • Groundside Roads (gravel) • Operations & Maintenance (Staff) • Public/Customers	• Impacting building envelopes. • Overland flooding and ponding resulting in accessibility issues. • Erosion and washouts of gravel surfaces. • Increased maintenance and replacement efforts. • Reduced level of service.
Extreme Rainfall	• Buildings • Lighting, Navigation and Communication • Runways, Taxiways • Parking and Sidewalks • Drainage • Groundside Roads • Operations & Maintenance (Staff) • Public/Customers • Emergency Services	• Similar to Annual Precipitation.

Climate Hazards	Airport Component	Impacts
Lightning	• Buildings • Lighting, Navigation and Communication • Electrical • Fuelling (tanks and pumps) • Operations & Maintenance (Staff) • Emergency Services	• Damage to electrical systems resulting in Airport shut down. • Grounded aircraft. • Replacement of equipment and electrical systems. • Electrical shock to the operators. • Financial impact.
Persistent Precipitation	• Buildings • Lighting, Navigation and Communication • Runways, Taxiways • Parking and Sidewalks • Drainage Infrastructure • Groundside Roads • Operations & Maintenance • Emergency Services	• Similar to Annual Precipitation.
Freezing Rain/ Unseasonal Snow	• Lighting, Navigation and Communication • Runways, Taxiways • Parking and Sidewalks • Public/Customers • Operations & Maintenance (Staff)	• Poor road and runway conditions. • Impact electrical system that may be cause temporary shut down. • Grounded aircraft.
Wildfire Risk	• Buildings • Lighting, Navigation and Communication • Public/Customers • Operations & Maintenance (Staff) • Emergency Services	• Airport is shut down for services; grounded aircraft or no flights allowed to land. • Fire fighting water would impact or cause damage to property. • Fire could impede emergency service access.
Tornado	• Buildings • Lighting, Navigation and Communication • Fuelling (tanks and pumps) • Operations & Maintenance (Staff) • Emergency Services	• Severe damage resulting in high financial cost of restoring the infrastructure.
Snow Accumulation	• Lighting, Navigation and Communication • Runways, Taxiways • Drainage Infrastructure • Parking and Sidewalk Facilities • Groundside Roads	• Poor road and runway conditions. • Impact electrical system that may be cause temporary shut down. • Grounded aircraft. • Increase snow removal for public and emergency access.

Climate Hazards	Airport Component	Impacts
	• Public/Customers • Operations & Maintenance (Staff)	
Heavy Winds	• Lighting, Navigation and Communication • Fuelling (tanks and pumps) • Public/Customers • Operations & Maintenance (Staff) • Emergency Services	• Damage to the equipment resulting in financial cost of restoring the infrastructure. • Grounded aircraft impacting service.
Hottest Days	• Buildings • Runways and Taxiways • Parking and Sidewalks • Public/Customers • Operations & Maintenance (Staff) • Emergency Services	• Building ventilation system is operating more frequently. Shorter service lifespan of ventilation and cooling equipment system. • Heat stroke (working outdoors). • Heating of pavement structure impacting service life. • Increase resources for road maintenance. • Increase financial cost for replacements.

Figure 4-25 Risk Score Based on Climate Hazards for 2080s

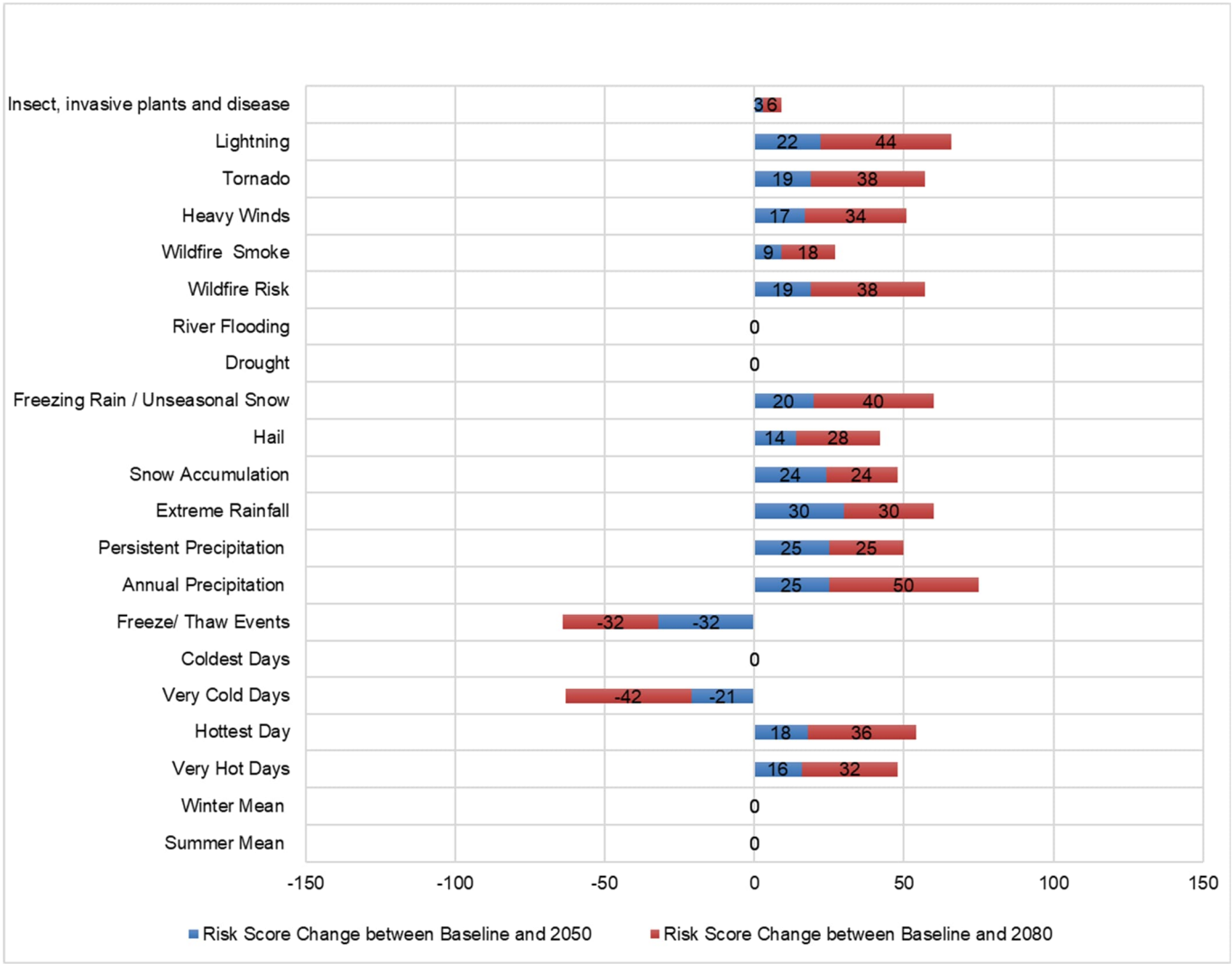


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure
Wildfire Smoke	Public

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-26** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events and Very Cold Days, are showing downward trend as the climate is warming. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-26 Climate Trends and Risk Score (Deltas)



4.8 Waste Management

Although the City owns the facilities, a third-party contractor operates and manages the sites. Snow removal and road access are managed and operated by the City. Waste carts are also owned by the City, who will address any replacements if damaged.

It is also noted that the landfill will be closed in the late 2023. The landfill will then be replaced with a transfer station, which will have both indoor and outdoor operations. **This evaluation includes the future transfer station.**

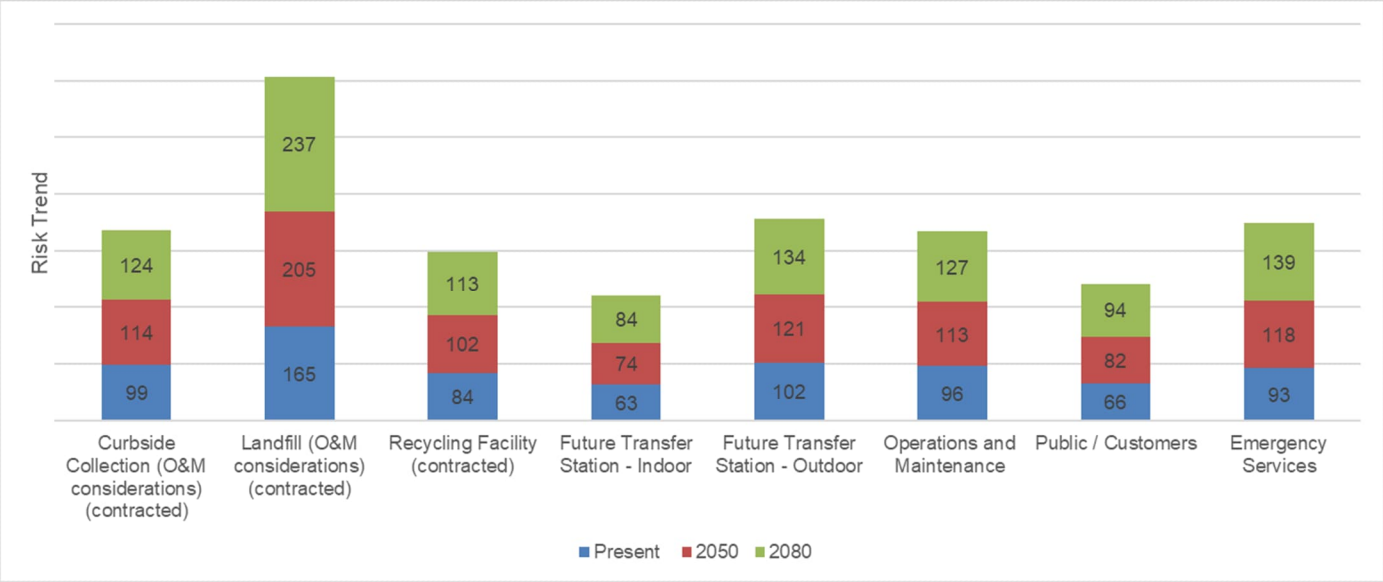
The Master Risk Assessment for Waste Management is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable?*** The average total Risk Score from Present Day To 2080s Is 343. The vulnerable components that scored above 343 are identified in **Table 4-15** and illustrated on **Figure 4-27**.

Table 4-15 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Landfill Operations	165	205	237	**607**
Future Transfer Station - Outdoor	102	121	134	**357**
Emergency Services	93	118	139	**350**

Figure 4-27 Waste Management Components Overall Risk Score



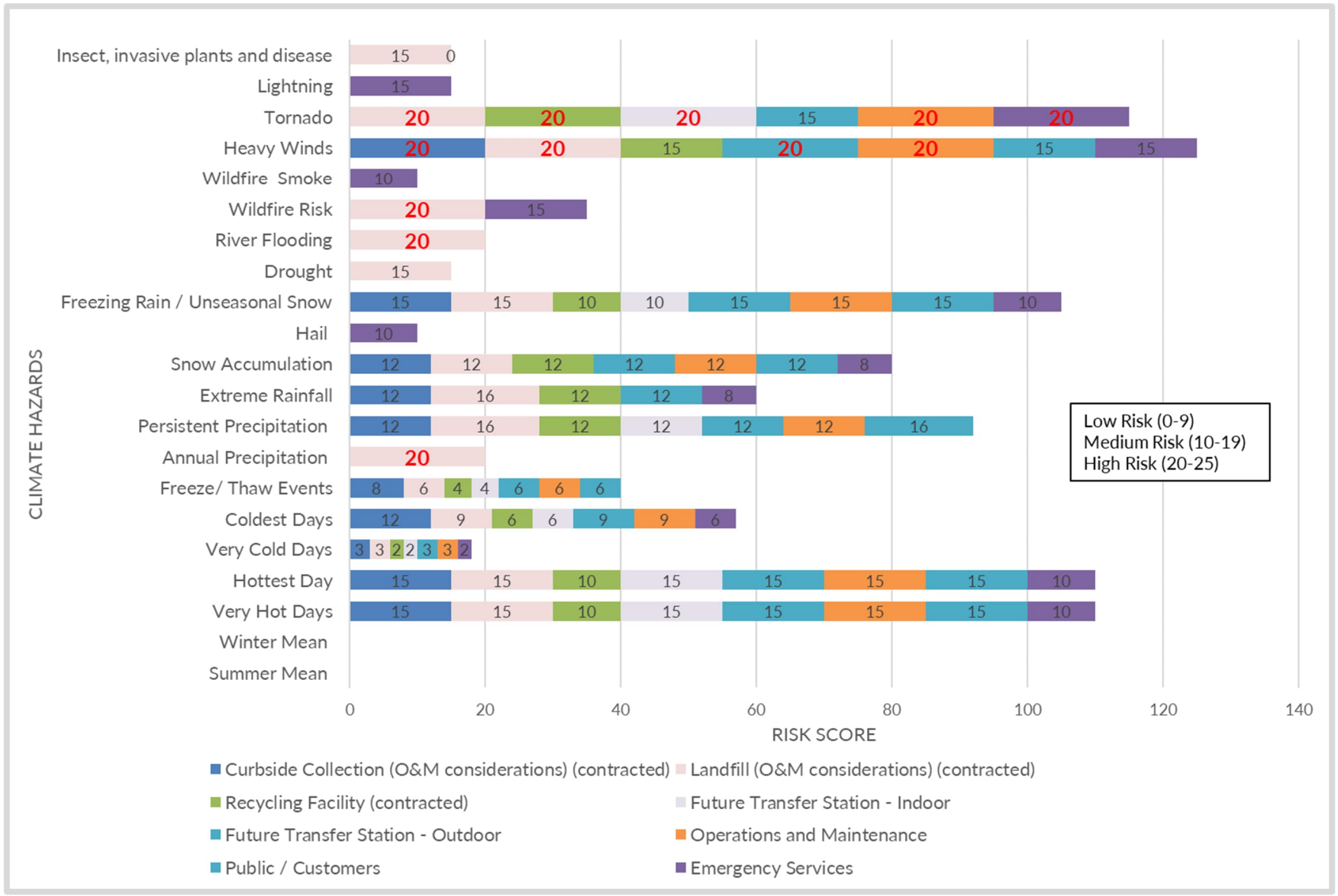
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-16** and illustrated on **Figure 4-28**. **Table 4-16** also described the discussed impacts due to the climate hazards.

Table 4-16 Climate Hazards

Climate Hazards	Waste Management Component	Impacts
Heavy Winds	• Curbside Collection • Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors • Operations and Maintenance • Public • Emergency Services	• Damage buildings and bins. • Blown waste. • Increased maintenance and replacement efforts. • Danger to the public. • Reduced level of service.
Hottest Days, Very Hot Days	• Curbside Collection • Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors and indoors • Operations and Maintenance • Public • Emergency Services	• Vehicles overheat shorten service life of equipment. • Poor working conditions (heat stroke). • Garbage odours and health issues. • Landfill fires.
Freezing Rain/Unseasonal Snow	• Curbside Collection • Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors and indoors • Operations and Maintenance • Public • Emergency Services	• Poor road conditions. • Impact operations with reduced production.
Extreme Rainfall	• Curbside Collection • Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors • Operations and Maintenance • Public	• Localized flooding resulting in poor conditions or impede access. • Localized flooding at the landfill and transfer stations. • Water pumping may be required. • Site grading to mitigate ponding.
Persistent Precipitation	• Curbside Collection • Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors and indoors • Operations and Maintenance • Public	• Localized flooding resulting in poor conditions or impede access. • Localized flooding at the landfill and transfer stations. • Water pumping may be required. • Site grading to mitigate ponding.

Climate Hazards	Waste Management Component	Impacts
Snow Accumulation	• Curbside Collection • Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors and indoors • Operations and Maintenance • Public	• Increase need for snow removal. • Impede access for collection.
Tornado	• Landfill Operations • Recycling Facilities • Future Transfer Station – outdoors and indoors • Operations and Maintenance • Emergency Services	• Severe infrastructure damage resulting in high financial cost in replacement and restoration.

Figure 4-28 Risk Score Based on Climate Hazards for 2080s

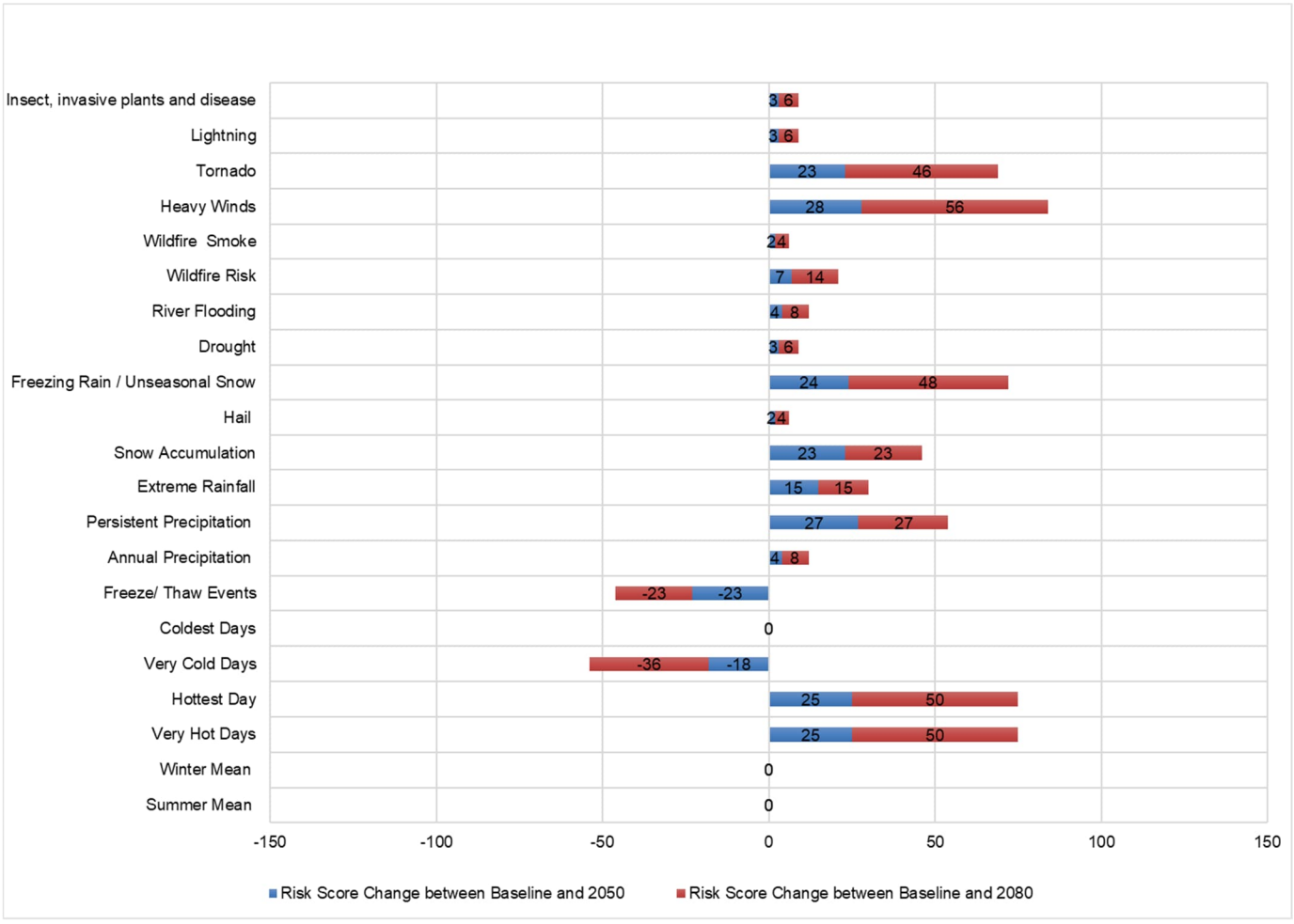


2. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure & Services
Wildfire Risk	
Annual Precipitation	Landfill Operations
River Flooding	

3. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-29** shows the top five climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events and Very Cold Days, are showing downward trend as the climate is warming. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-29 Climate Trends and Risk Score (Deltas)



4.9 Environment/Parks

Environment and parks are comprised of the following assets:

- Mowed Green Spaces
- Ornamental Plantings
- Baseball/Softball Diamonds
- Park Infrastructure (Play Structures, Benches)
- Soccer Fields
- Outdoor Rinks
- Treed Natural Spaces
- Trails (paved and unpaved)
- Boulevard Trees
- Pedestrian Bridges
- Golf Course
- Emergency Services
- Operations and Maintenance Staff

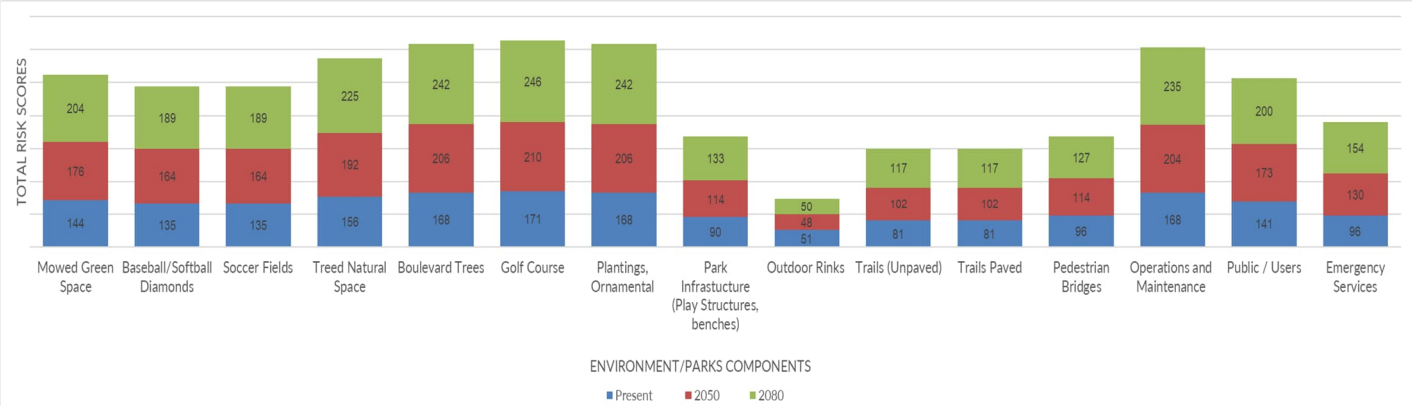
The Master Risk Assessment for Environment and Parks is found in **Appendix A**. The four key questions are addressed as follows:

1. ***Which infrastructure components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 457. The vulnerable components that scored above 457 are identified in **Table 4-17** and illustrated on **Figure 4-30**.

Table 4-17 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Golf Course	171	210	246	**627**
Boulevard Trees, Ornamental Plantings	168	206	242	**616**
Operations and Maintenance	168	204	235	**607**
Treed Natural Space	156	192	225	**573**
Mowed Green Space	144	176	204	**524**
Public Users	141	173	200	**514**
Baseball/Softball Diamonds, Soccer Fields	135	164	189	**488**

Figure 4-30 Environment/Parks Components Overall Risk Score



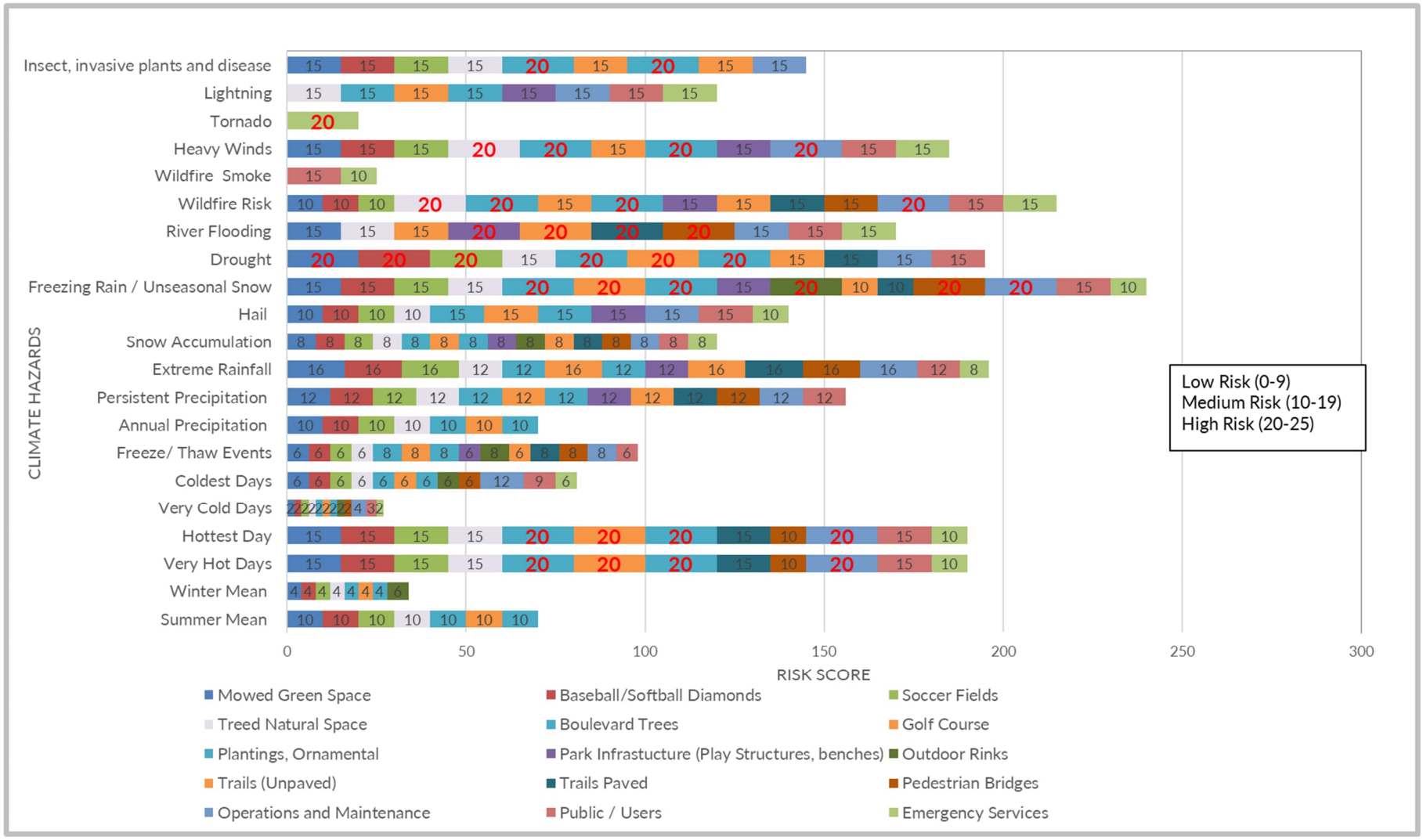
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-18** and illustrated on **Figure 4-31** with Environment/Parks components and risk scores identified. **Table 4-18** also described the discussed impacts due to the climate hazards.

Table 4-18 Climate Hazards

Climate Hazards	Environment/Parks Component	Impacts
Freezing Rain/ Unseasonal Snow	• Mowed Green Space • Baseball/softball Diamonds • Soccer Fields • Treed Natural Space Trails (paved and unpaved) • Boulevard Trees • Golf Course • Plantings, Ornamental • Park Infrastructure (play structures, benches) • Outdoor Rinks • Pedestrian Bridges • Trails Unpaved and paved • Operations and Maintenance Staff • Public users	• Damage vegetation. • Increase replacement and maintenance activities and costs. • Slippery surfaces for users, O&M staff.
Wildfire Risk	• Similar to Freezing Rain/Unseasonal Snow except Outdoor Rinks • Emergency Service	• Similar to Freezing Rain/Unseasonal Snow • Increase use of water during hottest days. • Flooding and pond of surfaces during extreme rainfall.
Hottest Days, Very Hot Days	• Similar to Freezing Rain/Unseasonal Snow except Park Infrastructure and Trails Unpaved.	

Climate Hazards	Environment/Parks Component	Impacts
Extreme Rainfall	• Similar to Freezing Rain/Unseasonal Snow except Outdoor Rinks.	
River Flooding	• Mowed Green Space • Treed Natural Space Trails (paved and unpaved) • Golf Course • Park Infrastructure • Trails (unpaved) • Trails (paved) • Pedestrian Bridges • Operations and Maintenance • Public/Users • Emergency Services	• Damage to the vegetation and infrastructure. • Increase replacement and maintenance activities and costs.
Heavy Winds	• Mowed Green Space • Ornamental Plantings • Baseball/softball Diamonds • Park Infrastructure (play structures, benches) • Soccer Fields • Treed Natural Space Trails (paved and unpaved) • Boulevard Trees • Golf Course • Public/Users • Emergency Services • Operations and Maintenance Staff	• Damage to the vegetation and infrastructure. • Increase replacement and maintenance activities and costs.
Drought	• Similar to Freezing Rain except for Park Infrastructure, Outdoor rinks, Pedestrian Bridges	• Vegetation kills resulting in increasing replacement and maintenance activities costs.
Hail	• Similar to Freezing Rain expect for Outdoor Rinks, Park Infrastructure, Pedestrian Bridge	• Vegetation kills resulting in increasing replacement and maintenance activities costs.
Inset, Invasive Plants, and Diseases	• Similar to Drought except for Trails Paved, Pedestrian Bridge, Public Users, Emergency Services	• Vegetation damage or kills resulting in increasing replacement and maintenance activities costs.

Figure 4-31 Risk Score Based on Climate Hazards for 2080s

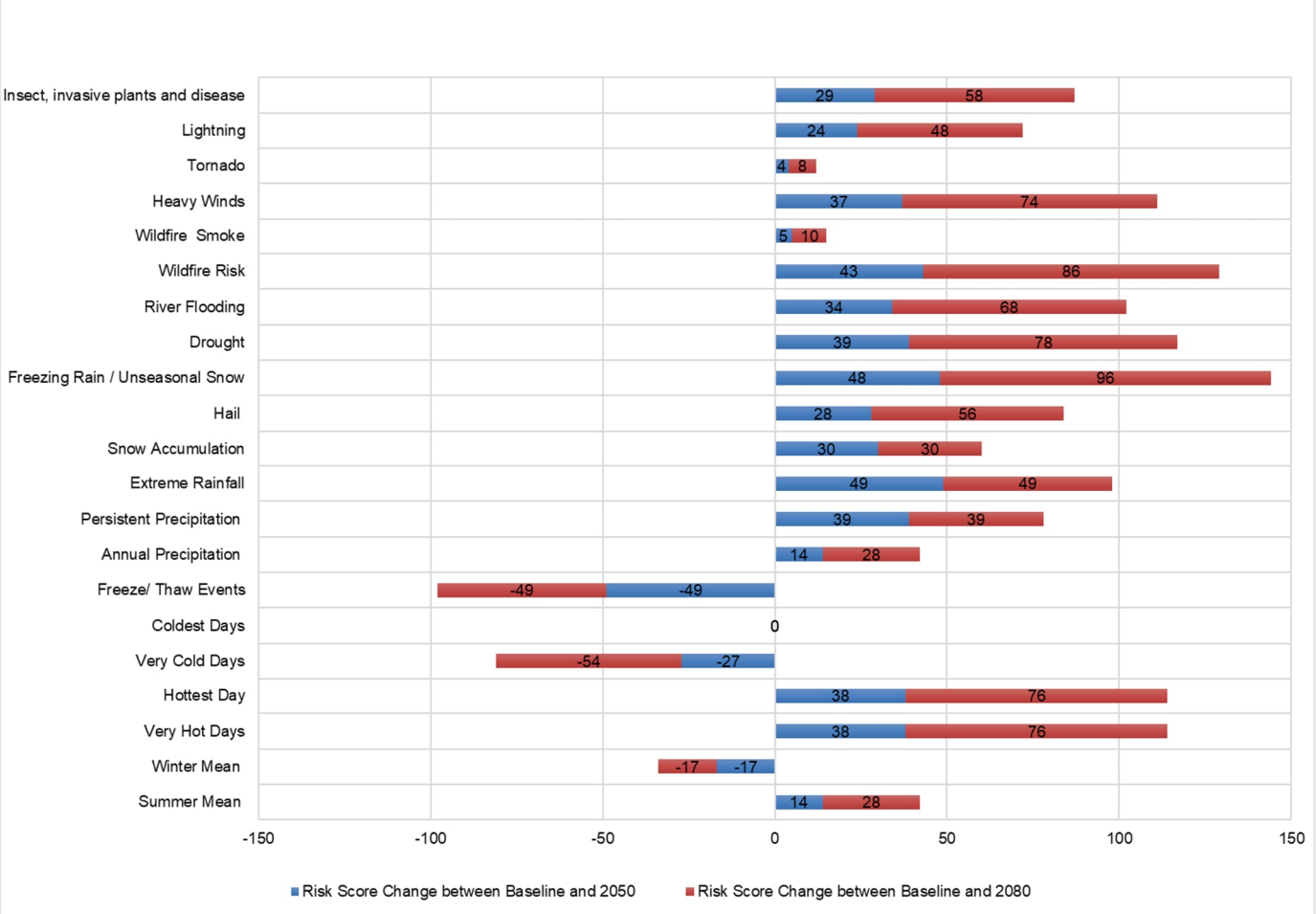


3. ***What are other individual high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure
Tornado	Emergency Services

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-32** showed the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Winter Mean, and Very Cold Days, are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-32 Climate Trends and Risk Score (Deltas)



4.10 Facilities

The City owns and operates many facilities including:

- City Hall;
- Arenas - Max McLean, Border, Encana Arena;
- Max McLean Curling Rink;
- Aquatic Centre;
- Community Centre;
- Stoney Creek Centre;
- Ski Maintenance Building;
- Community Services Maintenance Shop;
- Camrose Museum Buildings;
- Youth Centre;
- Bill Fowler Centre;
- Police Station;
- Fire Hall;
- CREDCO Building;
- Library;
- Airport Terminal;
- Public Works Office & Shop;
- 39 Street Shop – Public Works Storage;
- 46 Street Shop – Utilities;
- Landfill Office;
- Recycle Depot;
- Food Bank Building;

The analysis for facilities, as discussed with the City, was grouped as follows:

- City Hall;
- Rec Facilities (Arenas - Max McLean, Border, Encana Arena, Max McLean Curling Rink, Aquatic Centre, Community Centre);
- Police Station;
- Fire Hall (new building);
- Library/Mirror Lake Centre;
- Misc. Buildings (Stoney Creek Centre, Ski Maintenance Building, Community Services Maintenance Shop, Camrose Museum Buildings, Youth Centre, Bill Fowler Centre, CREDCO building, Food Bank Building)

Relevant infrastructure for each group of facilities is listed below:

- Civil - Site, Parking, Landscaped Areas, Stormwater;
- Structural - Building Envelope;

- Mechanical – HVAC;
- Electrical - Electrical and Communications;
- Plumbing - Water and Wastewater;
- Life Safety;
- Building Staff;
- Public / Customers;
- IT (Server Rooms);
- Emergency Services;
- Solar – Rec Facilities only; and
- Speciality Equipment (Ice Plant, Pool) - Rec Facilities only.

The Master Risk Assessment for Facilities system is found in **Appendix A**. The four key questions are addressed in the following sections.

