CLIMATE CHANGE ADAPTATION STRATEGY

2018 UPDATE AND ACTION PLAN

CITY OF VANCOUVER | SUSTAINABILITY GROUP

CITY OF VANCOUVER | GREENEST CITY


the people
NEW DEAL
THERE IS NO
PLANET B

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Front cover photograph: "A False Creek", Public Art by Rhonda Weppler and Trevor Mahovsky graphically simulating a 5m sea level rise in Vancouver. www.afalsecreek.ca

Executive Summary

The October 2018 Intergovernmental Panel on Climate Change (IPCC) special report[1] stated that "limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society." Mitigation efforts (such as those in the Renewable City Action Plan) are more important than ever to limit the extent of climate change we experience. There is also an increasing imperative to prepare for the shocks and stresses associated with a changing climate.

Projections from global climate models for the 2050s in Vancouver (relative to the baseline time period 1971-2000) signal a worsening of what has been observed: hotter, drier summers; warmer, wetter winters; and sea level rise. Extreme events such as intense rain and heatwaves are anticipated to increase in frequency and intensity. The growing season will become longer and streamflow will change in peak flow timing and volume.

These projections translate to a range of impacts to our human, natural and built systems. Examples include: increased risk of health and safety impacts; new and existing buildings being maladapted to new climate normals; increased loss of trees and vegetation; and increased street, property and shoreline flooding. Limited benefits are expected such as increasing opportunities to grow certain food crops and lower winter heating bills.

This is the second iteration of the nationally leading Climate Change Adaptation Strategy that aims to prepare Vancouver for the shocks and stresses associated with new climate normals. Proactively planning for change allows for a greater variety of implementation options, harnessing windows of opportunity and lower costs.

Strong initial steps have been taken in Vancouver to prepare for the impacts of climate change but continued momentum is needed. The 2012 Climate Change Adaptation Strategy is responsible for the implementation of over 50 actions across the city, which has increased Vancouver's preparedness for climate change. A climate adaptation lens has been incorporated in diverse projects ranging from the technical detail of new wharf designs to including climate resilience principles in community plans.

Achievements from the 2012 Strategy include the internationally recognized Coastal Flood Risk Assessment, changes in the way we design and approach drainage, and an Urban Forest Action Plan that targets neighbourhoods with high temperature and high heat vulnerability for tree planning.

The 2018 Strategy includes a new set of priorities, supporting actions and several new focus areas. As the field of adaptation matures, practitioners are recognizing that successful implementation requires enabling factors that reach beyond an action plan. Adaptation is not a one-off effort but requires building the capacity within a given organization and community to continue learning, collaborating and innovating over years. Actions are now split into Core Actions and Enabling Actions. Other focus areas are: better integration with other city work via co-benefits and earlier identification of overlap, and focusing more explicitly on equity.

[1]IPCC, 2018: Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

The Strategy relies on a diversity of existing City and community strategies and efforts that aim to improve the overall resilience of the city to shocks and stresses. It also relies on efforts to address inequities and systemic vulnerabilities that challenge resilience. Of particular note in this regard is the Resilient Vancouver Strategy (RVS) approved in April 2019. The impacts caused by climate change (dealt with in this Strategy) are one of many types of shocks and stresses Vancouver will face in coming decades. The RVS deals with broader resilience-building within the city and works in unison with this Strategy to improve Vancouver's ability to prepare for, respond and recover from shocks and stresses.

The Strategy is composed of five Core Action areas and seventeen Enabling Actions that address adaptation efforts until the next update. Core Actions build on the work started in 2012 and are divided into five action areas:

1. Climate Robust Infrastructure
2. Climate Resilient Buildings
3. Healthy and Vigorous Natural Areas and Green Space
4. Connected and Prepared Communities
5. Coastal Preparedness

In many instances good adaptation work is already planned or underway, instigated by a different driver such as sustainability, resilience or risk management.

Table 1 outlines the core action areas and each focus of attention. Those categorized as 'enhance planned action' have had good success over the last six years and have many actions planned that support adaptation. 'New action needed' denotes that these action areas include a fair number of new actions.

