



Weather and Climate Readiness Plan

October 2014



Re | sili | ent, adj.

1. Able to bounce back after change or adversity.
2. Capable of preparing for, responding to, and recovering from difficult conditions.

OCTOBER 2014

This report was prepared by Jeff Zukiwsky and Richard Boyd (All One Sky Foundation) on behalf of the City of Leduc. If you have any questions or comments regarding the information included in this report, please contact:

Kerra Chomlak
Environmental Sustainability Coordinator, City of Leduc
(780) 980-8442
KChomlak@leduc.ca

ALL ONE SKY FOUNDATION

PO Box 19012
809 49th Avenue SW
Calgary, Alberta
T2S 1A0

403.471.6247



EXECUTIVE SUMMARY



Weather patterns and climate affect nearly every aspect of life in the City of Leduc. Temperature, precipitation, and extreme weather events affecting the region have changed over the past 50-100 years. With further changes projected in the future we can expect to see significant impacts on our community—be it through greater incidences of grass fires, tornados, storms, overland flooding, water scarcity or uncomfortably high

temperatures. The City of Leduc recognizes the importance of being better prepared for weather and climate impacts now, and in the future.

Building on the City's existing risk management process, the Weather and Climate Readiness Plan (WCRP) identifies a number of priority risks to Leduc's corporate services, resulting from weather and climate hazards. The severity of a risk is judged by the extent to which it affects our vision for public health and safety, and economy, the environment, and the provision of infrastructure and services.

In total twenty-one weather-related risks to corporate services were identified, of which eight were judged to be priorities requiring immediate action. Priority risks arise from: ❶ overland flooding from extreme precipitation events, ❷ ice and snow storms; ❸ tornados; ❹ heat waves; ❺ lightning storms; ❻ water scarcity; ❼ hail storms; and ❽ wind storms. These risks are the focus of the WCRP. Low priority risks will be kept under review in case circumstances change and they become more significant in the future.

The City of Leduc is already committed to numerous actions that help manage the above priority risks, including:

- An updated and tested Municipal Emergency Plan and Emergency Preparedness Guide;
- Water demand management programs and a Water Conservation, Efficiency and Productivity Plan which seeks to ensure reliable and sustainable access to safe drinking water;

“

The severity of a risk is judged by the extent to which it affects our vision for public health and safety, and economy, the environment, and the provision of infrastructure and services.

”

- An Environment Plan which recommends actions to promote water conservation and effective stormwater management; and
- Strategic planning activities which support the climate resiliency and sustainability of natural systems, including the Municipal Development Plan and Parks, Open Spaces and Trails Master Plan.



It is important we follow through on these commitments if the goals of the WCRP are to be achieved.

In addition to existing actions that help mitigate priority weather and climate risks, twenty actions are identified in the WCRP.

A number of actions can be implemented quickly with minimal investment, such as enhancing public awareness of the Emergency Preparedness Guide, expanding stormwater maintenance, disseminating tornado preparedness information to City staff, and developing educational materials for residents to minimize stormwater run-off from private properties. A number of actions require a higher level of investment, such as retrofitting civic facilities and buildings with tornado-safe spaces and installing back-up power sources in critical community facilities. Other actions involve studies to increase our understanding of the risks faced by Leduc, such as conducting a heat wave vulnerability study and an engineering vulnerability assessment of the stormwater system. Implementation of these actions will ensure the City of Leduc remains a vibrant community under a wider range of current and future climate conditions.

The WCRP is a living document and will be periodically reviewed and updated to ensure it remains relevant and effective. We will report on implementation of the WCRP actions annually via the Environmental Progress Report.

contents

Section One INTRODUCTION	8
Section Two VISION	9
Our Goal	9
Guiding Principles	9
City Leadership	11
Section Three ACHIEVING THE VISION	12
Project Framework	12
Section Four WEATHER TRENDS AND CLIMATE PROJECTIONS	14
Historic Climate Trends and Events	14
Future Climate Profile for Leduc	17
Section Five WEATHER AND CLIMATE RISKS	18
Risk Assessment	18
Priority Risk Events for the City of Leduc	20
Section Six WEATHER AND CLIMATE READINESS ACTIONS	22
Formulating Actions	22
Support Implementation of Existing Actions	23
Weather and Climate Readiness Action Plan	24
Mainstreaming	30
Section Seven IMPLEMENTATION	31
Act	31
Monitor and Report	31
Review and Update	31



1

INTRODUCTION

The effects of climate change are already apparent in the City of Leduc, with observable changes in temperature, precipitation, and extreme weather events over the last half century. Moreover, many of the climatic changes forecast for the next 30-40 years are ‘locked in’—the result of past greenhouse gas (GHG) emissions. Regardless of the success, or otherwise, of global efforts to reduce GHG emissions, further climate change is inevitable. The impact of these changes for our community could be significant—be it through greater incidences of grass fires, tornados, storms and overland flooding, increased strain on water resources and quality, or uncomfortably high temperatures. These impacts cannot be ignored and preparing for climate change is essential to ensuring the City of Leduc continues to prosper as a desirable place to live and work.

“A resilient city is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures so as to still be able to maintain essentially the same functions, structures, systems, and identity.”

[Working Definition, ResilientCity.org]

The City of Leduc recognizes the importance of climate readiness planning in the Municipal Development Plan 2012 (MDP) and the Environment Plan 2012 (EP), committing to the development of a climate change readiness plan for the City. To fulfil this commitment the City of Leduc prepared the Weather and Climate Readiness Plan (WCRP). The WCRP represents the first step towards improving the resilience of our community to future climate changes. It addresses two broad questions:

1. How are we vulnerable to current weather and projected future climate conditions?
2. What actions are needed (and justified) to increase our resilience to key impacts arising from current and projected future climate conditions?



... preparing for climate change is essential to ensuring the City of Leduc continues to prosper as a desirable place to live and work.



2 | VISION



By identifying key potential impacts and corresponding actions, residents of Leduc can be confident that the City is adequately prepared to cope with the impacts of climate change being experienced right now, and in the future. The WCRP will be integrated with the City's overall risk management strategy.