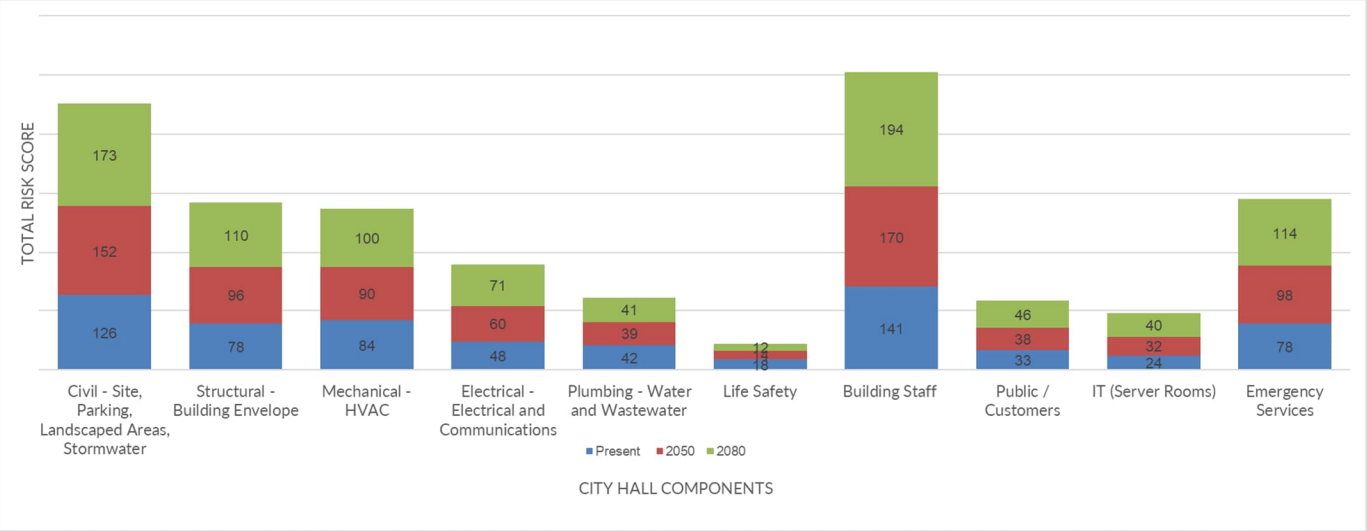
4.10.1 City Hall

1. ***Which infrastructure/asset components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 236. The vulnerable components that scored above 236 are identified in **Table 4-19** and illustrated on **Figure 4-33.**

Table 4-19 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Building Staff	141	170	194	**505**
Civil – Site, Parking, Landscaped Areas, and Stormwater Drainage	126	152	173	**451**
Emergency Services	78	98	114	**290**
Structural – Building Envelope	78	96	110	**284**
Mechanical - HVAC	84	90	100	**274**

Figure 4-33 City Hall Components Overall Risk Score



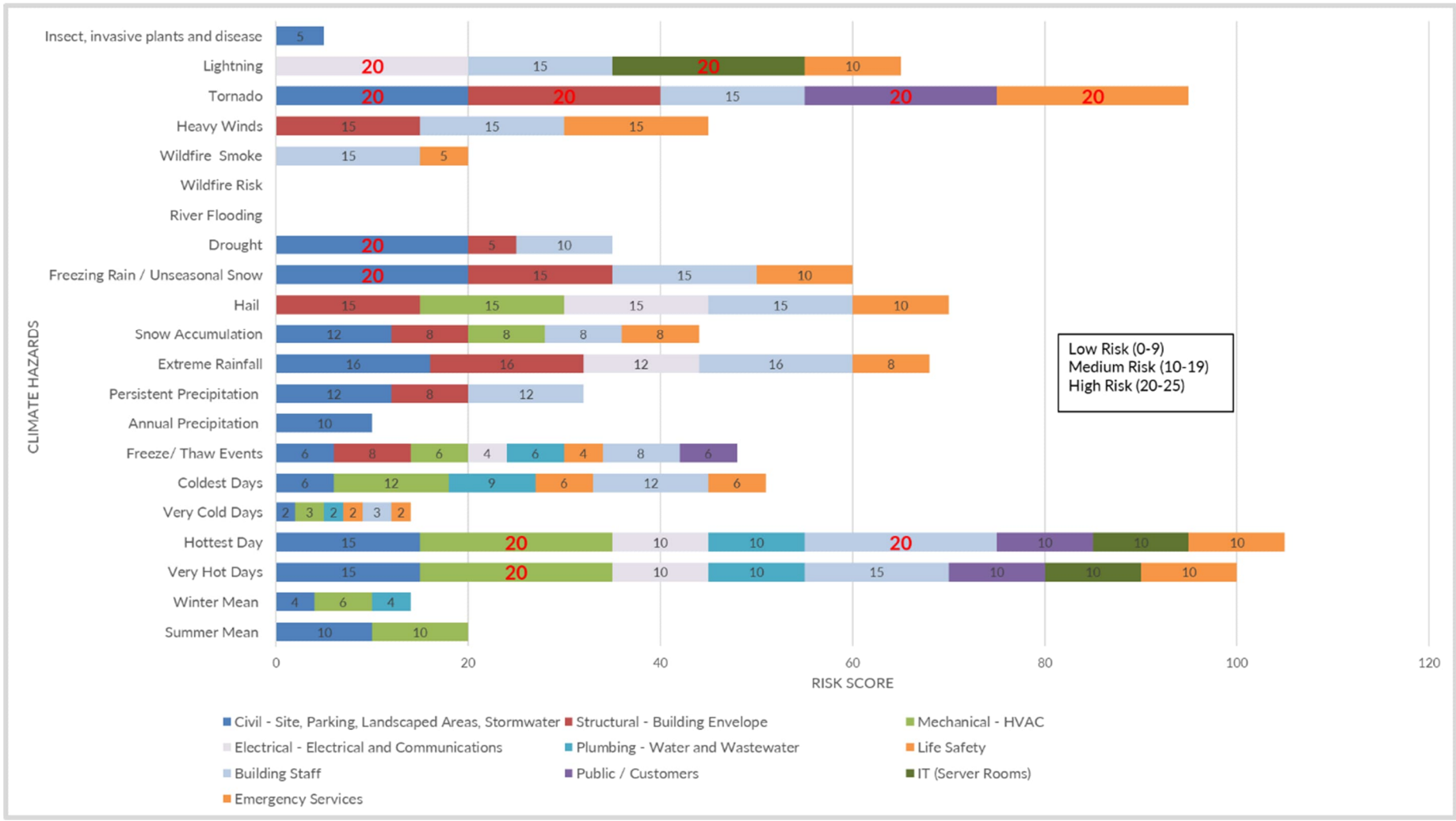
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-20** and illustrated on **Figure 4-34** with City Hall components and risk scores identified.

Table 4-20 Climate Hazards

Climate Hazards	City Hall (Facilities) Component	Impacts
Very Hot Days and Hottest Days	• Civil Site • Mechanical HVAC • Electrical and Communications • Plumbing – Water and Wastewater • Building Staff • Public/Customers • IT Server Room • Emergency Services	• Landscaped areas may be stressed. • Minor impact on asphalt surfaces of parking areas. • Increase energy consumption to cool the space. • Air conditioning and ventilation is overworking to keep up with the demands. • Increase cost in replacements. • Increase maintenance activities and costs. • Public seeking refuge in building to cool off that may not be working well.
Tornado	• Civil Site • Structural and Building Envelope • Building Staff • Public/Customers • Emergency Services	• Severe damage to buildings and infrastructure resulting in increase in replacement and restoration cost. • Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public.

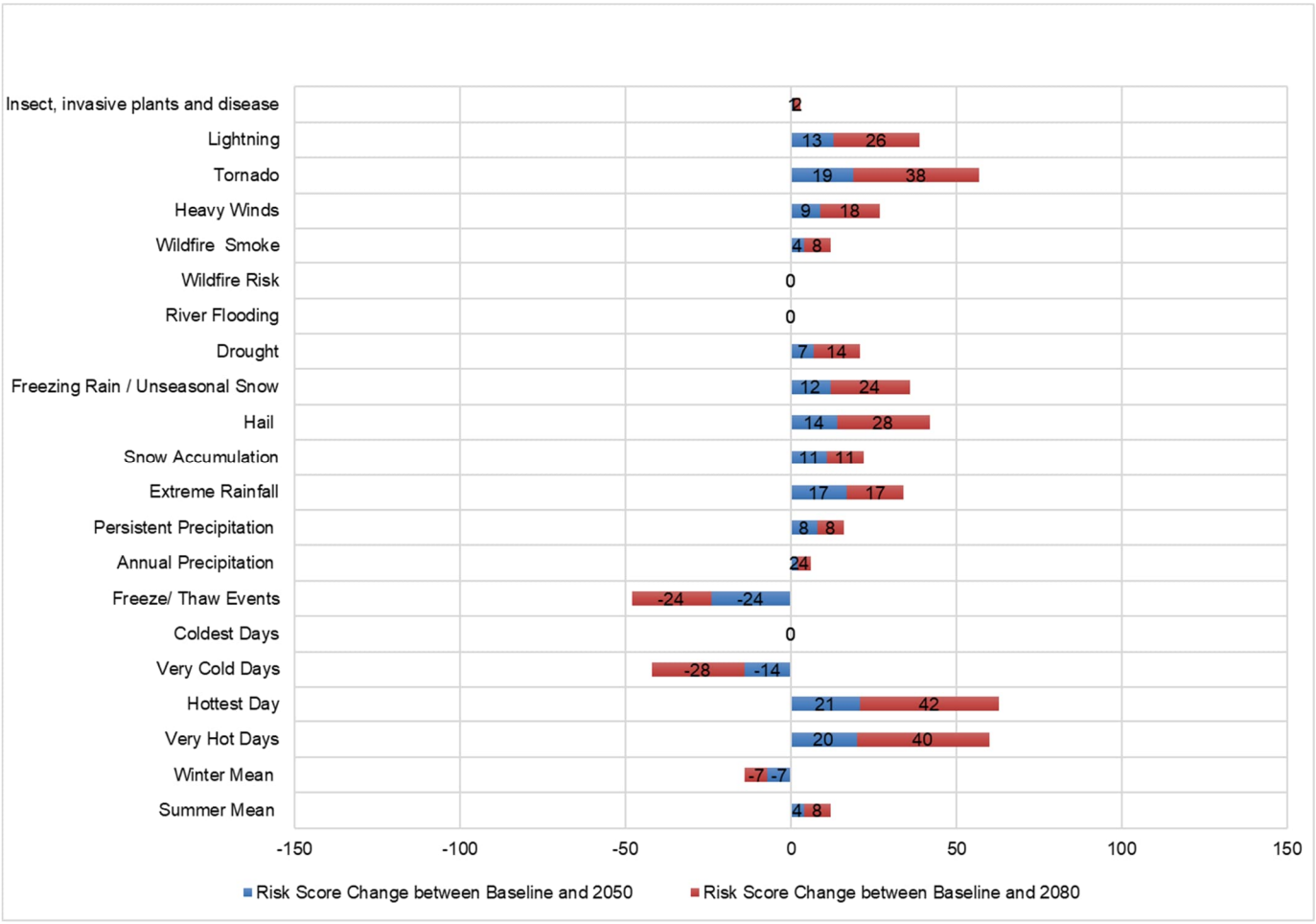
Climate Hazards	City Hall (Facilities) Component	Impacts
		• Fallen objects obstructing access. Longer recovery time and ability to service the public.
Hail	• Building Envelope • Mechanical HVAC • Electrical and Communications • Building Staff • Emergency Services	• Damage to the exposed systems resulting in increase replacement costs.
Extreme Rain	• Civil Site • Structural and Building Envelope • Electrical and Communications • Building Staff • Emergency Services	• Causing site to pool or pond. • Saturating ground/foundation. • Seepage through windows or increase moisture in wall and roof systems.
Freezing Rain/ Unseasonal Snow	• Civil Site • Structural and Building Envelope • Building Staff • Emergency Services	• Slippery surfaces impeding access and drivability. Walking hazards for public and staff. • Increase need to salt and sanding.
Lightning	• Electrical and Communications • Building Staff • IT Server Room • Emergency Services	• Damage to the communication and electrical systems resulting in repairs, replacements. • Increase in replacement costs and operational costs.
Coldest Days	• Civil Site • Mechanical HVAC • Plumbing – Water and Wastewater • Life Safety • Building Staff • Emergency Services	• Increase energy consumption for heating. • Potential freezing of plumbing systems and fire water lines.
Freeze/Thaw Events	• Civil Site • Structural and Building Envelope • Mechanical HVAC • Electrical and Communications • Plumbing – Water and Wastewater • Life Safety • Building Staff	• Impact sidewalks and parking areas subgrades. • Minor impacts on exposed infrastructure. • Impact subgrades of buried utilities.

Figure 4-34 Risk Score Based on Climate Hazards for 2080s



3. ***What other individual infrastructure with high-risk scores that are noteworthy?*** All of the high-risk scores are listed in the above.
4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-35** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days, and Winter Mean are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-35 Climate Trends and Risk Score (Deltas)



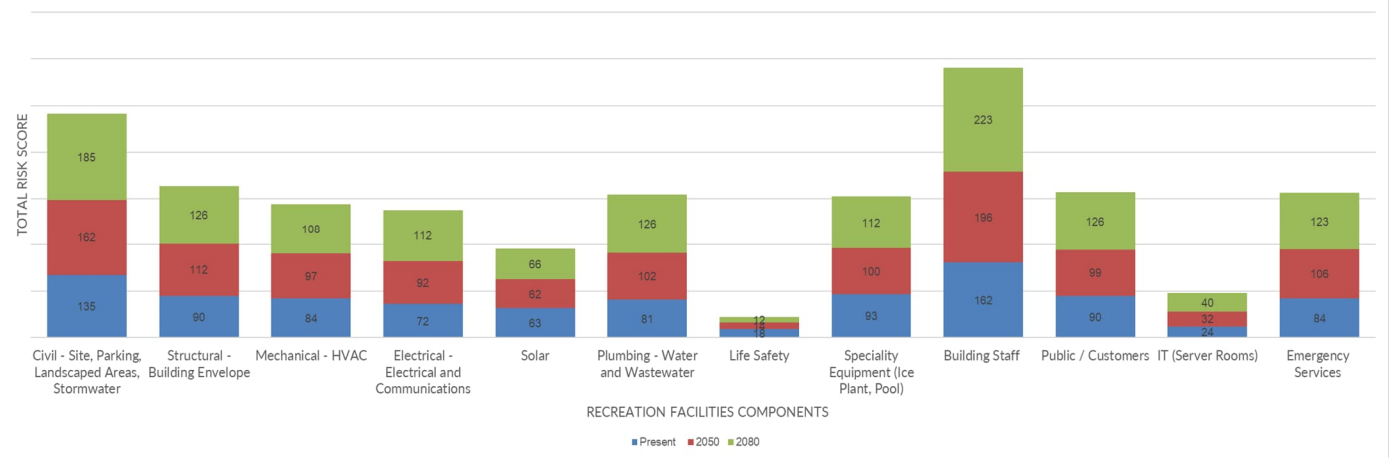
4.10.2 Recreational Facilities

1. ***Which infrastructure/asset components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 302. The vulnerable components that scored above 302 are identified in **Table 4-21** and illustrated on **Figure 4-36**.

Table 4-21 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Building Staff	162	196	223	**581**
Civil Site	135	162	185	**482**
Structural – Building Envelope	90	112	126	**328**
Emergency Services	84	106	123	**313**
Plumbing – Water and Wastewater	81	102	126	**309**
Specialty Equipment (Ice Plant, Pool)	93	100	112	**305**

Figure 4-36 Recreational Facilities Components Overall Risk Score

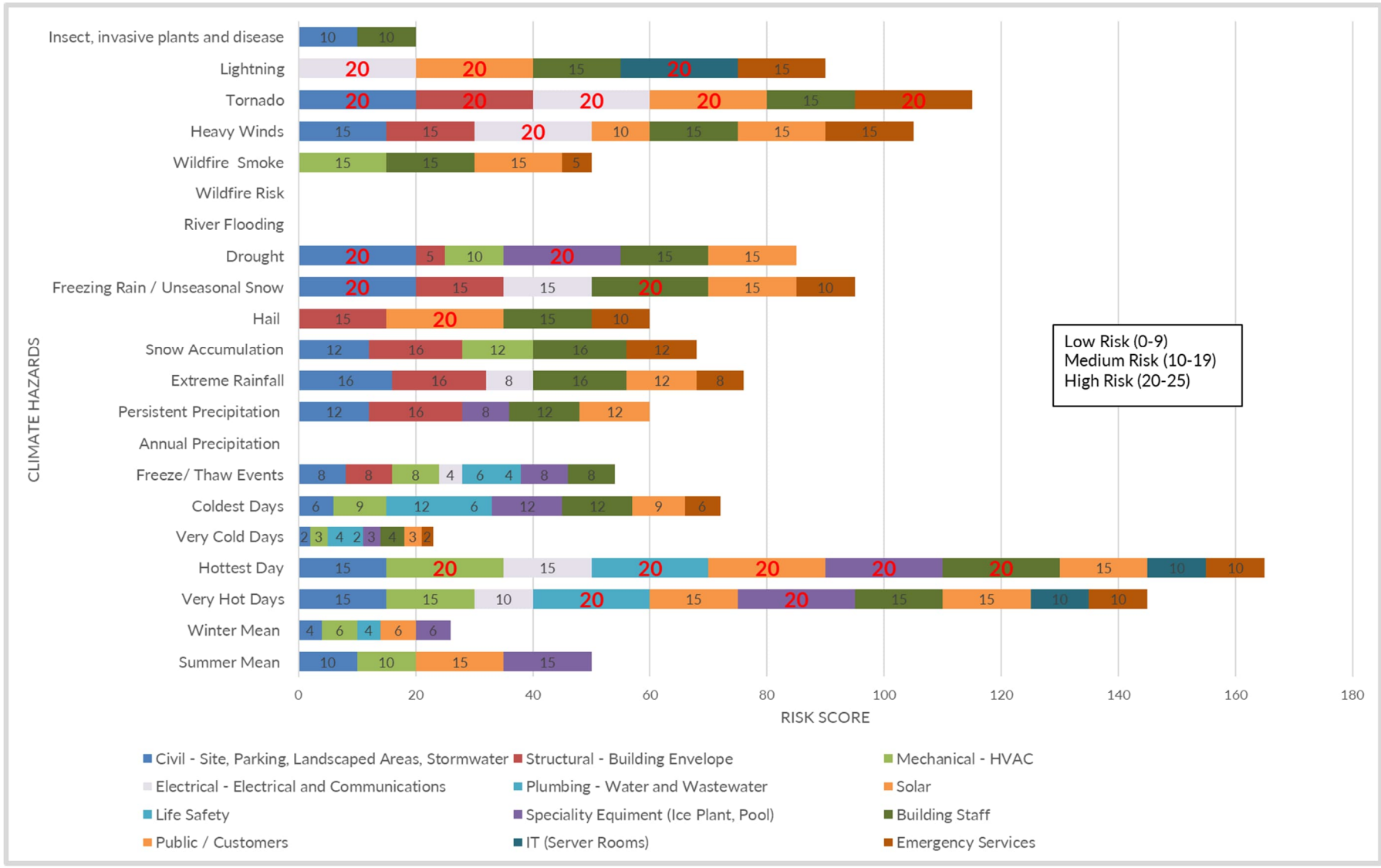


2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-22** and illustrated on **Figure 4-37** with Recreational Facilities components and risk scores identified.

Table 4-22 Climate Hazards

Climate Hazards	Recreational Facilities Component	Impacts
Very Hot Days and Hottest Days	• Civil Site • Mechanical HVAC • Electrical and Communications • Plumbing – Water and Wastewater • Solar • Specialty Equipment • Building Staff • Public/Customers • IT Server Room • Emergency Services	• Landscaped areas may be stressed. • Minor impact on asphalt surfaces of parking areas. • Increase energy consumption to cool the space. • Air conditioning and ventilation is overworking to keep up with the demands. • Specialty equipment may overheat. • Increase cost in replacements in equipment. • Increase maintenance activities and costs. • Public seeking refuge in building to cool off that may not be working well.
Heavy Winds and Tornado	• Civil Site • Structural and Building Envelope • Electrical and Communications • Solar • Building Staff • Public/Customers • Emergency Services	• Severe damage to buildings and infrastructure resulting in increase in replacement and restoration cost. • Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public. • Fallen objects obstructing access.
Freezing Rain/Unseasonal Snow	• Civil Site • Structural and Building Envelope • Electrical and Communications • Building Staff • Emergency Services	• Damage to exposed structures and equipment resulting in replacements and maintenance costs. • Slippery surfaces impeding access and drivability. Walking hazards for public and staff. • Increase need to salt and sanding.
Drought	• Civil Site • Structural and Building Envelope • Mechanical HVAC • Specialty Equipment • Building Staff • Public/Customers	• Vegetation kills resulting in increase replacements and costs. • Reduced available water for consumption and use at the pools. • Public would need to observe water conservation policies.
Lightning	• Electrical and Communications • Solar • Building Staff • IT Server Room • Emergency Services	• Damage to the communication and electrical system (inclusive of solar) resulting in repairs, replacements. • Increase in replacement costs and operational costs.
Extreme Rainfall	• Civil Site • Structural and Building Envelope • Electrical and Communications • Building Staff • Emergency Services	• Causing site to pool or pond. • Saturating ground/foundation. • Seepage through windows or increase moisture in wall and roof systems.

Figure 4-37 Risk Score Based on Climate Hazards for 2080s

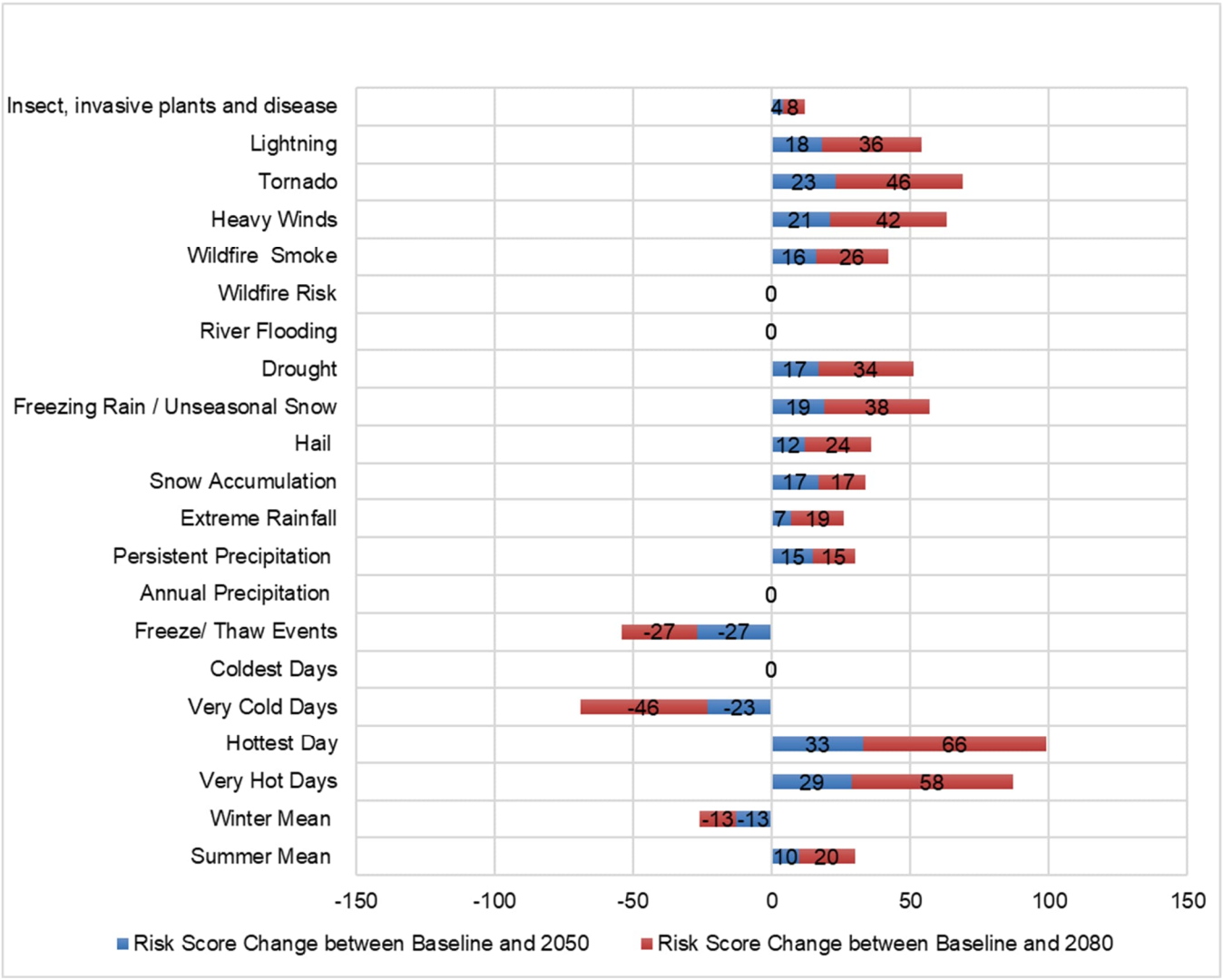


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure
Hail	Solar and Building Envelope

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-38** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days and Winter Means are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-38 Climate Trends and Risk Score (Deltas)



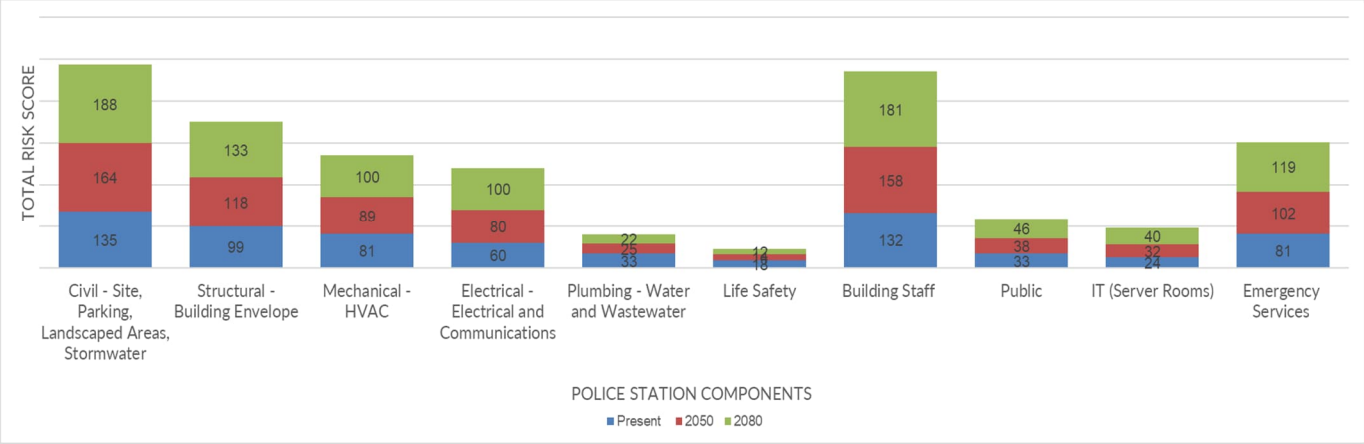
4.10.3 Police Station

1. ***Which infrastructure/asset components are the most vulnerable?*** The average Total Risk score from Present Day to 2080s is 264. The vulnerable components that scored above 264 are identified in **Table 4-23** and illustrated on **Figure 4-39**.

Table 4-23 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Civil Site	135	164	188	**487**
Building Staff	132	158	181	**471**
Structural – Building Envelope	99	118	133	**350**
Emergency Services	81	102	119	**302**
Mechanical - HVAC	81	89	100	**270**

Figure 4-39 Police Station Components Overall Risk Score

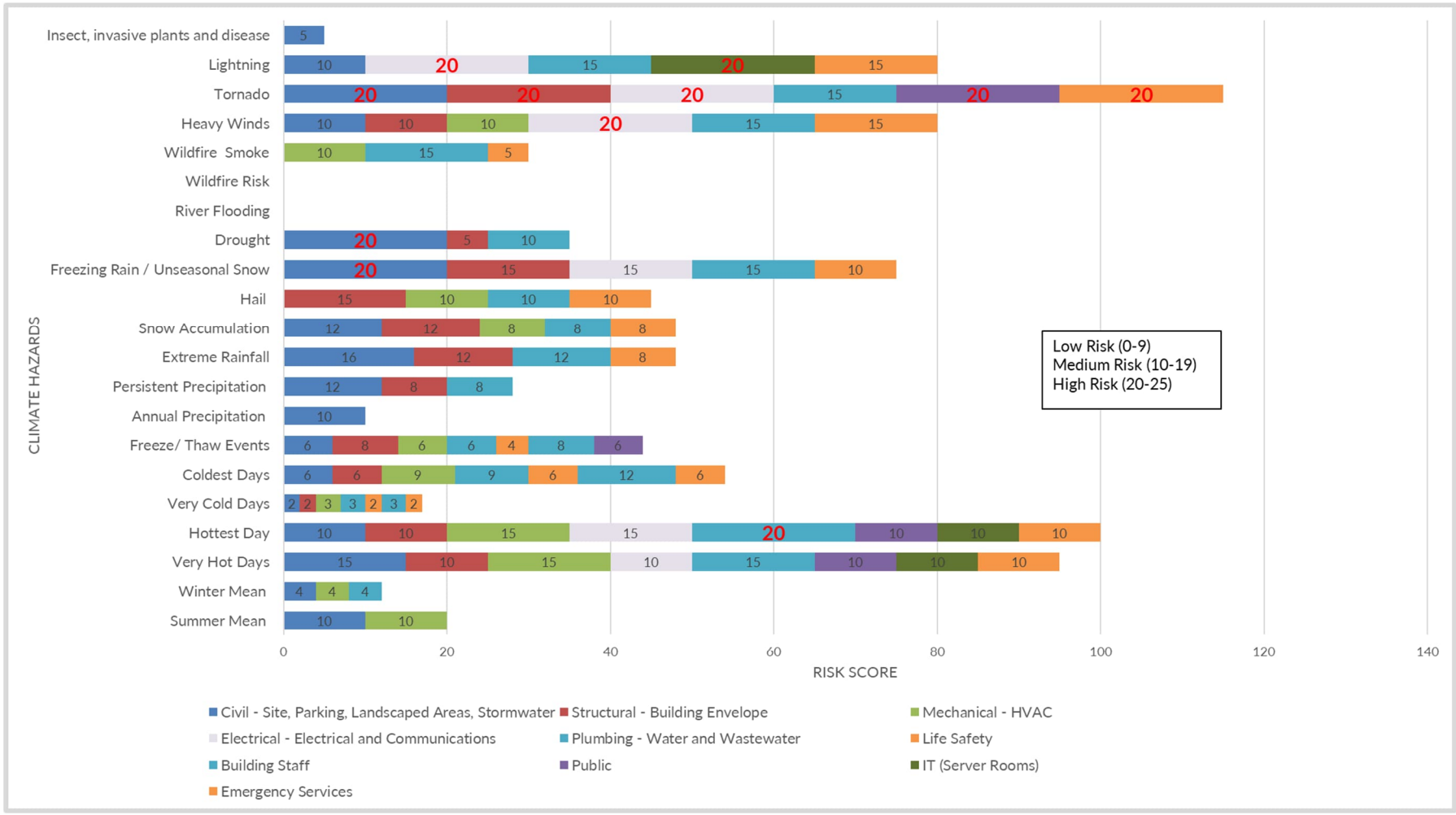


2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-24** and illustrated on **Figure 4-40** with Police Station components and risk scores identified.

Table 4-24 Climate Hazards

Climate Hazards	Police Station Component	Impacts
Heavy Winds and Tornado	• Civil Site • Structural and Building Envelope • Electrical and Communications • Building Staff • Public/Customers • Emergency Services	• Severe damage to buildings and infrastructure resulting in increase in replacement and restoration cost. • Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public. • Fallen objects obstructing access.
Very Hot Days and Hottest Days	• Civil Site • Mechanical HVAC • Electrical and Communications • Specialty Equipment • Building Staff • Public/Customers • IT Server Room • Emergency Services	• Landscaped areas may be stressed. • Minor impact on asphalt surfaces of parking areas. • Increase energy consumption to cool the space. • Air conditioning and ventilation is overworking to keep up with the demands. • Specialty equipment may overheat. • Increase cost in replacements in equipment. • Increase maintenance activities and costs. • Public seeking refuge in building to cool off that may not be working well.
Freezing Rain/ Unseasonal Snow	• Civil Site • Structural and Building Envelope • Electrical and Communications • Building Staff • Emergency Services	• Damage to exposed structures and equipment resulting in replacements and maintenance costs. • Slippery surfaces impeding access and drivability. • Slippery surfaces impeding access and drivability. Walking hazards for public and staff. • Increase need to salt and sanding.
Coldest Days	• Civil Site • Structural and Building Envelope • Mechanical – HVAC • Plumbing • Life Safety • Building Staff	• Vegetation kills due to cold temperatures resulting in replacements. • Mechanical system operations more frequent to warm the building space. • Freezing of plumbing and life safety resulting breaks and water damage to the building. • Increase replacement and maintenance costs.
Lightning	• Civil Site • Electrical and Communications • Building Staff • IT Server Room • Emergency Services	• Damage to tall trees. • Damage to the communication and electrical system resulting in repairs, replacements. • Increase in replacement costs and operational costs.

