

An aerial photograph of Calgary, Alberta, Canada, showing a mix of urban development and green spaces. In the background, the city skyline is visible with several high-rise buildings. The middle ground is dominated by a dense forest of trees with yellow and orange autumn foliage. A river or canal winds through the greenery, with a bridge crossing it. In the foreground, there are some buildings and a parking lot. The sky is blue with light clouds.

IMPLEMENTING CLIMATE ADAPTATION THE CITY OF CALGARY

Implementing Climate Adaptation

Calgary's Climate Adaptation Action Plan

➤ Moving from Plan to Action

- People
- Built Infrastructure
- Natural Infrastructure
- Water

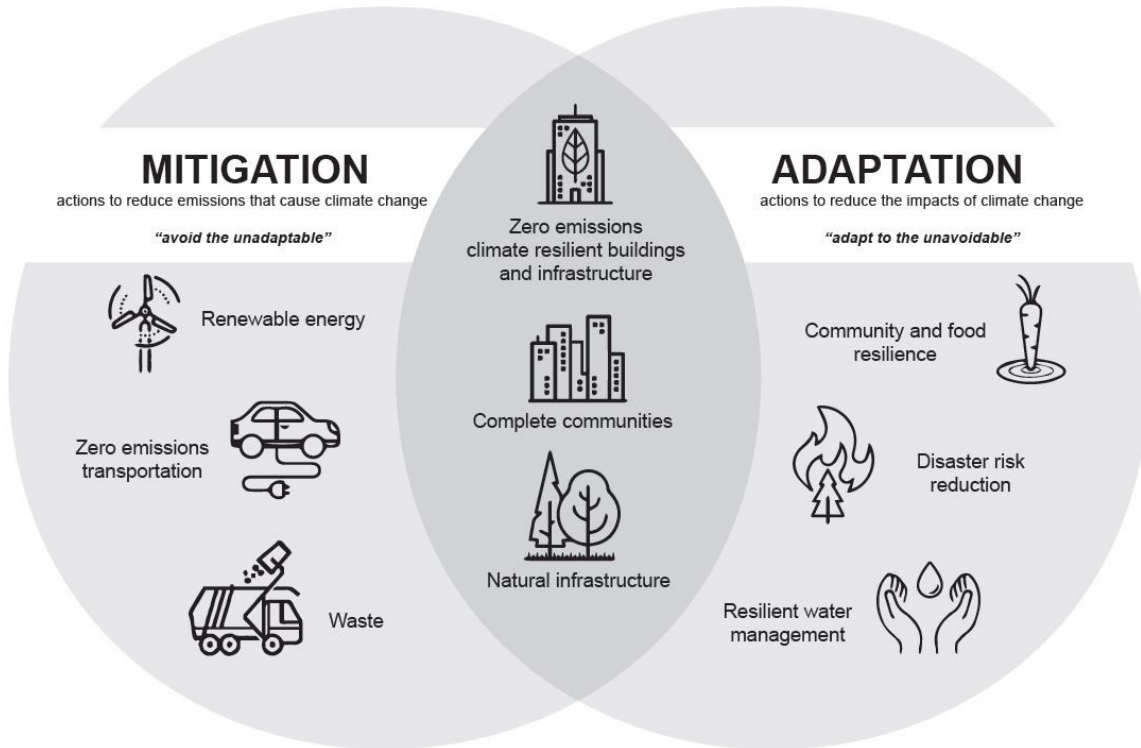
➤ Measuring Progress

Calgary's Organizational Realignment

Funding Adaptation Work



Calgary's Climate Strategy

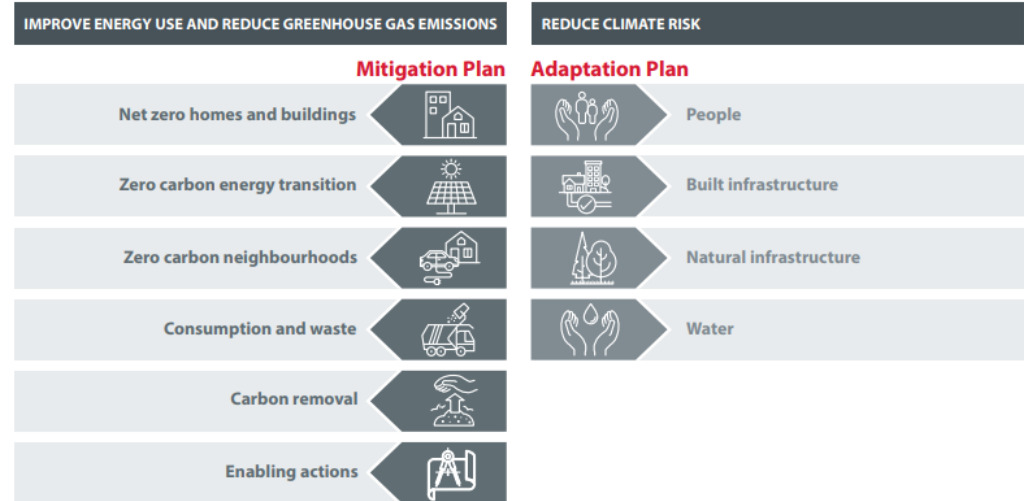


Vision
Calgary is a resilient city and our decisions are guided by economic, social and climate resilience

Principles

- Innovation
- Equity and inclusiveness
- Integration
- Relevance
- Collective responsibility
- Commitment
- Indigenous knowledge and reconciliations

Goals



Implementation

- Integrated decision-making
- Community engagement
- Capacity building
- Readiness and timing
- Partnerships
- Funding
- Accountability and transparency

<https://www.calgary.ca/environment/climate/climate-strategy.html>

Adaptation:

The *process* taken to adjust to the actual or expected climate and its effects (IPCC, 2019).

In Calgary, it refers to the laws, policies, programs, tools and strategies that will reduce the negative impacts and prepare for the benefits of climate change on our city's infrastructure, natural assets, economy and people.