Our Goal

By improving the capabilities of our citizens, infrastructure, economy, environment, and institutions to plan for, cope with, and respond to the impacts of climate change, the City of Leduc will remain a vibrant community where:

- A strong business community is fostered;
- Residents enjoy active healthy lifestyles with a strong sense of belonging;
- Our natural environment is healthy and clean; and
- Our local government is responsive and accountable.

Guiding Principles

Development of the WCRP is informed by the following guiding principles for good climate readiness planning:

- Collaborate with City staff—effective climate resilience requires coordination and cooperation between different departments to ensure that actions make use of local knowledge, avoid conflicts, have broad support, and have the best chance for success.
- Understand existing vulnerabilities to climate—the need to enhance resilience is greatest for corporate services that are adversely affected by weather now.
- Impacts should be prioritized—resources are best used by focusing attention on corporate services that are most severely affected by weather and climate, those which have long-term lifetimes or long-term implications, where high values are at stake, or where critical infrastructure is involved.
- Consider a wide range of actions—after prioritizing climate impacts, a wide spectrum of responses should be considered, including behavioural, technological, infrastructural, informational, organizational, and socio-economic actions.

- Actions need to be sustainable—Actions to build resilience to weather and climate must avoid any detrimental impacts on other parts of our society, the economy, or the natural environment.
- Actions need to be evidence-based—they should make use of the latest research, data, and practical experience, so that decisions are well-supported and informed.
- Actions should be robust under uncertain future climate conditions—precedence should be given to actions that are flexible, will pay-off immediately under current climate conditions, will manage multiple impacts and generate other benefits in addition to reducing climate risks.
- Actions need to be equitable—decisions should take account of which vulnerable groups in Leduc benefit from an action, as well as who bears the costs of that action.
- Actions should not be performed in isolation from existing policies, plans, and administrative processes—existing practices should be reviewed and incrementally adapted to better cope with current and future climate impacts.



“ By improving the capabilities of our citizens, infrastructure, economy, environment, and institutions to plan for, cope with, and respond to the impacts of climate change, the City of Leduc will remain a vibrant community ... ”



City Leadership

As champion of the need to enhance Leduc's climate resilience, it is important that the City show leadership and make climate readiness a mainstream component of municipal operations. Hence, the WCRP first focuses on 'corporate services' and the infrastructure necessary to support the provision of those services. This includes, for example, the provision and management of potable water, wastewater collection, waste collection and disposal, public transport, roads, parks and natural spaces, civic facilities, community development, and emergency services, as well as land-use planning and general administration and management. Increasing the resilience of corporate services will provide positive examples to residents and local businesses. It is expected that the scope of subsequent iterations of the WCRP would be extended to encompass impacts faced by the wider community in Leduc that are not currently addressed.



3



ACHIEVING THE VISION

The need to adapt to climatic conditions has been a feature of life since the beginning of time. It is an ongoing activity that affects the way we live, how we design our infrastructure, and how we provide goods and services. Preparing for future climate change is a challenge, however, because the scale and speed of the adjustments required are unprecedented and because the exact nature of the anticipated changes remains uncertain. The City of Leduc believes there are good reasons to tackle these challenges head on, and take steps now to prepare for a future climate that will be different from the past.

Project Framework

The overall approach to development of the WCRP is grounded in existing standards for risk management based on the International Organization for Standardization's (ISO) 31000, Risk management – Principles and Guidelines. This standard has been modified for climate readiness planning in Leduc. It follows a four-phase, iterative process (shown in Figure 1). The WCRP was developed working through the first three phases of the process:

PHASE 1: **DEFINE CONTEXT**

- Phase one involves establishing the context and rules for the risk assessment (Phase 2). This included: defining the jurisdictional, operational, spatial, and temporal scope of the assessment; assembling and analyzing climate trend data and future climate projections for the Leduc region; identifying the potential impacts of climate variables on the City of Leduc; and developing scales to analyze the relative severity of weather and climate impacts. The WCRP considers changing weather and climate risks to the 2050s. This timeframe looks ahead to the types of changes and challenges, which policy-makers and citizens might face within their lifetimes. It also reflects a planning horizon that, although long in political terms, lies within the productive life of key public infrastructure investments and strategic land-use planning and development decisions.

“In many ways, building resilience is doing what [we] have always done—strategic planning, risk assessment, investing in infrastructure [...] using the best information available about potential risks.”

[Weathering the Storm: Building Resilience to Climate Change, Center for Climate and Energy Solutions]

PHASE 2: **ASSESS RISKS**

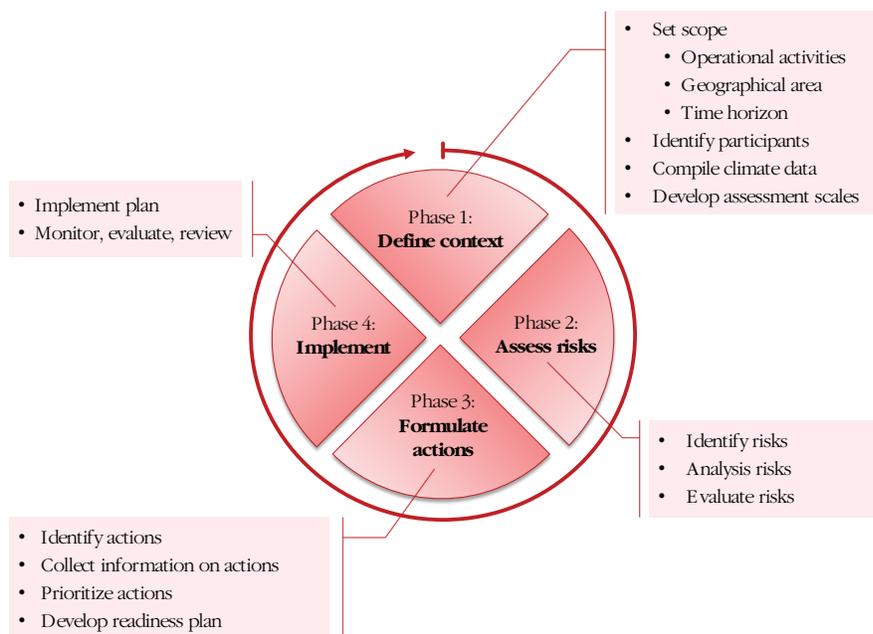
- Phase two consists of a one-day climate risk assessment workshop with City staff. In line with the ISO 31000 standard, the purpose of the workshop is to:
 1. Identify existing weather, and potential future, climate-related risks;
 2. Analyze the severity of each risk (i.e. prioritize each risk), based on its consequences and the likelihood of realizing those consequences; and
 3. Evaluate risks collectively to verify the results of the risk analysis and to determine the relative acceptability of each risk (i.e., separate priority risks from non-priority risks).