Figure 4-40 Risk Score Based on Climate Hazards for 2080s

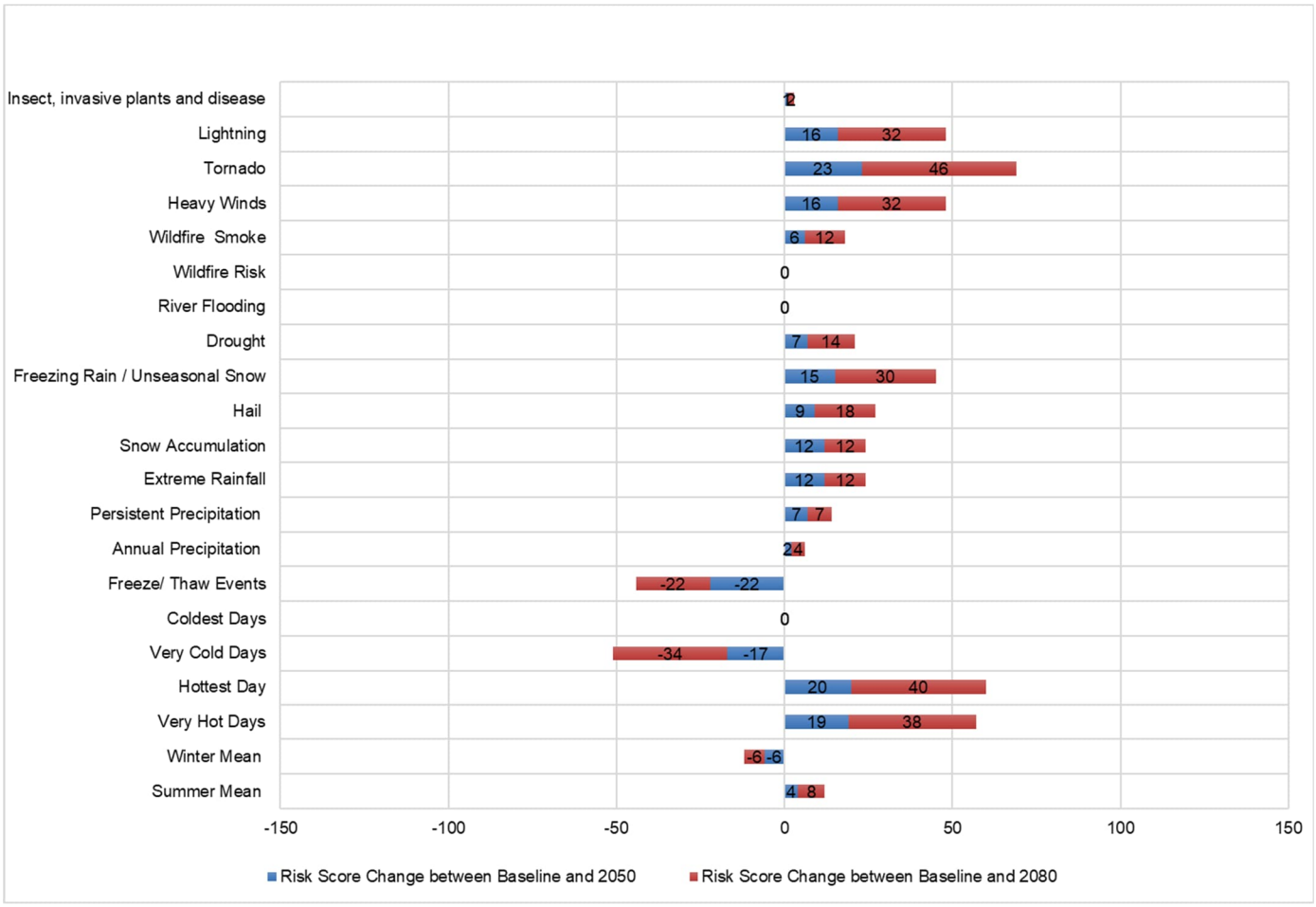


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure
Drought	Civil – Site, Parking, Landscaped Areas

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-41** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days and Winter Means are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-41 Climate Trends and Risk Score (Deltas)



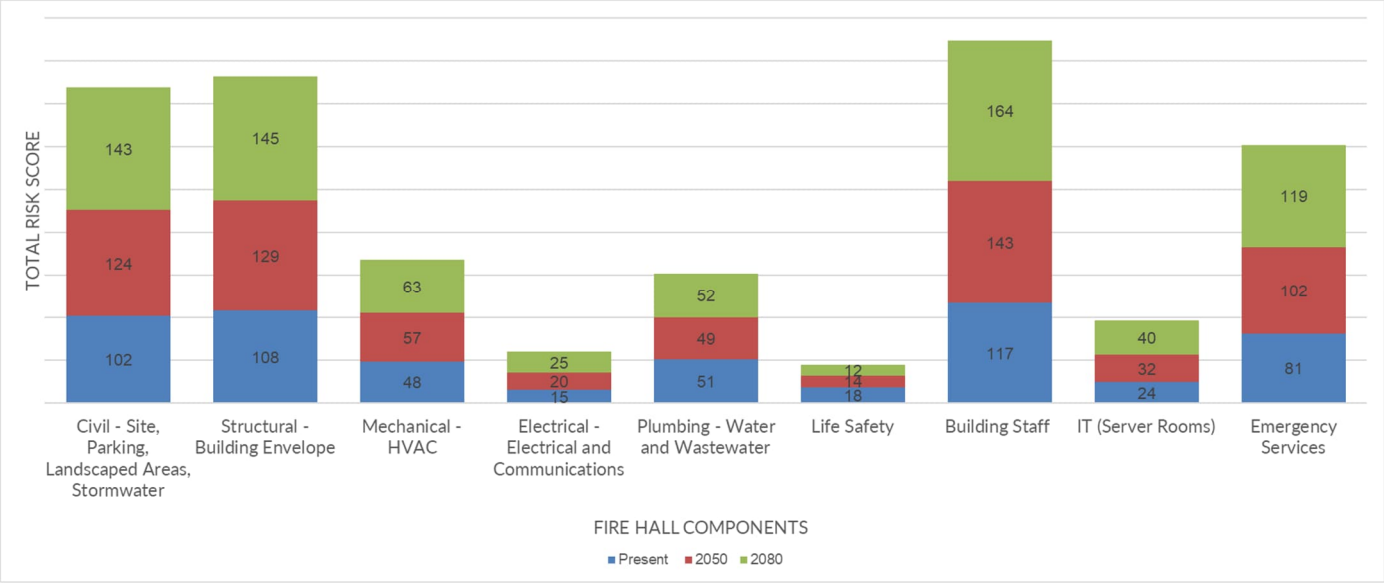
4.10.4 Fire Hall

1. ***Which infrastructure/asset components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 230. The vulnerable components that scored above 230 are identified in **Table 4-25** and illustrated on **Figure 4-42**.

Table 4-25 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Building Staff	117	143	164	**424**
Structural – Building Envelope	108	129	145	**382**
Civil Site	102	124	143	**369**
Emergency Services	81	102	119	**302**

Figure 4-42 Fire Hall Components Overall Risk Score

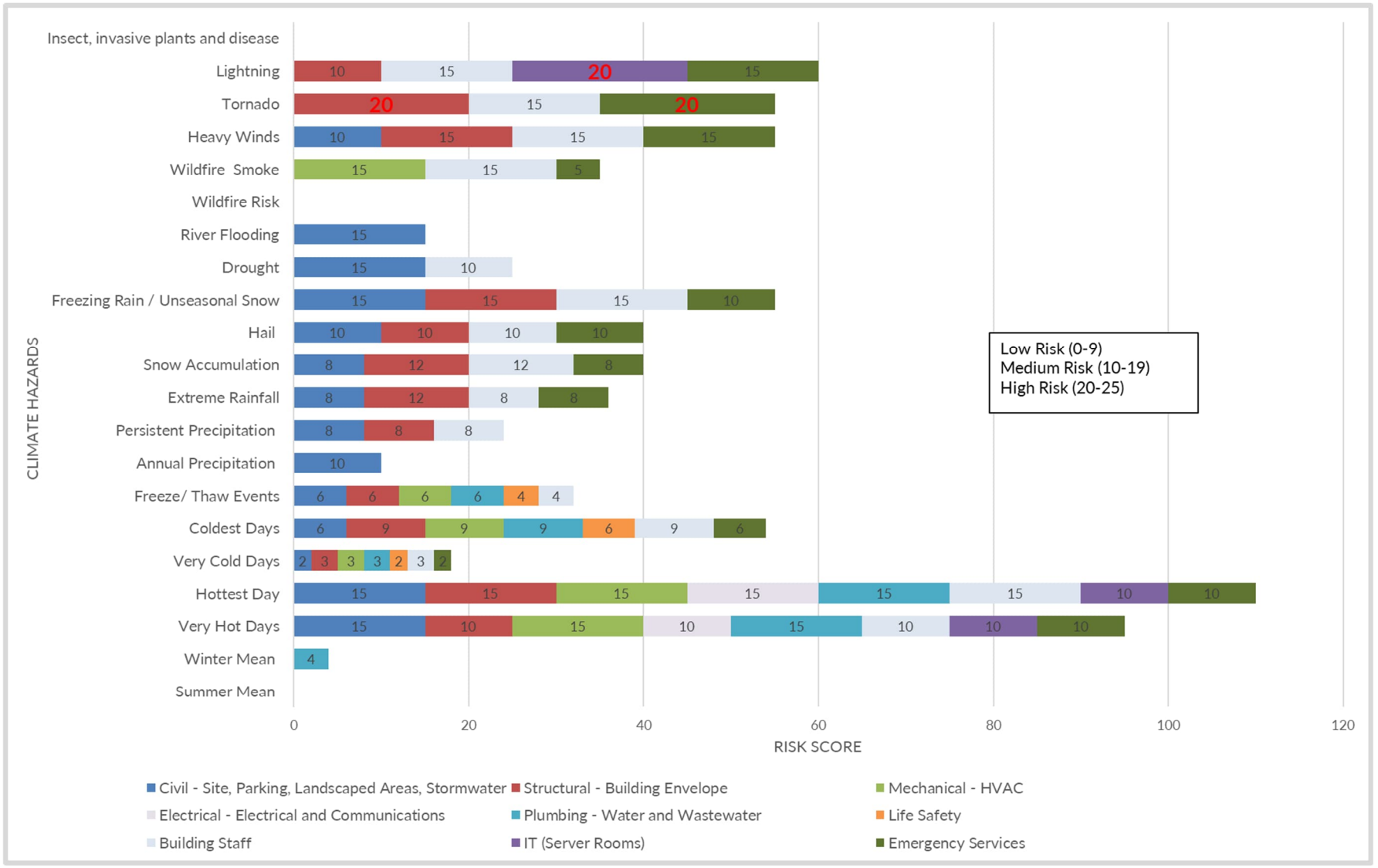


2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-26** and illustrated on **Figure 4-43** with Fire Hall components and risk scores identified.

Table 4-26 Climate Hazards

Climate Hazards	Fire Hall Component	Impacts
Heavy Winds and Tornado	• Civil Site • Structural and Building Envelope • Building Staff • Emergency Services	• Severe damage to buildings and infrastructure resulting in increase in replacement and restoration cost. • Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering staff. • Fallen objects obstructing access.
Very Hot Days, and Hottest Days	• Civil Site • Structural – Building Envelope • Mechanical HVAC • Electrical and Communications • Plumbing - Water and Wastewater • Building Staff • IT Server Room • Emergency Services	• Landscaped areas may be stressed. • Minor impact on asphalt surfaces of parking areas. • Increase energy consumption to cool the buildings. • Air conditioning and ventilation is overworking to keep up with the demands. • Increase cost in replacements in equipment. • Increase maintenance activities and costs.
Freezing Rain/ Unseasonal Snow	• Civil Site • Structural and Building Envelope • Building Staff • Emergency Services	• Damage to exposed structures and equipment resulting in replacements and maintenance costs. • Slippery surfaces impeding access and drivability. Slippery surfaces impeding access and drivability. Walking hazards for staff. • Increase need to salt and sanding.

Figure 4-43 Risk Score Based on Climate Hazards for 2080s

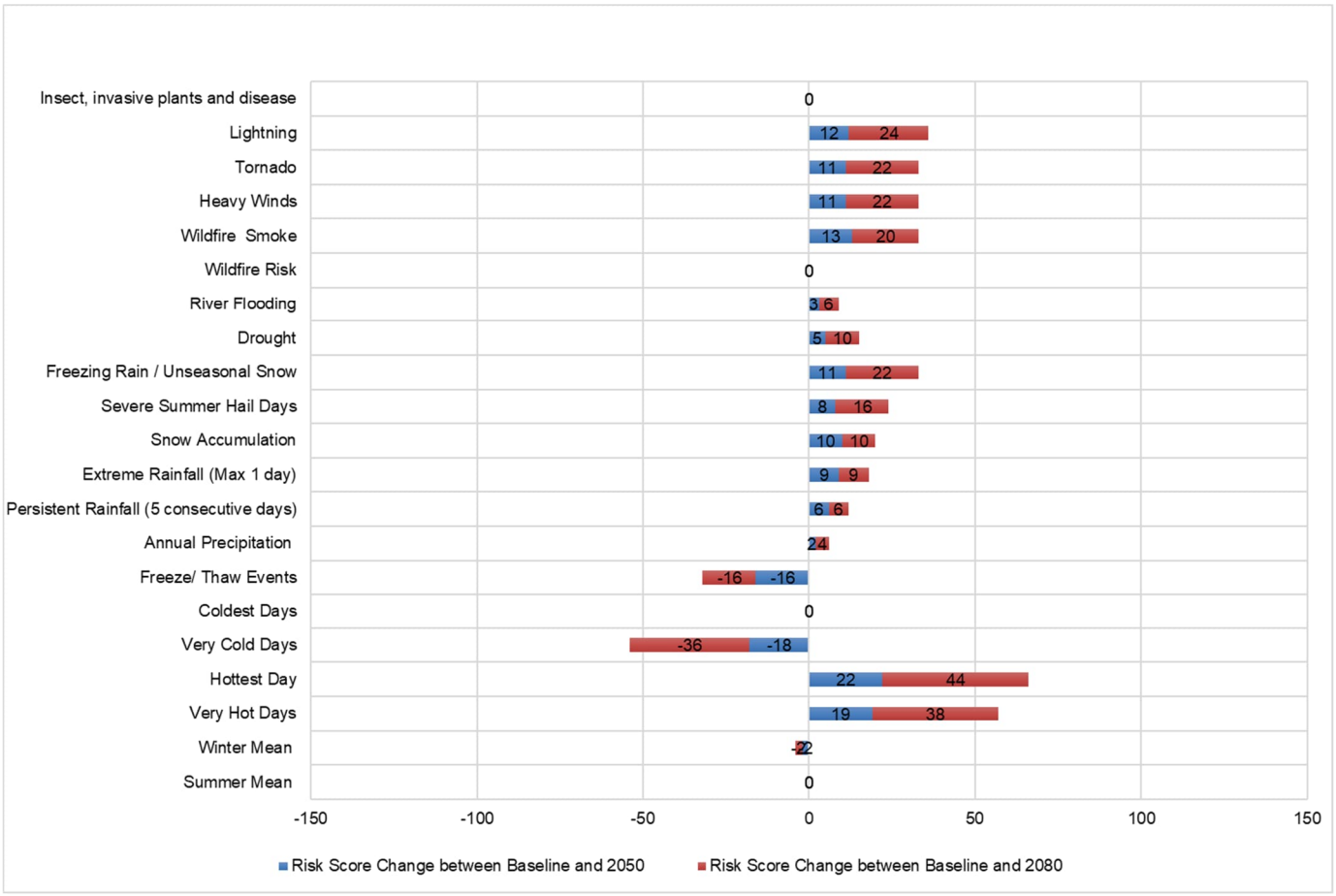


3. ***What other individual infrastructure with high-risk scores that are noteworthy?***

Climate Hazards	Impacted Infrastructure
Lightning	IT Server (electrical systems)

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-44** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days and Winter Means are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-44 Climate Trends and Risk Score (Deltas)



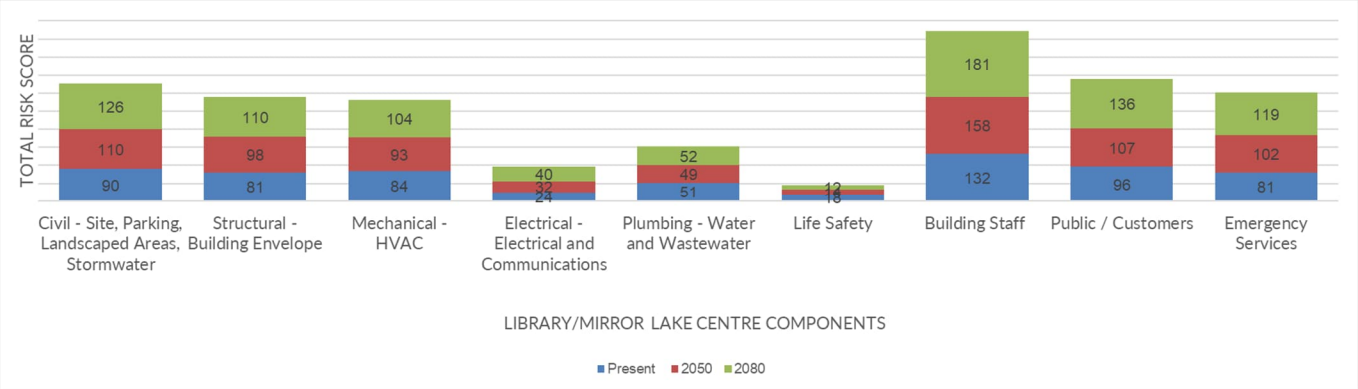
4.10.5 Library/Mirror Lake Centre

1. ***Which infrastructure/asset components are the most vulnerable***? The average Total Risk Score from Present Day to 2080s is 268. The vulnerable components that scored above 268 are identified in **Table 4-27** and illustrated on **Figure 4-45**.

Table 4-27 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Building Staff	132	158	181	**471**
Public/Customers	96	107	136	**339**
Civil Site	90	110	125	**326**
Emergency Services	81	102	119	**302**
Structural – Building Envelope	81	98	110	**289**
Mechanical - HVAC	84	93	104	**281**

Figure 4-45 Library/Mirror Lake Centre Components Overall Risk Score

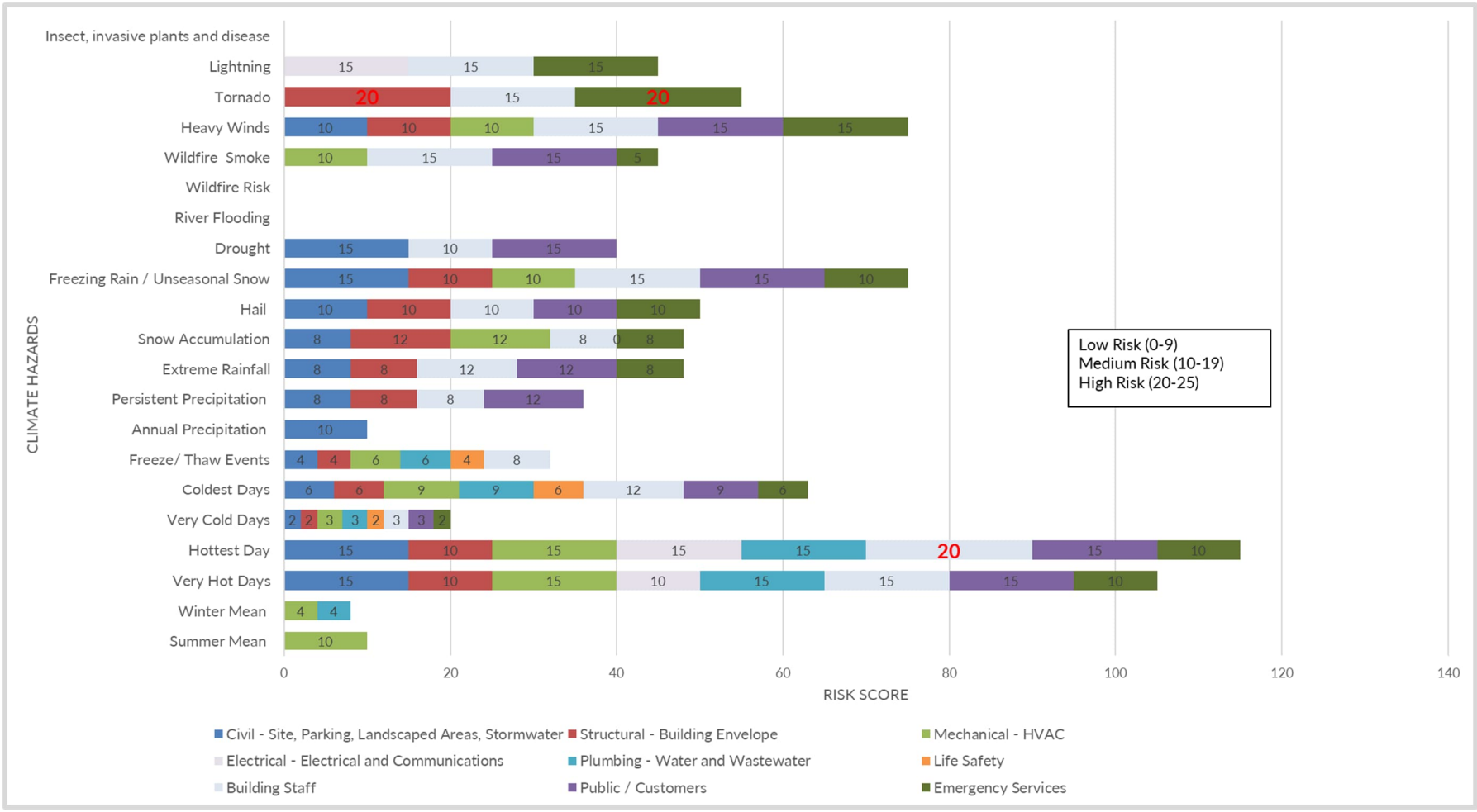


2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-28** and illustrated on **Figure 4-46** with Library/Mirror Lake components and risk scores identified.

Table 4-28 Climate Hazards

Climate Hazards	Library/Mirror Lake Centre Component	Impacts
Very Hot Days and Hottest Days	• Civil Site • Structural – Building Envelope • Mechanical HVAC • Electrical and Communications • Plumbing - Water and Wastewater • Building Staff • Public/Customers • Emergency Services	• Landscaped areas may be stressed. • Minor impact on asphalt surfaces of parking areas. • Increase energy consumption to cool the buildings. • Air conditioning and ventilation is overworking to keep up with the demands. • Increase cost in replacements in equipment. • Increase maintenance activities and costs. • Public seeking refuge in building to cool off that may not be working well.
Heavy Winds and Tornado	• Civil Site • Structural and Building Envelope • Mechanical - HVAC • Building Staff • Public/Customers • Emergency Services	• Severe damage to buildings and infrastructure resulting in increase in replacement and restoration cost. • Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public and staff. • Fallen objects obstructing access.
Freezing Rain/Unseasonal Snow	• Civil Site • Structural and Building Envelope • Mechanical - HVAC • Building Staff • Public/Customers • Emergency Services	• Damage to exposed structures and equipment resulting in replacements and maintenance costs. • Slippery surfaces impeding access and drivability. Walking hazards for public and staff. • Increase need to salt and sanding.

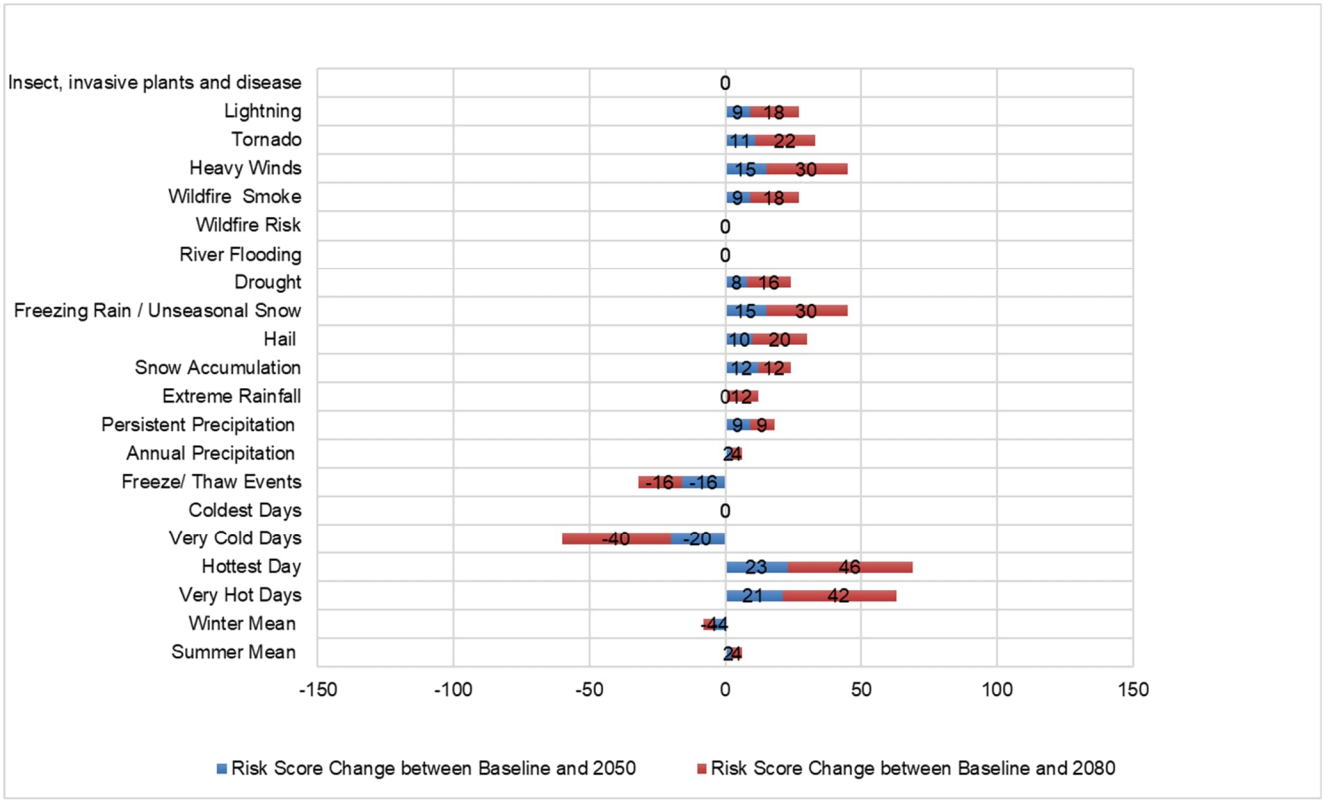
Figure 4-46 Risk Score Based on Climate Hazards for 2080s



3. ***What other individual infrastructure with high-risk scores that are noteworthy?*** All are identified under No. 2.

4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-47** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days and Winter Means are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-47 Climate Trends and Risk Score (Deltas)



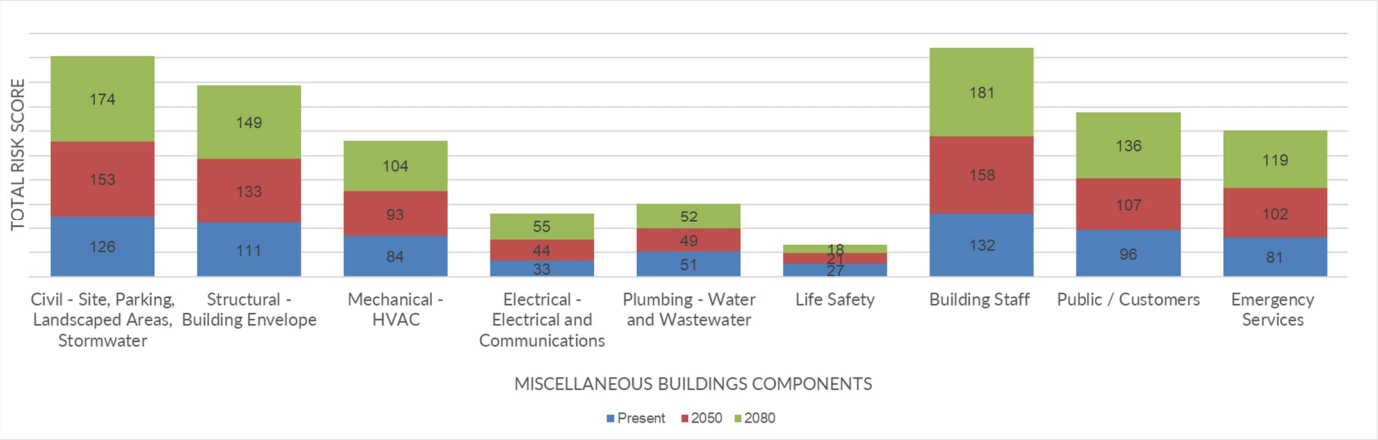
4.10.6 Miscellaneous Buildings

1. ***Which infrastructure/asset components are the most vulnerable?*** The average Total Risk Score from Present Day to 2080s is 304. The vulnerable components that scored above 304 are identified in **Table 4-29** and illustrated on **Figure 4-48**.

Table 4-29 Vulnerable Components Identified (Above Average)

Components	Present Day Risk Score	2050s Risk Score	2080s Risk Score	TOTAL
Civil Site	126	153	174	**453**
Building Staff	132	158	181	**471**
Structural – Building Envelope	111	133	149	**393**
Public/Customers	96	107	136	**339**

Figure 4-48 Miscellaneous Buildings Components Overall Risk Score



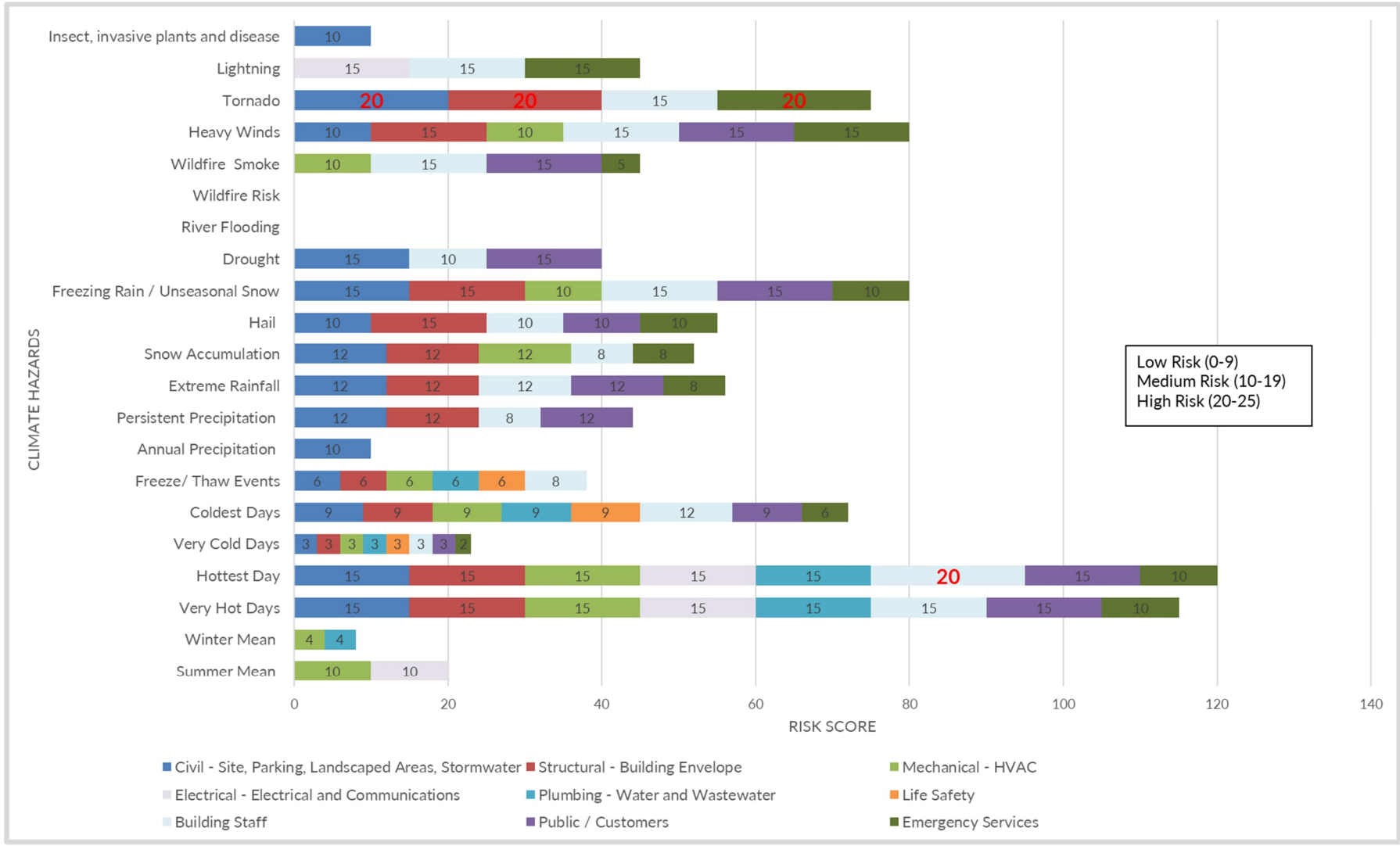
2. ***Which climate hazards have the highest impacts on the overall infrastructure?*** Climate hazards which have total risk scores that are above the calculated average are identified on **Table 4-30** and illustrated on **Figure 4-49** with Miscellaneous Buildings components and risk scores identified. **Table 4-30** also described the discussed impacts due to the climate hazards.

Table 4-30 Vulnerable Components Identified (Above Average)

Climate Hazards	Miscellaneous Buildings Component	Impacts
Very Hot Days and Hottest Days	• Civil Site • Structural – Building Envelope • Mechanical HVAC • Electrical and Communications • Plumbing - Water and Wastewater • Building Staff • Public/Customers • Emergency Services	• Landscaped areas may be stressed. • Minor impact on asphalt surfaces of parking areas. • Increase energy consumption to cool the buildings. • Air conditioning and ventilation is overworking to keep up with the demands. • Increase cost in replacements in equipment. • Increase maintenance activities and costs. • Public seeking refuge in building to cool off that may not be working well.

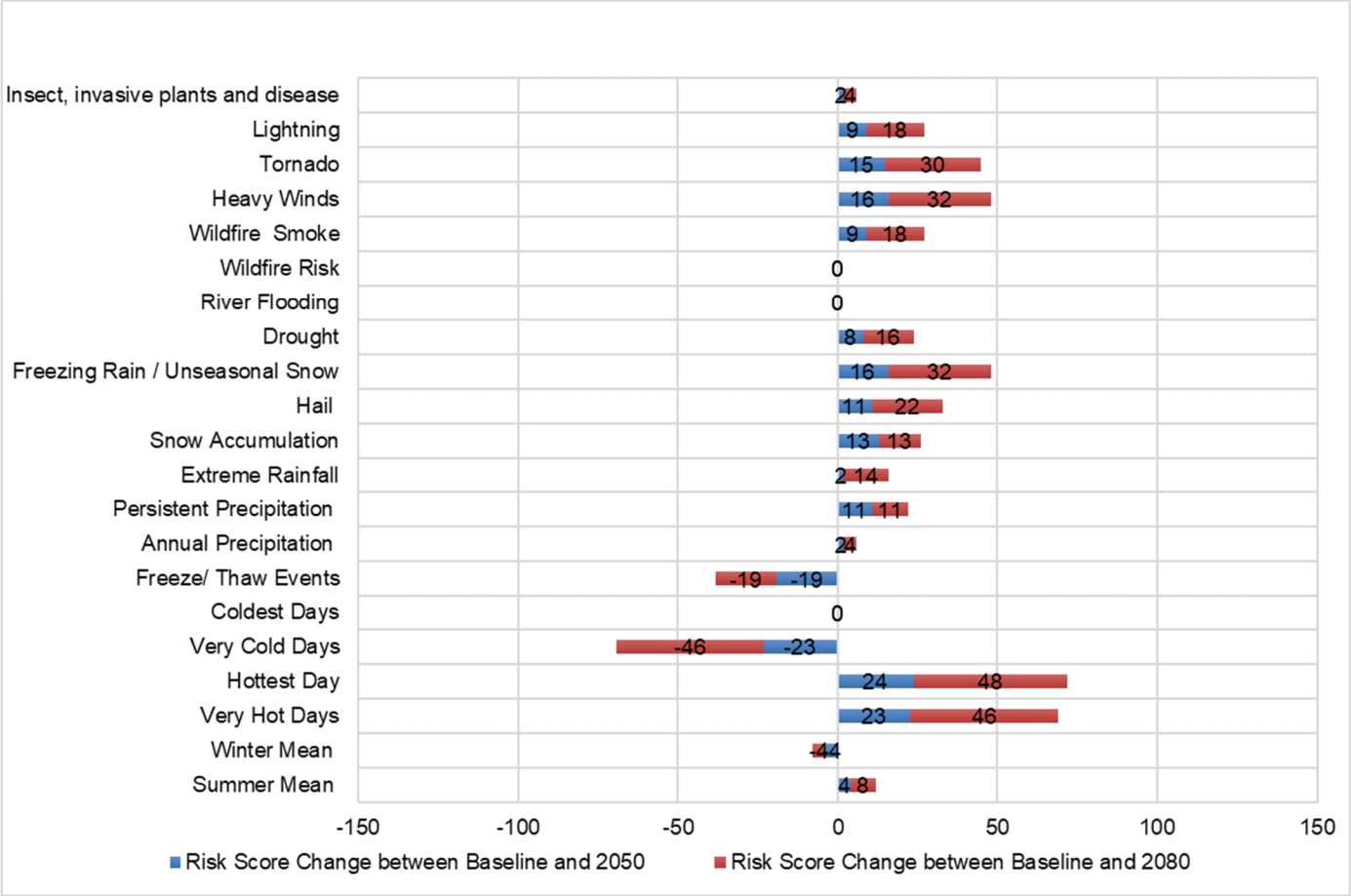
Climate Hazards	Miscellaneous Buildings Component	Impacts
Heavy Winds and Tornado	• Civil Site • Structural and Building Envelope • Mechanical - HVAC • Building Staff • Public/Customers • Emergency Services	• Severe damage to buildings and infrastructure resulting in increase in replacement and restoration cost. • Damage to assets and need for more frequent replacement. • Increase financial cost of repairs/replacements. • Loose/fallen materials endangering public and staff. • Fallen objects obstructing access.
Coldest Days	• Civil Site • Structural and Building Envelope • Mechanical – HVAC • Plumbing • Life Safety • Building Staff • Public/Customers • Emergency Services	• Vegetation kills due to cold temperatures resulting in replacements. • Mechanical system operations more frequent to warm the building space. • Freezing of plumbing and life safety resulting breaks and water damage to the building. • Increase replacement and maintenance costs.
Freezing Rain/Unseasonal Snow	• Civil Site • Structural and Building Envelope • Mechanical - HVAC • Building Staff • Public/Customers • Emergency Services	• Damage to exposed structures and equipment resulting in replacements and maintenance costs. • Slippery surfaces impeding access and drivability. Walking hazards for public and staff. • Increase need to salt and sanding.
Extreme Rainfall	• Civil Site • Structural and Building Envelope • Building Staff • Public/Customers • Emergency Services	• Erosion/washout of subgrades or gravel surfaces. • Temporary shut down of services (e.g. roads) and access to facilities or sites. • Increase financial cost of repairs/replacements.
Hail	• Civil Site • Structural and Building Envelope • Building Staff • Public/Customers • Emergency Services	• Damage to the exposed systems resulting in increase replacement costs. • Safety hazard to public and staff.