Resilience:

The *capacity* to prepare for, respond to, and recover from the impacts of hazardous climatic events while incurring minimal damage to societal wellbeing, the economy and the environment.

https://www.ipcc.ch/site/assets/uploads/2019/01/SYRA_R5-Glossary_en.pdf



People

- Climate-resilient communities
- Managing extreme weather and climate-related events



Built Infrastructure

- Climate-resilient City-owned infrastructure
- Climate-resilient homes and buildings (privately-owned)
- Climate-resilient utility services



Natural Infrastructure

- Integrating natural infrastructure value
- Investing in natural infrastructure



Water

- River flood management
- Stormwater management
- Water supply and wastewater management



People

- Climate-resilient communities
- Managing extreme weather and climate-related events

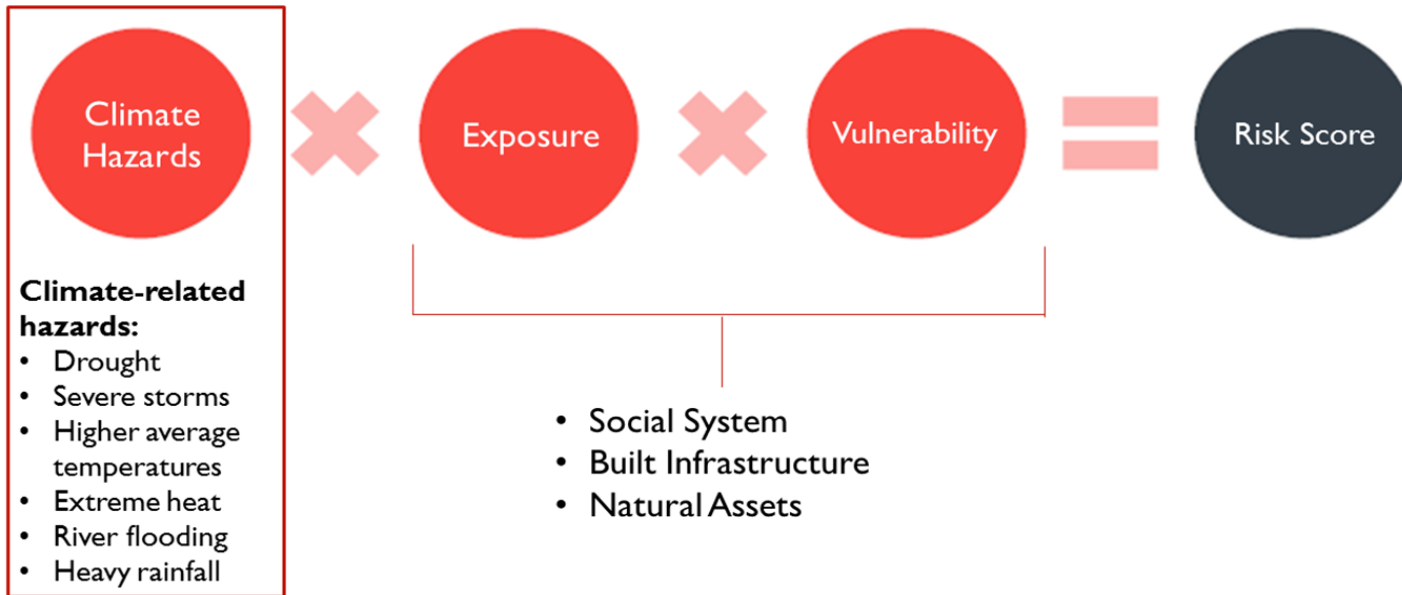
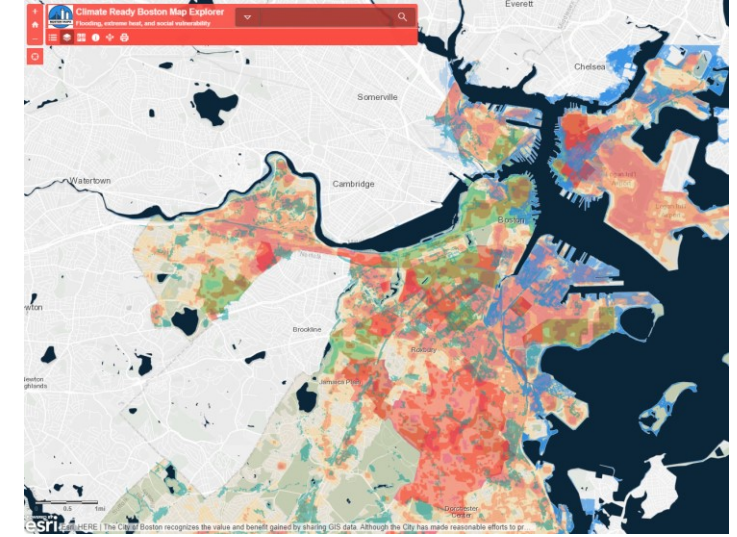
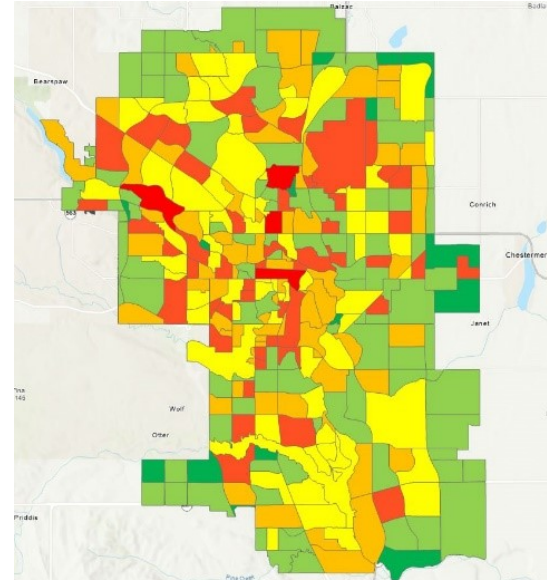
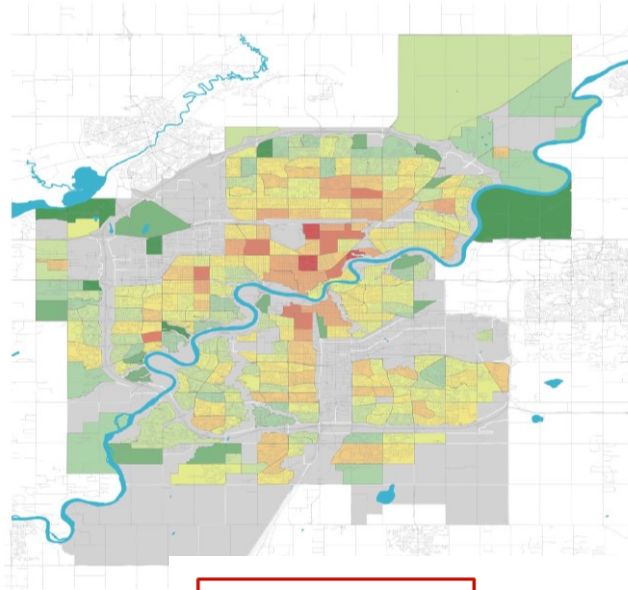
Key Actions:

- Community climate vulnerability and resilience working group
- Community climate-change ambassadors
- Develop a climate equity toolkit
- Map and develop equitable access to community spaces during climate hazard events
- Complete community climate risk profiles
- Strategies to reduce the climate change vulnerabilities of Calgary's food systems
- Support the regionalization and diversification of food supply
- Integrate projected climate risks into service continuity strategies and plans.
- Integrate projected climate risks into health and safety protocols for City personnel.
- Identify and reduce climate vulnerability in The City's supply chain

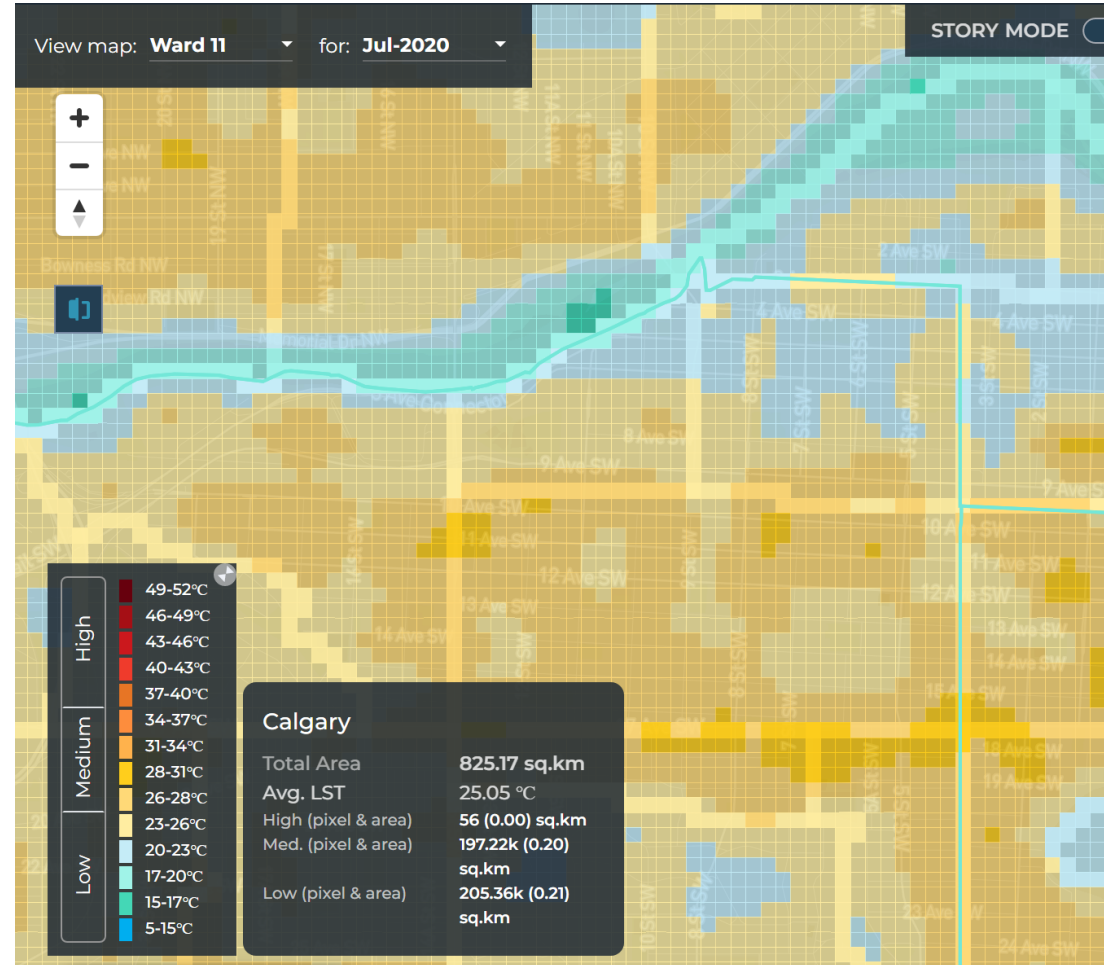


Community Climate Risk Index

- Legend**
- Roads
 - Lakes and Rivers
 - Climate Risk Score
 - 0 - 0.1 (lowest)
 - 0.1 - 0.2
 - 0.2 - 0.3
 - 0.3 - 0.4
 - 0.4 - 0.5
 - 0.5 - 0.6
 - 0.6 - 0.7
 - 0.7 - 0.8
 - 0.8 - 0.9
 - 0.9 - 1 (highest)
 - No CRI score



- Based on LiDAR surface temperature data
- Identify warmest microclimates within a community
- The warmest areas align with highly paved areas. The coolest spaces are greenspaces and water features
- Target shade and cooling interventions
- Coming soon to a public geodatabase soon!





Built Infrastructure

- Climate-resilient City-owned infrastructure
- Climate-resilient homes and buildings (privately-owned)
- Climate-resilient utility services

- Update asset management tools include climate risk and adaptation considerations
- Develop guidance for climate-resilient retrofits
- Incorporate climate resilience throughout downtown planning
- Support climate resilience with The City's Civic Partners

Climate Risk and Resilience Assessments

Larger scale assessments > \$10,000,000, 30+ years, opportunity to reduce climate risk

CITY OF CALGARY
WSP PROJECT NO.: 211-10348-01

FOREST LAWN MULTIPLEX CLIMATE CHANGE RESILIENCE ASSESSMENT



Process:

- Prompt project teams to think about climate risk
- Typically completed between the 30-60% design phase
- Results including list of recommendations to reduce climate risk
- Prioritize implementation based on high level return on investment
- E.g. projects: Glenbow museum, Forest Lawn Multiplex, Marda Loop Mainstreets, Stephen Ave redesign, etc.

Step 1
Define Infrastructure
- Establish the Context (Scope)

Step 2
Evaluate Climate Changes
- Risk Identification

Step 3
Conduct Risk Assessment
- Risk Analysis

Step 4
Conclude & Recommend
*- Risk Evaluation
- Risk Reduction*



Conduct the Climate Risk Assessment

Risk Classification	Rating	Description of Risk	Recommended Risk Treatment
Slight	1-2	<ul style="list-style-type: none"> No permanent damage No service disruption 	Tolerable: risks do not require further consideration
Low	3-6	<ul style="list-style-type: none"> Minor asset or system damage Minor service disruption may occur Minor repairs or restoration 	Monitor: controls or coping strategies recommended
Medium	5, 9	<ul style="list-style-type: none"> Limited damage to asset or system Brief service disruption may occur Minor repairs and some equipment replacement or restoration 	Requires some attention: some controls required to reduce risk levels. Monitor risk for changes over time.
High	10-15	<ul style="list-style-type: none"> May result in significant damage, loss, or require complete replacement Lengthy service disruptions may occur 	Requires much attention: high priority control measures required.
Extreme	20-25	<ul style="list-style-type: none"> May result in significant damage, loss, or require complete replacement Lengthy service disruptions may occur, alternate service delivery may be required 	Not acceptable: significant controls required.