Table 1. *Core Action Areas and their Focus of Attention*

Action Area	Action Category	Focus of Attention
Climate Robust Infrastructure	Enhance planned action	• Improve understanding of water flow in the city and integrate management (Rain City Strategy and Integrated Utility Management Planning) • Increase use of green infrastructure where appropriate • 'Fit for purpose' approach to water end use • Resilient Vancouver Critical Infrastructure project
Climate Resilient Buildings	New action needed	'Future proofing' the building stock • New: Building requirements and design options to improve climate resilience • Existing: Upcoming Deep Retrofit Strategy supports co-benefits to enhance resilience • Thermal comfort and hotter summers
Healthy and Vigorous Natural Areas and Green Space	Enhance planned action	• Support implementation of the Urban Forest Strategy (UFS) actions for climate change • Move urban forest maintenance from a reactive to a proactive standard of excellence • Soil preservation • Water quality
Connected and Prepared Communities	New action needed	• Health and safety during heat waves in non-market housing and surrounding neighbourhoods • Address wildfire smoke events (air quality) • Support continuation and scaling up of community resilience-building programs such as Resilient Neighbourhoods Pilot Program
Coastal Preparedness	Enhance planned action	• Floodplain development regulations and guidelines • Engagement and design competitions • Conceptual design for adaptation approaches for the Fraser River • Study of climate change impacts to waterfront parks and open spaces

Glossary

Shocks and Stresses: The Resilient Vancouver Strategy defines shocks and stresses as follows: Shocks are sudden-onset events such as earthquakes, floods and extreme weather. Stresses are conditions that weaken the urban fabric of a city on a daily or reoccurring basis such as racism, social isolation and poverty. Climate adaptation related stresses refer to the climate trends that impact systems such as hotter, drier summers and sea level rise.

Climate-related hazards: Climatic events and trends that have the potential to cause harm to human and environmental systems i.e., drought, snowstorm, temperature extremes etc.

Robust: A quality of resilience. Robustness denotes positive performance across a range of future scenarios. Robust infrastructure is well-conceived, constructed and managed and will not fail catastrophically when design thresholds are exceeded.

"Fit for purpose" approach: A system is appropriate enough and of necessary standard for the function it was designed to do.

Green Infrastructure: Green infrastructure mimics natural water processes. It works with plants, soils, trees, and built structures to capture and clean rainwater before returning it to our waterways and atmosphere. *Examples: green roofs, bioswales, rain gardens.*

Grey Infrastructure: Traditional engineered infrastructure that does not include natural elements.

Heating and Cooling Degree Days: These indicators provide a measure of how cold and hot it gets and for how many days in a year. They are important when planning heating, ventilation and air conditioning systems and building design. Heating Degree Days (HDD) and Cooling Degree Days (CDD) measure the difference between the average outdoor temperature and a comfortable interior temperature of 18ºC. For example, a daily mean outdoor temperature of 10ºC contributes eight HDD while a daily mean outdoor temperature of 20ºC contributes two CDD. They are reported summed over each day of the year.

What You Can Do

Community participation is a key factor in responding to the climate change challenge – both in lowering carbon pollution and preparing for the impacts of climate change. Priority actions are those that reduce carbon pollution thereby helping limit the extent of climate change experienced during our generation and future generations.

Avoiding the worst effects of climate change will require massive collective action globally. Here are some ways you can help:

1. **Support government and businesses taking climate action.**
2. **If you own a motor vehicle - consider getting around by by walking, rolling, taking transit and/or using shared vehicles instead.** If you feel personal vehicle ownership is a must, when it comes time to replace your vehicle, look at zero emission options - there are more models, incentives, and electric vehicle (EV) charging stations than ever before.
3. **If you own a condo, encourage the strata committee to explore energy saving opportunities for your building.** An energy audit will provide customized options, but switching to zero emissions space and water heating equipment at time of replacement are our top climate friendly picks. Also, consider providing EV charging in your parkade, which will make your building more attractive to current and future EV drivers.
4. **If you own a house, consider zero emissions space and water heating at time of replacement.** If you rent, encourage building managers to switch to zero emissions heating. Incentives and reduced operating costs can make them very attractive options. Did you know heat pumps are amazingly efficient and operate as air conditioning in the summer?
5. **What you eat matters when it comes to climate change.** Carbon emissions from growing, rearing, farming, processing, transporting, storing, cooking, and disposing of meat and dairy are major carbon polluters globally. The more plant based proteins you eat, the healthier for you and the planet (and likely your pocket book too).