Figure 4-49 Risk Score Based on Climate Hazards for 2080s



3. ***What other individual infrastructure with high-risk scores that are noteworthy?*** All are noted in No. 2
4. ***What is the climate risk score trend from current to 2080s timescale?*** **Figure 4-50** shows the climate hazards will continue to impact the infrastructure with an increasing risk score. Contrary, climate hazards such as Freeze/thaw Events, Very Cold Days and Winter Means are showing downward trend as the climate is warming. Coldest Days appeared to remain consistent from 2050s to 2080s. The climate hazard noted as "0" means no change from baseline to 2080.

Figure 4-50 Climate Trends and Risk Score (Deltas)



4.11 Community (Social) and Local Economy

This section outlines the results of the City's Climate Risk Assessment process with a focus on impacts to the Community and Local Economy. The overall goal of the climate risk assessment in this section was to identify and prioritize climate change impacts affecting the City.

The scope of the climate risk assessment process for the Community and Local Economy in Camrose is defined below. The assessment considers climate related events and trends that may result in:

- **Direct Impacts** to public safety (loss of life, morbidity, injury, disease, etc.), quality of life (recreation, lifestyle, evacuations, etc.), municipal finances, or the local economy.
- **Indirect Impacts** to public safety (loss of life, morbidity, injury, disease, etc.), quality of life (recreation, lifestyle, etc.), or the local economy, as a result of impacts and damage to property & infrastructure, and interruption of services.

The scope is also limited to:

- Impacts arising from projected climate changes to the **2060s (2051-2080)** time period, under a **high greenhouse gas emissions scenario** (RCP 8.5)[2].
- Impacts within the geographic boundaries of the City of Camrose.
- **Impacts related to changes in the climate.** The assessment does not consider impacts related to, for example, provincial policy or legislative changes, broad economic impacts, or impacts related to demographic or population changes that might affect the workforce, etc.
- **Impacts on the Camrose of today.** While we are considering climate projections out to the 2060's, we consider those changes in terms of Camrose today, in terms of exiting development, land use patterns and resource capacity. The goal is to overlay the future climate on the Camrose of today. Doing so allows us to determine the climate adaptations that are necessary to implement now, to be resilient to climate changes anticipated in the future.
- **Impacts that are worsening (becoming more frequent or severe) as a result of climate change**. Climate change impacts that are improving with climate change, such as extreme cold events, snowstorms, and freeze-thaw cycles, are not included within this scope. Climate change may also provide some benefits, in terms of increased opportunities for recreation or agriculture. These potential benefits are also excluded.

The climate impact scenarios in **Table 4-31** outlined the ways in which climate hazards or impacts could affect social systems, community assets and/or the local economy in Camrose. The impact scenarios characterize the cause-and-effect relationship, or impact chain, between climate hazards (or changes) and consequences for the City. The impact scenarios were reviewed and updated by stakeholders at the **Climate Risk Assessment Workshop** on October 6, 2022.

[2] RCP (Representative Concentration Pathway) 8.5 is a "business as usual" scenario and assumes that world greenhouse gas emissions continue to increase at current rates through the end of the century.

Table 4-31 Climate Impact Scenarios

	Climate Driver	Impact	Description	Potential Social/Economic Consequences
1	Hotter Temperatures	Extended Heat Wave	A heat event similar, or worse, than the 2021 heat wave	• Health impacts, particularly on vulnerable populations with no or limited access to air conditioning, such as seniors and those with low income and/or housing challenged. • Increased cooling costs.
2	Hotter Temperatures	Prolonged Drought	Multi-year 'exceptional' drought (1:50 year event)	• Impacts to local farmers – reduced crop yields and affects to agriculturally-dependent local businesses, reduced community cash flow. • Impact to water-reliant local businesses. • Food security issues. • Potential impact to ground water/water table/water availability.
3	Extreme Weather	High Wind Event	A windstorm with gusts of greater than 110km per hour	• Impact on local events (delays/cancellations). • Health impacts, particularly on vulnerable populations such as low income and/or housing challenged. • Damage to utilities - power outage, loss of communications. • Property damage – shingles off homes/businesses, cost to repair. • Increased insurance costs.
4	Extreme Weather	Major Hail Event	Hailstorm with hail stones of 45 mm ("golf ball" sized) or greater	• Impact on local events (delays/cancellations). • Health impacts, particularly on vulnerable populations such as low income and/or housing challenged. • Property damage – roofing, siding, windows, cars, cost to repair.
5	Extreme Weather	Major Tornado	An EF (Enhanced Fujita) 3+ tornado with wind speeds between 218 to 266 km per hour and potential for "severe damage"	• Impact on local events (delays/cancellations). • Health impacts, particularly on vulnerable populations such as low income and/or housing challenged. • Damage to utilities - power outage, loss of communications. • Property damage – homes destroyed, cost to repair. • Emergency management implications.
6	Hotter Temperatures / Heavy Rainfall	Reduced Water Quality (Non-Potable)	Long-term/prolonged reduction in water quality in local water bodies	• Potential health impacts (blue-green algae). • Loss of recreation opportunities (fishing, boating) and reduced quality of life. • Financial impact to agriculture (increased water treatment and animal illness and disease).

	Climate Driver	Impact	Description	Potential Social/Economic Consequences
7	Hotter Temperatures	Loss Of Outdoor Winter Recreation Opportunities	Short winter recreation period (~100 'winter' days)	• Reduced quality of life (Nordic skiing, hockey, snowmobile, sledding, etc.). • Loss of culture (Scandinavian culture).
8	Hotter Temperatures	Increased Space Cooling Costs	Space cooling requirements increase significantly in the future (~450% increase)	• Increased costs for residents and business • Increased need for home and building retrofits – windows, walls, air conditioning, etc.
9	Hotter Temperatures	Freezing Rainstorm	Precipitation event in which rain freezes on impact	• Impact on local events (delays/cancellations). • Health impacts, particularly on vulnerable populations such as seniors and persons with disabilities. • Damage to utilities - power outage, loss of communications. • Property damage – cost to repair. • Transportation disruption – implications for emergency services and local business. • Damage to trees.
10	Hotter Temperatures	Wildland Fire	A wildland urban interface fire occurs, causing damage	• Local evacuations and displacement. • Potential health impacts (injuries/fatalities). • Damage to utilities - power outage, loss of communications. • Property damage.
11	Hotter Temperatures	Wildfire Smoke	Smoke from wildfires causing very high health risks (a '10' on the Air Quality Health Index)	• Health impacts (injuries/fatalities), particularly on seniors and those with existing (respiratory) health conditions. • Impacts to summer outdoor recreation (hiking, running, etc.) and reduced quality of life. • Increased costs of air filtration for residents and businesses.
12	Extreme weather	Extended power outage	3-day power outage caused by extreme weather (wildfire, wind, etc.) – affecting a neighbourhood / large area of City	• Health impacts (hospitalization/fatalities), particularly on vulnerable populations if event happens during extreme heat or cold. • Financial impact, particularly on vulnerable populations, such as lower income, with inability to purchase generator. • Closures and lost revenues for local businesses. • Loss of communications. • Basement flooding (sump pumps do not work).
13	Heavy rainfall	Overland flooding	Short-duration high intensity rainfall event (1:100-year, 1 hour event) requiring public 'intervention'	• Transportation disruption (flooded roads) - implications for emergency services and local business. • Basement flooding and property damage. • Increase insurance costs / risk.

The climate risk assessment results focused on the impacts of climate change to the Community and Local Economy in Camrose are presented below in both a Risk Matrix (**Figure 4-51**) and a Summary Table (**Table 4-32**).

Figure 4-51 Climate Risk Assessment Results (Matrix)

CONSEQUENCE	Rare	Unlikely	Possible	Likely	Almost Certain
Very High	Major Tornado			Extended Heat Wave	
High			Prolonged Drought Extended Power Outage		
Medium			Overland Flooding	Wildland Fire	High Wind Event Freezing Rainstorm Wildfire Smoke Major Hail Event Increased Space Cooling Costs
Low			Reduced Water Quality		
Very Low				Loss Of Outdoor Winter Recreation	
	LIKELIHOOD				

Table 4-32 Climate Risk Assessment Results (Table)

Impact	Historic Likelihood	Future Likelihood	Consequence	Risk Score
Extended Heat Wave	1	4	5	20
High Wind Event	4	5	3	15
Freezing Rainstorm	4	5	3	15
Wildfire Smoke	4	5	3	15
Major Hail Event	4	5	3	15
Increased Space Cooling Costs	3	5	3	15
Prolonged Drought	2	3	4	12
Extended Power Outage	1	3	4	12
Increased Space Cooling Costs	3	5	3	15
Wildland Fire	3	4	3	12
Overland Flooding	2	3	3	9
Major Tornado	1	1	5	5
Reduced Water Quality	2	3	1.5	4.5
Loss Of Outdoor Winter Recreation	3	4	1	4

As stated, the goal of the risk assessment process is to prioritize climate change risks, with the understanding that the City has finite resources and capacity and will be unable to address all potential risks. To support decision-making in terms of the risks that are to be considered in the climate adaptation action planning process, the decision thresholds outlined in **Table 4-33** is proposed. Further discussion on Adaptation planning will be discussed in **Section 5**.

Table 4-33 Climate Risk Assessment Decision Thresholds

Label	Decision
Very High Priority	Adaptation actions should be developed in the near-term to reduce risk to acceptable levels.
High Priority	Adaptation actions should be developed in the near- medium-term, to reduce risk to acceptable levels.
Medium Priority	Adaptation actions may be developed, particularly where low-cost options are available that provide other social, economic or environmental benefits.
Low Priority	No action required at this time beyond monitoring and consideration as part of regular reviews.
Very Low Priority	No action required at this time beyond monitoring and consideration as part of regular reviews.

4.12 Risk Assessment Summary

The risk assessment using PIEVC High Level Screen (HLS) tool was conducted on ten assets (built infrastructure) in **Workshop 2** with the City of Camrose's engineering and operations leads. The results of each asset were presented in **Sections 4.1** to **4.10** of this report with details discussing and identifying the vulnerable assets when exposed to the climate hazards. **Section 4.11** focused on the community (social) and local economy discussion led by All One Sky Foundation. Within the PIEVC High Level Screening tool, building staff and public users were also included in the risk assessment as well as emergency services.

The following summarizes the risk assessment results and analysis:

1. Impacts on Built Infrastructure

The ten asset categories that were evaluated are:

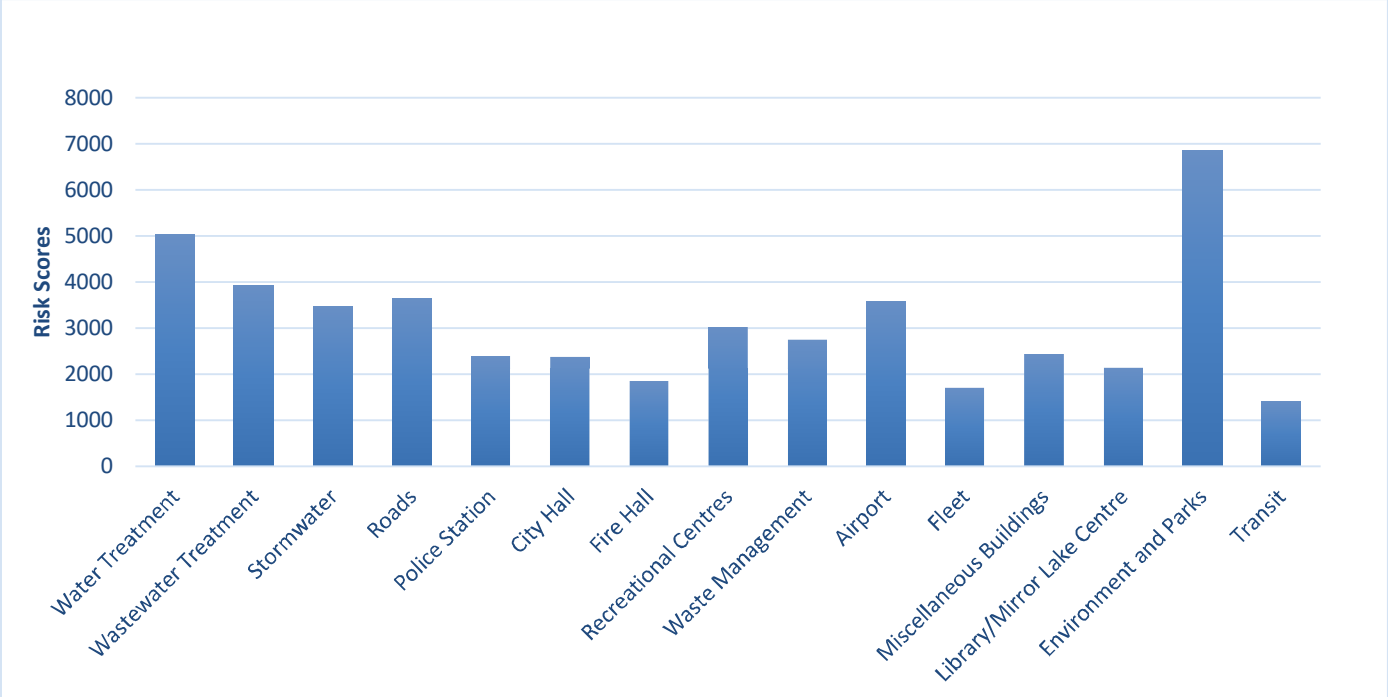
1. Stormwater;
2. Water;
3. Wastewater;
4. Waste Management;
5. Municipal facilities (City Hall, Recreational Centres, Police Station, Fire Hall, Library/Mirror Lake Centre, and Miscellaneous Buildings);
6. Fleet;
7. Roads;
8. Transit;
9. Airport; and
10. Environment and Parks.

In addition to the built assets, the emergency services, operational staff, building staff, and public users were also included in the risk analysis. Each asset listed above has several components that were assessed individually, and each component has a risk score that identifies its level of vulnerability. The total risk scores are calculated to show which components have the most risks and which climate hazard have the most impact. The high scorers are highlighted as ones that scored above average.

Using this data, **Figure 4-52** compares the total risk scores for all of City's assets. Note that this risk score does not include the discussion of "criticality"; this is discussed in **Section 6.0**.

Figure 4-52 shows that the **Environment and Parks** is the most vulnerable assets compared to the other infrastructure. **Water Treatment Systems** and **Wastewater Treatment Systems** are the next two most vulnerable assets in comparison; however, the risk scores are nearly half of Environment and Parks as there are fewer components exposed to climate hazards. Built infrastructure, including buildings, roads, bridges and underground utilities, often have lower risk scores as these structures were designed to engineering standards that considered varying historical climate impacts. Built infrastructure/designed structures are therefore more robust compared to natural vegetation.

Figure 4-52 Overall Asset Comparison



2. Impacts on Staff, Public and Emergency Services

Within the PIEVC HLS tool, the staff, public and emergency services were also assessed. Similar to the built assets, likelihood of climate impacts, and consequence scoring were given to each of these group to obtain a risk score. All three groups often have high-risk scores and are vulnerable to the climate hazards as discussed in the following:

- Operations and maintenance staff, who are working outside the buildings and at the outdoor infrastructures, often have high-risk scores as they are exposed to all the elements of the climate hazards listed. This impacts their ability to conduct their tasks and exposes them to various types of safety hazards.
- The public and users are exposed to the climate hazards while using the services. Examples of risks include freezing rain causing icy roads, overland flooding, fallen objects from heavy winds, reduction in water consumption due to drought conditions. These risks could result in adverse health impacts or lost of revenues and/or property damage. The vulnerable population of the community has less resources to protect or shield themselves from these adverse effects of climate hazards.
- Emergency services, similar to the operations and maintenance staff, are exposed to the various types of climate hazards while conducting their tasks. Their working conditions are sometimes more hazardous, as they are the first respondence to any emergencies. With extreme climate events, their exposure to high level of hazards is elevated.

3. Impacts on Community (social) and Local Economy

In addition to the impacts discussed in Item 2, the highest climate impacts on the population are extended heat wave, followed by prolonged drought, high wind, hail, increase cooling and heating cost. Particularly with senior and low-income population, they do not have the resources to guard against these climate hazards. Damage to the basic services such as loss of utilities, loss of communication systems, transportation disruption, property damage, etc., also have cascading impact on people's health and well being, and financially.

With increasing warming trends, there are opportunities for businesses, assets, and social aspects. These include:

- Warmer winters;
- Longer shoulder seasons; and
- Less freeze/thaw events.

5 ADAPTATION PLANNING

A series of adaptation workshops, **Workshop 3**, were conducted in November 2022 with the City's departmental leads. For continuity, the departmental leads who attended **Workshop 1** and **Workshop 2** attended this Workshop. The workshops facilitated by Associated Engineering and All One Sky Foundation are listed in the following:

- **3A:** Water, Wastewater, Stormwater;
- **3B:** Roads, Transit, Fleet, Airport;
- **3C:** Facilities, Properties;
- **3D:** Waste Management, Environment/Parks; and
- **3E:** Community (social aspect) and Local Economy

The Community Climate Adaptation Planning Guide developed by All One Sky Foundation was used in guiding the workshop discussion. The recommended options for adaptation actions are listed in the following:

1. **No Action** – no additional actions required; business as usual.
2. **Conduct Research, Studies, or Assessments** to obtain further information on the nature of the risk to better inform the decision-making process.
3. **Update Policies, plans, standards, guidelines or bylaws** that consider climate risks and opportunities.
4. **Modify Operations and/or Maintenance** schedules, activities with the consideration of climate impacts.
5. **Build New or Upgrade Existing Infrastructure** to provide protection against climate risks.
6. **Increase Awareness and Education** to help community better understand risks and adaptation actions.
7. **Incorporate Emergency Management** such as response and evacuation planning, hazard mapping, and earl warning or alert systems.
8. **Consider Human Resourcing** options and evaluate the need for additional staff time allocated to climate adaptation planning, implementation and establishing task force.

5.1 Built Infrastructure

Associated Engineering facilitated the discussions during **Workshops 3A** to **3D** which identified the adaptation actions for each asset. These actions were examined for the medium to high-risk climate impacts. The discussions were summarized and tabulated in **Appendix B** for each asset. Each summary table highlights the following:

- Recommended adaptation actions;
- Time frame of implementation; and
- Climate hazards having medium to high-risk scores.

The time frames were grouped into:

- 0 to 5 years as immediate to short-term; and
- 5 to 10 years for longer term implementation.

5.2 Community (social) and Local Economy

The goal of the climate adaptation action planning process was to identify actions that can be implemented by the City to manage high priority climate change risks affecting the Community and Local Economy. An **Action Planning Workshop** was held on December 1, 2022 to consider:

1. What actions are currently being implemented to manage the social/economic consequences of each impact?
2. What new actions, or improvements/updates to existing actions, are needed to manage the social/economic consequences of each impact more effectively?

Table 5-1 provides a summary of recommended actions to be implemented by the City of Camrose to manage high priority climate change risks affecting the local economy and community. For each recommended action, the following information was provided:

1. **What is the estimated timeframe for having this action implemented (operational)?**
    a. Ongoing;
    b. Near-term (next 1-2 years);
    c. Short-term (2-5 years);
    d. Medium-term (5-10 years); and
    e. Long-term (10+ years).
2. **Which priority climate impact does the action help to manage?**
    a. **Heat**: extended heat wave and increased space cooling costs;
    b. **Wind**: high winds and tornadoes;
    c. **Storm**: Hail and freezing rain;
    d. **Fire**: Wildland fire and smoke;
    e. **Drought**: prolonged drought; and
    f. **Power**: extended power outage.

Table 5-1 Climate Adaptation Actions for Camrose – Community (social) and Local Economy

Recommended Action	Time	Heat	Wind	Storm	Fire	Drought	Power
1. Develop a Heat Wave Response Plan. The Response Plan should include research on the impacts of extreme heat on Camrose, including projections of future extreme heat from climate change, to identify public health and safety risks and vulnerabilities, and heat-related triggers at which point the activation of heat wave response is required. It should also identify public education and communication protocols, including for reaching vulnerable groups during a heat event.	Near-term	✓					
2. Conduct research to identify existing programs and funding options for a commercial and residential rebate, financing, or incentive program to support property owners with retrofits aimed at reducing space cooling costs, such as air conditioning, insulation, windows, heat pump, etc.	Near-term	✓					
3. Based on the results of the research, implement a local rebate program, for example the Clean Energy Improvement Program.	Short-term	✓					
4. Update the City website to include information for residents on the local impacts of extreme weather and climate change, and how citizens can be better prepared. Information should include opportunities for residents, businesses, and local organizations to get funding for climate resilience actions.	Near-term	✓	✓	✓	✓	✓	✓
5. Partner with Family and Community Support Services (FCSS) to improve communication, collaboration and capacity building with inter-agency groups and vulnerable populations to respond to climate change and extreme weather events.	Near-term	✓	✓	✓	✓	✓	✓
6. Complete an assessment of City spaces (buildings, facilities, assets, etc.) that could be used to provide refuge from extreme heat and wildfire smoke events.	Short-term	✓			✓		
7. Based on results of the assessment of City spaces, upgrade or retrofit City buildings, facilities, assets, and public spaces to ensure adequate protection and refuge from extreme heat and wildfire smoke.	Long-term	✓			✓		
8. Update the Major Outdoor Events Policy to include wind thresholds and specific requirements for event organizers.	Near-term			✓			

Recommended Action	Time	Heat	Wind	Storm	Fire	Drought	Power
9. Review and update engineering design standards to account for the impacts of climate change on City buildings, facilities, and assets, using a 'climate lens'.	Short-term	✓	✓	✓	✓	✓	✓
10. Establish internal (City) design guidelines for climate resilient City buildings, facilities, and assets, using a 'climate lens'.	Short-term	✓	✓	✓	✓	✓	✓
11. Develop a Climate Resilience Guide which provides information and resources for residents and businesses to enhance the resilience of their homes and properties to extreme weather and climate change impacts.	Short-term	✓	✓	✓	✓	✓	✓
12. Expand the extreme weather alert system to better reach vulnerable populations, in partnership with FCSS and in collaboration with inter-agency groups, to improve communication during emergency events.	Near-term	✓	✓	✓	✓		✓
13. Develop a Wildfire Smoke Response Plan. The Response Plan should include research on the impacts of wildfire smoke on Camrose, future smoke projections from climate change, to identify public health and safety risks and vulnerabilities, and smoke-related triggers at which the activation of response is required. It should also identify public education and communication protocols, including for reaching vulnerable groups during a severe smoke event.	Short-term				✓		
14. Conduct an assessment of wildland fire hazard and risk, following the FireSmart Guidebook for Community Protection, to determine the wildfire threat potential in Camrose by evaluating building materials, landscaping, topography and fire behavior potential for values-at-risk. The results of this assessment will determine the need (or not) for FireSmart community planning in Camrose.	Short-term				✓		
15. Conduct research on the impacts of climate change on local drought risk and water supply, including potential economic impacts.	Medium-term					✓	
16. Based on drought risk research, update the Drought Response Plan, if and as needed, and consider climate change risks in water supply master planning.	Medium-term					✓	
17. Enhance water supply leak detection and monitoring systems.	Medium-term					✓	

Recommended Action	Time	Heat	Wind	Storm	Fire	Drought	Power
18. Implement a tiered (block) water pricing system to reduce (peak) water demand.	Short-term					✓	
19. Develop a Power Outage Response Plan for the City, including an assessment of existing back up power supplies, the need for additional backup power, as well as public education and communication on power outage response, particularly for vulnerable populations.	Medium-term		✓	✓			✓
20. Increase annual budget and resources for emergency response and management planning, including consideration of climate change impacts.	Medium-term	✓	✓	✓	✓		✓
21. Conduct annual monitoring to identify the location and needs of vulnerable and homeless populations in and around Camrose. Incorporate this information into emergency response planning to ensure effective communication in an emergency.	Short-term	✓	✓	✓	✓		✓
22. Update City procurement policies to ensure climate changes, impacts and adaptation are a consideration in bids/tenders for all City projects.	Short-term	✓	✓	✓	✓	✓	✓
23. Consider climate change in all strategic planning processes, including updates to the Municipal Development Plan, Area Structure Plans, and economic development planning.	Ongoing	✓	✓	✓	✓	✓	✓

6 RECOMMENDATIONS

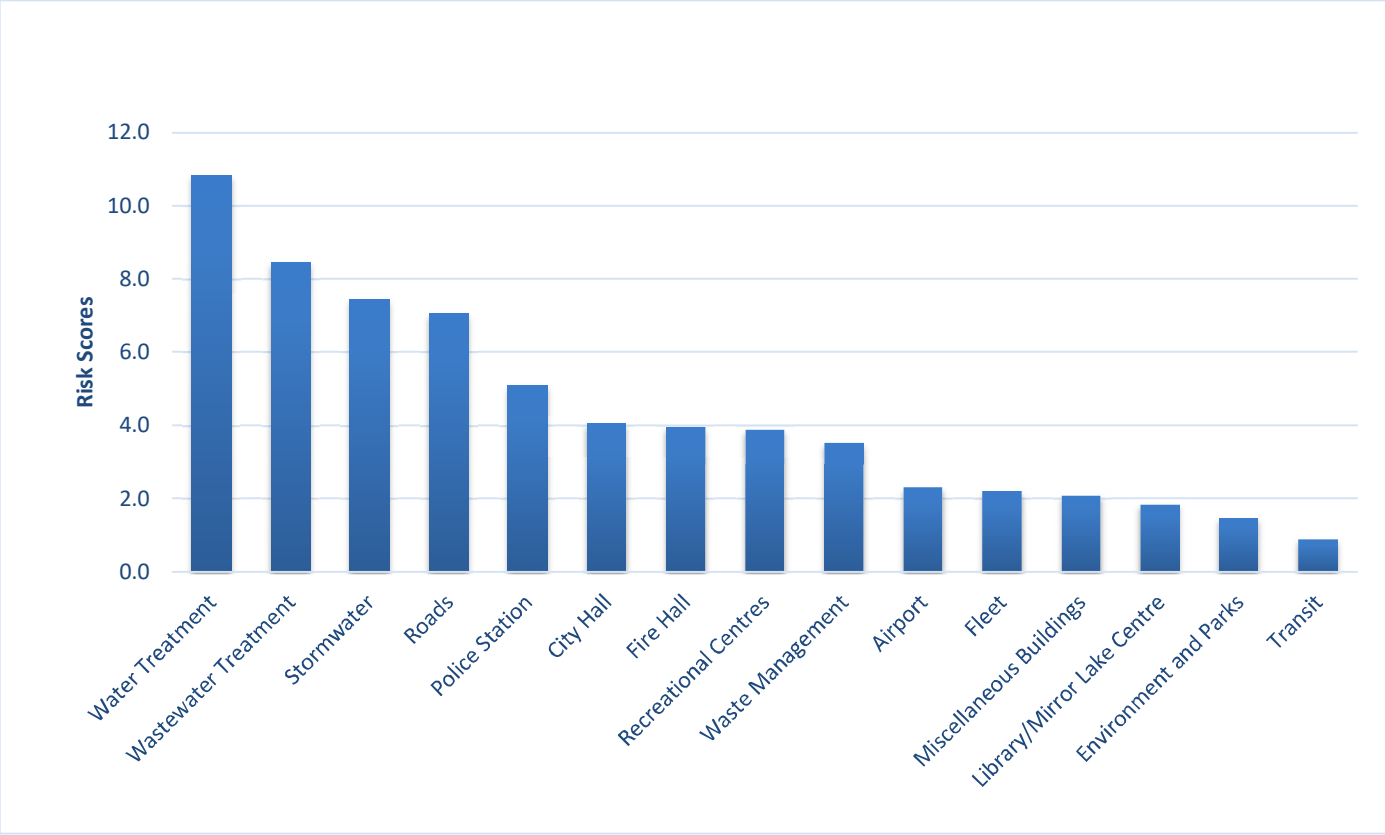
Following the Risk Assessment and the review of the Adaptation Planning, these are many actions that the City can take. As such, a more guided approach is required; a high risk for one asset category may be of lower priority than a high risk for another asset category. Priority rankings based on **criticality of the infrastructure** are provided below including the rationale:

Table 6-1 Asset Priority Ranking (1 = Highest Priority, 0 = Lowest Priority)

Asset	Priority Ranking	Rationale
Stormwater	1	Critical for public safety to protect from flooding.
Wastewater Treatment	1	Critical for public health and the environment.
Water Treatment	1	Critical for public health and safety.
Airport	0.3	Airport is mainly used for leisure, but can also be used for emergency transportation, when necessary.
Fleet	0.6	Required for maintenance of important infrastructure.
Roads	0.9	Required for emergency response and evacuation.
Transit	0.3	Needed for transportation throughout the City, but not part of emergency response.
Environment and Parks	0.1	Important for recreational activities, physical and mental well-being, to promote environmental responsibility, and reduce heat island effect within urban areas, but not critical infrastructure.
Waste Management	0.6	Important for the removal of waste and for environmental protection.
City Hall	0.8	Critical as a facility to provide information and used as shelter locations during weather events.
Recreational Centres	0.6	Important for the enjoyment of space, can be used as shelter locations during weather events
Police Station	1	Critical for public safety (emergency response).
Fire Hall	1	Critical for public safety (emergency response).
Library/Mirror Lake Centre	0.4	Leisure use for public, but not viewed as critical facility for emergency use.
Miscellaneous Buildings	0.4	Leisure use for public, but not viewed as critical facility for emergency use.

Using these priority rankings, the normalized total risk score (total risk score for one asset divided by the total risk score of all assets) was multiplied by the priority ranking. The results of this analysis are shown in **Figure 6-1**.

Figure 6-1 Asset Risk Ranking Based on Priority



With these priority rankings assigned, a clearer picture of how the City should direct adaptation actions is formed. City can consider starting with low cots actions and those that can be implemented along with planned policy or bylaw updates, and/or mainstreamed into the infrastructure renewal, community planning and development projects.
The top four asset priorities are:

- **Water Treatment;**
- **Wastewater Treatment;**
- **Stormwater; and**
- **Roads.**

Among the facilities, **Police Station, Fire Hall, City Hall, and Recreational Centres** are the highest ranked as critical buildings because they provide critical services to the City.

The following tables list the recommended actions for adaptation planning for the above recommended priority infrastructure. Although the recommendations provided time frame indicated, the City is encouraged to implement based on the capital plan and modify as needed.

Note that the socio-economic recommended actions are discussed in **Section 5**, **Table 5-1**.