Not Just an Assessment Process

Outcomes:

1. **To inform decision making**
 - The 'fit' in other City processes
 - Conceptual to detailed design
2. **To build more resilient infrastructure and public spaces, and thus a more resilient community.**





Natural Infrastructure

- Integrating natural infrastructure value
- Investing in natural infrastructure

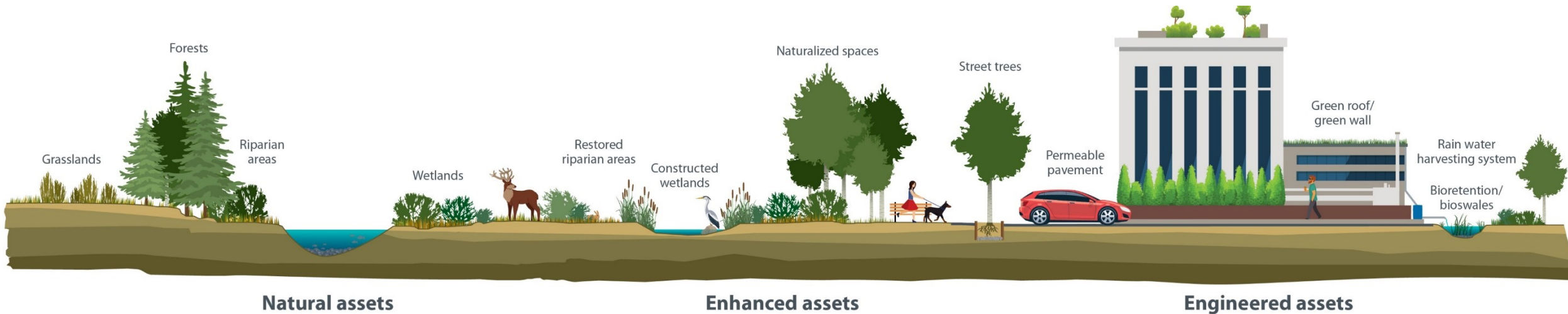
- Develop and implement an integrated funding strategy
- Develop guidance to support on the ground implementation
- Implement operational practices that improve climate resilience of natural infrastructure
- Integrate natural infrastructure into Calgary's greater downtown
- Improve equitable access to natural infrastructure

Natural Infrastructure in Municipal Landuse Planning



MDP 2.6: Natural Infrastructure is better able to self-adapt to the stresses and shocks associated with Calgary’s changing climate than hard infrastructure.

Protecting and using natural infrastructure appropriately can offset costly investments in new hard infrastructure, while providing additional social, economic and environmental co-benefits.



A range of assets from **natural through engineered** which rely on **ecological and hydrological processes** to provide **municipal, ecosystem, and societal services** as well as **resilience benefits**.

Natural Infrastructure Approach to Service Delivery

ENVIRONMENT

+

SOCIETY

+

ECONOMY

FLOOD MITIGATION

WATER QUALITY

WATER QUANTITY

BIODIVERSITY

HABITAT

AIR QUALITY

CLIMATE REGULATION

CLIMATE RESILIENCE

EQUITY

PUBLIC HEALTH

POSITIVE WELL-BEING

RECREATION

SOCIAL CAPITAL

SKILLS

HISTORICAL - CULTURAL

CAPITAL INVESTMENT

OPERATIONAL COSTS

JOBS

PROPERTY VALUES

AVOIDED DAMAGES

ACCESS TO CAPITAL

TOURISM



Natural Asset Inventory

City of Calgary Natural Asset Inventory

Natural Assets | Natural Asset Map | Tree Assets | Registry

Area of Natural Assets by City Sector

Asset Area (ha)

- 654.67
- 1726.84
- 3803.01
- 3877.18
- 4951.35
- 6025.52

Total Area by Asset Type

Summary of Natural Assets

Asset Type	Area (ha)	No. of Trees	Area of Canopy Cover (ha)	Length of Ephemeral Stream (km)
Agricultural/Annual Crops	11,239.70	1890	47.34	506.15
Agricultural/Pasture/Fallow	1,635.75	113	12.40	98.28
Forest	2,218.35	6123	1,634.08	121.43
Grassland	7,641.00	2451	403.67	436.40
Natural Wetland	1,204.85	73	15.20	6.83
Reservoir	361.81		4.30	0.01
Shrubland	438.75	26	209.41	20.10
Storm ponds/Modified Wetlands	1,608.88	163	10.67	4.00
Stream/Rivers	917.49	70	27.63	24.63
Total	27,266.58	10909	2,364.78	1,217.83

Habitat Condition Rating Breakdown by Asset Type

EXCELLENT TO GOOD: 28% (Blank), 79% (Forest)

MODERATE TO FAIR: 30% (Forest), 41% (Natural Wetland)

POOR: 11% (Forest), 24% (Natural Wetland)

Percent of Area by Asset

47% (Forest), 28% (Grassland), 7% (Agriculture), 6% (Natural Wetland), 2% (Reservoir/Storm...), 2% (Shrubland), 1% (Stream/Rivers)

Land Use Class: All

Agency Steward: All

Riparian Management Zone: Conservation, Developed, Flood and Erosion Control, NA, Recreation, Restoration

Source Watershed Vulnerability: High, Low, Moderate, NA, Very High, Very Low

City of Calgary Natural Asset Inventory

Natural Assets | Natural Asset Map | Tree Assets | Registry

Natural Areas Map Viewer

The map viewer (in the middle) displays all individual natural assets within the City boundary. Due to technical limitations with Power BI, the assets will only display season, a full scale high level overview. For the dynamic to different areas, explore individual

Table

Area (ha)
11,239.70
1,635.75
2,218.35
7,641.00
1,204.85
361.81
438.75
1,608.88
917.49
27,266.58

Tree Assets Map

Tree Type

70% (Deciduous), 29% (Coniferous), 1% (Blank)

Tree Maturity

70% (Small), 29% (Medium), 1% (Large)

Top 10 Tree Species by Average DBH

Tree Statistics by Natural Asset Type

Asset Type	Average DBH (cm)	Average Rating
Agriculture/Annual Crops	5.88	67.08
Agriculture/Pasture/Fallow	5.45	85.22
Forest	88.38	81.81
Grassland	10.21	86.80
Natural Wetland	6.76	95.80
Shrubland	38.32	71.34
Storm ponds/Modified wetlands	6.70	73.84
Total	26.26	82.94

<http://go.greenanalytics.ca/calgary>



Valuation of Natural Assets







- Outcomes
- Services
- Natural Assets
- Inventory
- Valuation
- Risks
- Integrate
- Implement

Natural infrastructure within the City of Calgary has a

Replacement cost of \$6.9 billion

which generates a flow of

ANNUAL service value of \$2.5 billion

 Recreation \$899 million/year	 Amenity and Enjoyment \$50 million/year	 Habitat \$33.7 million/year
 Water Retention \$1,166 million/year	 Urban Heat Reduction \$381 million/year	 Carbon Storage \$1.8 million/year



Think about the value differently – economics*



This is not a price on nature – assessing value of the service

Building Natural Areas in the City

- Mini Forests in Temple, Mayland Heights
- 16th Ave Naturalization and Canyon Meadows Bee Boulevard
- Raingardens and bioretention
- More to come in 2023!