PHASE 3: **FORMULATE ACTIONS**

- The purpose of Phase 3 is to identify and screen actions to manage priority risks with a view to determining priorities for the WCRP. For each priority risk identified in Phase 2, this involves determining how Leduc and other jurisdictions in the Capital Region currently manage the risk, and how current actions can be improved and/or new actions developed to better manage each priority risk.

The output of Phases 3 is the WCRP. A Background Report providing more detail on Phase 1 to Phase 3 is available separately.

Figure 1: Four Phase Process for Managing Climate Impacts



4

WEATHER TRENDS AND CLIMATE PROJECTIONS

Historic Climate Trends and Events

The reality is that our climate is already changing and we are experiencing the effects in Leduc now. Even if significant reductions in global GHG emissions are made today, we will still need to cope with at several decades of further climate change. But what are the projected changes in climate for the Leduc region that the WCRP needs to consider?

Trends in our past climate provide a useful window into the future. An assessment of data from local weather stations shows that the climate in the Leduc region has changed significantly over the last century.¹ For example, mean annual temperature has been increasing at a rate of +2.0°C per century. To put this level of warming in context, the mean annual temperature at Leduc over the last 30 years is about +2.7°C. Historical warming has been most pronounced in winter and summer (+3.1 and +2.2°C per century, respectively). The increase in mean annual temperature in the Leduc region is approximately double the observed rate of warming globally over the same period—confirming predictions that climate change will be felt more acutely in Alberta. Future projections for the Leduc region are for a further increase in mean annual temperature of 2.0°C by the 2050s (see Table 1). Mean annual precipitation in the Leduc region has been increasing at a rate of +31 mm per century. Precipitation has increased in all seasons with the exception of summer, which shows a slight declining trend. Future projections are for a further increase in mean annual precipitation of 5 per cent by the 2050s (see Table 1).

¹ All weather trends are derived from Environment Canada’s adjusted and homogenized data set for weather stations in the Leduc forecast region.

“Weather reflects short-term conditions of the atmosphere—what you see outside on any particular day—while climate is the average daily weather at a certain location for an extended period of time—several decades, centuries, or millennia.”

[US National Oceanic and Atmospheric Administration]



... preparing for climate change is essential to ensuring the City of Leduc continues to prosper as a desirable place to live and work.





Stream flows are also sensitive to changes in temperature and precipitation, which affect both glacier mass and the seasonality and form (rain versus snow) of precipitation. Stream flows in the North Saskatchewan River at Edmonton—the primary source of drinking water for the City of Leduc—have been declining over the last century.² This decline has been attributed to a loss of glacier mass and resulting decreases in flows during the summer and fall seasons.³ Stream flows in the North Saskatchewan River look to continue to decline as glaciers in Alberta are projected to lose 80 to 90 per cent of their volume by the end of the century, with corresponding reductions in the contribution of those glaciers to stream flows.⁴

A number of extreme weather events have also affected the Leduc region in the recent past (see Table 2). We may experience more of these events in the decades to come, as there is growing consensus that the frequency and intensity of extreme weather events is likely to increase this century.

² Sauchyn, D. and St. Jacques, J., 2012, Science, Assessments and Data Availability Related to Anticipated Climate and Hydrologic Changes in Inland Freshwaters of the Prairies Region (Lake Winnipeg Drainage Basin), Prairie Adaptation Research Collaborative, University of Regina, Regina.

³ Demuth, M. and Pietroniro, A., 2003, The Impact of Climate Change on the Glaciers of the Canadian Rocky Mountain Eastern Slopes and Implications for Water Resource-Related Adaptation in the Canadian Prairies, Prairie Adaptation Research Collaborative, University of Regina, Regina.

⁴ Marshall, S. and White, E., 2010, Alberta Glacier Inventory and Ice Volume Estimation, Report for the Alberta Water Research Institute, 55 pp.

Table 1: Projected Climate for Leduc Region Relative to 1961-1990 Period

Climate element	Period	Baseline climate ^a (1961-1990)	Projected change relative to baseline by 2050s ^b	
			Mean	Range ^c
Average temperature	Annual	+1.4°C	+2.0°C	+1.7 to +2.5
Average temperature	Winter	-9.9°C	+2.4°C	+2.0 to +3.0
Average temperature	Summer	+13.1°C	+2.3°C	+1.8 to +2.7
Average max temperature	Jul	+19.0°C	+2.1°C	+1.8 to +2.4
Average min temperature	Jan	-15.0°C	+3.7°C	+2.6 to +4.3
Extreme max temperature	30-yr average	+34.7°C	7% warmer	+5% to +11%
Extreme min temperature	30-yr average	-45.5°C	9% warmer	+7% to +10%
Average precipitation	Annual	1.6 mm / day	+5%	+1% to +9%
Average precipitation	Winter	0.9 mm / day	+13%	+7% to +17%
Average precipitation	Spring	1.5 mm / day	+10%	+3% to +17%
Average precipitation	Summer	2.5 mm / day	-1%	-6% to +6%
Average precipitation	Autumn	1.2 mm / day	+7%	+1% to +11%
Average snowfall	Winter	81 mm	+3%	-6% to +11%
Average snowfall	Spring	63 mm	-14%	-9% to -21%
Average snowfall	Autumn	48 mm	-28%	-23% to -37%
Growing degree days (DDs)	Annual	1,408 DDs	+304 DDs	+252 to +396
Average frost free days	Dec-May	103 days	+17 days	+8 to +30

Source:

All baseline and projected values derived from the Pacific Climate Impacts Consortium (PCIC) Regional Analysis Tool (BETA)

Notes:

^a Modeled baseline figure against which projected changes for the 2050s are measured.