Table 6-2 Water Treatment Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Water Treatment			
1	Conduct Research	Understand and conduct research/ assessments on the impact of climate hazards on the treatment facility and water treatment processes/components. Implement best practices and Inform changes to SOP's, and standards for future updates.	0-5 years
2		Complete stress testing of the treatment process. Review ISL plan for adaptation-do any of the stressor change the timeframe for upgrades. Review the age/life cycle of the system.	0-5 years
3		Conduct treatment effectiveness assessment and its response to extreme weather (eg. Heat and cold).	0-5 years
4		Understand the impacts and frequency of frazil ice on the intake.	0-5 years
5		Research and assess for additional storage options or alternate source options such as a regional water system.	5-10 years
6		Review opportunities for integrating renewable energy.	5-10 years
7	Update Policies, Plans, Standards, Guidelines and Bylaws	Review, update or upgrade design standards, operations, SOP'S, policies, and plans based on researched information and/or AEP procedures.	0-5 years
8		Implement water conservation program to reduce the demand.	0-5 years
9		Update or upgrade SOP, engineering design standards, based on the research/studies.	5-10 years
10		Promote and provide incentives for water conservation in urban agriculture, including grey water recycling and water retention and storage technologies.	5-10 years
11	Operations and Maintenance	Review budget for increase O&M cost due to more frequent maintenance and replacements. Recognize and Increase replacement value for budget planning.	0-5 years
12		Review water treatment robustness in treating varying raw water quality and potential cost increase with the treatment.	0-5 years
13		Monitor, research and assess system and its performance to compare capacity versus demand.	0-5 years
14		Update and upgrade treatment systems, O&M frequency and procedures accordingly to maintain level of service.	5-10 years
15		Conduct building audit for energy consumption and efficiency.	5-10 years
16		Inspect building for cracking caused by ground settlement due to freeze/thaw events.	5-10 years

No.	Categories of Actions	Recommended Actions	Time Frame
17	Build New or Upgrade Existing Infrastructure	Review and assess need for new construction of treatment facility components (e.g. Raw water pond, booster station etc.)	0-5 years
18		Identify and review options to increase raw water supply (ie. Construction of a new raw water pond or increasing dam height/reservoir depth.)	0-5 years
19	Increase Awareness and Education	Educate public on climate impact, best practices and associated costs implications.	0-5 years
20		Develop a safety policy for staff when working under extreme conditions.	0-5 years
		Conduct training to staff on the changes made in SOPs.	0–5 years
21	Emergency Management	Review conservation programs, procedures, (Including EMP and ERP) and assessments. Update or upgrade with consideration for climate hazards including identifying redundancies and backup systems. Develop new procedures if required. Solicit feedback from Emergency services and implement accordingly.	0-5 years
22		Develop a city-wide heat wave emergency preparedness and response plan	0-5 years
23	Human Resourcing	Consider additional resourcing with further understanding in areas requiring expertise.	0-5 years
24		Consider resources related to further understanding of lake hydraulics and water licensing options.	0-5 years

Table 6-3 Wastewater Treatment Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Wastewater Treatment			
1	Conduct Research	Understand and conduct research/ assessments on the impact of climate hazards on all the components of the treatment facility (eg. processes components, lift stations, lagoons, etc). Implement best practices. Inform changes to SOP's, and standards for future updates.	0-5 years
2		Review design standard, Master Plan, and integrate climate impact consideration.	0-5 years
3		Conduct failure mode assessment and criticality analysis	0-5 years
4		Review opportunities for integrating renewable energy.	5-10 years
5	Update Policies, Plans, Standards, Guidelines and Bylaws	Review and update design standards, assumptions, SOP'S, policies, and plans based on researched information.	0-5 years
6		Develop safety policy for staff when working under extreme conditions.	0-5 years
7	Operations and Maintenance	Review budget for increase O&M cost due to more frequent maintenance and replacements. Recognize and Increase replacement value for budget planning.	0-5 years
8		Monitor I/I flows and impacts on pipe capacity, Conduct an I/I study to investigate options to reduce I/I flows into the wastewater collection system.	0-5 years
9		Monitor, research and assess system condition, capacities and its performance. Update and upgrade treatment systems, O&M frequency and procedures accordingly to maintain level of service.	5-10 years
10		Conduct Audit building envelop/energy consumption.	0-10 years
11	Increase Awareness and Education	Educate public on climate impact, best practices and associated costs implications.	0-5 years
12		Conduct training to staff on the changes made in SOPs.	0-5 years
13	Emergency Management	Review EMP and ERP's. Update or upgrade with consideration for climate hazards. Solicit feedback from Emergency services and implement accordingly.	0-5 years
14	Human Resourcing	Consider additional resourcing with further understanding in areas requiring expertise.	5-10 years

Table 6-4 Stormwater Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Stormwater System			
1	**Conduct Research**	Assess impacts with climate hazards considerations and/or conduct failure mode assessment and criticality assessment to test the system against climate hazards.	0-5 years
2		Review Master Plans and identify the problematic areas where systems (culverts, ditches) may be undersized for future climate considerations	0-5 years
3	**Update Policies, Plans, Standards, Guidelines and Bylaws**	Review SOPs, Plans (eg. Dam Safety O&M) with the consideration of climate hazards.	0-5 years
4		Upgrade engineering design standards, plans, policies for new development and upgrade where study has identified risk areas.	5-10 years
5		Develop safety policy for staff when working under extreme conditions.	0-5 years
6		Update stormwater management plans to include climate hazards. The plan can also include environmental monitoring and runoff quality into receiving bodies.	0-5 years
7	**Operations and Maintenance**	Review budget for increase O&M cost due to more frequent maintenance and replacements. Increase replacement value for budget planning.	0-5 years
8		Site monitor and review performance against climate hazards.	0–5 years
9	**Increase Awareness and Education**	Identify additional training based on review of the SOP with the consideration of climate hazards.	0-5 years
10		Communicate with public on safety and hazards around stormwater systems during climate hazards.	0–5 years
11		Stoney Creek - Educate the public of danger/safety around creek areas during and after extreme climate events.	0–5 years
12	**Emergency Management**	Update Emergency Response Plan with updated flood maps and inform public of plans. Review with EMS and solicit feedback.	5–10 years
13	**Build New or Upgrade Existing Infrastructure**	Mirror Lake Dam - Review the design of dam structure and how it fairs against high temperatures. The dam is leaking therefore need to review future upgrades or replacements.	0-5 years
14		Snow Dump - Review SOPS snow piling height and volume accumulation and snow melt water management at the site.	0-5 years

Table 6-5 Roads Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Roads			
1	**Conduct Research**	Conduct research or investigate current best practice and/or design standards that adapts to the climate hazards. E.g. Investigate types of aggregates for base work and surfacing material. Review impact of climate risks on bridges.	0-5 years
2	**Update Policies, Plans, Standards, Guidelines and Bylaws**	Review standards and performance with the consideration of climate hazards and risks - identify if changes are required.	0-5 years
3		Ramps - Many ramps are not maintained by City. City to review by-laws to and revise them with the consideration of climate hazards. City does not enforce how the ramps would be maintained for access, as long as it meets the intent.	0-5 years
4	**Operations and Maintenance**	Review budget for increase O&M cost due to more frequent maintenance and replacements to maintain level of service. Increase replacement value for budget planning.	0-5 years
5		Inspect and assess infrastructure with consideration for climate risks. Collect and review performance of new standards and update maintenance requirement/ procedures (SOP's) based on the review.	0–5 years
6	**Build New or Upgrade Existing Infrastructure**	Apply new standards.	5-10 years
7	**Increase Awareness and Education**	Conduct staff training on new policies, plans, SOP's. Communicate new standards and operational procedures if there are any changes. Communicate with public of any changes.	0-5 years
8		Communicate with public on closures, safety and hazards during extreme climate events.	0–5 years
9	**Emergency Management**	Review and update or upgrade ERP with consideration of climate hazards. Solicit Emergency services feedback and modify accordingly.	0-5 years

Table 6-6 Police Station Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Police Station			
1	**Conduct Research**	Review design and operations standards for future new buildings. Assess threshold performance on system.	0-5 years
2		Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	0-5 years
3		Review the opportunity to incorporate renewable energy.	0-5 years
4	**Update Policies, Plans, Standards, Guidelines and Bylaws**	Review for natural landscape in the future. Change to more heat tolerant species.	5-10 years
5		Review policies, SOP, SWP and update or upgrade where applicable (eg. hours of operations as an example), and around extreme weather.	0-5 years
6		Develop safety policy for staff when working under extreme conditions.	0-5 years
7	**Operations and Maintenance**	Recognize that there will be an increase repairs and replacement, which will increase operations and maintenance costs.	0-5 years
8		Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0–5 years
9		Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room, building envelop) and electrical services against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	5-10 years
10	**Build New or Upgrade Existing Infrastructure**	Mechanical HVAC building - This is an old building and will required replacement. This replacement is in the capital plan in the next 10 years. Consider build new in a different location. Replace as needed until building is relocated to a new building. New building to consider climate hazards.	5-10 years
11	**Increase Awareness and Education**	Communicate and educate public on Extreme weather events.	0-5 years
12		Be aware of policies and SOP change.	0–5 years
13	**Emergency Management**	Review ERP and SOP with consideration of climate hazards. Update accordingly.	0–5 years

Table 6-7 Fire Hall Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
Fire Hall			
1	**Conduct Research**	Continue to monitor and inspect the system for its performance and ensure the system is maintaining the desired level of service. Review design and operations standards for future new buildings.	0-5 years
2		Review the opportunity to incorporate renewable energy.	0-5 years
3	**Update Policies, Plans, Standards, Guidelines and Bylaws**	Review design standards, operation standards, policies, SOP, SWP and update or upgrade where applicable (e.g. hours of operations as an example), and around extreme weather.	0-5 years
4		Review for natural landscape in the future. Change to more heat tolerant species.	5-10 years
5		Develop safety policy for staff when working under extreme conditions.	0-5 years
6	**Operations and Maintenance**	Recognize that there will be an increase repairs and replacement, which will increase operations and maintenance costs.	0-5 years
7		Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room, building envelop) and electrical services against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	0–5 years
8		Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0–5 years
9		Monitor existing building envelope to evaluate for upgrades.	5-10 years
10	**Increase Awareness and Education**	Be aware of policies and SOP change.	5-10 years
11	**Emergency Management**	Review ERP with consideration for climate hazards. Update accordingly.	0–5 years
12	**Build New or Upgrade Existing System**	Mechanical HVAC building – Review technologies for filtration and change to better system based on research.	5-10 years
13		EOC and Generator – Building currently houses the EOC and back-up generator	5-10 years

Table 6-8 City Hall Recommended Actions

No.	Categories of Actions	Recommended Actions	Time Frame
City Hall			
1	**Conduct Research**	Conduct research, assessments or study related to performance of the facility components (Building envelop, HVAC, IT server room etc.) against climate hazards to develop inspection checklist or Identify performance thresholds.	0-5 years
2		Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	0-5 years
3		Review the opportunity to integrate renewable energy.	5-10 years
4	**Update Policies, Plans, Standards, Guidelines and Bylaws**	Review for natural landscape in the future. Change to more heat tolerant species.	0-5 years
5		Consider identifying targets for level of service. E.g. using green building rating system as a guide for design standards. Review operating standard with the consideration for climate hazards for existing and future buildings.	0-5 years
6		Review policies, SOP, SWP and update or upgrade where applicable (e.g. hours of operations as an example), and around extreme weather.	0-5 years
7		Develop safety policy for staff when working under extreme conditions.	0-5 years
8	**Operations and Maintenance**	Recognize that there will be an increase repairs and replacement to maintain level of service and deal with complaints, which will increase operations and maintenance costs.	0-5 years
9		Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room cooling system) and services (electrical service, fueling service, groundside roads) against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	0–5 years
10		Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0-5 years
11	**Build New or Upgrade Existing Infrastructure**	Upgrade systems based on research and inspection.	5-10 years
12	**Increase Awareness and Education**	Identify and conduct additional training for staff based on research outcomes.	0-5 years
		Communicate with public on climate risk and maintain service when City hall host ECP activities.	0-5 years
13	**Emergency Management**	Review ERP and SWP with consideration of climate hazards. Update accordingly.	0-5 years
14		Emergency Operating Center - Future consideration for City Hall to be EOC. Work with EMS and solicit for feedback.	5-10 years

Many of the adaptation actions indicated above also apply to other assets and will have cross cutting applications across all departments. Each adaptation action should not be conducted in isolation but be implemented across all departments. This encourages information and experiences to be shared and transferred amongst City's leadership. The following table shows the potential adaptation application for all departments, which were also identified in **Workshop 3**.

Table 6-9 Cross Cutting Potential Adaptation Applicable to All Departments/Corporation

All Departments/Corporation
Increase public engagement and community awareness of climate change impacts and adaptations through public open houses, schools and other discussion forums.
Increase cross-departmental collaboration and information sharing to improve management of climate change risks and opportunities.
Increase education and public awareness of the health and safety impacts of climate change.
Create and disseminate climate related risk maps across City departments, and to residents, businesses and other organizations to support more resilient development and planning.
Develop an education and awareness program to increase understanding of the benefits of local food production, and appreciation of local food.
Employ an adaptive management approach to climate adaptation planning.
Increase staff training on climate change impacts and adaptations across all departments.
Increase the resilience of City buildings to climate hazards and extreme weather, for example through updates to the City's development process, including zoning, planning and permitting.
Integrate climate change science and concepts into school curriculums.
Promote densification in all City planning and developments.
Promote sharing of City maps and emergency information to improve emergency response.
Promote the use of renewable energy sources in homes and buildings.
Avoid flood prone areas through zoning, planning and development restrictions.

The following are also recommendations:

- **Shifting Time Frame.** The time frames used in the assessment of this report (i.e. current, 2050s, 2080s) are viewed as time steps and do not mean that the risks will not occur until these time steps. The City will need to plan for risks now and modify as severity increases with time.
- **Monitor, Assess, and Update Risk Scores and Adaptation Actions.** Both the risk assessment and initial adaptation plans are living documents. The City is encouraged to identify performance or tolerance threshold (e.g. temperature, precipitation) of the asset so that it provides a baseline for monitoring. As the City improves or make modifications to reduce the risks and vulnerabilities to the assets, the adaptation plans can be updated. This encourages improvements and furthering the reduction and removal of risks.
- **Continual Review of Climate Data.** The City should also monitor the ongoing evolution of climate projections. This will allow the City to update the risk score and evaluate its vulnerabilities and exposure based on current and science-based information. Adaptation actions will be adjusted accordingly while staying flexible and adaptable to the potential market fluctuations.

7 CONCLUSION

The objective of this Assessment is to identify and evaluate the potential impact climate change may have on the City's infrastructure. The buildings and infrastructure that form the physical backbone of the City must be designed and managed in a way that the impacts of extreme climate events are reduced. This will help to protect City's investments and ensure that assets are protected well into the future, safeguarding its social and economic well being. The Assessment was conducted for the City of Camrose using the PIEVC High Level Screening Assessment Procedure and included the identification of risk mitigation measures for identified impacts.

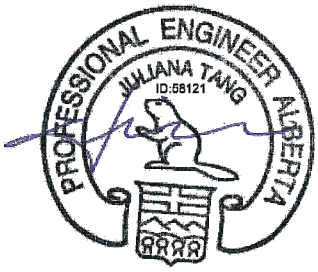
The findings of this Assessment showed several the interactions between climate and infrastructure are anticipated to become high-risk interactions over time. The analysis and recommendations are based on regionally downscaled projections from global climate models that are consistent with national and international projections.

Recommendations provided are intended for flexibility in adjustments and effective response to future uncertainties thus reduce the impacts and building a climate resilient infrastructure for the future.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Engineering Alberta Ltd.



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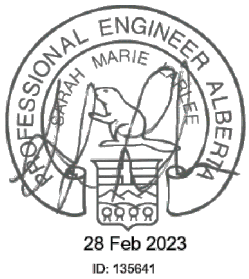

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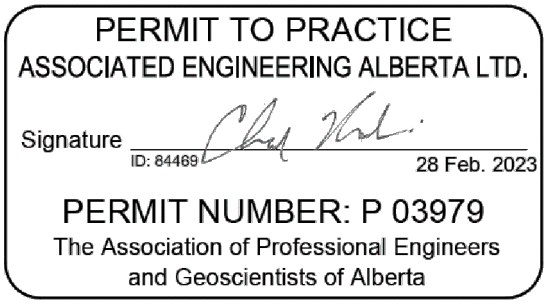

APPENDIX A - MASTER RISK ASSESSMENT WORKSHEETS

CITY OF **Camrose**

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Airport

Temperature

#	Asset	Year	Summer Mean Daily Temp (˚C) – Summer Mean				Winter Mean Daily Temp (°C) – Winter Mean				Days above +30°C – Very Hot Days				Warmest Maximum Temperature (°C) – Hottest Day				Days below -30°C – Very Cold Days				Coldest Minimum Temperature (˚C) – Coldest Days				# Freeze/ Thaw Events – Freeze/ Thaw Events			
	Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Buildings (terminal)	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		6
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	2	4
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		4
2	Lighting and Navigation, Communication	Baseline		3		0		3		0		3		0		3		0		3		9		3		9		3		9
		2050		4		0		2		0		4		0		4		0	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		3		3		9		2		6
3	~~Private Hangars (na)~~	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
4	Runways, Taxiways	Baseline		3		0		3		0		3		12		3		12		3		9		3		9		3		12
		2050		4		0		2		0	Y	4	4	16	y	4	4	16	y	2	3	6	y	3	3	9	y	2	4	8
		2080		5		0		2		0		5		20		5		20		1		3		3		9		2		8
5	Parking and Sidewalks Facilities	Baseline		3		0		3		0		3		12		3		12		3		0		3		0		3		9
		2050		4		0		2		0	y	4	4	16	y	4	4	16		2		0		3		0	y	2	3	6
		2080		5		0		2		0		5		20		5		20		1		0		3		0		2		6
6	Drainage Infrastructure	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
7	Electrical Service	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
8	Fuelling Service (Tank, Pumps)	Baseline		3		0		3		0		3		0		3		0		3		12		3		12		3		9
		2050		4		0		2		0		4		0		4		0	Y	2	4	8	Y	3	4	12	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		4		3		12		2		6
9	Groundside Roads (gravel)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
10	Operations & Maintenace	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		12
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	4	8
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		8
14	Public / Customers	Baseline		3		0		3		0		3		0		3		6		3		9		3		9		3		12
		2050		4		0		2		0		4		0	Y	4	2	8	Y	2	3	6	Y	3	3	9	Y	2	4	8
		2080		5		0		2		0		5		0		5		10		1		3		3		9		2		8
15	Emergency Services (How will ES be impacted to service the Airport?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

#	Asset	Year	Annual Total Precipitation (mm) – Annual Precipitation				Maximum 5-day Consecutive Precipitation (mm) – Persistent Precipitation				Maximum One-Day Precipitation (mm) – Extreme Rainfall				Winter Precipitation – Snow Accumulation				Severe Summer Hail Days (% Change Relative to Present) – Hail				Years >/= 1 Freezing Rain Warnings – Freezing Rain / Unseasonal Snow				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August) – Drought			
	Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Buildings (terminal)	Baseline		3		9		3		9		3		9		3		0		3		9		3		0		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0	Y	4	3	12		4		0		4		0
		2080		5		15		4		12		4		12		4		0		5		15		5		0		5		0
2	Lighting and Navigation, Communication	Baseline		3		9		3		9		3		6		3		9		3		9		3		12		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	4	16		4		0
		2080		5		15		4		12		4		8		4		12		5		15		5		20		5		0
3	~~Private Hangars (na)~~	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
4	Runways, Taxiways	Baseline		3		12		3		9		3		12		3		12		3		0		3		12		3		0
		2050	y	4	4	16	y	4	3	12	y	4	4	16	y	4	4	16		4		0	y	4	4	16		4		0
		2080		5		20		4		12		4		16		4		16		5		0		5		20		5		0
5	Parking and Sidewalks Facilities	Baseline		3		9		3		9		3		12		3		9		3		0		3		9		3		0
		2050	y	4	3	12	y	4	3	12	y	4	4	16	Y	4	3	12		4		0	y	4	3	12		4		0
		2080		5		15		4		12		4		16		4		12		5		0		5		15		5		0
6	Drainage Infrastructure	Baseline		3		9		3		12		3		12		3		9		3		0		3		0		3		0
		2050	y	4	3	12	y	4	4	16	y	4	4	16	y	4	3	12		4		0		4		0		4		0
		2080		5		15		4		16		4		16		4		12		5		0		5		0		5		0
7	Electrical Service	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
8	Fuelling Service (Tank, Pumps)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
9	Groundside Roads (gravel)	Baseline		3		9		3		9		3		12		3		9		3		0		3		0		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0		4		0		4		0
		2080		5		15		4		12		4		16		4		12		5		0		5		0		5		0
10	Operations & Maintenace	Baseline		3		9		3		9		3		9		3		9		3		9		3		9		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
		2080		5		15		4		12		4		12		4		12		5		15		5		15		5		0
14	Public / Customers	Baseline		3		9		3		9		3		12		3		9		3		9		3		12		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	3	12	Y	4	3	12	Y	4	4	16		4		0
		2080		5		15		4		12		4		16		4		12		5		15		5		20		5		0
15	Emergency Services (How will ES be impacted to service the Airport?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events / Biodiversity

#	Asset	Year	Flooding – River Flooding				Climate Moisture Deficit – Wildfire Risk				Climate Moisture Deficit – Wildfire Smoke				Mean # days/year with Daily Peak Wind >70 km/h – Heavy Winds				Tornado – Tornado				Lightning – Lightning				Biodiversity – Insect, invasive plants and disease			
	Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Buildings (terminal)	Baseline		3		0		3		12		3		0		3		0		3		12		3		9		3		0
		2050		4		0	Y	4	4	16		4		0		4		0	Y	4	4	16	Y	4	3	12		4		0
		2080		5		0		5		20		5		0		5		0		5		20		5		15		5		0
2	Lighting and Navigation, Communication	Baseline		3		0		3		12		3		0		3		9		3		12		3		12		3		0
		2050		4		0	Y	4	4	16		4		0	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		20		5		0		5		15		5		20		5		20		5		0
3	~~Private Hangars (na)~~	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
4	Runways, Taxiways	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
5	Parking and Sidewalks Facilities	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6	Drainage Infrastructure	Baseline		3		0		3		6		3		0		3		0		3		0		3		0		3		0
		2050		4		0	y	4	2	8		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		10		5		0		5		0		5		0		5		0		5		0
7	Electrical Service	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		20		5		0
8	Fuelling Service (Tank, Pumps)	Baseline		3		0		3		0		3		0		3		12		3		12		3		12		3		0
		2050		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		20		5		20		5		20		5		0
9	Groundside Roads (gravel)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
10	Operations & Maintenace	Baseline		3		0		3		9		3		9		3		9		3		9		3		9		3		9
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12
		2080		5		0		5		15		5		15		5		15		5		15		5		15		5		15
14	Public / Customers	Baseline		3		0		3		9		3		12		3		12		3		0		3		0		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0		4		0		4		0
		2080		5		0		5		15		5		20		5		20		5		0		5		0		5		0
15	Emergency Services (How will ES be impacted to service the Airport?)	Baseline		3		0		3		9		3		6		3		9		3		12		3		12		3		0
		2050		4		0	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		15		5		10		5		15		5		20		5		20		5		0

City of Camrose

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Environment and Parks

Temperature

#	Asset	Period	Summer Mean Daily Temp (˚C) – Summer Mean				Winter Mean Daily Temp (∘C) – Winter Mean				Days above +30°C – Very Hot Days				Warmest Maximum Temperature (∘C) – Hottest Day				Days below -30°C – Very Cold Days				Coldest Minimum Temperature (˚C) – Coldest Days				# Freeze/ Thaw Events – Freeze/ Thaw Events			
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
	Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
1	Mowed Green Space	Baseline		3		6		3		6		3		9		3		9		3		6		3		6		3		9
		2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	3	6
		2080		5		10		2		4		5		15		5		15		1		2		3		6		2		6
2	Baseball/Softball Diamonds	Baseline		3		6		3		6		3		9		3		9		3		6		3		6		3		9
		2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	3	6
		2080		5		10		2		4		5		15		5		15		1		2		3		6		2		6
3	Soccer Fields	Baseline		3		6		3		6		3		9		3		9		3		6		3		6		3		9
		2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	3	6
		2080		5		10		2		4		5		15		5		15		1		2		3		6		2		6
4	Treed Natural Space	Baseline		3		6		3		6		3		9		3		9		3		6		3		6		3		9
		2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	3	6
		2080		5		10		2		4		5		15		5		15		1		2		3		6		2		6
5	Boulevard Trees	Baseline		3		6		3		6		3		12		3		12		3		6		3		6		3		12
		2050	Y	4	2	8	Y	2	2	4	Y	4	4	16	Y	4	4	16	Y	2	2	4	Y	3	2	6	Y	2	4	8
		2080		5		10		2		4		5		20		5		20		1		2		3		6		2		8
6	Golf Course	Baseline		3		6		3		6		3		12		3		12		3		6		3		6		3		12
		2050	Y	4	2	8	Y	2	2	4	Y	4	4	16	y	4	4	16	Y	2	2	4	Y	3	2	6	Y	2	4	8
		2080		5		10		2		4		5		20		5		20		1		2		3		6		2		8
6	Plantings, Ornamental	Baseline		3		6		3		6		3		12		3		12		3		6		3		6		3		12
		2050	Y	4	2	8	Y	2	2	4	Y	4	4	16	Y	4	4	16	Y	2	2	4	Y	3	2	6	Y	2	4	8
		2080		5		10		2		4		5		20		5		20		1		2		3		6		2		8
6	Park Infrastructure (Play Structures, benches)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
6	Outdoor Rinks	Baseline		3		0		3		9		3		0		3		0		3		6		3		6		3		12
		2050		4		0	Y	2	3	6		4		0		4		0	Y	2	2	4	Y	3	2	6	Y	2	4	8
		2080		5		0		2		6		5		0		5		0		1		2		3		6		2		8
6	Trails (Unpaved)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
6	Trails Paved	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		12
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0	Y	2	4	8
		2080		5		0		2		0		5		15		5		15		1		0		3		0		2		8
6	Pedestrian Bridges	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		12
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6	Y	2	4	8
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		8
6	Operations and Maintenance	Baseline		3		0		3		0		3		12		3		12		3		12		3		12		3		12
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	4	8	Y	3	4	12	Y	2	4	8
		2080		5		0		2		0		5		20		5		20		1		4		3		12		2		8
6	Public / Users	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
6	Stand Alone Public Washrooms (move to facilites)	Baseline		3		0		3		0		3		9		3		9		3		9		3		12		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	4	12	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		3		3		12		2		6
6	Skate Park (move to facilites)	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		0		3		0		2		6
6	Emergency Services (How will ES be impacted to service Parks Asset?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

#	Asset	Period	Annual Total Precipitation (mm) – Annual Precipitation				Maximum 5-day Consecutive Precipitation (mm) – Persistent Precipitation				Maximum One-Day Precipitation (mm) – Extreme Rainfall				Winter Precipitation – Snow Accumulation				Severe Summer Hail Days (% Change Relative to Present) – Hail				Years >/= 1 Freezing Rain Warnings – Freezing Rain / Unseasonal Snow				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August) – Drought			
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
	Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
1	Mowed Green Space	Baseline		3		6		3		9		3		12		3		6		3		6		3		9		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	4	16
		2080		5		10		4		12		4		16		4		8		5		10		5		15		5		20
2	Baseball/Softball Diamonds	Baseline		3		6		3		9		3		12		3		6		3		6		3		9		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	4	16
		2080		5		10		4		12		4		16		4		8		5		10		5		15		5		20
3	Soccer Fields	Baseline		3		6		3		9		3		12		3		6		3		6		3		9		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	4	16
		2080		5		10		4		12		4		16		4		8		5		10		5		15		5		20
4	Treed Natural Space	Baseline		3		6		3		9		3		9		3		6		3		6		3		9		3		9
		2050	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	3	12
		2080		5		10		4		12		4		12		4		8		5		10		5		15		5		15
5	Boulevard Trees	Baseline		3		6		3		9		3		9		3		6		3		9		3		12		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	4	16
		2080		5		10		4		12		4		12		4		8		5		15		5		20		5		20
6	Golf Course	Baseline		3		6		3		9		3		12		3		6		3		9		3		12		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	4	16
		2080		5		10		4		12		4		16		4		8		5		15		5		20		5		20
6	Plantings, Ornamental	Baseline		3		6		3		9		3		9		3		6		3		9		3		12		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	4	16
		2080		5		10		4		12		4		12		4		8		5		15		5		20		5		20
6	Park Infrastructure (Play Structures, benches)	Baseline		3		0		3		9		3		9		3		6		3		9		3		9		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	3	12		4		0
		2080		5		0		4		12		4		12		4		8		5		15		5		15		5		0
6	Outdoor Rinks	Baseline		3		0		3		0		3		0		3		6		3		0		3		12		3		0
		2050		4		0		4		0		4		0	Y	4	2	8		4		0	Y	4	4	16		4		0
		2080		5		0		4		0		4		0		4		8		5		0		5		20		5		0
6	Trails (Unpaved)	Baseline		3		0		3		9		3		12		3		6		3		0		3		6		3		9
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0	Y	4	2	8	Y	4	3	12
		2080		5		0		4		12		4		16		4		8		5		0		5		10		5		15
6	Trails Paved	Baseline		3		0		3		9		3		12		3		6		3		0		3		6		3		9
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0	Y	4	2	8	Y	4	3	12
		2080		5		0		4		12		4		16		4		8		5		0		5		10		5		15
6	Pedestrian Bridges	Baseline		3		0		3		9		3		12		3		6		3		0		3		12		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0	Y	4	4	16		4		0
		2080		5		0		4		12		4		16		4		8		5		0		5		20		5		0
6	Operations and Maintenance	Baseline		3		0		3		9		3		12		3		6		3		9		3		12		3		9
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12
		2080		5		0		4		12		4		16		4		8		5		15		5		20		5		15
6	Public / Users	Baseline		3		0		3		9		3		9		3		6		3		9		3		9		3		9
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	3	12
		2080		5		0		4		12		4		12		4		8		5		15		5		15		5		15
6	Stand Alone Public Washrooms (move to facilites)	Baseline		3		0		3		6		3		9		3		9		3		9		3		9		3		0
		2050		4		0	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
		2080		5		0		4		8		4		12		4		12		5		15		5		15		5		0
6	Skate Park (move to facilites)	Baseline		3		0		3		9		3		9		3		0		3		0		3		9		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0	Y	4	3	12		4		0
		2080		5		0		4		12		4		12		4		0		5		0		5		15		5		0
6	Emergency Services (How will ES be impacted to service Parks Asset?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events / Biodiversity

#	Asset	Period	Flooding – River Flooding				Climate Moisture Deficit – Wildfire Risk				Climate Moisture Deficit – Wildfire Smoke				Mean # days/year with Daily Peak Wind >70 km/h – Heavy Winds				Tornado – Tornado				Lightning – Lightning				Biodiversity – Insect, invasive plants and disease			
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
	Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
1	Mowed Green Space	Baseline		3		9		3		6		3		0		3		9		3		0		3		0		3		9
		2050	Y	4	3	12	Y	4	2	8		4		0	Y	4	3	12		4		0		4		0	Y	4	3	12
		2080		5		15		5		10		5		0		5		15		5		0		5		0		5		15
2	Baseball/Softball Diamonds	Baseline		3		0		3		6		3		0		3		9		3		0		3		0		3		9
		2050		4		0	Y	4	2	8		4		0	Y	4	3	12		4		0		4		0	Y	4	3	12
		2080		5		0		5		10		5		0		5		15		5		0		5		0		5		15
3	Soccer Fields	Baseline		3		0		3		6		3		0		3		9		3		0		3		0		3		9
		2050		4		0	Y	4	2	8		4		0	Y	4	3	12		4		0		4		0	Y	4	3	12
		2080		5		0		5		10		5		0		5		15		5		0		5		0		5		15
4	Treed Natural Space	Baseline		3		9		3		12		3		0		3		12		3		0		3		9		3		9
		2050	Y	4	3	12	Y	4	4	16		4		0	Y	4	4	16		4		0	Y	4	3	12	Y	4	3	12
		2080		5		15		5		20		5		0		5		20		5		0		5		15		5		15
5	Boulevard Trees	Baseline		3		0		3		12		3		0		3		12		3		0		3		9		3		12
		2050		4		0	Y	4	4	16		4		0	Y	4	4	16		4		0	Y	4	3	12	Y	4	4	16
		2080		5		0		5		20		5		0		5		20		5		0		5		15		5		20
6	Golf Course	Baseline		3		9		3		9		3		0		3		9		3		0		3		9		3		9
		2050	Y	4	3	12	Y	4	3	12		4		0	Y	4	3	12		4		0	Y	4	3	12	Y	4	3	12
		2080		5		15		5		15		5		0		5		15		5		0		5		15		5		15
6	Plantings, Ornamental	Baseline		3		0		3		12		3		0		3		12		3		0		3		9		3		12
		2050		4		0	Y	4	4	16		4		0	Y	4	4	16		4		0	Y	4	3	12	Y	4	4	16
		2080		5		0		5		20		5		0		5		20		5		0		5		15		5		20
6	Park Infrastructure (Play Structures, benches)	Baseline		3		12		3		9		3		0		3		9		3		0		3		9		3		0
		2050	Y	4	4	16	Y	4	3	12		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		20		5		15		5		0		5		15		5		0		5		15		5		0
6	Outdoor Rinks	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6	Trails (Unpaved)	Baseline		3		12		3		9		3		0		3		0		3		0		3		0		3		9
		2050	Y	4	4	16	Y	4	3	12		4		0		4		0		4		0		4		0	Y	4	3	12
		2080		5		20		5		15		5		0		5		0		5		0		5		0		5		15
6	Trails Paved	Baseline		3		12		3		9		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16	Y	4	3	12		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		15		5		0		5		0		5		0		5		0		5		0
6	Pedestrian Bridges	Baseline		3		12		3		9		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16	Y	4	3	12		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		15		5		0		5		0		5		0		5		0		5		0
6	Operations and Maintenance	Baseline		3		9		3		12		3		0		3		12		3		0		3		9		3		9
		2050	Y	4	3	12	Y	4	4	16		4		0	Y	4	4	16		4		0	Y	4	3	12	Y	4	3	12
		2080		5		15		5		20		5		0		5		20		5		0		5		15		5		15
6	Public / Users	Baseline		3		9		3		9		3		9		3		9		3		0		3		9		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		15		5		15		5		15		5		15		5		0		5		15		5		0
6	Stand Alone Public Washrooms (move to facilites)	Baseline		3		9		3		12		3		0		3		9		3		12		3		9		3		0
		2050	Y	4	3	12	Y	4	4	16		4		0	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		15		5		20		5		0		5		15		5		20		5		15		5		0
6	Skate Park (move to facilites)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6	Emergency Services (How will ES be impacted to service Parks Asset?)	Baseline		3		9		3		9		3		6		3		9		3		12		3		9		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		15		5		15		5		10		5		15		5		20		5		15		5		0

City of Camrose

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Facilities

City Hall

Climate Parameter – Temperature

#	Item	Period	Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (◦C)				Days above +30°C				Warmest Maximum Temperature (◦C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
			Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
	Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		6		3		9		3		9		3		6		3		6		3		9
		2050	y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	3	6
		2080		5		10		2		4		5		15		5		15		1		2		3		6		2		6
2	Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		12
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	4	8
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		8
3	Mechanical - HVAC	Baseline		3		6		3		9		3		12		3		12		3		9		3		12		3		9
		2050	Y	4	2	8	Y	2	3	6	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	3	6
		2080		5		10		2		6		5		20		5		20		1		3		3		12		2		6
4	Electrical - Electrical and Communications	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		6
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8		2		0		3		0	Y	2	2	4
		2080		5		0		2		0		5		10		5		10		1		0		3		0		2		4
5	Plumbing - Water and Wastewater	Baseline		3		0		3		6		3		6		3		6		3		6		3		9		3		9
		2050		4		0	Y	2	2	4	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	3	9	Y	2	3	6
		2080		5		0		2		4		5		10		5		10		1		2		3		9		2		6
6	Life Safety	Baseline		3		0		3		0		3		0		3		0		3		6		3		6		3		6
		2050		4		0		2		0		4		0		4		0	Y	2	2	4	Y	3	2	6	Y	2	2	4
		2080		5		0		2		0		5		0		5		0		1		2		3		6		2		4
7	Building Staff	Baseline		3		0		3		0		3		9		3		12		3		9		3		12		3		12
		2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	4	8
		2080		5		0		2		0		5		15		5		20		1		3		3		12		2		8
8	Public / Customers	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		10		5		10		1		0		3		0		2		6
9	IT (Server Rooms)	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8		2		0		3		0		2		0
		2080		5		0		2		0		5		10		5		10		1		0		3		0		2		0
10	Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Climate Parameter – Precipitation

#	Item	Period	Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
			Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
	Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		9		3		12		3		9		3		0		3		12		3		12
		2050	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16	Y	4	4	16
		2080		5		10		4		12		4		16		4		12		5		0		5		20		5		20
2	Structural - Building Envelope	Baseline		3		0		3		6		3		12		3		6		3		9		3		9		3		3
		2050		4		0	Y	4	2	8	Y	4	4	16	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	1	4
		2080		5		0		4		8		4		16		4		8		5		15		5		15		5		5
3	Mechanical - HVAC	Baseline		3		0		3		0		3		0		3		6		3		9		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	2	8	Y	4	3	12		4		0		4		0
		2080		5		0		4		0		4		0		4		8		5		15		5		0		5		0
4	Electrical - Electrical and Communications	Baseline		3		0		3		0		3		9		3		0		3		9		3		0		3		0
		2050		4		0		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0		4		0
		2080		5		0		4		0		4		12		4		0		5		15		5		0		5		0
5	Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
6	Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
7	Building Staff	Baseline		3		0		3		9		3		12		3		6		3		9		3		9		3		6
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	2	8
		2080		5		0		4		12		4		16		4		8		5		15		5		15		5		10
8	Public / Customers	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
9	IT (Server Rooms)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
10	Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Climate Parameter – Extreme Events

#	Item	Period	Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
			River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
	Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		0		3		12		3		0		3		3
		2050		4		0		4		0		4		0		4		0	Y	4	4	16		4		0	Y	4	1	4
		2080		5		0		5		0		5		0		5		0		5		20		5		0		5		5
2	Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		9		3		12		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0		4		0
		2080		5		0		5		0		5		0		5		15		5		20		5		0		5		0
3	Mechanical - HVAC	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
4	Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		20		5		0
5	Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6	Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
7	Building Staff	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
		2050		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
		2080		5		0		5		0		5		15		5		15		5		15		5		15		5		0
8	Public / Customers	Baseline		3		0		3		0		3		0		3		0		3		12		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	4	16		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		20		5		0		5		0
9	IT (Server Rooms)	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		20		5		0
10	Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		3		3		9		3		12		3		6		3		0
		2050		4		0		4		0	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0
		2080		5		0		5		0		5		5		5		15		5		20		5		10		5		0

CITY OF Camrose

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Temperature

	Summer Mean Daily Temp (˚C)	Winter Mean Daily Temp (˚C)	Days above +30°C	Warmest Maximum Temperature (˚C)	Days below -30°C	Coldest Minimum Temperature (˚C)	# Freeze/ Thaw Events
	Summer Mean	**Winter Mean**	**Very Hot Days**	**Hottest Day**	**Very Cold Days**	**Coldest Days**	**Freeze/ Thaw Events**
Climate Projections (RCP 8.5)							
Baseline	15.7	-11.8	4	31.2	9.8	-36.9	92.2
2050	17.7	-9.4	12	33.6	4.8	-33.4	84.9
2080	19.9	-7	27	36.2	1.9	-29.2	77.9