Mini Forest Pilot Project

Summary Report – 1st Growing Season (2022)

Resource Stewardship, Parks and Open Spaces

Canyon Meadows Bee Boulevard



<https://youtu.be/3frkqNjScpk>

What has value?



Key Actions:

- Improve upstream water storage solutions
- Improve understanding of climate impacts on flood frequency and severity, and to groundwater
- Integrate watershed management concepts and practices
- Integrate climate projections in developing and updating stormwater management
- Improve our understanding of stormwater flood risk
- Develop and implement a Green Stormwater Infrastructure (GSI) Plan



Water

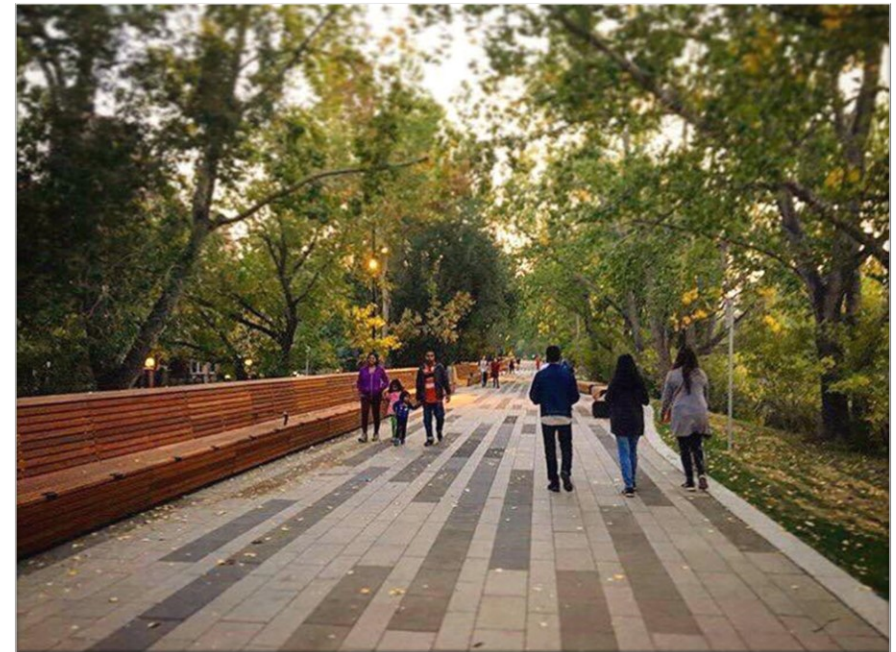
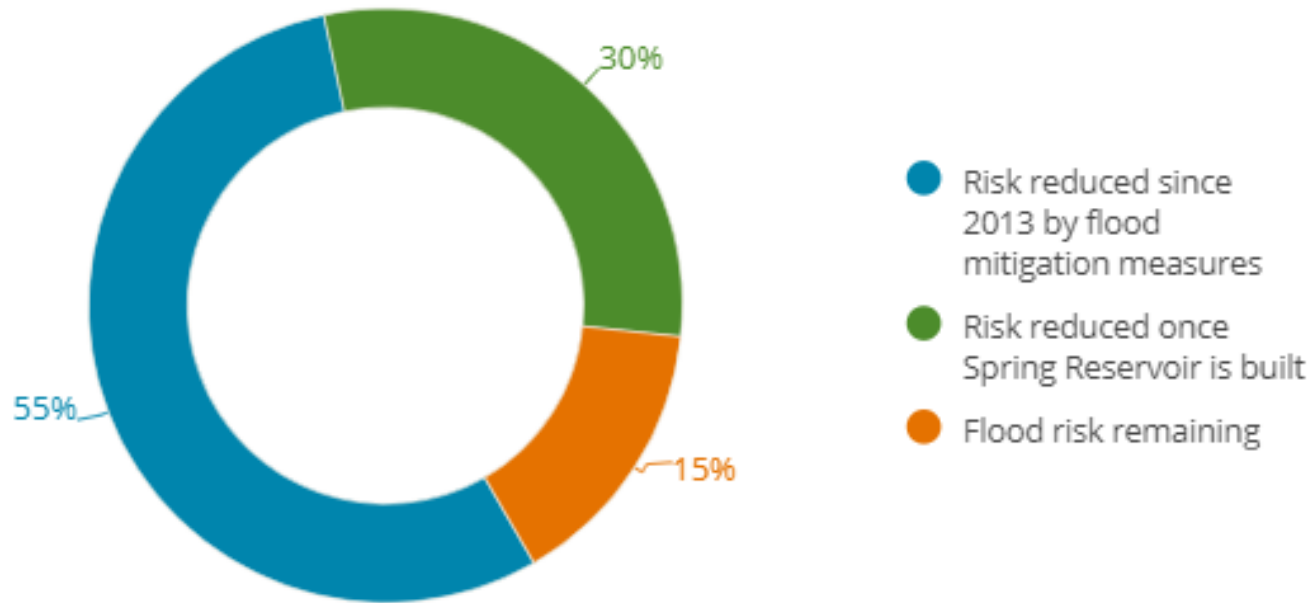
- River flood management
- Stormwater management
- Water supply and wastewater management

- Improve understanding of climate impacts on long-term river flow, water quality, treatment, and demand
- Improve water usage and water loss data
- Conserve and preserve our water under drought and other changing climate conditions
- Investigate, evaluate and implement innovative alternative water supply sources
- Improve understanding of climate risk to wastewater collection, treatment processes