^b All projected changes reflect the difference between the average value over the period 2041-2070 (i.e., the 2050s) and the average value over the period 1961-1990 (i.e., the baseline climate).

^c The range in projected changes reflects the 25th (lower) and 75th (upper) percentiles of all model projections.





Table 2: Extreme Weather Events Affecting the Leduc Region

Extreme weather event	Historical frequency of event in region
Severe hail events	2.5 events per year
Freezing rain	7 days per year
Blizzards	4 hours per year
Extreme snowfall event	36 cm in one day
Thunderstorms	25 days with storms per year
Strong winds ^a	2 days per year
Tornados (F0-F5)	9 tornados per decade
Lightning strikes	0.8 strikes per km ² per year
Hot days (max temp > 30°C)	3 days per year

Source:

Environment Canada and Natural Resources Canada

Notes:

^a Defined as sustained winds speeds equal to or greater than 63 km per hour

Future Climate Profile for Leduc

Table 1 summarizes the main projected changes in climate for the Leduc Region by the 2050s. Although not explicitly shown in Table 1 we can expect more precipitation to fall as rain or freezing rain, as opposed to snow. The share of total precipitation falling as snow in winter, spring and autumn is projected to fall by 9 per cent, 22 per cent and 31 per cent, respectively, by the 2050s.

In addition to the changes shown in Table 1, we could see more intense precipitation events in the Leduc region. Total precipitation on ‘very wet days’⁵ has been increasing at a rate of about 6 mm per decade over the last 60 years. If this trend continues total precipitation falling on very wet days will be 28 per cent higher by the 2050s.

⁵ A very wet day is defined as the annual sum of the amount of precipitation falling on each day during a year that is above the 95th percentile of precipitation falling during the 1961-1990 baseline period.

5



WEATHER AND CLIMATE RISKS

Risk Assessment

Developing an efficient readiness plan requires awareness of pertinent weather and climate risks and, importantly, an understanding of the relative importance of those risks. Attempting to manage every single risk facing the City of Leduc is unlikely to be practical or financially responsible. Rather, priorities need to be established so that actions taken are commensurate with the anticipated risks, and respect the capacity and resources of the City. To ensure public money is spent wisely and efficiently, a screening assessment was conducted to identify and distinguish between material risks that require action now and those (lower priority) risks for which the need for action is not urgent.

The risk screening assessment was conducted at a full-day workshop involving 13 City staff from different departments. The workshop proceeded in three steps, in line with the International Organization for Standardization's (ISO) 31000, Risk management - Principles and Guidelines. The process followed was designed to complement and build upon the City's existing risk management framework. Full details of the process are provided in the accompanying Background Report.

“Risk is often expressed in terms of a combination of the consequences of an event [like extreme weather] and the associated likelihood of occurrence.”

[ISO 31000:2009(E)]



“

... preparing for climate change is essential to ensuring the City of Leduc continues to prosper as a desirable place to live and work.

”

STEP 1: IDENTIFY WEATHER AND CLIMATE-RELATED EVENTS THAT COULD IMPACT CITY SERVICES AND SUPPORTING INFRASTRUCTURE.

In total, 21 potential risk events were identified by workshop attendees, affecting the City's parks, recreational and cultural assets, water and sanitary services, emergency services, roads and transportation, storm drainage, waste management, and civic facilities and property.

STEP 2: ANALYZE RISK EVENTS TO DETERMINE THEIR RELATIVE SEVERITY.

For the purpose of this exercise, the severity of a risk event is defined by:

$$\begin{array}{l} \text{The level of} \\ \text{expected outcome} \\ \text{or risk rating} \end{array} = \begin{array}{l} \text{The level of (positive or} \\ \text{negative) consequence of} \\ \text{the event should it happen} \end{array} \times \begin{array}{l} \text{The likelihood of} \\ \text{suffering that level of} \\ \text{(positive or negative)} \\ \text{consequence} \end{array}$$

In order to establish the severity of a risk it is necessary to assign a 'score' to both the consequence and likelihood of each risk event. To achieve the long-term vision for the City of Leduc outlined in the MDP a number of objectives must be met concerning: health and safety, finance and the economy, culture and the environment, and infrastructure and municipal services. A scale was developed to score the consequences of each risk event in terms of the impact it would have on each of these areas, whether it be minor, slight, through to catastrophic. In this way, the severity of each risk event is assessed according to the extent to which it affects achievement of the MDP's vision for the City of Leduc. To maintain consistency with the City's existing risk management framework a 6-point consequence scale was constructed. Similarly, a 6-point scale was constructed to enable workshop attendees to assign likelihoods to the consequences of each risk event.

When analyzing the identified risk events workshop attendees were instructed to think about the potential consequences and likelihood of seeing those consequences in the 2050s.

STEP 3: EVALUATE RISK EVENTS TO DETERMINE THEIR RELATIVE ACCEPTABILITY.

In the preceding step each identified risk event was assigned an initial risk rating, determined by the combination of consequence and likelihood scores. Risk ratings range from 'very low' through to 'extreme'. According to the City's existing risk management framework, risk events rated as 'moderate' or higher are deemed unacceptable and require immediate action. Risk events rated as 'very low' or 'low' are judged to be acceptable at this point in time. No further action is required beyond ongoing monitoring and reconsideration of these risk events in subsequent iterations of the WCRP. The initial risk ratings and implied urgency for action were validated and modified through staff and expert review, resulting in a set of eight priority risk events.