Precipitation

	Annual Total Precipitation (mm)	Maximum 5-day Consecutive Precipitation (mm)	Maximum One-Day Precipitation (mm)	Winter Precipitation	Severe Summer Hail Days (% Change Relative to Present)	Years >/= 1 Freezing Rain Warnings	Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)
	Annual Precipitation	**Persistent Precipitation**	**Extreme Rainfall**	**Snow Accumulation**	**Hail**	**Freezing Rain / Unseasonal Snow**	**Drought**
Baseline	446	32	32	61	-	-	-
2050	473	34	34	67	+	+	+
2080	496	35	35	72	++	++	++

Extreme Events

	Flooding	Climate Moisture Deficit	Climate Moisture Deficit	Mean # days/year with Daily Peak Wind >70 km/h	Tornado	Lightning	Biodiversity
	River Flooding	**Wildfire Risk**	**Wildfire Smoke**	**Heavy Winds**	**Tornado**	**Lightning**	**Insect, invasive plants and disease**
Baseline	-	-	-	-	-	-	-
2050	+	+	+	+	+	+	+
2080	++	++	++	++	++	++	++

Facilities

Fire Hall (New Building)

			Y/N	L	C	R
1	Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3	0	
		2050		4	0	
		2080		5	0	
2	Structural - Building Envelope	Baseline		3	0	
		2050		4	0	
		2080		5	0	
3	Mechanical - HVAC	Baseline		3	0	
		2050		4	0	
		2080		5	0	
4	Electrical - Electrical and Communications	Baseline		3	0	
		2050		4	0	
		2080		5	0	
5	Plumbing - Water and Wastewater	Baseline		3	0	
		2050		4	0	
		2080		5	0	
6	Life Safety	Baseline		3	0	
		2050		4	0	
		2080		5	0	
7	Building Staff	Baseline		3	0	
		2050		4	0	
		2080		5	0	
8	Public (assumed no public or customers?)	Baseline		3	0	
		2050		4	0	
		2080		5	0	
9	IT (Server Rooms)	Baseline		3	0	
		2050		4	0	
		2080		5	0	
9	Emergency Services (How will ES be impacted?)	Baseline		3	0	
		2050		4	0	
		2080		5	0	

City of Camrose

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Climate Parameter: Temperature		Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (∘C)				Days above +30°C				Warmest Maximum Temperature (∘C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
		Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
	2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
	2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Facilities																													
Library/Mirror Lake Centre																													
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		9		3		9		3		6		3		6		3		6
	2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	2	4
	2080		5		0		2		0		5		15		5		15		1		2		3		6		2		4
2 Structural - Building Envelope	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		6
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6	Y	2	2	4
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		4
3 Mechanical - HVAC	Baseline		3		6		3		6		3		9		3		9		3		9		3		9		3		9
	2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		10		2		4		5		15		5		15		1		3		3		9		2		6
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		6		3		9		3		0		3		0		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	3	12		2		0		3		0		2		0
	2080		5		0		2		0		5		10		5		15		1		0		3		0		2		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		6		3		9		3		9		3		9		3		9		3		9
	2050		4		0	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		0		2		4		5		15		5		15		1		3		3		9		2		6
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		6		3		6		3		6
	2050		4		0		2		0		4		0		4		0	Y	2	2	4	Y	3	2	6	Y	2	2	4
	2080		5		0		2		0		5		0		5		0		1		2		3		6		2		4
7 Building Staff	Baseline		3		0		3		0		3		9		3		12		3		9		3		12		3		12
	2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	4	8
	2080		5		0		2		0		5		15		5		20		1		3		3		12		2		8
8 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9		2		0
	2080		5		0		2		0		5		15		5		15		1		3		3		9		2		0
9 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Climate Parameter: Precipitation		Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
		Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
	2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
	2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		6		3		6		3		6		3		6		3		9		3		9
	2050	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	3	12
	2080		5		10		4		8		4		8		4		8		5		10		5		15		5		15
2 Structural - Building Envelope	Baseline		3		0		3		6		3		6		3		9		3		6		3		6		3		0
	2050		4		0	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	2	8	Y	4	2	8		4		0
	2080		5		0		4		8		4		8		4		12		5		10		5		10		5		0
3 Mechanical - HVAC	Baseline		3		0		3		0		3		0		3		9		3		0		3		6		3		0
	2050		4		0		4		0		4		0	Y	4	3	12		4		0	Y	4	2	8		4		0
	2080		5		0		4		0		4		0		4		12		5		0		5		10		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
7 Building Staff	Baseline		3		0		3		6		3		9		3		6		3		6		3		9		3		6
	2050		4		0	Y	4	2	8	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	2	8
	2080		5		0		4		8		4		12		4		8		5		10		5		15		5		10
8 Public / Customers	Baseline		3		0		3		9		3		9		3		0		3		6		3		9		3		9
	2050		4		0	Y	4	3	12	Y		3	0		4		0	Y	4	2	8	Y	4	3	12	Y	4	3	12
	2080		5		0		4		12		4		12		4		0		5		10		5		15		5		15
9 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
	2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Climate Parameter: Extreme Events		Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
		River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
	2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
	2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		6		3		0		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	2	8		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		10		5		0		5		0		5		0
2 Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		6		3		12		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	4	16		4		0		4		0
	2080		5		0		5		0		5		0		5		10		5		20		5		0		5		0
3 Mechanical - HVAC	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8		4		0		4		0		4		0
	2080		5		0		5		0		5		10		5		10		5		0		5		0		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		0		3		0		3		9		3		0
	2050		4		0		4		0		4		0		4		0		4		0	Y	4	3	12		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		15		5		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
7 Building Staff	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
	2080		5		0		5		0		5		15		5		15		5		15		5		15		5		0
8 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0
	2080		5		0		5		0		5		15		5		15		5		0		5		0		5		0
9 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		3		3		9		3		12		3		9		3		0
	2050		4		0		4		0	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
	2080		5		0		5		0		5		5		5		15		5		20		5		15		5		0

Risk Assessment Worksheet — City of Camrose

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Temperature

Item	Period	Summer Mean Daily Temp (˚C) — Summer Mean				Winter Mean Daily Temp (◦C) — Winter Mean				Days above +30°C — Very Hot Days				Warmest Maximum Temperature (◦C) — Hottest Day				Days below -30°C — Very Cold Days				Coldest Minimum Temperature (˚C) — Coldest Days				# Freeze/ Thaw Events — Freeze/ Thaw Events			
Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
	2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
	2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Facilities																													
Misc. Buildings (Stoney Creek Center, Ski Maintenance Building, Community Services Maintenance Shop, Camrose Museum Buildings, Youth Center, Bill Fowler Center, CREDCO building, Food Bank Building)																													
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
	2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
2 Structural - Building Envelope	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
	2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
3 Mechanical - HVAC	Baseline		3		6		3		6		3		9		3		9		3		9		3		9		3		9
	2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		10		2		4		5		15		5		15		1		3		3		9		2		6
4 Electrical - Electrical and Communications	Baseline		3		6		3		0		3		9		3		9		3		0		3		0		3		0
	2050	Y	4	2	8		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0		2		0
	2080		5		10		2		0		5		15		5		15		1		0		3		0		2		0
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		6		3		9		3		9		3		9		3		9		3		9
	2050		4		0	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		0		2		4		5		15		5		15		1		3		3		9		2		6
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		9		3		9		3		9
	2050		4		0		2		0		4		0		4		0	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		0		2		0		5		0		5		0		1		3		3		9		2		6
7 Building Staff	Baseline		3		0		3		0		3		9		3		12		3		9		3		12		3		12
	2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	4	8
	2080		5		0		2		0		5		15		5		20		1		3		3		12		2		8
8 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9		2		0
	2080		5		0		2		0		5		15		5		15		1		3		3		9		2		0
9 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

Item	Period	Annual Total Precipitation (mm) — Annual Precipitation				Maximum 5-day Consecutive Precipitation (mm) — Persistent Precipitation				Maximum One-Day Precipitation (mm) — Extreme Rainfall				Winter Precipitation — Snow Accumulation				Severe Summer Hail Days (% Change Relative to Present) — Hail				Years >/= 1 Freezing Rain Warnings — Freezing Rain / Unseasonal Snow				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August) — Drought			
Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
	2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
	2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		9		3		9		3		9		3		6		3		9		3		9
	2050	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	3	12
	2080		5		10		4		12		4		12		4		12		5		10		5		15		5		15
2 Structural - Building Envelope	Baseline		3		0		3		9		3		9		3		9		3		9		3		9		3		0
	2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
	2080		5		0		4		12		4		12		4		12		5		15		5		15		5		0
3 Mechanical - HVAC	Baseline		3		0		3		0		3		0		3		9		3		0		3		6		3		0
	2050		4		0		4		0		4		0	Y	4	3	12		4		0	Y	4	2	8		4		0
	2080		5		0		4		0		4		0		4		12		5		0		5		10		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
7 Building Staff	Baseline		3		0		3		6		3		9		3		6		3		6		3		9		3		6
	2050		4		0	Y	4	2	8	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	2	8
	2080		5		0		4		8		4		12		4		8		5		10		5		15		5		10
8 Public / Customers	Baseline		3		0		3		9		3		9		3		0		3		6		3		9		3		9
	2050		4		0	Y	4	3	12	Y		3	0		4		0	Y	4	2	8	Y	4	3	12	Y	4	3	12
	2080		5		0		4		12		4		12		4		0		5		10		5		15		5		15
9 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
	2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events

Item	Period	Flooding — River Flooding				Climate Moisture Deficit — Wildfire Risk				Climate Moisture Deficit — Wildfire Smoke				Mean # days/year with Daily Peak Wind >70 km/h — Heavy Winds				Tornado — Tornado				Lightning — Lightning				Biodiversity — Insect, invasive plants and disease			
Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
	2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
	2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		6		3		12		3		0		3		6
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	4	16		4		0	Y	4	2	8
	2080		5		0		5		0		5		0		5		10		5		20		5		0		5		10
2 Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		9		3		12		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0		4		0
	2080		5		0		5		0		5		0		5		15		5		20		5		0		5		0
3 Mechanical - HVAC	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8		4		0		4		0		4		0
	2080		5		0		5		0		5		10		5		10		5		0		5		0		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		0		3		0		3		9		3		0
	2050		4		0		4		0		4		0		4		0		4		0	Y	4	3	12		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		15		5		0
5 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
7 Building Staff	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
	2080		5		0		5		0		5		15		5		15		5		15		5		15		5		0
8 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0
	2080		5		0		5		0		5		15		5		15		5		0		5		0		5		0
9 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		3		3		9		3		12		3		9		3		0
	2050		4		0		4		0	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
	2080		5		0		5		0		5		5		5		15		5		20		5		15		5		0

Camrose — Risk Assessment Worksheet	Consequence Score
	0 - No Effect 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

Climate Parameter

Temperature

		Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (◦C)				Days above +30°C				Warmest Maximum Temperature (◦C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
		Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
	2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
	2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Facilities																													
Police Station																													
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		6		3		9		3		6		3		6		3		6		3		9
	2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	2	8	Y	2	2	4	Y	3	2	6	Y	2	3	6
	2080		5		10		2		4		5		15		5		10		1		2		3		6		2		6
2 Structural - Building Envelope	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		12
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6	Y	2	4	8
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		8
3 Mechanical - HVAC	Baseline		3		6		3		6		3		9		3		9		3		9		3		9		3		9
	2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		10		2		4		5		15		5		15		1		3		3		9		2		6
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		6		3		9		3		0		3		0		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	3	12		2		0		3		0		2		0
	2080		5		0		2		0		5		10		5		15		1		0		3		0		2		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		6		3		0		3		0		3		9		3		9		3		9
	2050		4		0	Y	2	2	4		4		0		4		0	Y	2	3	6	Y	3	3	9	Y	2	3	6
	2080		5		0		2		4		5		0		5		0		1		3		3		9		2		6
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		6		3		6		3		6
	2050		4		0		2		0		4		0		4		0	Y	2	2	4	Y	3	2	6	Y	2	2	4
	2080		5		0		2		0		5		0		5		0		1		2		3		6		2		4
7 Building Staff	Baseline		3		0		3		0		3		9		3		12		3		9		3		12		3		12
	2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	4	8
	2080		5		0		2		0		5		15		5		20		1		3		3		12		2		8
8 Public	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		9
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8		2		0		3		0	Y	2	3	6
	2080		5		0		2		0		5		10		5		10		1		0		3		0		2		6
9 IT (Server Rooms)	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8		2		0		3		0		2		0
	2080		5		0		2		0		5		10		5		10		1		0		3		0		2		0
10 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

		Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
		Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
	2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
	2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		9		3		12		3		9		3		0		3		12		3		12
	2050	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16	Y	4	4	16
	2080		5		10		4		12		4		16		4		12		5		0		5		20		5		20
2 Structural - Building Envelope	Baseline		3		0		3		6		3		9		3		9		3		9		3		9		3		3
	2050		4		0	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	1	4
	2080		5		0		4		8		4		12		4		12		5		15		5		15		5		5
3 Mechanical - HVAC	Baseline		3		0		3		0		3		0		3		6		3		6		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	2	8		4		0		4		0
	2080		5		0		4		0		4		0		4		8		5		10		5		0		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		0		3		0		3		9		3		0
	2050		4		0		4		0		4		0		4		0		4		0	Y	4	3	12		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		15		5		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
7 Building Staff	Baseline		3		0		3		6		3		9		3		6		3		6		3		9		3		6
	2050		4		0	Y	4	2	8	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	2	8
	2080		5		0		4		8		4		12		4		8		5		10		5		15		5		10
8 Public	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
9 IT (Server Rooms)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
10 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
	2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events

		Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
		River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
	2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
	2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		6		3		12		3		6		3		3
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	4	16	Y	4	2	8	Y	4	1	4
	2080		5		0		5		0		5		0		5		10		5		20		5		10		5		5
2 Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		6		3		12		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	4	16		4		0		4		0
	2080		5		0		5		0		5		0		5		10		5		20		5		0		5		0
3 Mechanical - HVAC	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8		4		0		4		0		4		0
	2080		5		0		5		0		5		10		5		10		5		0		5		0		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		12		3		12		3		12		3		0
	2050		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16	Y	4	4	16		4		0
	2080		5		0		5		0		5		0		5		20		5		20		5		20		5		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
7 Building Staff	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
	2080		5		0		5		0		5		15		5		15		5		15		5		15		5		0
8 Public	Baseline		3		0		3		0		3		0		3		0		3		12		3		0		3		0
	2050		4		0		4		0		4		0		4		0	Y	4	4	16		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		20		5		0		5		0
9 IT (Server Rooms)	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		0
	2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		20		5		0
10 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		3		3		9		3		12		3		9		3		0
	2050		4		0		4		0	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
	2080		5		0		5		0		5		5		5		15		5		20		5		15		5		0

Risk Assessment Worksheet	
Consequence Score	0 - No Effect 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

Climate Parameter

Temperature

Climate Parameter	Year	Summer Mean Daily Temp (˚C) — Summer Mean				Winter Mean Daily Temp (°C) — Winter Mean				Days above +30°C — Very Hot Days				Warmest Maximum Temperature (°C) — Hottest Day				Days below -30°C — Very Cold Days				Coldest Minimum Temperature (˚C) — Coldest Days				# Freeze/ Thaw Events — Freeze/ Thaw Events			
Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
	2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
	2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Facilities																													
Rec Facilities (Arenas - Max McLean, Border, Encana Arena Max McLean Curling Rink Aquatic Center Community Center)																													
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		6		3		6		3		9		3		9		3		6		3		6		3		12
	2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	4	8
	2080		5		10		2		4		5		15		5		15		1		2		3		6		2		8
2 Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		12
	2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	4	8
	2080		5		0		2		0		5		0		5		0		1		0		3		0		2		8
3 Mechanical - HVAC	Baseline		3		6		3		9		3		9		3		12		3		9		3		9		3		12
	2050	Y	4	2	8	Y	2	3	6	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	3	9	Y	2	4	8
	2080		5		10		2		6		5		15		5		20		1		3		3		9		2		8
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		6		3		9		3		0		3		0		3		6
	2050		4		0		2		0	Y	4	2	8	Y	4	3	12		2		0		3		0	Y	2	2	4
	2080		5		0		2		0		5		10		5		15		1		0		3		0		2		4
5 Plumbing - Water and Wastewater	Baseline		3		0		3		6		3		12		3		12		3		12		3		12		3		9
	2050		4		0	Y	2	2	4	Y	4	4	16	Y	4	4	16	Y	2	4	8	Y	3	4	12	Y	2	3	6
	2080		5		0		2		4		5		20		5		20		1		4		3		12		2		6
6 Solar	Baseline		3		9		3		9		3		9		3		12		3		0		3		0		3		0
	2050	Y	4	3	12	Y	2	3	6	Y	4	3	12	Y	4	4	16		2		0		3		0		2		0
	2080		5		15		2		6		5		15		5		20		1		0		3		0		2		0
7 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		6		3		6		3		6
	2050		4		0		2		0		4		0		4		0	Y	2	2	4	Y	3	2	6	Y	2	2	4
	2080		5		0		2		0		5		0		5		0		1		2		3		6		2		4
8 Speciality Equiment (Ice Plant, Pool)	Baseline		3		9		3		9		3		12		3		12		3		9		3		12		3		12
	2050	y	4	3	12	Y	2	3	6	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	4	8
	2080		5		15		2		6		5		20		5		20		1		3		3		12		2		8
9 Building Staff	Baseline		3		0		3		0		3		9		3		12		3		12		3		12		3		12
	2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	4	8	Y	3	4	12	Y	2	4	8
	2080		5		0		2		0		5		15		5		20		1		4		3		12		2		8
10 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9		2		0
	2080		5		0		2		0		5		15		5		15		1		3		3		9		2		0
11 IT (Server Rooms)	Baseline		3		0		3		0		3		6		3		6		3		0		3		0		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8		2		0		3		0		2		0
	2080		5		0		2		0		5		10		5		10		1		0		3		0		2		0
11 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

Climate Parameter	Year	Annual Total Precipitation (mm) — Annual Precipitation				Maximum 5-day Consecutive Precipitation (mm) — Persistent Precipitation				Maximum One-Day Precipitation (mm) — Extreme Rainfall				Winter Precipitation — Snow Accumulation				Severe Summer Hail Days (% Change Relative to Present) — Hail				Years >/= 1 Freezing Rain Warnings — Freezing Rain / Unseasonal Snow				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August) — Drought			
Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
	2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
	2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		9		3		12		3		9		3		0		3		12		3		12
	2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16	Y	4	4	16
	2080		5		0		4		12		4		16		4		12		5		0		5		20		5		20
2 Structural - Building Envelope	Baseline		3		0		3		12		3		12		3		12		3		9		3		9		3		3
	2050		4		0	Y	4	4	16	Y	4	4	16	Y	4	4	16	Y	4	3	12	Y	4	3	12	Y	4	1	4
	2080		5		0		4		16		4		16		4		16		5		15		5		15		5		5
3 Mechanical - HVAC	Baseline		3		0		3		0		3		0		3		9		3		0		3		0		3		6
	2050		4		0		4		0		4		0	Y	4	3	12		4		0		4		0	Y	4	2	8
	2080		5		0		4		0		4		0		4		12		5		0		5		0		5		10
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		6		3		0		3		0		3		9		3		0
	2050		4		0		4		0	Y	4	2	8		4		0		4		0	Y	4	3	12		4		0
	2080		5		0		4		0		4		8		4		0		5		0		5		15		5		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
6 Solar	Baseline		3		0		3		0		3		0		3		0		3		12		3		0		3		0
	2050		4		0		4		0		4		0		4		0	Y	4	4	16		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		20		5		0		5		0
7 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
8 Speciality Equiment (Ice Plant, Pool)	Baseline		3		0		3		6		3		0		3		0		3		0		3		0		3		12
	2050		4		0	Y	4	2	8		4		0		4		0		4		0		4		0	Y	4	4	16
	2080		5		0		4		8		4		0		4		0		5		0		5		0		5		20
9 Building Staff	Baseline		3		0		3		9		3		12		3		12		3		9		3		12		3		9
	2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	4	16	Y	4	3	12	Y	4	4	16	Y	4	3	12
	2080		5		0		4		12		4		16		4		16		5		15		5		20		5		15
10 Public / Customers	Baseline		3		0		3		9		3		9		3		0		3		0		3		9		3		9
	2050		4		0	Y	4	3	12	Y		3	0		4		0		4		0	Y	4	3	12	Y	4	3	12
	2080		5		0		4		12		4		12		4		0		5		0		5		15		5		15
11 IT (Server Rooms)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
11 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		6		3		9		3		6		3		6		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	3	12	Y	4	2	8	Y	4	2	8		4		0
	2080		5		0		4		0		4		8		4		12		5		10		5		10		5		0

Extreme Events

Climate Parameter	Year	Flooding — River Flooding				Climate Moisture Deficit — Wildfire Risk				Climate Moisture Deficit — Wildfire Smoke				Mean # days/year with Daily Peak Wind >70 km/h — Heavy Winds				Tornado — Tornado				Lightning — Lightning				Biodiversity — Insect, invasive plants and disease			
Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
	2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
	2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1 Civil - Site, Parking, Landscaped Areas, Stormwater	Baseline		3		0		3		0		3		0		3		9		3		12		3		0		3		6
	2050		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0	Y	4	2	8
	2080		5		0		5		0		5		0		5		15		5		20		5		0		5		10
2 Structural - Building Envelope	Baseline		3		0		3		0		3		0		3		9		3		12		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0		4		0
	2080		5		0		5		0		5		0		5		15		5		20		5		0		5		0
3 Mechanical - HVAC	Baseline		3		0		3		0		3		3		3		0		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	3	12		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		15		5		0		5		0		5		0		5		0
4 Electrical - Electrical and Communications	Baseline		3		0		3		0		3		0		3		12		3		12		3		12		3		0
	2050		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16	Y	4	4	16		4		0
	2080		5		0		5		0		5		0		5		20		5		20		5		20		5		0
5 Plumbing - Water and Wastewater	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6 Solar	Baseline		3		0		3		0		3		0		3		6		3		12		3		12		3		0
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	4	16	T	4	4	16		4		0
	2080		5		0		5		0		5		0		5		10		5		20		5		20		5		0
7 Life Safety	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
8 Speciality Equiment (Ice Plant, Pool)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
9 Building Staff	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		6
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	2	8
	2080		5		0		5		0		5		15		5		15		5		15		5		15		5		10
10 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0
	2080		5		0		5		0		5		15		5		15		5		0		5		0		5		0
11 IT (Server Rooms)	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		0
	2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		20		5		0
11 Emergency Services (How will ES be impacted?)	Baseline		3		0		3		0		3		3		3		9		3		12		3		9		3		0
	2050		4		0		4		0	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
	2080		5		0		5		0		5		5		5		15		5		20		5		15		5		0

City of Camrose

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Fleet

- City of Camrose has 161 pieces of equipment in our Fleet including:
  - 47 Light vehicles (up to 56 during the summer)- Pickup trucks and SUV's
  - 26 Commercial Vehicles – Trucks over 1 ton
  - 46 Off Road Equipment - Graders, Loaders, Backhoes etc.
  - 29 Grounds and Trail Maintenance Equipment - Mowers, Skid steer loader, UTV's
  - 13 Misc. road maintenance & support equipment - Spray patcher, tar kettle, hotbox, loader-mounted snowblower, mobile air compressor

Climate Parameter – Temperature

#	Asset		Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (∘C)				Days above +30°C				Warmest Maximum Temperature (∘C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
			Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
	Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Light Vehicles (Pick-up)	Baseline		3		0		3		0		3		6		3		6		3		6		3		9		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	y	3	3	9		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		9		2		0
2	Commercial Vehicles (dump trucks)	Baseline		3		0		3		0		3		6		3		6		3		6		3		9		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	y	3	3	9		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		9		2		0
3	Off-Road Equipment	Baseline		3		0		3		0		3		9		3		9		3		9		3		12		3		12
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	y	3	4	12	Y	2	4	8
		2080		5		0		2		0		5		15		5		15		1		3		3		12		2		8
4	Ground and Trail Maintenance Equipment	Baseline		3		0		3		0		3		6		3		6		3		9		3		12		3		12
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	3	6	y	3	4	12	Y	2	4	8
		2080		5		0		2		0		5		10		5		10		1		3		3		12		2		8
5	Road Maintenance and Support Equipment	Baseline		3		0		3		0		3		6		3		6		3		9		3		9		3		12
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	3	6	Y	3	3	9	Y	2	4	8
		2080		5		0		2		0		5		10		5		10		1		3		3		9		2		8
6	Communication Systems (Radios, Towers, Repeaters)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
7	Operations & Maintenace	Baseline		3		0		3		0		3		9		3		12		3		9		3		12		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	3	6
		2080		5		0		2		0		5		15		5		20		1		3		3		12		2		6
8	Public / Customers	Baseline		3		0		3		0		3		0		3		9		3		9		3		0		3		0
		2050		4		0		2		0		4		0	Y	4	3	12	Y	2	3	6		3		0		2		0
		2080		5		0		2		0		5		0		5		15		1		3		3		0		2		0
9	Emergency Services (How will ES be impacted to service Fleet Asset?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Climate Parameter – Precipitation

#	Asset		Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
			Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
	Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Light Vehicles (Pick-up)	Baseline		3		0		3		0		3		0		3		0		3		9		3		0		3		0
		2050		4		0		4		0		4		0		4		0	y	4	3	12		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		15		5		0		5		0
2	Commercial Vehicles (dump trucks)	Baseline		3		0		3		0		3		0		3		0		3		9		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	3	12		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		15		5		0		5		0
3	Off-Road Equipment	Baseline		3		0		3		0		3		0		3		0		3		6		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	2	8		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		10		5		0		5		0
4	Ground and Trail Maintenance Equipment	Baseline		3		0		3		0		3		0		3		0		3		9		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	3	12		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		15		5		0		5		0
5	Road Maintenance and Support Equipment	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
6	Communication Systems (Radios, Towers, Repeaters)	Baseline		3		0		3		0		3		0		3		0		3		9		3		12		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0
		2080		5		0		4		0		4		0		4		0		5		15		5		20		5		0
7	Operations & Maintenace	Baseline		3		0		3		0		3		0		3		0		3		9		3		9		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	3	12	Y	4	3	12		4		0
		2080		5		0		4		0		4		0		4		0		5		15		5		15		5		0
8	Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		0
		2050		4		0		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0
		2080		5		0		4		0		4		12		4		12		5		0		5		0		5		0
9	Emergency Services (How will ES be impacted to service Fleet Asset?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Climate Parameter – Extreme Events

#	Asset		Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
			River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
	Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Light Vehicles (Pick-up)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
2	Commercial Vehicles (dump trucks)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
3	Off-Road Equipment	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
4	Ground and Trail Maintenance Equipment	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
5	Road Maintenance and Support Equipment	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6	Communication Systems (Radios, Towers, Repeaters)	Baseline		3		0		3		0		3		0		3		9		3		12		3		12		3		0
		2050		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		15		5		20		5		20		5		0
7	Operations & Maintenace	Baseline		3		0		3		0		3		0		3		9		3		0		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	3	12		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		15		5		0		5		0		5		0
8	Public / Customers	Baseline		3		9		3		0		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	3	12		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		15		5		0		5		0		5		0		5		0		5		0		5		0
9	Emergency Services (How will ES be impacted to service Fleet Asset?)	Baseline		3		9		3		0		3		6		3		9		3		12		3		12		3		0
		2050	Y	4	3	12		4		0	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		15		5		0		5		10		5		15		5		20		5		20		5		0

City of Camrose

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Roads

			Climate Parameter																											
			Temperature																											
			Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (°C)				Days above +30°C				Warmest Maximum Temperature (°C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
			Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
	Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Asphalt Roads	Baseline		3		9		3		0		3		12		3		12		3		9		3		0		3		12
		2050	Y	4	3	12		2		0	Y	4	4	16	Y	4	4	16	Y	2	3	6		3		0	Y	2	4	8
		2080		5		15		2		0		5		20		5		20		1		3		3		0		2		8
2	Gravel Roads	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
3	Sidewalks	Baseline		3		0		3		0		3		12		3		12		3		6		3		0		3		9
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	2	4		3		0	Y	2	3	6
		2080		5		0		2		0		5		20		5		20		1		2		3		0		2		6
4	Ramps, Etc.	Baseline		3		0		3		0		3		12		3		12		3		6		3		0		3		9
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	2	4		3		0	Y	2	3	6
		2080		5		0		2		0		5		20		5		20		1		2		3		0		2		6
5	Laneways	Baseline		3		0		3		0		3		12		3		12		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		20		5		20		1		0		3		0		2		6
6	Road Signs	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
7	Signal Intersections	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		0		3		0		2		6
8	Pedestrian Crossing Flashers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		0		3		0		2		6
9	Roadway Bridges	Baseline		3		0		3		0		3		9		3		12		3		9		3		9		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		15		5		20		1		3		3		9		2		6
10	Operations and Maintenance	Baseline		3		0		3		0		3		9		3		9		3		9		3		12		3		12
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	4	12	Y	2	4	8
		2080		5		0		2		0		5		15		5		15		1		3		3		12		2		8
11	Public / Customers	Baseline		3		0		3		0		3		0		3		9		3		0		3		0		3		12
		2050		4		0		2		0		4		0	Y	4	3	12		2		0		3		0	Y	2	4	8
		2080		5		0		2		0		5		0		5		15		1		0		3		0		2		8
12	Emergency Services (How will ES be impacted to service emergencies occuring on the Road Assets?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

			Precipitation																											
			Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
			Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
	Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Asphalt Roads	Baseline		3		9		3		9		3		12		3		6		3		0		3		9		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0	Y	4	3	12		4		0
		2080		5		15		4		12		4		16		4		8		5		0		5		15		5		0
2	Gravel Roads	Baseline		3		12		3		9		3		12		3		3		3		0		3		6		3		9
		2050	Y	4	4	16	Y	4	3	12	Y	4	4	16	Y	4	1	4		4		0	Y	4	2	8	Y	4	3	12
		2080		5		20		4		12		4		16		4		4		5		0		5		10		5		15
3	Sidewalks	Baseline		3		0		3		0		3		6		3		0		3		0		3		9		3		0
		2050		4		0		4		0	Y	4	2	8		4		0		4		0	Y	4	3	12		4		0
		2080		5		0		4		0		4		8		4		0		5		0		5		15		5		0
4	Ramps, Etc.	Baseline		3		0		3		0		3		12		3		3		3		0		3		12		3		0
		2050		4		0		4		0	Y	4	4	16	Y	4	1	4		4		0	Y	4	4	16		4		0
		2080		5		0		4		0		4		16		4		4		5		0		5		20		5		0
5	Laneways	Baseline		3		9		3		12		3		12		3		9		3		0		3		12		3		0
		2050	Y	4	3	12	Y	4	4	16	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16		4		0
		2080		5		15		4		16		4		16		4		12		5		0		5		20		5		0
6	Road Signs	Baseline		3		0		3		0		3		0		3		0		3		6		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	2	8		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		10		5		0		5		0
7	Signal Intersections	Baseline		3		0		3		0		3		0		3		9		3		9		3		12		3		0
		2050		4		0		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	4	16		4		0
		2080		5		0		4		0		4		0		4		12		5		15		5		20		5		0
8	Pedestrian Crossing Flashers	Baseline		3		0		3		0		3		0		3		9		3		9		3		12		3		0
		2050		4		0		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	4	16		4		0
		2080		5		0		4		0		4		0		4		12		5		15		5		20		5		0
9	Roadway Bridges	Baseline		3		0		3		0		3		12		3		9		3		0		3		12		3		0
		2050		4		0		4		0	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16		4		0
		2080		5		0		4		0		4		16		4		12		5		0		5		20		5		0
10	Operations and Maintenance	Baseline		3		9		3		9		3		12		3		9		3		9		3		12		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	3	12	Y	4	3	12	Y	4	4	16		4		0
		2080		5		15		4		12		4		16		4		12		5		15		5		20		5		0
11	Public / Customers	Baseline		3		0		3		9		3		12		3		9		3		0		3		12		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16		4		0
		2080		5		0		4		12		4		16		4		12		5		0		5		20		5		0
12	Emergency Services (How will ES be impacted to service emergencies occuring on the Road Assets?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

			Extreme Events																											
			Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
			River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
	Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Asphalt Roads	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
2	Gravel Roads	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
3	Sidewalks	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
4	Ramps, Etc.	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
5	Laneways	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
6	Road Signs	Baseline		3		0		3		0		3		0		3		3		3		0		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	3	12		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		15		5		0		5		0		5		0
7	Signal Intersections	Baseline		3		0		3		0		3		0		3		9		3		0		3		9		3		0
		2050		4		0		4		0		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		5		0		5		0		5		15		5		0		5		15		5		0
8	Pedestrian Crossing Flashers	Baseline		3		0		3		0		3		0		3		9		3		0		3		9		3		0
		2050		4		0		4		0		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		5		0		5		0		5		15		5		0		5		15		5		0
9	Roadway Bridges	Baseline		3		9		3		6		3		0		3		9		3		9		3		9		3		0
		2050	Y	4	3	12	Y	4	2	8		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
		2080		5		15		5		10		5		0		5		15		5		15		5		15		5		0
10	Operations and Maintenance	Baseline		3		0		3		0		3		0		3		9		3		9		3		9		3		0
		2050		4		0		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
		2080		5		0		5		0		5		0		5		15		5		15		5		15		5		0
11	Public / Customers	Baseline		3		9		3		9		3		9		3		9		3		0		3		0		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0
		2080		5		15		5		15		5		15		5		15		5		0		5		0		5		0
12	Emergency Services (How will ES be impacted to service emergencies occuring on the Road Assets?)	Baseline		3		9		3		9		3		6		3		9		3		12		3		12		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		15		5		15		5		10		5		15		5		20		5		20		5		0

City of Camrose

Risk Assessment Worksheet

Consequence Score
- 0 - No Effect
- 1 - Insignificant
- 2 - Minor
- 3 - Moderate
- 4 - Major
- 5 - Catastrophic

Climate Parameter

Stormwater

Temperature

#	Asset	Year	Summer Mean Daily Temp (°C)				Winter Mean Daily Temp (°C)				Days above +30°C				Warmest Maximum Temperature (°C)				Days below -30°C				Coldest Minimum Temperature (°C)				# Freeze/ Thaw Events			
			Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
Climate Projections (RCP 8.5)		Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Storm Sewer Mains	Baseline		3		0		3		0		3		0		3		0		3		12		3		12		3		12
		2050		4		0		2		0		4		0		4		0	Y	2	4	8	y	3	4	12	y	2	4	8
		2080		5		0		2		0		5		0		5		0		1		4		3		12		2		8
2	Catch Basins	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		12
		2050		4		0		2		0		4		0		4		0		2		0		3		0	y	2	4	8
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		8
3	Storm Pump Station	Baseline		3		0		3		0		3		9		3		9		3		6		3		9		3		0
		2050		4		0		2		0	y	4	3	12	y	4	3	12	y	2	2	4	y	3	3	9		2		0
		2080		5		0		2		0		5		15		5		15		1		2		3		9		2		0
4	Wet Ponds	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
5	Drainage Ditches	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		6
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	2	4
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		4
5	Culverts	Baseline		3		0		3		0		3		0		3		0		3		9		3		9		3		9
		2050		4		0		2		0		4		0		4		0	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		3		3		9		2		6
6	Stoney Creek	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
7	Snow Dump Sites	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		6
8	Mirror Lake Dam	Baseline		3		0		3		0		3		6		3		6		3		9		3		9		3		9
		2050		4		0		2		0	y	4	2	8	y	4	2	8	y	2	3	6	y	3	3	9	y	2	3	6
		2080		5		0		2		0		5		10		5		10		1		3		3		9		2		6
9	Valleyview Dam (City Review)	Baseline		3		0		3		0		3		6		3		6		3		9		3		9		3		9
		2050		4		0		2		0	y	4	2	8	y	4	2	8	y	2	3	6	y	3	3	9	y	2	3	6
		2080		5		0		2		0		5		10		5		10		1		3		3		9		2		6
10	Creek Outfalls	Baseline		3		0		3		0		3		0		3		0		3		0		3		9		3		12
		2050		4		0		2		0		4		0		4		0		2		0	Y	3	3	9	Y	2	4	8
		2080		5		0		2		0		5		0		5		0		1		0		3		9		2		8
11	Operations and Maintenance	Baseline		3		0		3		0		3		6		3		6		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		10		5		10		1		3		3		9		2		0
12	Public / Customers	Baseline		3		0		3		0		3		6		3		6		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		10		5		10		1		3		3		9		2		0
13	Emergency Services (How will ES be impacted to service stormwater assets?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