Flood Risk Mitigation

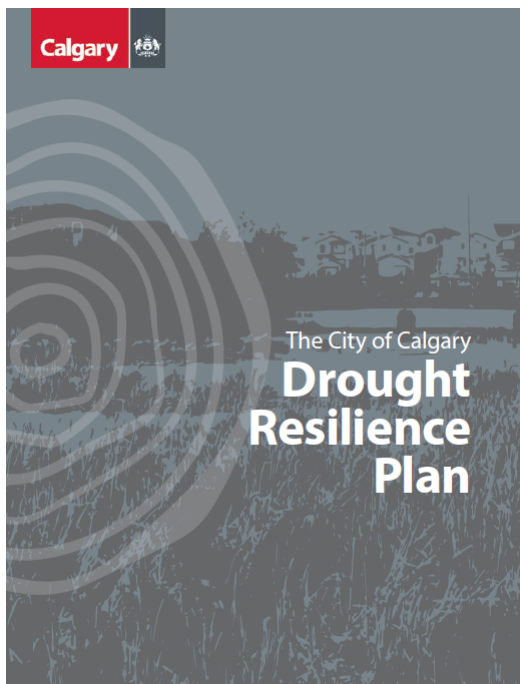
River Flood Risk Mitigated

(Amount of flood risk reduced compared to 2013 flood)

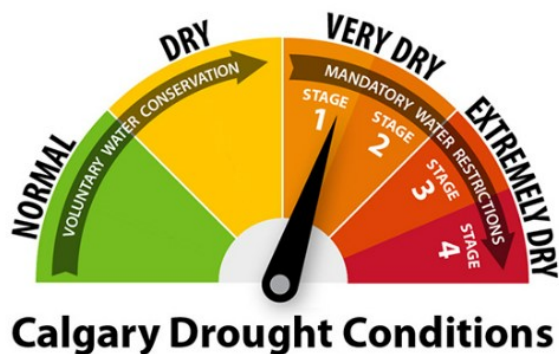




Drought Preparedness



Is there a drought in Calgary?



Homeowner Water Guide

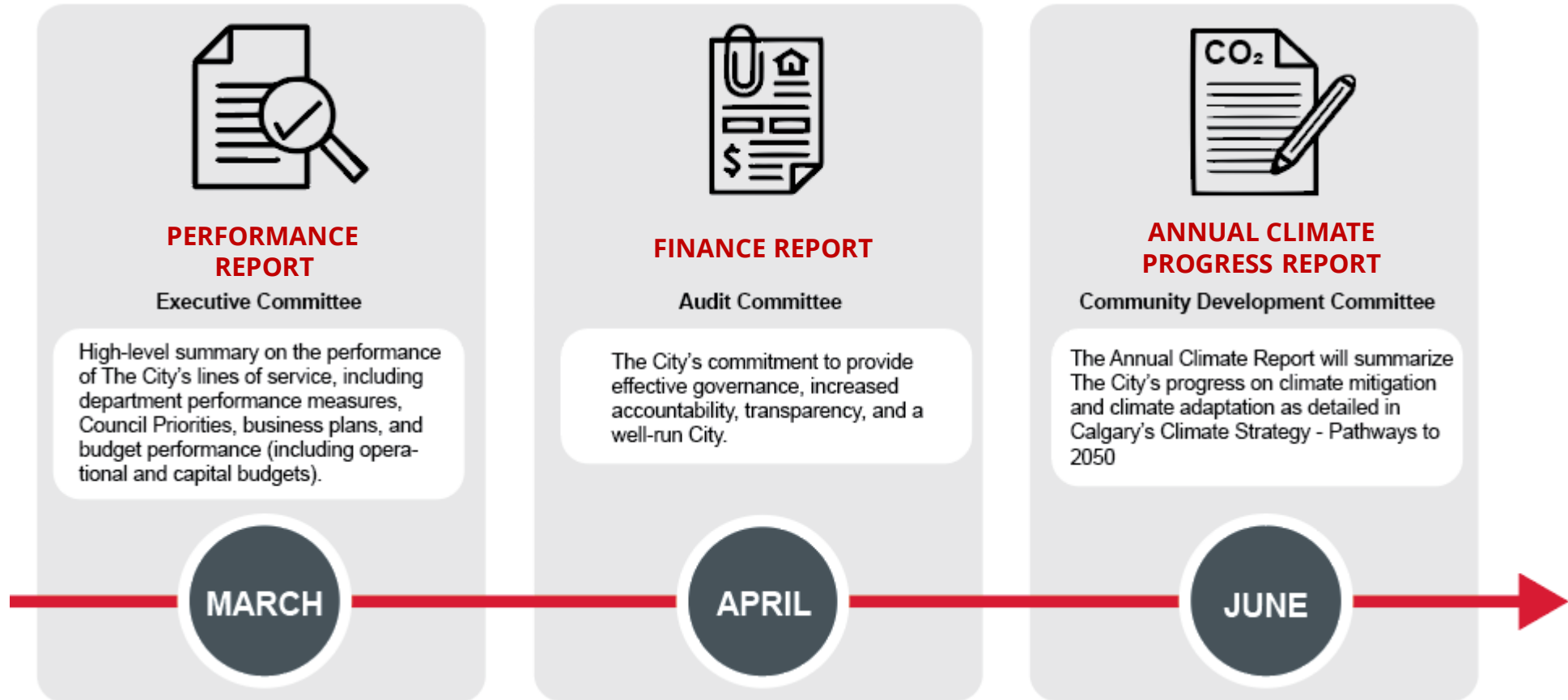
Discover a library of information about The City of Calgary's water services, where our drinking water comes from, and what hands-on programs, tips and tools we offer for creating a water-efficient home and yard.

	STAGE 1	STAGE 2	STAGE 3	STAGE 4
Sprinklers 	YES 2 hr max., one day/week	YES 1 hr max., one day/week	NO	NO
	Watering schedule is based on address: Odd addresses Thursday or Sunday Even addresses Wednesday or Saturday Watering is allowed between: <ul style="list-style-type: none"> • 4 a.m. – 7 a.m.; or • 9 a.m. – 11 a.m.; or • 7 p.m. – 10 p.m. 		NO	NO
Hoses with spray nozzle 	YES Anytime	YES Anytime	NO	NO
Hand watering 	YES Anytime	YES Anytime	YES Anytime	NO
Watering new grass 	YES Anytime	YES Anytime	YES Anytime	NO
Washing outdoor: Cars, windows, exterior building surfaces, sidewalks, driveways or walkways 	NO	NO	NO	NO
Filling outdoor pools or hot tubs 	YES Anytime	YES Anytime	NO	NO
Filling of fountains and other decorative features 	NO	NO	NO	NO

[Drought Resilience Plan | Engage \(calgary.ca\)](https://calgary.ca)



Climate Reporting Framework



Climate & Environment Analytics Project

Product

An online data analysis and advanced analytics platform providing City staff a set of tools to facilitate collective climate and environmental monitoring, reporting, and forecasting.