Priority Risk Events for the City of Leduc

In alignment with the City of Leduc’s existing risk management process, risks rated as moderate or higher are deemed unacceptable and require remedial action (Figure 2). Risks ranking as ‘low’ or ‘very low’ are evaluated to have sufficient existing risk controls in place, and no further action is required beyond ongoing monitoring and reconsideration of these risks in subsequent climate risk assessment processes. Risks rated as moderate or higher are the focus of the weather and climate readiness action planning. Priority risk events—risks rated as ‘moderate’ or higher in the risk assessment process—are listed below. These risk events are the focus of Phase 3—weather and climate readiness action planning.

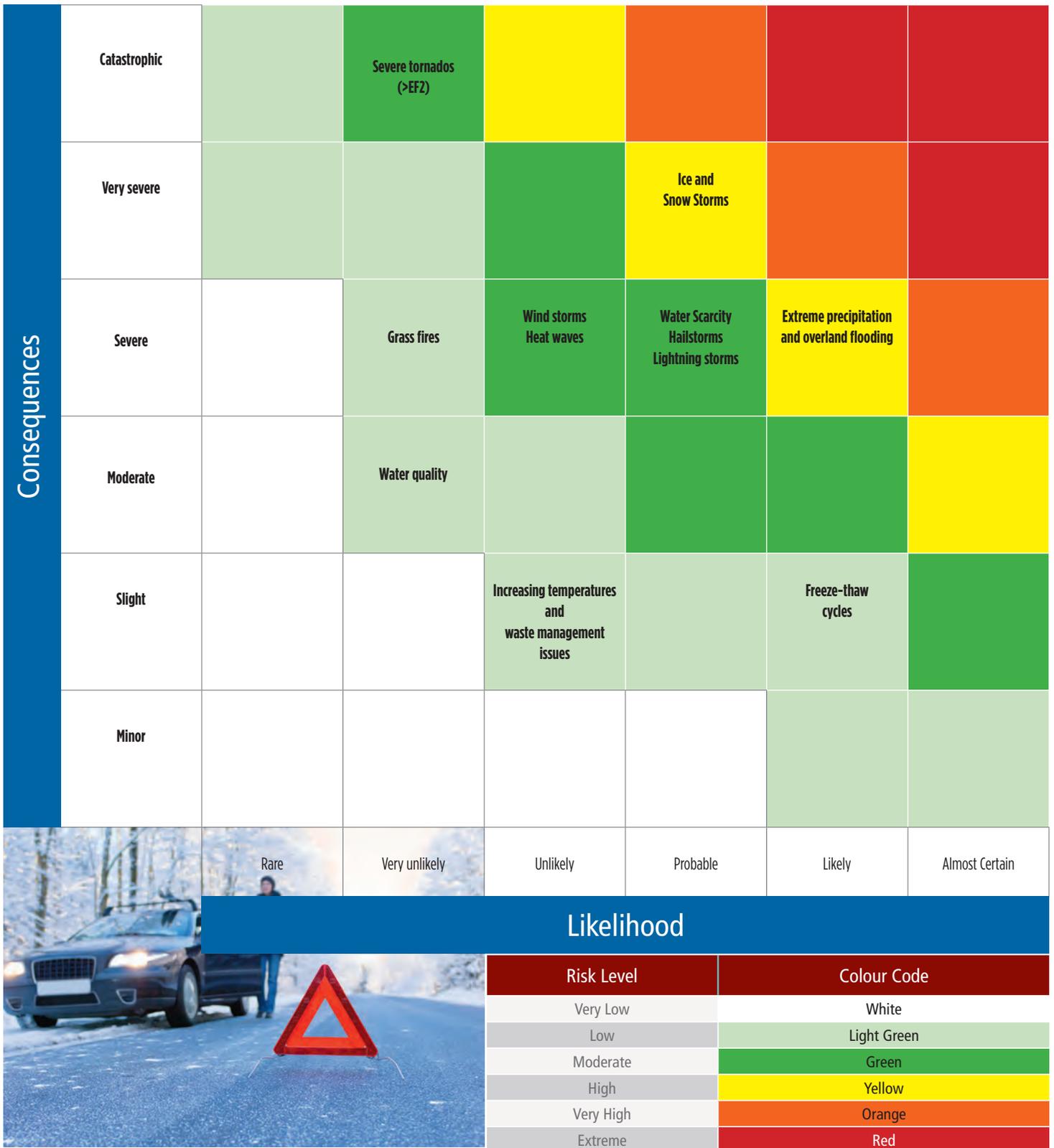
High Risk Events

1. Extreme precipitation causes overland flooding and damage to property and infrastructure, parks and recreational assets, and civic facilities, and disruption to public services and economic activity.
2. Ice and snow storms cause power outages, road accidents (injuries and fatalities) and disruptions to public transportation, and damage to infrastructure.

Moderate Risk Events

3. TORNADOS (>EF2) cause injuries and fatalities, damage to property and infrastructure, and disruption to public services and economic activity.
4. Heat waves cause adverse health effects on vulnerable populations.
5. Lightning storms cause power outages, injuries and fatalities, and damage to parks, trees and recreational assets.
6. Water scarcity and consequent inability to meet demand (residential, commerce, industry, parks and recreational assets, including trees) causes disruption to public services, economic activity and well-being, and damage to ‘green infrastructure’.
7. Hail storms cause damage to property and infrastructure, parks, trees and recreational assets, and civic facilities.
8. Wind storms cause damage to property and infrastructure, parks, trees and recreational assets, and civic facilities.

Figure 2: Risk Rating Matrix



6



WEATHER AND CLIMATE READINESS ACTIONS

Formulating Actions

In the preceding section, weather and climate risk events impacting the City of Leduc were identified, analyzed, evaluated and ranked in terms of whether they represented a material threat to municipal services and supporting infrastructure. This involved separating out relatively low priority risk events that could be set aside for now from relatively high priority risk events that require further, immediate attention. The next phase in developing the WCRP is to identify, describe, and screen potential actions to manage moderate or higher priority risk events, with a view to determining priorities for implementation. A financially responsible plan must respect the capacity of the City and ensure resources are allocated efficiently to priority actions that manage priority risk events.