#	Asset	Year	Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
			Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
Climate Projections (RCP 8.5)		Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Storm Sewer Mains	Baseline		3		0		3		9		3		12		3		0		3		0		3		0		3		0
		2050		4		0	y	4	3	12	y	4	4	16		4		0		4		0		4		0		4		0
		2080		5		0		4		12		4		16		4		0		5		0		5		0		5		0
2	Catch Basins	Baseline		3		0		3		6		3		9		3		9		3		9		3		0		3		0
		2050		4		0	y	4	2	8	y	4	3	12	y	4	3	12	y	4	3	12		4		0		4		0
		2080		5		0		4		8		4		12		4		12		5		15		5		0		5		0
3	Storm Pump Station	Baseline		3		0		3		9		3		9		3		0		3		3		3		0		3		0
		2050		4		0	y	4	3	12	y	4	3	12		4		0	y	4	1	4		4		0		4		0
		2080		5		0		4		12		4		12		4		0		5		5		5		0		5		0
4	Wet Ponds	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
5	Drainage Ditches	Baseline		3		0		3		9		3		12		3		9		3		0		3		0		3		9
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0		4		0	Y	4	3	12
		2080		5		0		4		12		4		16		4		12		5		0		5		0		5		15
5	Culverts	Baseline		3		0		3		9		3		12		3		6		3		0		3		9		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0	Y	4	3	12		4		0
		2080		5		0		4		12		4		16		4		8		5		0		5		15		5		0
6	Stoney Creek	Baseline		3		9		3		9		3		12		3		0		3		0		3		0		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16		4		0		4		0		4		0		4		0
		2080		5		15		4		12		4		16		4		0		5		0		5		0		5		0
7	Snow Dump Sites	Baseline		3		0		3		0		3		0		3		12		3		0		3		9		3		0
		2050		4		0		4		0		4		0	Y	4	4	16		4		0	Y	4	3	12		4		0
		2080		5		0		4		0		4		0		4		16		5		0		5		15		5		0
8	Mirror Lake Dam	Baseline		3		6		3		12		3		9		3		6		3		0		3		0		3		6
		2050	y	4	2	8	y	4	4	16	y	4	3	12	y	4	2	8		4		0		4		0	y	4	2	8
		2080		5		10		4		16		4		12		4		8		5		0		5		0		5		10
9	Valleyview Dam (City Review)	Baseline		3		6		3		12		3		9		3		6		3		0		3		0		3		6
		2050	y	4	2	8	y	4	4	16	y	4	3	12	y	4	2	8		4		0		4		0	y	4	2	8
		2080		5		10		4		16		4		12		4		8		5		0		5		0		5		10
10	Creek Outfalls	Baseline		3		0		3		9		3		12		3		0		3		0		3		0		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16		4		0		4		0		4		0		4		0
		2080		5		0		4		12		4		16		4		0		5		0		5		0		5		0
11	Operations and Maintenance	Baseline		3		9		3		9		3		12		3		6		3		12		3		12		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	4	16	Y	4	4	16		4		0
		2080		5		15		4		12		4		16		4		8		5		20		5		20		5		0
12	Public / Customers	Baseline		3		9		3		9		3		12		3		9		3		0		3		12		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0	Y	4	4	16		4		0
		2080		5		15		4		12		4		16		4		12		5		0		5		20		5		0
13	Emergency Services (How will ES be impacted to service stormwater assets?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events

#	Asset	Year	Flooding								Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
			River Flooding				Creek Flow				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
Climate Projections (RCP 8.5)		Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Storm Sewer Mains	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
2	Catch Basins	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
3	Storm Pump Station	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0	y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		20		5		0
4	Wet Ponds	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
5	Drainage Ditches	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0	Y	4	3	12
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		15
5	Culverts	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		9
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0	Y	4	3	12
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		15
6	Stoney Creek	Baseline		3		12		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		0		5		0		5		0		5		0		5		0		5		0		5		0
7	Snow Dump Sites	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
8	Mirror Lake Dam	Baseline		3		12		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050	y	4	4	16		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		0		5		0		5		0		5		0		5		0		5		0		5		0
9	Valleyview Dam (City Review)	Baseline		3		12		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050	y	4	4	16		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		0		5		0		5		0		5		0		5		0		5		0		5		0
10	Creek Outfalls	Baseline		3		12		3		0		3		6		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16		4		0	Y	4	2	8		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		0		5		10		5		0		5		0		5		0		5		0		5		0
11	Operations and Maintenance	Baseline		3		9		3		9		3		9		3		6		3		9		3		12		3		9		3		0
		2050	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		15		5		15		5		15		5		10		5		15		5		20		5		15		5		0
12	Public / Customers	Baseline		3		9		3		12		3		0		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	3	12	Y	4	4	16		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		15		5		20		5		0		5		0		5		0		5		0		5		0		5		0
13	Emergency Services (How will ES be impacted to service stormwater assets?)	Baseline		3		12		3		12		3		9		3		6		3		9		3		12		3		9		3		0
		2050	Y	4	4	16	Y	4	4	16	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		20		5		20		5		15		5		10		5		15		5		20		5		15		5		0

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Temperature

		Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (°C)				Days above +30°C				Warmest Maximum Temperature (°C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
		Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
	2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
	2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Transit																													
1 Community Bus	Baseline		3		0		3		0		3		12		3		12		3		12		3		0		3		0
	2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	4	8	Y	3		0		2		0
	2080		5		0		2		0		5		20		5		20		1		4		3		0		2		0
2 Bus Stops	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		6
	2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	2	4
	2080		5		0		2		0		5		0		5		0		1		0		3		0		2		4
5 Operations & Maintenace	Baseline		3		0		3		0		3		9		3		12		3		9		3		12		3		9
	2050		4		0		2		0	Y	4	3	12	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	3	6
	2080		5		0		2		0		5		15		5		20		1		3		3		12		2		6
6 Public / Customers	Baseline		3		0		3		0		3		12		3		12		3		9		3		12		3		12
	2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	4	12	Y	2	4	8
	2080		5		0		2		0		5		20		5		20		1		3		3		12		2		8
7 Emergency Services (How will ES be impacted to service the Transit assets and users of Transit service?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
	2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

		Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
		Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
	2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
	2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Transit																													
1 Community Bus	Baseline		3		0		3		0		3		0		3		0		3		12		3		9		3		0
	2050		4		0		4		0		4		0		4		0	Y	4	4	16	y	4	3	12		4		0
	2080		5		0		4		0		4		0		4		0		5		20		5		15		5		0
2 Bus Stops	Baseline		3		0		3		0		3		0		3		6		3		6		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	2	8	Y	4	2	8		4		0		4		0
	2080		5		0		4		0		4		0		4		8		5		10		5		0		5		0
5 Operations & Maintenace	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0
	2080		5		0		4		0		4		12		4		12		5		15		5		15		5		0
6 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		9		3		12		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12	y	4	3	12	Y	4	4	16		4		0
	2080		5		0		4		0		4		12		4		12		5		15		5		20		5		0
7 Emergency Services (How will ES be impacted to service the Transit assets and users of Transit service?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
	2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events

		Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
		River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
	2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
	2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
		Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
Transit																													
1 Community Bus	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
	2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0
2 Bus Stops	Baseline		3		0		3		0		3		0		3		9		3		0		3		0		3		0
	2050		4		0		4		0		4		0	Y	4	3	12		4		0		4		0		4		0
	2080		5		0		5		0		5		0		5		15		5		0		5		0		5		0
5 Operations & Maintenace	Baseline		3		0		3		0		3		6		3		9		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	2	8	Y	4	3	12		4		0		4		0		4		0
	2080		5		0		5		0		5		10		5		15		5		0		5		0		5		0
6 Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		0
	2050		4		0		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0
	2080		5		0		5		0		5		15		5		15		5		0		5		0		5		0
7 Emergency Services (How will ES be impacted to service the Transit assets and users of Transit service?)	Baseline		3		0		3		9		3		6		3		9		3		12		3		9		3		0
	2050		4		0	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
	2080		5		0		5		15		5		10		5		15		5		20		5		15		5		0

Risk Assessment Worksheet

Consequence Score

0 - No Effect
1 - Insignificant
2 - Minor
3 - Moderate
4 - Major
5 - Catastrophic

Climate Parameter

Waste Management

Temperature

#	Asset	Period	Summer Mean Daily Temp (˚C)				Winter Mean Daily Temp (°C)				Days above +30°C				Warmest Maximum Temperature (°C)				Days below -30°C				Coldest Minimum Temperature (˚C)				# Freeze/ Thaw Events			
			Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
	Climate Projections (RCP 8.5)	Baseline	15.7	3			-11.8	3			4	3			31.2	3			9.8	3			-36.9	3			92.2	3		
		2050	17.7	4			-9.4	2			12	4			33.6	4			4.8	2			-33.4	3			84.9	2		
		2080	19.9	5			-7	2			27	5			36.2	5			1.9	1			-29.2	3			77.9	2		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Curbside Collection (O&M considerations) (contracted)	Baseline		3		0		3		0		3		9		3		9		3		9		3		12		3		12
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	4	12	Y	2	4	8
		2080		5		0		2		0		5		15		5		15		1		3		3		12		2		8
3	Landfill (O&M considerations) (contracted)	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
4	Recycling Facility (contracted)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		6
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6	Y	2	2	4
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		4
4	Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		0		3		0		2		6
6	Future Transfer Station - Indoor	Baseline		3		0		3		0		3		9		3		9		3		6		3		6		3		6
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6	Y	2	2	4
		2080		5		0		2		0		5		15		5		15		1		2		3		6		2		4
6	Future Transfer Station - Outdoor	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
7	Operations and Maintenance	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
8	Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		0		3		0		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12		2		0		3		0	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		0		3		0		2		6
9	Emergency Services (How will ES be impacted to service WM facility?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

#	Asset	Period	Annual Total Precipitation (mm)				Maximum 5-day Consecutive Precipitation (mm)				Maximum One-Day Precipitation (mm)				Winter Precipitation				Severe Summer Hail Days (% Change Relative to Present)				Years >/= 1 Freezing Rain Warnings				Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)			
			Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
	Climate Projections (RCP 8.5)	Baseline	446	3			32	3			32	3			61	3			-	3			-	3			-	3		
		2050	473	4			34	4			34	4			67	4			+	4			+	4			+	4		
		2080	496	5			35	4			35	4			72	4			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Curbside Collection (O&M considerations) (contracted)	Baseline		3		0		3		9		3		9		3		9		3		0		3		9		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		4		12		4		12		4		12		5		0		5		15		5		0
3	Landfill (O&M considerations) (contracted)	Baseline		3		12		3		12		3		12		3		9		3		0		3		9		3		9
		2050	Y	4	4	16	Y	4	4	16	Y	4	4	16	Y	4	3	12		4		0	Y	4	3	12	Y	4	3	12
		2080		5		20		4		16		4		16		4		12		5		0		5		15		5		15
4	Recycling Facility (contracted)	Baseline		3		0		3		9		3		9		3		9		3		0		3		6		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0	Y	4	2	8		4		0
		2080		5		0		4		12		4		12		4		12		5		0		5		10		5		0
4	Public / Customers	Baseline		3		0		3		12		3		0		3		9		3		0		3		9		3		0
		2050		4		0	Y	4	4	16		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		4		16		4		0		4		12		5		0		5		15		5		0
6	Future Transfer Station - Indoor	Baseline		3		0		3		9		3		0		3		0		3		0		3		6		3		0
		2050		4		0	Y	4	3	12		4		0		4		0		4		0	Y	4	2	8		4		0
		2080		5		0		4		12		4		0		4		0		5		0		5		10		5		0
6	Future Transfer Station - Outdoor	Baseline		3		0		3		9		3		9		3		9		3		0		3		9		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		4		12		4		12		4		12		5		0		5		15		5		0
7	Operations and Maintenance	Baseline		3		0		3		9		3		0		3		9		3		0		3		9		3		0
		2050		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		4		12		4		0		4		12		5		0		5		15		5		0
8	Public / Customers	Baseline		3		0		3		12		3		0		3		9		3		0		3		9		3		0
		2050		4		0	Y	4	4	16		4		0	Y	4	3	12		4		0	Y	4	3	12		4		0
		2080		5		0		4		16		4		0		4		12		5		0		5		15		5		0
9	Emergency Services (How will ES be impacted to service WM facility?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events

#	Asset	Period	Flooding				Climate Moisture Deficit				Climate Moisture Deficit				Mean # days/year with Daily Peak Wind >70 km/h				Tornado				Lightning				Biodiversity			
			River Flooding				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
	Climate Projections (RCP 8.5)	Baseline	-	3			-	3			-	3			-	3			-	3			-	3			-	3		
		2050	+	4			+	4			+	4			+	4			+	4			+	4			+	4		
		2080	++	5			++	5			++	5			++	5			++	5			++	5			++	5		
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Curbside Collection (O&M considerations) (contracted)	Baseline		3		0		3		0		3		0		3		12		3		0		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	4	16		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		20		5		0		5		0		5		0
3	Landfill (O&M considerations) (contracted)	Baseline		3		12		3		12		3		0		3		12		3		12		3		0		3		9
		2050	Y	4	4	16	Y	4	4	16		4		0	Y	4	4	16	Y	4	4	16		4		0	Y	4	3	12
		2080		5		20		5		20		5		0		5		20		5		20		5		0		5		15
4	Recycling Facility (contracted)	Baseline		3		0		3		0		3		0		3		9		3		12		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0		4		0
		2080		5		0		5		0		5		0		5		15		5		20		5		0		5		0
4	Public / Customers	Baseline		3		0		3		0		3		0		3		9		3		0		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	3	12		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		15		5		0		5		0		5		0
6	Future Transfer Station - Indoor	Baseline		3		0		3		0		3		0		3		0		3		12		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	4	16		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		20		5		0		5		0
6	Future Transfer Station - Outdoor	Baseline		3		0		3		0		3		0		3		12		3		9		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	4	16	Y	4	3	12		4		0		4		0
		2080		5		0		5		0		5		0		5		20		5		15		5		0		5		0
7	Operations and Maintenance	Baseline		3		0		3		0		3		0		3		12		3		12		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16		4		0		4		0
		2080		5		0		5		0		5		0		5		20		5		20		5		0		5		0
8	Public / Customers	Baseline		3		0		3		0		3		0		3		9		3		0		3		0		3		0
		2050		4		0		4		0		4		0	Y	4	3	12		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		15		5		0		5		0		5		0
9	Emergency Services (How will ES be impacted to service WM facility?)	Baseline		3		0		3		9		3		6		3		9		3		12		3		9		3		0
		2050		4		0	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		0		5		15		5		10		5		15		5		20		5		15		5		0

City of Camrose

Risk Assessment Worksheet

Consequence Score

- 0 - No Effect
- 1 - Insignificant
- 2 - Minor
- 3 - Moderate
- 4 - Major
- 5 - Catastrophic

Climate Parameter

Climate Projections (RCP 8.5)

Group	Climate Parameter	Risk	Baseline	L	2050	L	2080	L
Temperature	Summer Mean Daily Temp (˚C)	Summer Mean	15.7	3	17.7	4	19.9	5
Temperature	Winter Mean Daily Temp (∘C)	Winter Mean	-11.8	3	-9.4	2	-7	2
Temperature	Days above +30°C	Very Hot Days	4	3	12	4	27	5
Temperature	Warmest Maximum Temperature (∘C)	Hottest Day	31.2	3	33.6	4	36.2	5
Temperature	Days below -30°C	Very Cold Days	9.8	3	4.8	2	1.9	1
Temperature	Coldest Minimum Temperature (˚C)	Coldest Days	-36.9	3	-33.4	3	-29.2	3
Temperature	# Freeze/ Thaw Events	Freeze/ Thaw Events	92.2	3	84.9	2	77.9	2
Precipitation	Annual Total Precipitation (mm)	Annual Precipitation	446	3	473	4	496	5
Precipitation	Maximum 5-day Consecutive Precipitation (mm)	Persistent Precipitation	32	3	34	4	35	4
Precipitation	Maximum One-Day Precipitation (mm)	Extreme Rainfall	32	3	34	4	35	4
Precipitation	Winter Precipitation	Snow Accumulation	61	3	67	4	72	4
Precipitation	Severe Summer Hail Days (% Change Relative to Present)	Hail	-	3	+	4	++	5
Precipitation	Years >/= 1 Freezing Rain Warnings	Freezing Rain / Unseasonal Snow	-	3	+	4	++	5
Precipitation	Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)	Drought	-	3	+	4	++	5
Extreme Events	Flooding	River Flooding	-	3	+	4	++	5
Extreme Events		Creek Flow	-	3	+	4	++	5
Extreme Events	Climate Moisture Deficit	Wildfire Risk	-	3	+	4	++	5
Extreme Events	Climate Moisture Deficit	Wildfire Smoke	-	3	+	4	++	5
Extreme Events	Mean # days/year with Daily Peak Wind >70 km/h	Heavy Winds	-	3	+	4	++	5
Extreme Events	Tornado	Tornado	-	3	+	4	++	5
Extreme Events	Lightning	Lightning	-	3	+	4	++	5
	Biodiversity	Insect, invasive plants and disease	-	3	+	4	++	5

Wastewater Treatment

Temperature

#	Asset	Year	Summer Mean Y/N	L	C	R	Winter Mean Y/N	L	C	R	Very Hot Days Y/N	L	C	R	Hottest Day Y/N	L	C	R	Very Cold Days Y/N	L	C	R	Coldest Days Y/N	L	C	R	Freeze/ Thaw Events Y/N	L	C	R
1	Collection Mains	Baseline		3		0		3		0		3		0		3		0		3		9		3		9		3		6
		2050		4		0		2		0		4		0		4		0	Y	2	3	6	Y	3	3	9	Y	2	2	4
		2080		5		0		2		0		5		0		5		0		1		3		3		9		2		4
2	Forcemains	Baseline		3		0		3		0		3		0		3		0		3		6		3		6		3		0
		2050		4		0		2		0		4		0		4		0	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		0		5		0		1		2		3		6		2		0
3	Lift station: 58 St / 50 Ave (1956, rebuilt 2006)	Baseline		3		0		3		0		3		9		3		9		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		15		5		15		1		2		3		6		2		0
4	Lift station: Cornerstone (2000)	Baseline		3		0		3		0		3		9		3		9		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		15		5		15		1		2		3		6		2		0
5	Lift station: South Lift Station (1991)	Baseline		3		0		3		0		3		9		3		9		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		15		5		15		1		2		3		6		2		0
6	Aeration Treatment / MBBR (Treatment)	Baseline		3		6		3		6		3		9		3		9		3		9		3		9		3		0
		2050	Y	4	2	8	Y	2	2	4	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9		2		0
		2080		5		10		2		4		5		15		5		15		1		3		3		9		2		0
7	Storage Cells	Baseline		3		9		3		6		3		12		3		6		3		6		3		0		3		6
		2050	Y	4	3	12	Y	2	2	4	Y	4	4	16	Y	4	2	8	Y	2	2	4		3		0	Y	2	2	4
		2080		5		15		2		4		5		20		5		10		1		2		3		0		2		4
8	Communication / SCADA (WWTP)	Baseline		3		0		3		0		3		9		3		9		3		6		3		9		3		0
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	2	4	Y	3	3	9		2		0
		2080		5		0		2		0		5		15		5		15		1		2		3		9		2		0
9	Building / HVAC / Drainage	Baseline		3		6		3		6		3		12		3		12		3		9		3		9		3		6
		2050	Y	4	2	8	Y	2	2	4	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	3	9	Y	2	2	4
		2080		5		10		2		4		5		20		5		20		1		3		3		9		2		4
10	Lagoon Discharge (to Creek)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
11	Sewer Services	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
12	Operations and Maintenance	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		0
13	Public / Customers	Baseline		3		0		3		0		3		6		3		6		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		10		5		10		1		3		3		9		2		0
14	Emergency Services (How will ES be impacted to service the WW Facility?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

#	Asset	Year	Annual Precipitation Y/N	L	C	R	Persistent Precipitation Y/N	L	C	R	Extreme Rainfall Y/N	L	C	R	Snow Accumulation Y/N	L	C	R	Hail Y/N	L	C	R	Freezing Rain / Unseasonal Snow Y/N	L	C	R	Drought Y/N	L	C	R
1	Collection Mains	Baseline		3		0		3		9		3		12		3		6		3		0		3		0		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8		4		0		4		0		4		0
		2080		5		0		4		12		4		16		4		8		5		0		5		0		5		0
2	Forcemains	Baseline		3		0		3		12		3		12		3		0		3		0		3		0		3		0
		2050		4		0	Y	4	4	16	Y	4	4	16		4		0		4		0		4		0		4		0
		2080		5		0		4		16		4		16		4		0		5		0		5		0		5		0
3	Lift station: 58 St / 50 Ave (1956, rebuilt 2006)	Baseline		3		6		3		9		3		9		3		0		3		0		3		9		3		0
		2050	Y	4	2	8	Y	4	3	12	Y	4	3	12		4		0		4		0	Y	4	3	12		4		0
		2080		5		10		4		12		4		12		4		0		5		0		5		15		5		0
4	Lift station: Cornerstone (2000)	Baseline		3		6		3		9		3		9		3		0		3		0		3		9		3		0
		2050	Y	4	2	8	Y	4	3	12	Y	4	3	12		4		0		4		0	Y	4	3	12		4		0
		2080		5		10		4		12		4		12		4		0		5		0		5		15		5		0
5	Lift station: South Lift Station (1991)	Baseline		3		6		3		12		3		12		3		0		3		0		3		12		3		0
		2050	Y	4	2	8	Y	4	4	16	Y	4	4	16		4		0		4		0	Y	4	4	16		4		0
		2080		5		10		4		16		4		16		4		0		5		0		5		20		5		0
6	Aeration Treatment / MBBR (Treatment)	Baseline		3		0		3		9		3		9		3		0		3		0		3		0		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12		4		0		4		0		4		0		4		0
		2080		5		0		4		12		4		12		4		0		5		0		5		0		5		0
7	Storage Cells	Baseline		3		9		3		6		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	3	12	Y	4	2	8		4		0		4		0		4		0		4		0		4		0
		2080		5		15		4		8		4		0		4		0		5		0		5		0		5		0
8	Communication / SCADA (WWTP)	Baseline		3		0		3		0		3		0		3		0		3		9		3		12		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0
		2080		5		0		4		0		4		0		4		0		5		15		5		20		5		0
9	Building / HVAC / Drainage	Baseline		3		0		3		9		3		9		3		6		3		6		3		12		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	4	16		4		0
		2080		5		0		4		12		4		12		4		8		5		10		5		20		5		0
10	Lagoon Discharge (to Creek)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
11	Sewer Services	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
12	Operations and Maintenance	Baseline		3		0		3		9		3		12		3		6		3		6		3		12		3		0
		2050		4		0	Y	4	3	12	Y	4	4	16	Y	4	2	8	Y	4	2	8	Y	4	4	16		4		0
		2080		5		0		4		12		4		16		4		8		5		10		5		20		5		0
13	Public / Customers	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
14	Emergency Services (How will ES be impacted to service the WW Facility?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events

#	Asset	Year	River Flooding Y/N	L	C	R	Creek Flow Y/N	L	C	R	Wildfire Risk Y/N	L	C	R	Wildfire Smoke Y/N	L	C	R	Heavy Winds Y/N	L	C	R	Tornado Y/N	L	C	R	Lightning Y/N	L	C	R	Insect, invasive plants and disease Y/N	L	C	R
1	Collection Mains	Baseline		3		12		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		0		5		0		5		0		5		0		5		0		5		0		5		0
2	Forcemains	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
3	Lift station: 58 St / 50 Ave (1956, rebuilt 2006)	Baseline		3		0		3		0		3		9		3		0		3		0		3		9		3		12		3		0
		2050		4		0		4		0	Y	4	3	12		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0
		2080		5		0		5		0		5		15		5		0		5		0		5		15		5		20		5		0
4	Lift station: Cornerstone (2000)	Baseline		3		0		3		0		3		0		3		0		3		0		3		9		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	Y	4	3	12	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		15		5		20		5		0
5	Lift station: South Lift Station (1991)	Baseline		3		6		3		0		3		12		3		0		3		0		3		12		3		12		3		0
		2050	Y	4	2	8		4		0	Y	4	4	16		4		0		4		0	Y	4	4	16	Y	4	4	16		4		0
		2080		5		10		5		0		5		20		5		0		5		0		5		20		5		20		5		0
6	Aeration Treatment / MBBR (Treatment)	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
7	Storage Cells	Baseline		3		0		3		0		3		0		3		0		3		9		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	3	12		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		15		5		0		5		0		5		0
8	Communication / SCADA (WWTP)	Baseline		3		0		3		0		3		6		3		0		3		12		3		12		3		12		3		0
		2050		4		0		4		0	Y	4	2	8		4		0	Y	4	4	16	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		10		5		0		5		20		5		20		5		20		5		0
9	Building / HVAC / Drainage	Baseline		3		0		3		0		3		6		3		9		3		9		3		12		3		12		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		10		5		15		5		15		5		20		5		20		5		0
10	Lagoon Discharge (to Creek)	Baseline		3		12		3		12		3		6		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16	Y	4	4	16	Y	4	2	8		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		20		5		10		5		0		5		0		5		0		5		0		5		0
11	Sewer Services	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
12	Operations and Maintenance	Baseline		3		9		3		0		3		9		3		6		3		9		3		12		3		9		3		0
		2050	Y	4	3	12		4		0	Y	4	3	12	Y	4	2	8	y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		15		5		0		5		15		5		10		5		15		5		20		5		15		5		0
13	Public / Customers	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
14	Emergency Services (How will ES be impacted to service the WW Facility?)	Baseline		3		12		3		12		3		9		3		3		3		9		3		12		3		9		3		0
		2050	Y	4	4	16	Y	4	4	16	Y	4	3	12	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		20		5		20		5		15		5		5		5		15		5		20		5		15		5		0

Risk Assessment Worksheet (City of Camrose)

Consequence Score
- 0 - No Effect
- 1 - Insignificant
- 2 - Minor
- 3 - Moderate
- 4 - Major
- 5 - Catastrophic

Climate Parameter — Climate Projections (RCP 8.5)

Group	Climate Parameter	Hazard	Baseline	L	2050	L	2080	L
Temperature	Summer Mean Daily Temp (°C)	Summer Mean	15.7	3	17.7	4	19.9	5
Temperature	Winter Mean Daily Temp (°C)	Winter Mean	-11.8	3	-9.4	2	-7	2
Temperature	Days above +30°C	Very Hot Days	4	3	12	4	27	5
Temperature	Warmest Maximum Temperature (°C)	Hottest Day	31.2	3	33.6	4	36.2	5
Temperature	Days below -30°C	Very Cold Days	9.8	3	4.8	2	1.9	1
Temperature	Coldest Minimum Temperature (°C)	Coldest Days	-36.9	3	-33.4	3	-29.2	3
Temperature	# Freeze/ Thaw Events	Freeze/ Thaw Events	92.2	3	84.9	2	77.9	2
Precipitation	Annual Total Precipitation (mm)	Annual Precipitation	446	3	473	4	496	5
Precipitation	Maximum 5-day Consecutive Precipitation (mm)	Persistent Precipitation	32	3	34	4	35	4
Precipitation	Maximum One-Day Precipitation (mm)	Extreme Rainfall	32	3	34	4	35	4
Precipitation	Winter Precipitation	Snow Accumulation	61	3	67	4	72	4
Precipitation	Severe Summer Hail Days (% Change Relative to Present)	Hail	-	3	+	4	++	5
Precipitation	Years >/= 1 Freezing Rain Warnings	Freezing Rain / Unseasonal Snow	-	3	+	4	++	5
Precipitation	Relative Standardized Precipitation Evapotranspiration Index-based Drought Severity Scale for Agricultural Growing Season (May-August)	Drought	-	3	+	4	++	5
Extreme Events	Flooding	Flooding	-	3	+	4	++	5
Extreme Events	Lake Ice	Frazil Ice						
Extreme Events	Climate Moisture Deficit	Wildfire Risk	-	3	+	4	++	5
Extreme Events	Climate Moisture Deficit	Wildfire Smoke	-	3	+	4	++	5
Extreme Events	Mean # days/year with Daily Peak Wind >70 km/h	Heavy Winds	-	3	+	4	++	5
Extreme Events	Tornado	Tornado	-	3	+	4	++	5
Extreme Events	Lightning	Lightning	-	3	+	4	++	5
	Biodiversity	Insect, invasive plants and disease	-	3	+	4	++	5

Water Treatment

Temperature

#	Asset	Year	Summer Mean				Winter Mean				Very Hot Days				Hottest Day				Very Cold Days				Coldest Days				Freeze/ Thaw Events			
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Driedmeat Lake (water quality)	Baseline		3		9		3		0		3		9		3		0		3		6		3		0		3		6
		2050	Y	4	3	12		2		0	Y	4	3	12		4		0	Y	2	2	4		3		0	Y	2	2	4
		2080		5		15		2		0		5		15		5		0		1		2		3		0		2		4
1	Driedmeat Lake (water quantity)	Baseline		3		0		3		0		3		9		3		0		3		0		3		0		3		0
		2050		4		0		2		0	Y	4	3	12		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		15		5		0		1		0		3		0		2		0
2	Raw Water Intake	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		12
		2050		4		0		2		0		4		0		4		0		2		0		3		0	Y	2	4	8
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		8
3	Raw Water Pumping Station	Baseline		3		0		3		0		3		12		3		12		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		20		5		20		1		3		3		9		2		0
4	Water Treatment Plant (process)	Baseline		3		9		3		6		3		12		3		12		3		3		3		0		3		0
		2050	Y	4	3	12	Y	2	2	4	Y	4	4	16	Y	4	4	16	Y	2	1	2		3		0		2		0
		2080		5		15		2		4		5		20		5		20		1		1		3		0		2		0
6	Communication / SCADA	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		2		0		4		0		4		0		2		0		3		0		2		0
		2080		5		0		2		0		5		0		5		0		1		0		3		0		2		0
7	Building / HVAC / Drainage	Baseline		3		6		3		6		3		12		3		12		3		9		3		9		3		6
		2050	Y	4	2	8	Y	2	2	4	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	3	9	Y	2	2	4
		2080		5		10		2		4		5		20		5		20		1		3		3		9		2		4
8	High Lift Pump Station #2 and Reservoir	Baseline		3		0		3		0		3		12		3		12		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		20		5		20		1		3		3		9		2		0
9	High Lift Pump Station #3 and Reservoir	Baseline		3		0		3		0		3		12		3		12		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		20		5		20		1		3		3		9		2		0
10	Distribution Water Mains	Baseline		3		0		3		0		3		0		3		0		3		9		3		9		3		9
		2050		4		0		2		0		4		0		4		0	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		0		5		0		1		3		3		9		2		6
11	Duggan Park Booster Station	Baseline		3		0		3		0		3		12		3		12		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	4	16	Y	4	4	16	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		20		5		20		1		3		3		9		2		0
12	Water Services	Baseline		3		0		3		0		3		0		3		0		3		12		3		9		3		0
		2050		4		0		2		0		4		0		4		0	Y	2	4	8	Y	3	3	9		2		0
		2080		5		0		2		0		5		0		5		0		1		4		3		9		2		0
13	Operations & Maintenance	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		9
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9	Y	2	3	6
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		6
14	Public / Customers	Baseline		3		0		3		0		3		9		3		9		3		9		3		9		3		0
		2050		4		0		2		0	Y	4	3	12	Y	4	3	12	Y	2	3	6	Y	3	3	9		2		0
		2080		5		0		2		0		5		15		5		15		1		3		3		9		2		0
15	Emergency Services (How will ES be impacted to service Water Facility?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		2		0	Y	4	2	8	Y	4	2	8	Y	2	2	4	Y	3	2	6		2		0
		2080		5		0		2		0		5		10		5		10		1		2		3		6		2		0

Precipitation

#	Asset	Year	Annual Precipitation				Persistent Precipitation				Extreme Rainfall				Snow Accumulation				Hail				Freezing Rain / Unseasonal Snow				Drought			
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Driedmeat Lake (water quality)	Baseline		3		9		3		12		3		9		3		9		3		0		3		0		3		12
		2050	Y	4	3	12	Y	4	4	16	Y	4	3	12	Y	4	3	12		4		0		4		0	Y	4	4	16
		2080		5		15		4		16		4		12		4		12		5		0		5		0		5		20
1	Driedmeat Lake (water quantity)	Baseline		3		12		3		12		3		9		3		9		3		0		3		0		3		12
		2050	Y	4	4	16	Y	2	4	8	Y	4	3	12	Y	4	3	12		4		0		4		0	Y	4	4	16
		2080		5		20		2		8		4		12		4		12		5		0		5		0		5		20
2	Raw Water Intake	Baseline		3		9		3		9		3		6		3		0		3		0		3		0		3		12
		2050	Y	4	3	12	Y	4	3	12	Y	4	2	8		4		0		4		0		4		0	Y	4	4	16
		2080		5		15		4		12		4		8		4		0		5		0		5		0		5		20
3	Raw Water Pumping Station	Baseline		3		0		3		0		3		9		3		6		3		0		3		12		3		0
		2050		4		0		4		0	Y	4	3	12	Y	4	2	8		4		0	Y	4	4	16		4		0
		2080		5		0		4		0		4		12		4		8		5		0		5		20		5		0
4	Water Treatment Plant (process)	Baseline		3		9		3		12		3		12		3		0		3		0		3		0		3		12
		2050	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0		4		0		4		0	Y	4	4	16
		2080		5		15		4		16		4		16		4		0		5		0		5		0		5		20
6	Communication / SCADA	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
7	Building / HVAC / Drainage	Baseline		3		0		3		9		3		9		3		6		3		6		3		12		3		0
		2050		4		0	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	4	16		4		0
		2080		5		0		4		12		4		12		4		8		5		10		5		20		5		0
8	High Lift Pump Station #2 and Reservoir	Baseline		3		9		3		0		3		0		3		0		3		9		3		0		3		0
		2050	Y	4	3	12		4		0		4		0		4		0	Y	4	3	12		4		0		4		0
		2080		5		15		4		0		4		0		4		0		5		15		5		0		5		0
9	High Lift Pump Station #3 and Reservoir	Baseline		3		9		3		0		3		0		3		0		3		9		3		0		3		0
		2050	Y	4	3	12		4		0		4		0		4		0	Y	4	3	12		4		0		4		0
		2080		5		15		4		0		4		0		4		0		5		15		5		0		5		0
10	Distribution Water Mains	Baseline		3		0		3		0		3		0		3		6		3		0		3		6		3		0
		2050		4		0		4		0		4		0	Y	4	2	8		4		0	Y	4	2	8		4		0
		2080		5		0		4		0		4		0		4		8		5		0		5		10		5		0
11	Duggan Park Booster Station	Baseline		3		9		3		6		3		0		3		0		3		9		3		0		3		9
		2050	Y	4	3	12	Y	4	2	8		4		0		4		0	Y	4	3	12		4		0	Y	4	3	12
		2080		5		15		4		8		4		0		4		0		5		15		5		0		5		15
12	Water Services	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		0
13	Operations & Maintenance	Baseline		3		9		3		9		3		9		3		6		3		6		3		9		3		12
		2050	Y	4	3	12	Y	4	3	12	Y	4	3	12	Y	4	2	8	Y	4	2	8	Y	4	3	12	Y	4	4	16
		2080		5		15		4		12		4		12		4		8		5		10		5		15		5		20
14	Public / Customers	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		12
		2050		4		0		4		0		4		0		4		0		4		0		4		0	Y	4	4	16
		2080		5		0		4		0		4		0		4		0		5		0		5		0		5		20
15	Emergency Services (How will ES be impacted to service Water Facility?)	Baseline		3		0		3		0		3		6		3		6		3		6		3		6		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	2	8	Y	4	2	8	Y	4	2	8		4		0
		2080		5		0		4		0		4		8		4		8		5		10		5		10		5		0