1

Corporate Data warehouse



- *Integrate source data in one place to support dashboards and portals.*
- *Web console app for manual data entry*

2

Corporate Dashboard



- *Track metrics against targets and monitor patterns, trends, and outliers.*

3

Corporate Reporting Portal



- *Generate reports*
- *Access climate and environmental datasets.*

4

Corporate Advanced Analytics Portal



- *Provide insights and recommendations.*

5

Citizen Dashboard

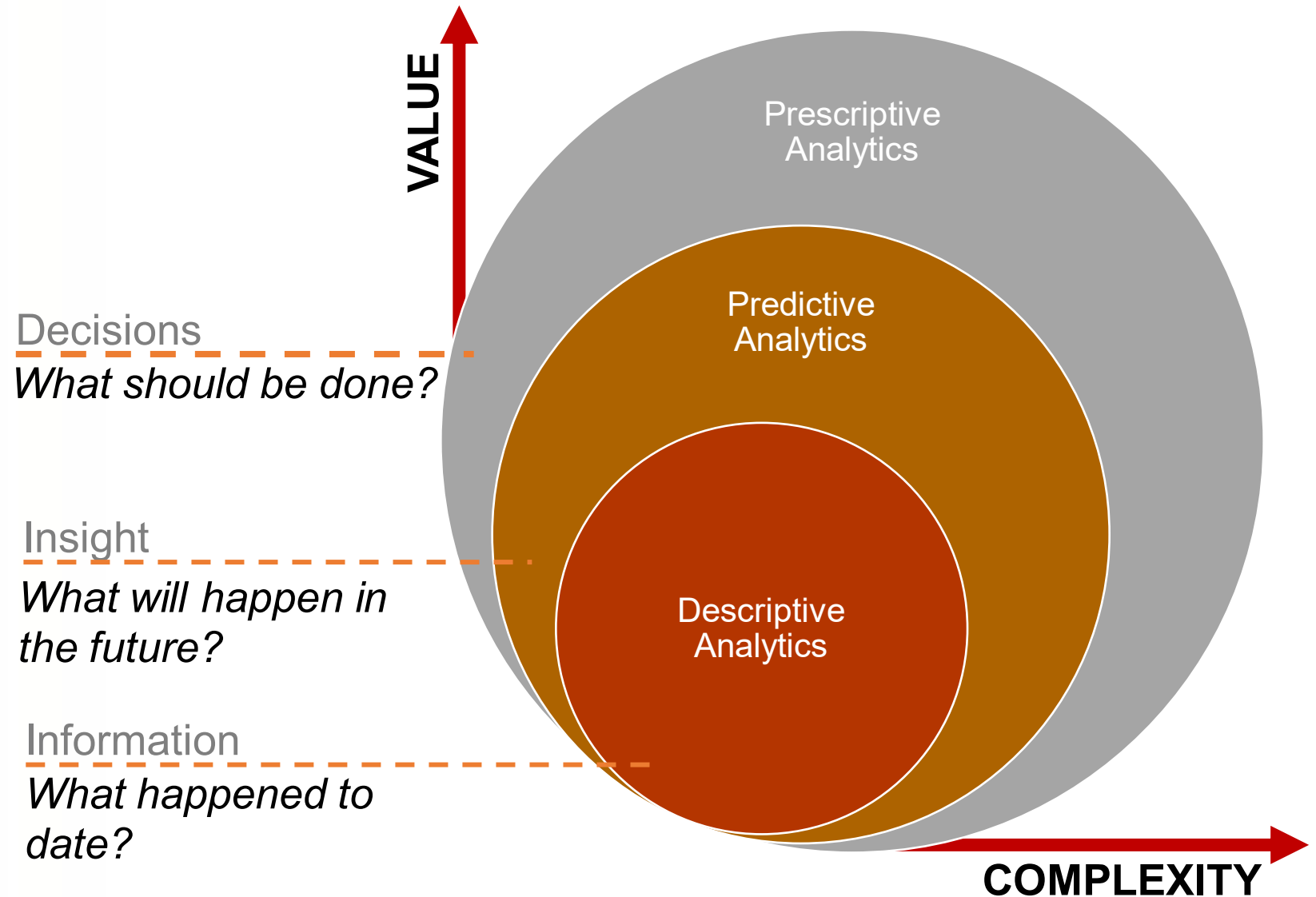


- *View indicators, summarized information*
- *Access displayed data via Open Data Portal.*

Climate & Environment Analytics Project

Goal

Deliver relevant and actionable climate and environmental information, insight and recommendations in a consistent, coordinated and integrated way.



Climate Dashboard

On track


Trending in the right direction and on track to meet targets

Needs Improvement


Trending in the right direction but will not meet targets at current trajectory

Target Not Defined

There is no target defined for this metric

610 


Energy efficient homes

No target defined 


351 


Buildings in the Energy Benchmarking Program

Needs Improvement 


11 

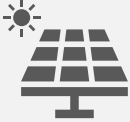
Climate Risk and Resilience Assessments completed