The formulation of priority risk management actions was informed by two half-day workshops held with key City staff. At these sessions, four key questions were considered:

- What is the City of Leduc currently doing to address the risk event?
- What are other communities in the Capital Region doing to address the risk event?
- Should current actions be improved given projected climate change? If so, how?
- What additional action(s) is needed?

“Adaptation [action] is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”

[Intergovernmental Panel on Climate Change]



A financially responsible plan must respect the capacity of the City and ensure resources are allocated efficiently to priority actions that manage priority risk events.



A long list of potential actions was compiled and subsequently analyzed, considering:

- The anticipated effectiveness of the action in managing the risk event or multiple risk events;
- The broad cost of the action;
- The feasibility of implementing the action, bearing in mind potential barriers; and
- The implementation timeframe, in terms of when the action is needed.

Support Implementation of Existing Actions

The action planning process revealed that the City of Leduc is already undertaking, or has made a commitment to undertake, many actions which help manage some of the identified priority weather and climate risk events. It is vital that the City of Leduc follow through on these commitments, and in doing so, reap the benefits the actions were originally designed to generate as well as support the overarching goal of the WCRP. Planned actions with significant co-benefits for the WCRP include:

- Continuing to update and test the Municipal Emergency Plan, ensuring an effective emergency communications plan with procedures, protocols and designated roles and responsibilities to guarantee a prompt and coordinated response to disasters or emergencies, including those related to extreme weather;
- Continue to promote the Emergency Preparedness Guide online and through other channels;
- Implementing recommendations from the Environment Plan focused on water conservation and efficiency, and water recycling;
- Implementing recommendations from the Environment Plan focused on effective stormwater management, including development of an Integrated Stormwater Management Plan for the City;
- Implementing recommendations from the Water Conservation, Efficiency and Productivity Plan focused on ensuring reliable access to safe drinking water; and
- Continuing existing water demand management programs, including the Voluntary Program of Lawn Watering and universal metering with a volume-based rate structure.



Weather and Climate Readiness Action Plan

The action planning process also revealed that the City of Leduc already has an effective Municipal Emergency Plan and state-of-the-art warning system in the event of extreme weather episodes. Bearing in mind the existing MEP, and assuming the City of Leduc will follow through on the existing commitments listed above, a total of 20 additional actions were formulated for the WCRP. These actions are presented below according to the risks that they are intended to mitigate. Some of the actions address multiple risk events (e.g., Action 3—Enhance public awareness of the Emergency Preparedness Guide—will help mitigate the consequences of all extreme weather-related risk events).



Ice, Snow and Hail Storms

Ice, snow and hail storms have various adverse impacts on the City of Leduc, including: power outages, road accidents (with consequent injuries and fatalities), disruptions to public transportation and economic activity, and damage to infrastructure, including recreation assets and civic facilities. Five priority actions are identified to:

- Reduce the frequency and duration of service disruptions (e.g., water, waste water, power);
- Reduce the consequences of service disruptions should they occur; and
- Reduce health and safety risks to residents and City employees by reducing the likelihood of road accidents and maintaining adequate access for emergency services.

Action	Cost	Timeframe	Notes
1. Ensure 'critical' community facilities have a back-up power source for at least 72 hours in the case of extended power outage caused	Very high (over \$500,000)*	Short-term (2-5 years)	<ul style="list-style-type: none"> • 'Critical' community facilities would include Civic Centre, fire halls or other emergency centers, Leduc Recreation Centre, etc. • Most of these facilities have a generator in place to support critical systems. These power sources should be assessed for adequacy considering the municipal emergency plan and business continuity plan.
2. Develop a travel-to-work policy for City staff during extreme events, including rules and procedures governing travel bans	Low (\$10,000-\$50,000)	Near-term (<2 years)	<ul style="list-style-type: none"> • Essential staff would need to be provided with necessary technology (e.g., IT, communications capacity) to work at home. • In particular, encourage residents to have a (72 hour) emergency kit
3. Continue to enhance public awareness of the Emergency Preparedness Guide	Very low (under \$10,000)	Ongoing	<ul style="list-style-type: none"> • Continue to increase awareness at community events, City Hall and other gathering places
4. Examine feasibility of a flexible working policy for City staff	Low (\$10,000-\$50,000)	Near-term (<2 years)	<ul style="list-style-type: none"> • Implementation of such a policy may follow, depending on the findings of the examination.
5. Hire a Municipal Emergency Plan (MEP) Coordinator	Medium (\$50,000-\$100,000)	Near-term (<2 years)	<ul style="list-style-type: none"> • One new City staff should be responsible for: coordination and implementation of the MEP, meeting legislative requirements, reviewing the business continuity plan, developing departmental emergency plans, coordinating training and exercises, supporting the Emergency Management Team, networking with stakeholders, and assisting in risk identification and implementation of the related recommendations contained in the WRAP

*The emergency management team is exploring opportunities for outsourcing back up power sources, in which case costs would be much lower.

Tornados and Wind Storms

Tornados and windstorms have the potential to severely impact all aspects the City—damaging infrastructure and property, disrupting economic activity and livelihoods, causing injuries and fatalities, etc. Six actions are identified to:

- Reduce health and safety risks to residents and City employees;
- Reduce the frequency and duration of service disruptions (e.g., water, waste water, power);
- Reduce the consequences of service disruptions should they occur; and
- Reduce damage to civic facilities and properties.