Extreme Events / Biodiversity

#	Asset	Year	Flooding				Frazil Ice				Wildfire Risk				Wildfire Smoke				Heavy Winds				Tornado				Lightning				Insect, invasive plants and disease			
			Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R	Y/N	L	C	R
1	Driedmeat Lake (water quality)	Baseline		3		12		3		0		3		6		3		0		3		6		3		0		3		0		3		9
		2050	Y	4	4	16		4		0	Y	4	2	8		4		0	Y	4	2	8		4		0		4		0	Y	4	3	12
		2080		5		20		5		0		5		10		5		0		5		10		5		0		5		0		5		15
1	Driedmeat Lake (water quantity)	Baseline		3		12		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	4	16		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		20		5		0		5		0		5		0		5		0		5		0		5		0		5		0
2	Raw Water Intake	Baseline		3		9		3		12		3		0		3		0		3		0		3		0		3		0		3		6
		2050	Y	4	3	12	Y	4	4	16		4		0		4		0		4		0		4		0		4		0	Y	4	2	8
		2080		5		15		5		20		5		0		5		0		5		0		5		0		5		0		5		10
3	Raw Water Pumping Station	Baseline		3		9		3		12		3		12		3		0		3		0		3		12		3		12		3		0
		2050	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0		4		0	Y	4	4	16	Y	4	4	16		4		0
		2080		5		15		5		20		5		20		5		0		5		0		5		20		5		20		5		0
4	Water Treatment Plant (process)	Baseline		3		12		3		0		3		9		3		0		3		6		3		0		3		0		3		6
		2050	Y	4	4	16		4		0	Y	4	3	12		4		0	Y	4	2	8		4		0		4		0	Y	4	2	8
		2080		5		20		5		0		5		15		5		0		5		10		5		0		5		0		5		10
6	Communication / SCADA	Baseline		3		0		3		0		3		0		3		0		3		12		3		0		3		12		3		0
		2050		4		0		4		0		4		0		4		0	Y	4	4	16		4		0	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		20		5		0		5		20		5		0
7	Building / HVAC / Drainage	Baseline		3		0		3		0		3		6		3		9		3		9		3		12		3		12		3		0
		2050		4		0		4		0	Y	4	2	8	Y	4	3	12	Y	4	3	12	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		10		5		15		5		15		5		20		5		20		5		0
8	High Lift Pump Station #2 and Reservoir	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		20		5		20		5		0
9	High Lift Pump Station #3 and Reservoir	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		20		5		20		5		0
10	Distribution Water Mains	Baseline		3		9		3		0		3		9		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	3	12		4		0	Y	4	3	12		4		0		4		0		4		0		4		0		4		0
		2080		5		15		5		0		5		15		5		0		5		0		5		0		5		0		5		0
11	Duggan Park Booster Station	Baseline		3		0		3		0		3		0		3		0		3		0		3		12		3		12		3		0
		2050		4		0		4		0		4		0		4		0		4		0	Y	4	4	16	Y	4	4	16		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		20		5		20		5		0
12	Water Services	Baseline		3		0		3		0		3		0		3		0		3		0		3		0		3		0		3		0
		2050		4		0		4		0		4		0		4		0		4		0		4		0		4		0		4		0
		2080		5		0		5		0		5		0		5		0		5		0		5		0		5		0		5		0
13	Operations & Maintenance	Baseline		3		9		3		12		3		9		3		6		3		9		3		12		3		9		3		0
		2050	Y	4	3	12	Y	4	4	16	Y	4	3	12	Y	4	2	8	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		15		5		20		5		15		5		10		5		15		5		20		5		15		5		0
14	Public / Customers	Baseline		3		9		3		0		3		12		3		0		3		0		3		0		3		0		3		0
		2050	Y	4	3	12		4		0	Y	4	4	16		4		0		4		0		4		0		4		0		4		0
		2080		5		15		5		0		5		20		5		0		5		0		5		0		5		0		5		0
15	Emergency Services (How will ES be impacted to service Water Facility?)	Baseline		3		12		3		0		3		12		3		3		3		9		3		12		3		9		3		0
		2050	Y	4	4	16		4		0	Y	4	4	16	Y	4	1	4	Y	4	3	12	Y	4	4	16	Y	4	3	12		4		0
		2080		5		20		5		0		5		20		5		5		5		15		5		20		5		15		5		0

APPENDIX B - ADAPTATION ACTION SUMMARY TABLES

Table B-1: Preliminary Climate Adaptation Action – Water Treatment

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/ Unseasonal Snow	Frazil Ice	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Understand and conduct research/ assessments on the impact of climate hazards on the treatment facility and water treatment processes/components. Implement best practices and Inform changes to SOP's, and standards for future updates.	0-5 years	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Complete stress testing of the treatment process. Review ISL plan for adaptation-do any of the stressor change the timeframe for upgrades. Review the age/life cycle of the system.	0-5 years			✓								✓	✓					
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
3	Review, update or upgrade design standards, operations, SOP'S, policies, and plans based on researched information and/or AEP procedures.	0-5 years	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Implement water conservation program to reduce the demand.	0-5 years			✓								✓	✓					
5	Update or upgrade SOP, design standards, based on the research/studies.	5-10 years	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓
	Operations and Maintenance																		
6	Review budget for increase O&M cost due to more frequent maintenance and replacements. Recognize and Increase replacement value for budget planning.	0-5 years			✓	✓		✓	✓	✓		✓	✓	✓	✓		✓		✓
7	Monitor, research and assess system and its performance.	0-5 years	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table B-1: Preliminary Climate Adaptation Action – Water Treatment

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/ Unseasonal Snow	Frazil Ice	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
	Update and upgrade treatment systems, O&M frequency and procedures accordingly to maintain level of service.																		
	Build New or Upgrade Existing Infrastructure																		
8	Review and assess need for new construction of treatment facility components (e.g. Raw water pond, booster station etc.)	0-5 years			✓			✓				✓	✓				✓		✓
	Increase Awareness and Education																		
9	Educate public on climate impact, best practices and associated costs implications.	0-5 years	✓		✓	✓	✓	✓			✓		✓	✓	✓	✓		✓	
10	Conduct training to staff on the changes made in SOPs.	0–5 years			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
	Emergency Management																		
11	Review conservation programs, procedures, (Including EMP and ERP) and assessments. Update or upgrade with consideration for climate hazards including identifying redundancies and backup systems. Develop new procedures if required. Solicit feedback from Emergency services and implement accordingly.	0-5 years	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
	Human Resourcing																		
12	Consider additional resourcing with further understanding in areas requiring expertise.	0-5 years			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓

Table B-2: Preliminary Climate Adaptation Action – Wastewater Treatment

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/ Unseasonal Snow	Creek Flow	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Understand and conduct research/ assessments on the impact of climate hazards on the treatment facility and processes/components. Implement best practices. Inform changes to SOP's, and standards for future updates.	0-5 years	✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓		✓
2	Review design standard, Master Plan, and integrate climate impact consideration.	0-5 years				✓	✓							✓					
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
3	Review, update or upgrade design standards, assumptions, SOP'S, policies, and plans based on researched information.	0-5 years	✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓		✓
	Operations and Maintenance																		
4	Review budget for increase O&M cost due to more frequent maintenance and replacements. Recognize and Increase replacement value for budget planning.	0-5 years			✓	✓	✓	✓	✓					✓	✓		✓		✓
5	Monitor, research and assess system condition, capacities and its performance. Update and upgrade treatment systems, O&M frequency and procedures accordingly to maintain level of service.	5-10 years			✓	✓	✓		✓	✓		✓		✓	✓	✓	✓		✓
	Increase Awareness and Education																		
6	Educate public on climate impact, best practices and associated costs implications.	0-5 years			✓														

Table B-2: Preliminary Climate Adaptation Action – Wastewater Treatment

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/ Unseasonal Snow	Creek Flow	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
7	Conduct training to staff on the changes made in SOPs.	0-5 years			✓	✓	✓		✓			✓		✓	✓	✓	✓		✓
	Emergency Management																		
8	Review EMP and ERP's. Update or upgrade with consideration for climate hazards. Solicit feedback from Emergency services and implement accordingly.	0-5 years	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓
	Human Resourcing																		
9	Consider additional resourcing with further understanding in areas requiring expertise.	5-10 years			✓														

Table B-3: Preliminary Climate Adaptation Action – Stormwater System

No.	Recommended Actions	Time Frame	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																	
1	Conduct research or study related to performance of the asset against changing climate and identify best management practices to mitigate and meet the required level of service	0-5 years		✓	✓	✓			✓									
2	Assess impacts with climate hazards considerations and/or conduct failure mode assessment and criticality assessment to test the system against climate hazards.	0-5 years		✓	✓	✓	✓					✓						
3	Review Master Plans and identify the problematic areas where systems (culverts, ditches) may be undersized for future climate considerations	0-5 years			✓	✓												
	Update Policies, Plans, Standards, Guidelines and Bylaws																	
4	Upgrade design standards, plans, policies for new development and upgrade where study has identified risk areas.	5-10 years	✓	✓	✓	✓	✓											
5	Review SOPs, Plans (eg. Dam Safety O&M) with the consideration of climate hazards.	0-5 years		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		
6	Snow Dump - Review SOPS snow piling height and volume accumulation and snow melt water management at the site.	0-5 years						✓		✓								
	Operations and Maintenance																	
7	Review budget for increase O&M cost due to more frequent maintenance and replacements. Increase replacement value for budget planning.	0-5 years			✓	✓	✓	✓	✓	✓		✓					✓	
8	Site monitor and review performance against climate hazards.	0–5 years		✓	✓	✓	✓		✓			✓						
	Increase Awareness and Education																	

Table B-3: Preliminary Climate Adaptation Action – Stormwater System

No.	Recommended Actions	Time Frame	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
9	Identify additional training based on review of the SOP with the consideration of climate hazards.	0-5 years		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓		✓
10	Communicate with public on safety and hazards around stormwater systems during climate hazards.	0–5 years			✓	✓		✓		✓			✓					
12	Stony Creek - Educate the public of danger/safety around creek areas during and after extreme climate events.	0-5 years			✓	✓	✓						✓					
	Emergency Management																	
13	Update Emergency Response Plan with updated flood maps and inform public of plans. Review with EMS and solicit feedback.	5–10 years	✓	✓	✓	✓					✓		✓					✓
	Build New or Upgrade Existing Infrastructure																	
14	Mirror Lake Dam - Review the design of dam structure and how it fairs against high temperatures. The dam is leaking therefore need to review future upgrades or replacements.	0-5 years		✓	✓								✓					

Table B-4: Preliminary Climate Adaptation Action – Roads

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Conduct research or investigate current best practice and/or design standards that adapts to the climate hazards. E.g. Investigate types of aggregates for base work and surfacing material. Review impact of climate risks on bridges.	0-5 years	✓		✓	✓	✓	✓	✓		✓		✓	✓					
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
2	Review standards and performance with the consideration of climate hazards and risks - identify if changes are required.	0-5 years	✓		✓	✓	✓	✓	✓		✓		✓						
3	Ramps - Many ramps are not maintained by City. City to review by-laws to and revise them with the consideration of climate hazards. City does not enforce how the ramps would be maintained for access, as long as it meets the intent.	0-5 years							✓										
	Operations and Maintenance																		
4	Review budget for increase O&M cost due to more frequent maintenance and replacements to maintain level of service. Increase replacement value for budget planning.	0-5 years		✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓
5	Inspect and assess infrastructure with consideration for climate risks. Collect and review performance of new standards and update maintenance requirement/ procedures (SOP's) based on the review. Increase O&M frequency to maintain level of service.	0–5 years	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓		✓
	Build New or Upgrade Existing Infrastructure																		

Table B-4: Preliminary Climate Adaptation Action – Roads

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
6	Apply new standards.	5-10 years	✓		✓	✓	✓	✓	✓										
							Increase Awareness and Education												
7	Conduct staff training on new policies, plans, SOP's. Communicate new standards and operational procedures if there are any changes. Communicate with public of any changes.	0-5 years	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		✓
8	Communicate with public on closures, safety and hazards during extreme climate events.	0–5 years			✓	✓			✓		✓			✓	✓	✓	✓		✓
9	Update communication plan – Public safety.	0–5 years			✓	✓	✓		✓		✓			✓	✓	✓			
							Emergency Management												
10	Review and update or upgrade ERP with consideration of climate hazards. Solicit Emergency services feedback and modify accordingly.	0-5 years			✓				✓			✓		✓	✓	✓	✓		✓

Table B-5: Preliminary Climate Adaptation Action – Fleet

No.	Recommended Actions	Time Frame	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																	
1	Conduct assessments (Failure Mode Assessment, criticality assessment, and EMP) and identify need for modifications/ replacements or equipment purchase.	0-5 years						✓			✓				✓	✓		✓
	Update Policies, Plans, Standards, Guidelines and Bylaws																	
2	Review SOPs, with consideration for climate hazards. Conduct job safety analysis.	0-5 years	✓	✓				✓			✓				✓			
	Operations and Maintenance																	
3	Change of operations to ensure that equipment is not overheating. Review and assess that the auxiliary coolers and sized appropriately. Update SOP as needed.	0-5 years		✓							✓							
4	Keep fleet well maintained. Increased usage and resulting repair and replacement frequency should be included in budget planning.	5-10 years	✓	✓				✓			✓		✓	✓	✓	✓		✓
5	Provide protection and redundancy.								✓		✓				✓	✓		✓
	Increase Awareness and Education																	
6	Operational awareness of how equipment behaves under extreme weather events. Aware of adaptive management requirements.	0-5 years	✓	✓							✓							
7	Conduct training on new policies, plans, SOPs.	0–5 years	✓	✓				✓			✓				✓			
8	Update communication plan - public safety. Prioritize communication resource.	0–5 years		✓	✓					✓			✓					
	Emergency Management																	
9	Provide protection and redundancy - what to do when the system is not in service.	0–5 years							✓		✓				✓	✓		✓

Table B-6: Preliminary Climate Adaptation Action – Transit

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	City to review and investigation further into on-demand service as an example for alternate level of service.	0-5 years			✓				✓			✓							
2	Assess customer needs (eg. shade, shelters) to maintain a level of service.	0-5 years	✓		✓	✓			✓		✓				✓	✓			
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
3	Review access and safety policies for public users. This may include accommodating people with physical disabilities, elderly, etc. while using the service. Review the policies with the consideration of extreme climate events.	0-5 years	✓		✓	✓			✓		✓				✓	✓			
	Operations and Maintenance																		
4	Review and update SOPs for working in extreme weather conditions - conduct a job safety analysis.	0-5 years	✓		✓	✓			✓		✓	✓			✓	✓			
5	Inspect, assess, and monitor the performance of facility components. Increase maintenance, repair and replacement frequencies and change operation accordingly.	5-10 years			✓				✓			✓				✓			
	Increase Awareness and Education																		
6	Educate public of any changes or modification to the services.	0-5 years	✓		✓	✓			✓		✓				✓	✓			
7	Conduct training on new policies, plans, SOPs. Increase awareness of equipment operation during extreme weather events and adaptation management requirements.	5-10 years	✓		✓	✓			✓		✓	✓			✓	✓			
	Emergency Management																		
8	Review and update ERP with Emergency Services to see how	5-10 years			✓				✓			✓			✓	✓	✓		✓

Table B-6: Preliminary Climate Adaptation Action – Transit

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	transit can be used as part of the Plan during these climate hazards conditions.																		
								Specific Actions											
S1	**Emergency Evacuations** - Transit will be used as an additional resource in the event of evacuation.	0-5 years			✓				✓			✓			✓	✓	✓		✓

Table B-7: Preliminary Climate Adaptation Action – Airport

No.	Recommended Actions	Time Frame	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																	
1	Conduct research or study related to performance of the asset against changing climate and identify best management practices to mitigate and meet the required level of service.	0-5 years		✓	✓	✓	✓				✓					✓		
2	Inspect, assess and monitor impacts with climate hazards considerations and/or conduct failure mode assessment and criticality assessment to test the system against climate hazards.	0-5 years		✓	✓	✓	✓	✓		✓	✓			✓	✓	✓		✓
	Update Policies, Plans, Standards, Guidelines and Bylaws																	
3	Assess policies, plans, and standards in the event of extreme climate to determine if any policies, plans, or standards need to be updated or upgraded and amend the documents accordingly.	0-5 years		✓	✓	✓	✓	✓		✓	✓			✓		✓		✓
4	Review SOPs, Plans (e.g. Fueling, O&M, etc.) with consideration for climate hazards.	0-5 years	✓	✓											✓	✓		✓
	Operations and Maintenance																	
5	Review budget for increase O&M cost due to more frequent maintenance and replacements to maintain level of service. Increase replacement value for budget planning.	0-5 years		✓	✓	✓	✓	✓		✓	✓			✓		✓		✓
6	Inspect, assess, and monitor the performance of assets (taxiways, runways, drainage infrastructure) and services (electrical service, fueling service, groundside roads) against climate hazards to maintain level of service. Increase maintenance and replacement frequencies accordingly.	5-10 years	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓		✓
	Increase Awareness and Education																	

Table B-7: Preliminary Climate Adaptation Action – Airport

No.	Recommended Actions	Time Frame	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
7	Identify and conduct additional training based on review of the SOP with the consideration of climate hazards. Communicate changes to the SOP accordingly for information and review and allow for modification/ changes based on potential review comments.	0-5 years		✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
8	Communicate with public on safety and hazards around and within the airport during climate hazards.	0–5 years		✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓
	Emergency Management																	
9	Update or upgrade ERP with consideration of climate hazards.	0–5 years	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
	Specific Actions																	
S1	**Building Envelop and HVAC** - Assess building envelop and HVAC system for potential upgrades.	5-10 years		✓														
S2	**Runway pavement** - The pavement has been replaced/reconstructed recently and can take more types of aircraft. Communicate with the Canadian Flight Supplement on the new pavement and determine types of aircrafts that can land on the runway.	5-10 years		✓														
S3	**Fixed Wing Ambulance** - Maintain level of service to allow the aircraft to use this facility.	5-10 years		✓	✓	✓	✓				✓			✓		✓		✓

Table B-8: Preliminary Climate Adaptation Action – Waste Management

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/ Unseasonal Snow	Freeze/ Thaw	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
1	Provide contractor the expected level of service - include climate risk in the discussion.	0–5 years			✓	✓	✓		✓		✓					✓			✓
	Operations and Maintenance																		
2	Review budget for increase O&M cost due to more frequent maintenance and replacements. Recognize and Increase replacement value for budget planning.	0-5 years														✓			
3	Inspect and monitor extreme weather event and assess impact on collection equipment, fleet, and landfill and recycling facility. Increase O&M frequency, repair and replacement accordingly to maintain access and level of service. Utilize resources such as AEP flood study to inform inspections.	5-10 years			✓	✓	✓	✓	✓	✓	✓			✓	✓	✓			✓
4	Review the operations at the landfill to prevent activity overlap/interaction between operations and public for safety purpose. Educate public on safety at the landfill and when the landfill is closed during extreme weather events.	0-5 years			✓		✓		✓		✓					✓			
	Build New or Upgrade Existing Infrastructure																		
5	City to consider climate impacts when designing the new transfer station. Landfill is planned to be closed in late 2023.	0-5 years			✓	✓	✓	✓	✓		✓			✓	✓			✓	✓
	Increase Awareness and Education																		

Table B-8: Preliminary Climate Adaptation Action – Waste Management

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/ Unseasonal Snow	Freeze/ Thaw	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
6	Educate the public about maintain communication about proper public care and use of the cart to help reduce the replacement cost.	0-5 years														✓			
							Emergency Management												
7	Review plans, programs and procedures with consideration for climate hazards and extreme climate events. Update or upgrade accordingly. Include planning for disasters. Solicit feedback from Emergency services and implement accordingly.	0–10 years			✓	✓	✓		✓		✓				✓	✓			✓

Table B-9: Preliminary Climate Adaptation Action – Environment and Parks

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/Unseasonal Snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Conduct research on the different plants, trees, vegetation species and surface that are more tolerant to the climate impacts. Review and implement best practices to reduce replacements and prolong the life of vegetation and decrease irrigation requirement.	0-5 years	✓		✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	
2	Review the effects and benefits of Low Impact Development and encourage cross-cutting (discipline) discussion to identify opportunities.	0-5 years	✓		✓	✓		✓	✓			✓	✓		✓	✓	✓	✓	
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
3	Assess policies, plans, and standards including SOP in the event of extreme climate hazards and update based on research including increased naturalization.	0-5 years	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
4	Review design standards to incorporate stormwater management with tree maintenance and survival.	0–5 years	✓		✓	✓		✓	✓			✓	✓		✓	✓	✓	✓	
	Operations and Maintenance																		
5	Review budget for increase O&M cost due to more frequent maintenance and replacements. Recognize and Increase replacement value for budget planning.	0-5 years	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	
6	Monitor O&M frequency effectiveness and economy and increase/ decrease accordingly. Perform O&M during economical times frame.	0–5 years	✓		✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	

Table B-9: Preliminary Climate Adaptation Action – Environment and Parks

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/Unseasonal Snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
7	Review and monitor assets and surface features and their locations, and species and replace as needed. Use engineering tools to review climate hazard locations, Reinstall features outside of these locations.	5-10 years	✓		✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	
	Build New or Upgrade Existing Infrastructure																		
8	Naturalize existing areas to limit maintenance requirements; seek grants that fund these activities. Consider green infrastructure during future upgrade or expansion activities (e.g. bioswales) that provide sustainable stormwater management.	5-10 years	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
9	Identify areas where restoration activities are possible to increase the footprint of treed natural space.	5-10 years	✓		✓	✓	✓	✓	✓			✓	✓	✓			✓	✓	
10	Identify surfaces subject to flooding and identify opportunities to replace surfaces with native woody vegetation or relocate surfaces to areas with sufficient clearance for floods. Update masterplans accordingly.	5-10 years			✓	✓	✓		✓				✓	✓	✓			✓	
	Increase Awareness and Education																		
11	Educate public on climate impact and hazards on green spaces and surface features. Engage public on adaptation actions, associated cost and solicit feedback.	0-5 years	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	
12	Communicate with public on safety precautions during climate events.	0–5 years			✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
	Emergency Management																		

Table B-9: Preliminary Climate Adaptation Action – Environment and Parks

No.	Recommended Actions	Time Frame	Summer Mean	Coldest days	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/Unseasonal Snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Insects, Invasive Plants and Disease	Tornado
13	Review SWP and ERP. Update or upgrade with consideration for climate hazards and solicit feedback from Emergency services.	0-5 years			✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
							Specific Actions												
S1	**Human Resourcing:** Increase resources with increasing events occurring - identify in budget planning.	0-5 years			✓		✓									✓			
S2	**Generated Waste** - Waste generation increased with more use which impacts increased O&M effort and cost. Identify as a potential increase in O&M costs.	5-10 years																✓	

Table B-10.3: Preliminary Climate Adaptation Action – Facilities: Police Station

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Review design and operations standards for future new buildings. Assess threshold performance on system.	0-5 years			✓	✓			✓		✓	✓			✓	✓			
2	Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	0-5 years			✓								✓						
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
3	Review for natural landscape in the future. Change to more heat tolerant species.	5-10 years			✓								✓						
4	Review policies, SOP, SWP and update or upgrade where applicable (eg. hours of operations as an example), and around extreme weather.	0-5 years	✓		✓	✓			✓		✓	✓	✓		✓	✓	✓		✓
	Operations and Maintenance																		
5	Recognize that there will be an increase repairs and replacement, which will increase operations and maintenance costs.	0-5 years	✓		✓	✓			✓		✓	✓	✓		✓	✓	✓		✓
6	Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room, building envelop) and electrical services against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	5-10 years			✓	✓	✓	✓	✓		✓	✓				✓	✓		
7	Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0–5 years			✓				✓			✓				✓	✓		✓

Table B-10.3: Preliminary Climate Adaptation Action – Facilities: Police Station

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Build New or Upgrade Existing Infrastructure																		
8	**Mechanical HVAC building -** 'This is an old building and will required replacement. This replacement is in the capital plan in the next 10 years. Consider build new in a different location. Replace as needed until building is relocated to a new building. New building to consider climate hazards.	5-10 years		✓	✓							✓			✓	✓			
	Increase Awareness and Education																		
9	Communicate and educate public on Extreme weather events.	0-5 years			✓														✓
10	Be aware of policies and SOP change.	0–5 years	✓		✓	✓			✓			✓	✓		✓	✓	✓		✓
	Emergency Management																		
11	Review ERP and SOP with consideration of climate hazards. Update accordingly.	0–5 years	✓	✓	✓	✓			✓			✓	✓		✓	✓	✓		✓
	Specific Actions																		

Table B-10.1.: Preliminary Climate Adaptation Action – Facilities: City Hall

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
							Conduct Research												
1	Conduct research, assessments or study related to performance of the facility components (Building envelop, HVAC, IT server room etc.) against climate hazards to develop inspection checklist or Identify performance thresholds.	0-5 years			✓	✓													
2	Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	0-5 years			✓														
							Update Policies, Plans, Standards, Guidelines and Bylaws												
3	Review for natural landscape in the future. Change to more heat tolerant species.	0-5 years			✓								✓						
4	Consider identifying targets for level of service. E.g. using green building rating system as a guide for design standards. Review operating standard with the consideration for climate hazards for existing and future buildings.	0-5 years	✓	✓	✓	✓			✓			✓				✓			✓
5	Review policies, SOP, SWP and update or upgrade where applicable (e.g. hours of operations as an example), and around extreme weather.	0-5 years	✓		✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
							Operations and Maintenance												
6	Recognize that there will be an increase repairs and replacement to maintain level of service and deal with complaints, which will increase operations and maintenance costs.	0-5 years	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
7	Inspect, assess, and monitor the performance of facility components	0–5 years			✓	✓	✓	✓	✓		✓	✓	✓			✓			✓

Table B-10.1.: Preliminary Climate Adaptation Action – Facilities: City Hall

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	(Site, Parking, Landscaped Areas, Stormwater, IT Server room cooling system) and services (electrical service, fueling service, groundside roads) against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.																		
8	Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0-5 years			✓				✓			✓				✓	✓		
	Build New or Upgrade Existing Infrastructure																		
9	Upgrade systems based on research and inspection.	5-10 years	✓	✓	✓	✓			✓			✓				✓			✓
	Increase Awareness and Education																		
10	Identify and conduct additional training for staff based on research outcomes.	0-5 years	✓		✓	✓	✓		✓		✓	✓	✓		✓	✓	✓		✓
11	Communicate with public on climate risk and maintain service when City hall host ECP activities.	0-5 years			✓				✓			✓				✓	✓		✓
	Emergency Management																		
12	Review ERP and SWP with consideration of climate hazards. Update accordingly.	0-5 years	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
13	Emergency Operating Center - Future consideration for City Hall to be EOC. Work with EMS and solicit for feedback.	5-10 years			✓														

Table B-10.2: Preliminary Climate Adaptation Action – Facilities: Recreational Facility

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Conduct research, assessments or study related to performance of the facility components (Building envelop, HVAC, IT server room etc.) against climate hazards to develop inspection checklist or Identify performance thresholds.	0-5 years		✓	✓	✓	✓		✓		✓	✓	✓		✓	✓			✓
2	Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	0-5 years			✓														
3	Upgrade systems based on research and inspection. Monitor and assess for future upgrades where necessary.	5-10 years		✓	✓	✓	✓		✓		✓	✓	✓			✓			
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
4	Review for natural landscape in the future. Change to more heat tolerant species.	5-10 years			✓								✓						
5	Consider identifying targets for level of service. Eg. using green building rating system as a guide for design standards. Review operating standards with consideration for climate hazards for existing and future buildings.	0-5 years		✓	✓	✓	✓		✓		✓		✓		✓	✓			✓
6	Review policies, SOP, SWP and update or upgrade where applicable (e.g. hours of operations as an example), and around extreme weather.	0-5 years	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓
	Operations and Maintenance																		
7	Recognize that there will be an increase repairs and replacement, which will increase operations and maintenance costs.	0-5 years	✓	✓	✓				✓			✓	✓			✓	✓		✓

Table B-10.2: Preliminary Climate Adaptation Action – Facilities: Recreational Facility

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
8	Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room) and electrical services against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	0–5 years	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓
9	Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0–5 years			✓				✓			✓				✓	✓		
	Increase Awareness and Education																		
10	Communicate and educate public on Extreme weather events, climate impacts and associated costs.	0-5 years		✓	✓	✓	✓		✓				✓		✓	✓			
11	Be aware of policies and SOP change.	0-5 years	✓		✓	✓	✓				✓	✓	✓		✓	✓	✓	✓	✓
	Emergency Management																		
12	Review ERP and SOP with consideration of climate hazards. Update accordingly.	0–5 years		✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓
	Specific Actions																		
S1	**Emergency Operating Center** - Communicate with EMS if the facility will be used for emergency purpose. Maintain access and ensure systems are in proper function emergency services (e.g. fire hydrants, communication, sprinkler system, etc.)	5-10 years			✓				✓			✓				✓	✓		✓

Table B-10.4: Preliminary Climate Adaptation Action – Facilities: Fire Hall

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Continue to monitor and inspect the system for its performance and ensure the system is maintaining the desired level of service. Review design and operations standards for future new buildings.	0-5 years			✓	✓			✓		✓	✓				✓	✓		
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
2	Review for natural landscape in the future. Change to more heat tolerant species.	5-10 years			✓								✓						
3	Review design standards, operation standards, policies, SOP, SWP and update or upgrade where applicable (e.g. hours of operations as an example), and around extreme weather.	0-5 years			✓	✓			✓		✓	✓	✓		✓	✓	✓		
	Operations and Maintenance																		
4	Recognize that there will be an increase repairs and replacement, which will increase operations and maintenance costs.	0-5 years			✓				✓		✓	✓	✓		✓	✓	✓		✓
5	Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room, building envelop) and electrical services against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	0–5 years			✓	✓			✓		✓	✓				✓	✓		
6	Maintain level of service with special consideration for facility's electrical components and emergency services against climate hazards.	0–5 years			✓				✓			✓				✓	✓		

Table B-10.4: Preliminary Climate Adaptation Action – Facilities: Fire Hall

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
7	Monitor existing building envelope to evaluate for upgrades.	5-10 years			✓	✓			✓		✓	✓				✓	✓		
	Increase Awareness and Education																		
8	Be aware of policies and SOP change.	5-10 years			✓				✓		✓	✓	✓		✓	✓	✓		✓
	Emergency Management																		
9	Review ERP with consideration for climate hazards. Update accordingly.	0–5 years			✓	✓			✓		✓	✓	✓		✓	✓	✓		✓
	Specific Actions																		
S1	**Mechanical HVAC building –** Review technologies for filtration and change to better system based on research.	5-10 years													✓				
S2	**EOC and Generator –** Building currently houses the EOC and back-up generator	5-10 years			✓														

Table B-10.5: Preliminary Climate Adaptation Action – Facilities: Library/Mirror Lake Centre

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Evaluate user safety during weather relief operations.	0-5 years			✓		✓		✓		✓	✓				✓	✓		
2	Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	5-10 years			✓	✓	✓		✓			✓	✓		✓	✓			
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
3	Review SOP to include extreme weather events. Identify any operations that may be done differently.	0-5 years	✓		✓	✓			✓			✓	✓		✓	✓	✓		✓
	Operations and Maintenance																		
4	Recognize that there will be an increase repairs and replacement, which will increase operations and maintenance costs.	0-5 years		✓	✓				✓		✓				✓	✓	✓		
5	Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, plumbing, IT Server room, building envelop) and electrical services against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	5-10 years		✓	✓			✓	✓		✓	✓	✓		✓	✓	✓		
6	Review need for upgrades for public safety.	0-5 years			✓	✓	✓		✓			✓	✓		✓	✓			
	Increase Awareness and Education																		
7	Be aware of policies and SOP change.	0–5 years	✓		✓	✓			✓			✓	✓		✓	✓	✓		✓
8	Provide public awareness and education on extreme weather events and associated cost increase to maintain level of service	0-5 years			✓	✓	✓		✓			✓	✓		✓	✓			

Table B-10.5: Preliminary Climate Adaptation Action – Facilities: Library/Mirror Lake Centre

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
Emergency Management																			
9	Review ERP with consideration for climate hazards. Update accordingly.	0–5 years		✓	✓				✓		✓	✓			✓	✓	✓		✓

Table B-10.6: Preliminary Climate Adaptation Action – Facilities: Misc. Buildings.

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
	Conduct Research																		
1	Conduct research, assessments or study related to performance of the facility components (Building envelop, HVAC, IT server room etc.) against climate hazards to develop inspection checklist or Identify performance thresholds.	0-5 years		✓	✓	✓	✓		✓		✓	✓			✓	✓			
2	Research on climate tolerant species for the landscaped areas that is suitable for the region and will not result in diseases.	0-5 years			✓														
3	Assess for future upgrades.	5-10 years			✓	✓	✓				✓	✓							
	Update Policies, Plans, Standards, Guidelines and Bylaws																		
4	Review for natural landscape in the future. Change to more heat tolerant species.	0-5 years			✓								✓						
5	Consider identifying targets for level of service. E.g. using green building rating system as a guide for design standards. Review operating standard with consideration for climate hazards for existing and future buildings.	0-5 years		✓	✓	✓	✓		✓		✓	✓			✓	✓			
6	Review policies, SOP, SWP and update or upgrade where applicable (e.g. hours of operations as an example), and around extreme weather.	0-5 years			✓	✓	✓		✓			✓	✓	✓		✓	✓		✓
	Operations and Maintenance																		
7	Recognize that there will be an increase repairs and replacement to maintain level of service and deal with complaints, which will increase operations and maintenance costs.	5-10 years		✓	✓	✓	✓		✓		✓	✓			✓		✓		

Table B-10.6: Preliminary Climate Adaptation Action – Facilities: Misc. Buildings.

No.	Recommended Actions	Time Frame	Coldest days	Summer Mean	Very hot and hottest days (above +30C)	Extreme Rainfall (max 1 day)	Persistent Rainfall (5 consecutive days)	Annual Precipitation	Freezing Rain/unseasonal snow	Freeze/ thaw events	Heavy Snow Accum-ulation	Severe Hail	Drought	River Flooding	Wildfire Risk/ Smoke	Heavy Winds	Lightning	Invasive Plants and Disease	Tornado
8	Inspect, assess, and monitor the performance of facility components (Site, Parking, Landscaped Areas, Stormwater, IT Server room cooling system) and services (electrical service, fueling service, groundside roads) against climate hazards to maintain level of service. Increase maintenance, repair and replacement frequencies accordingly.	5-10 years		✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
	Increase Awareness and Education																		
10	Provide awareness of policies and SOP change.	0-5 years			✓	✓			✓			✓	✓		✓	✓	✓		✓
11	Provide awareness and education on extreme weather events and associated cost to maintain the level of service.	0–5 years		✓	✓	✓	✓		✓		✓	✓	✓		✓	✓			
	Emergency Management																		
12	Review ERP with consideration for climate hazards. Update accordingly.	5-10 years		✓	✓	✓	✓		✓		✓	✓			✓	✓	✓		✓