On Track 


\$1M 


Clean-energy home improvements

On Track 


1% residential 


Rooftop solar capacity

Needs Improvement 


100% 


Green energy procurement

On Track 


2601 


Electric cars in Calgary

Needs Improvement 


25% 


Mode share

Needs Improvement 


353ha 


Natural area restored or enhanced

Needs Improvement 


351 LPCD 


Water consumption in Calgary

On Track 


38k kg/day 

Stormwater sediment loadings

On Track 

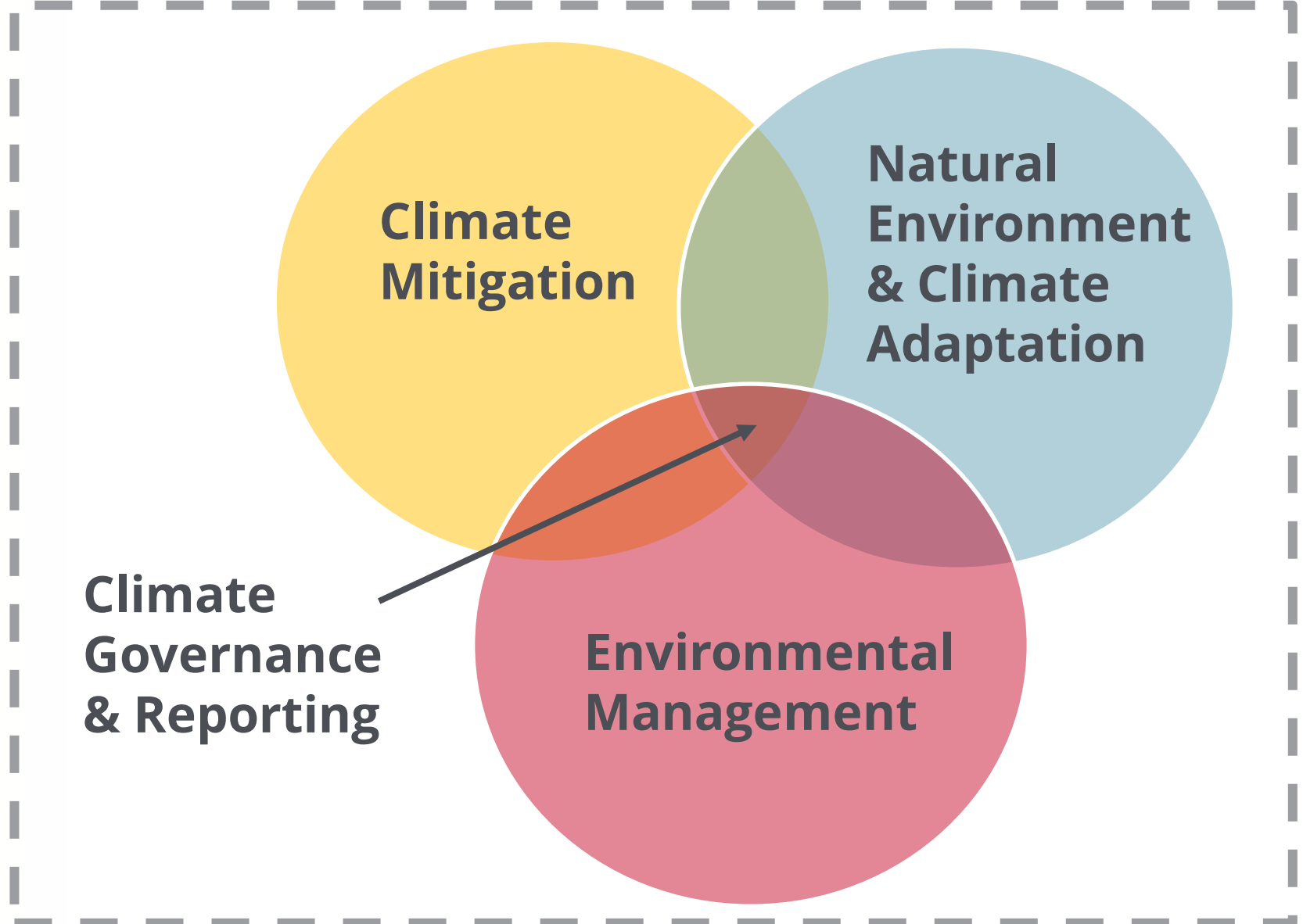
55% 

River flood risk mitigated

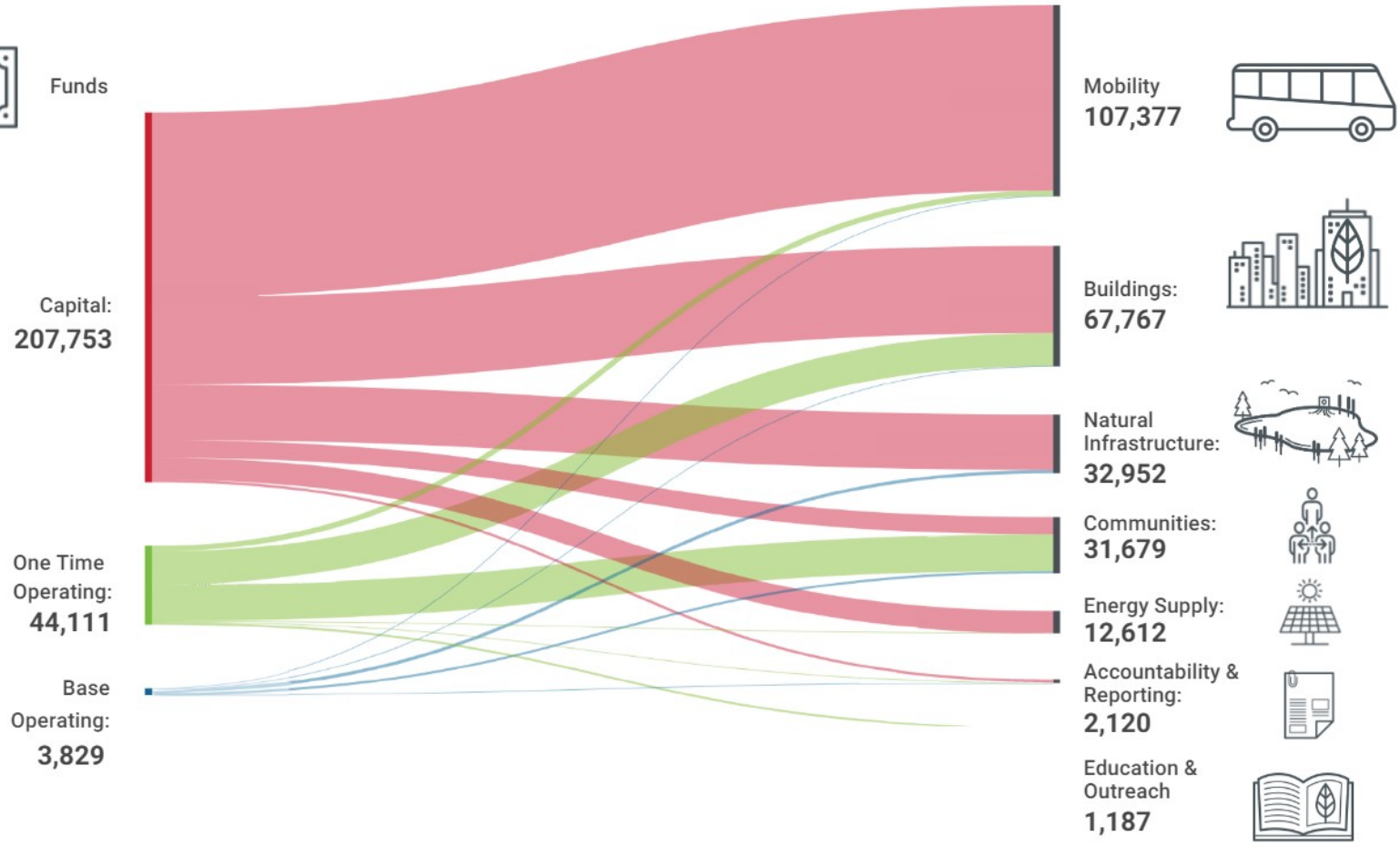
On Track 

Organizational Realignment

Planning & Development Services



Investing in Our Path to 2026



Funding Climate Adaptation

Questions?

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