Action	Cost	Timeframe	Notes
6. Investigate the requirements and feasibility of applying 'post-disaster' construction standards to new critical infrastructure development	Low (\$10,000- \$50,000)	Near-term (<2 years)	•Determine what the 'post-disaster' standards are and define which facilities, buildings and infrastructure should be built to this standard
7. Conduct gap and analysis and evaluation to determine the need for tornado-safe spaces within existing civic facilities and buildings	Very low (under \$10,000)	Near-term (<2 years)	•Determine which facilities and buildings currently have tornado safe spaces, and which do not, and which existing and new facilities should have such spaces
8. Retrofit existing civic facilities and buildings with tornado-safe spaces	To be determined based on results of Action 7	Medium-term (6-10 years)	•Retrofit existing buildings and facilities as justified, based on results of gap analysis and evaluation (action 7)
9. Ensure tornado-safe spaces are incorporated within design and development of new civic facilities and buildings	Medium (\$50,000- \$100,000)	As required when new facilities are developed	•Implement where justified based on results of action 7 •Cost is the incremental cost per facility and will vary by property •Utilize Edmonton's "Tornado - Shelter in Place" information as a guide
10. Raise public awareness of precautions to take in the event of a tornado (warning), and shelter-in-place information	Very low (under \$10,000)	Ongoing	•Incorporate information into update of Emergency Preparedness Guide
11. Disseminate information on tornado preparedness to City staff, ensuring awareness of tornado-safe spaces and protocols.	Very low (under \$10,000)	Ongoing	•A possible role for the MEP coordinator in conjunction with OHS

Heat Waves

Heat waves and temperature extremes can have adverse health (including fatalities) and well-being (including discomfort) impacts—the elderly, socially isolated, chronically ill, and young infants are particularly vulnerable. Two actions are identified to:

- Reduce health and well-being risks to participants at organized events in Leduc; and
- Improve understanding of the vulnerability of residents to heat waves and thus establish whether a Heatwave Early Warning System (HEWS) covering the City of Leduc is needed to reduce health risks to vulnerable groups.

Action	Cost	Timeframe	Notes
12. Conduct a heat wave vulnerability study to determine the number, location, and exposure of those at risk from heat waves	Low (\$10,000-\$50,000)	Short-term (2-5 years)	•Based on the vulnerability study, if justified, develop a Heatwave Early Warning System (HEWS) for the City of Leduc.
13. Embed requirement for hydration / cooling stations within guide for event planning applications.	Very low (under \$10,000)	Near-term (<2 years)	•Specify conditions under which hydration / cooling stations are required - e.g., if maximum temperature is forecast to exceed an acceptable threshold (25 C?).

Lightning Storms

Lightning storms can down trees, increase fire risk, damage property, result in power outages, and directly or indirectly present a health and safety risk. One action is identified to:

- Reduce the frequency of power outages caused by lightning storms, and consequent disruption to economic and social activity, and the potential for health and safety risks.

Action	Cost	Timeframe	Notes
14. Work with utility provider(s) to explore the option for future transmission lines to be buried underground in the City of Leduc	Very low (under \$10,000)	Near-term (<2 years)	Determine the relative (technical and economic) costs and benefits underground versus above ground transmission lines

Extreme Precipitation and Flooding

Extreme precipitation events can lead to surface (overland) flooding, which can inundate stormwater infrastructure, cause sewer backup, increase pollution load in water bodies, and damage property and infrastructure (including recreational assets and civic facilities). During flooding events economic and social activity can be severely disrupted. Four actions are identified to:

- Reduce the frequency of stormwater system inundation and overland flooding risks in existing developments today; and
- Improve understanding of future overland flooding risks to inform (a) actions to reduce the risk of flooding in existing developments and (b) to inform the design of new developments to minimize flooding risk.

Action	Cost	Timeframe	Notes
15. Enhance the maintenance regime for the storm water collection and maintenance system	High (\$100,000- \$500,000)	Medium-term (6-10 years)	<ul style="list-style-type: none"> •Focus on inspection and cleaning of catch basins •Cost covers the need to purchase an additional vacuum truck and pay for additional staff.
16. Develop an educational program targeting households to minimize adverse effects of storm run-off from private properties	Very low (under \$10,000)	Near-term (<2 years)	<ul style="list-style-type: none"> •Focus on on-site retention of stormwater through slowing, spreading or sinking •Similar programs exist in other parts of the capital region.
17. Update Intensity-Duration-Frequency (IDF) curves to reflect current and projected precipitation patterns	Very low (under \$10,000)	Short-term (2-5 years)	<ul style="list-style-type: none"> •Work with the City of Edmonton and other jurisdictions in the capital region •New IDF curves will inform an update of the Minimum Engineering Design Standards
18. Conduct a detailed engineering vulnerability assessment to characterize and prioritize risks posed to the stormwater system from projected future climate	Medium (\$50,000- \$100,000)	Near-term (<2 years)	<ul style="list-style-type: none"> •Utilize the Engineers Canada – Public Infrastructure Engineering Vulnerability Committee protocol



Water Scarcity

Water is essential to all aspects of life in Leduc. Residents, the economy, and the natural environment all need clean fresh water in sufficient amounts to thrive. While water supply has not historically been an issue in Leduc, population growth and increased demand for water, coupled with increasing temperatures, changing precipitation patterns and melting glaciers, may lead to decreased water availability in the future. Two actions are identified to:

- Ensure the City of Leduc continues to have an adequate, safe and reliable water supply in the future; and
- Reduce the impact of dry spells and drought on trees, parks and other natural areas in the City.

The City of Leduc is actively working towards these objectives, and will continue to do so through implementation of the Water Conservation, Efficiency and Productivity Plan

Action	Cost	Timeframe	Notes
19. Monitor projected water supply and water demand in Leduc	No Cost	Ongoing	<ul style="list-style-type: none"> •Existing and planned policies, programs and projects to manage water use and water supply are judged adequate to meet demand projections for the next 10-20 years •The need for additional management of water use and supply should be re-evaluated in future
20. Increase tree and green space watering capability in the event of drought or dry spells	Medium (\$50,000-\$100,000)	Short-term (2-5 years)	<ul style="list-style-type: none"> •Could utilize gaiters or similar technology, or additional water trucks



Mainstreaming

In addition to the 20 specific actions identified above, it is important to ensure that climate readiness—as a matter of routine—is ‘mainstreamed’ into City strategies, plans, policies, programs, projects, and administrative processes. For example:

- Climate readiness should be considered in all future land use and development decisions, including administrative processes such as bids, tenders and contracts for planning and development work;
- Strategic plans (e.g., the Parks, Open Spaces and Trails Master Plan) and neighborhood-scale plans (e.g., the Telford Lake Master Plan) should consider potential future climate change impacts; and
- Decisions related to the design, maintenance, and upgrading of long-life infrastructural assets and facilities should likewise consider future climate change impacts.

The mainstreaming of climate readiness should also be integrated in future iterations of the Municipal Development Plan and other relevant municipal bylaws.



The action planning process revealed that the City of Leduc is already undertaking, or has made a commitment to undertake, many actions which help manage some of the identified priority weather and climate risk events.



7



IMPLEMENTATION

The preceding section identified 20 actions that could be implemented now, along with many existing commitments that the City of Leduc should fulfill. Collectively, this package of measures will put the City of Leduc in a better position to efficiently manage priority weather and climate risks to municipal services and supporting infrastructure over the next several decades.

“It is not the strongest of the species that survive, not the most intelligent, but the one most responsive to change.”

[Charles Darwin]

Act

The recommended actions listed in Section 6 function as a priority ‘shopping-list’ at this time, which City staff and Council can use to identify and prioritize initiatives. The actions have been characterized by different timeframes and resource implications. This will help the City of Leduc prioritize its investments to address priority weather and climate risk events. These actions should be considered for inclusion in the City’s annual budget cycle, with actions budgeted for and implemented annually in order of priority.

Monitor and Report

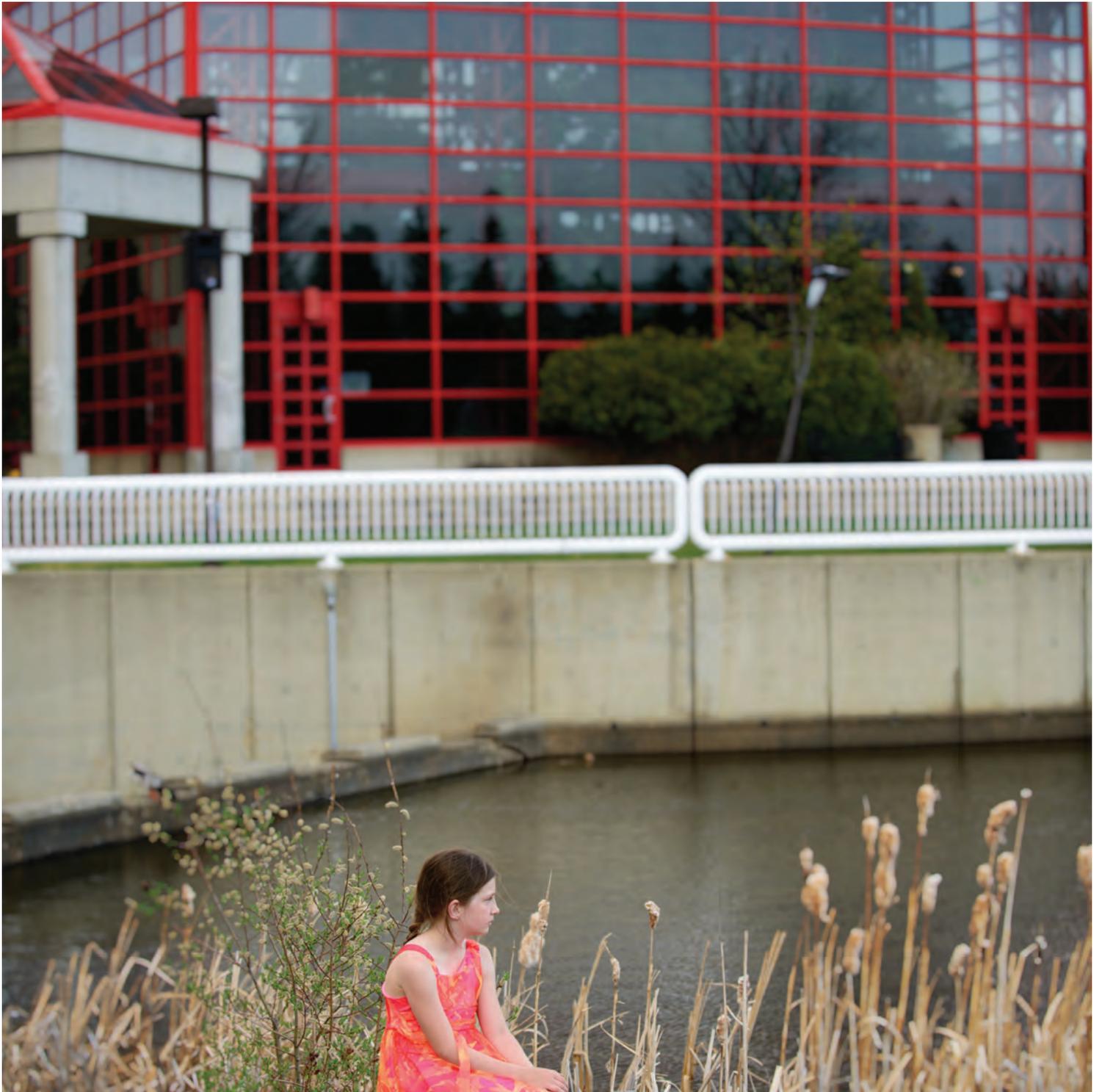
As with any strategic planning process, it is important to periodically look back and examine the effectiveness of the WCRP (and implementation) in meeting the stated goal. To this end, the City of Leduc should monitor the effectiveness of implementation of the WCRP and report on implementation annually. Reporting will be done via the City’s Environmental Progress Report.

Review and Update

The weather and climate readiness planning process is circular and iterative (see Figure 1). The WCRP will be reviewed and updated regularly (e.g. every 5 years or in conjunction with updates to the Environment Plan) to ensure it takes account of:

- Lessons learned from the implementation, monitoring, and reporting process;
- New information on climate projections and corresponding impacts; and
- Changes in the City’s sustainability, development, or other goals.

Future updates of the WCRP should follow the same risk-based approach employed here and remain consistent with the City’s existing risk management framework.



www.leduc.ca  

Civic Centre #1 Alexandra Park, Leduc, AB T9E 4C4

P 780.980.7177 | **F** 780.980.7127 | info@leduc.ca