Please refer to the City's Renewable City Action Plan and Climate Emergency website for other ideas.

While the City has been making concerted effort to reduce our greenhouse gas emissions, climate change effects are already being experienced. Preparing to moderate the associated impacts and harnessing the benefits is the goal of the City's Adaptation Strategy. In addition to what city governments can do, there are many actions you can take in your households, neighbourhoods and at work to be part of the solution in adapting to the new normals of climate change.

Climate scientists anticipate the most significant changes in climate in the Vancouver area include increased frequency and intensity of precipitation, higher temperatures and sea level rise. The following pages outline the main challenges and opportunities posed by these changes and what we can do to prepare.

By the 2050s Vancouver will have

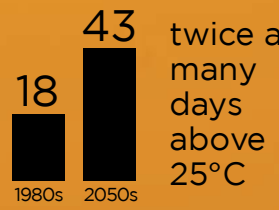
HOTTER, DRIER SUMMERS

MAJOR IMPACTS:

more frequent heat waves

hottest days even hotter

37°



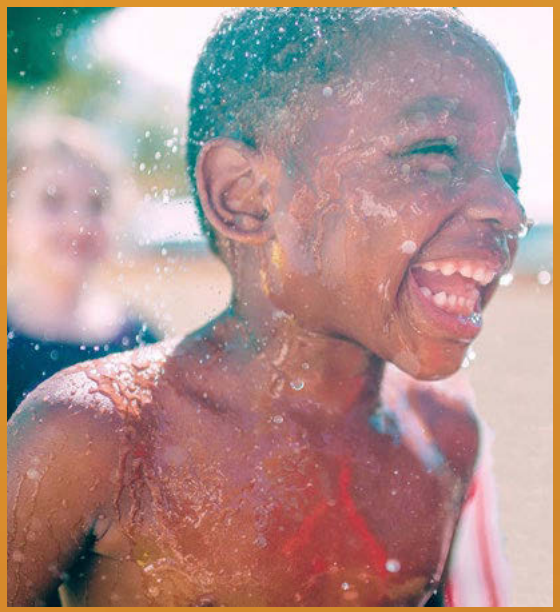
twice as many days above 25°C

WHICH MEANS

increased health risks to vulnerable people

20% less rain

increased water restrictions



What to expect

Anticipated challenges and opportunities

- More frequent and longer heat waves will put Vancouverites, who are more vulnerable to heat, at risk of heat-related illness.
- Higher summer temperatures may make some of the existing building stock uncomfortable given the lack of air conditioning. Temperatures will be exacerbated in urban areas due to the urban heat island effect.
- Poor air quality days resulting from ground-level ozone[2] and smoke from wildfires are anticipated to increase; impacting physical and mental health, outdoor work, recreation, and tourism.
- Increasing drought stress on vegetation and trees combined with more stringent water restrictions.
- Increase in invasive plants and species.
- Increase in active transportation and use of water-related recreation opportunities.

[2]Ground-level ozone results from photochemical reactions between oxides of nitrogen and volatile organic compounds in the presence of sunlight and is a major component of smog. Higher levels typically occur from May to September.

What you can do to prepare:

- Convert your oil, natural gas, or electric heating system to an efficient heat pump to add summer cooling.
- Add insulation to help keep your home cool in the summer and reduce bills in the winter.
- Increase shade around your home by planting trees and other vegetation that lowers surface and air temperatures by providing shade and cooling through evapotranspiration.
- Consider installing a green roof.
- Water conservation measures such as water saving appliances and equipment, rain barrels, water conservation actions, planting drought tolerant lawns and gardens.
- Know the signs and symptoms of heat stress.
- Check on your neighbours and know where those more vulnerable to heat are in your community (pregnant mothers and young children/infants, people with existing health concerns, people with respiratory illness, people taking certain prescription or non-prescription drugs and elderly seniors living alone).
- Know where the cooling centres, spray parks and outdoor swimming pools, and cleaner air spaces near you are (available at vancouver.ca or by calling 3-1-1).
- Stay safe in the summer heat: Follow these tips to stay cool.

By the 2050s Vancouver will have

WARMER, WETTER WINTERS

MAJOR IMPACTS:

58% decrease in snowpack

WHICH MEANS

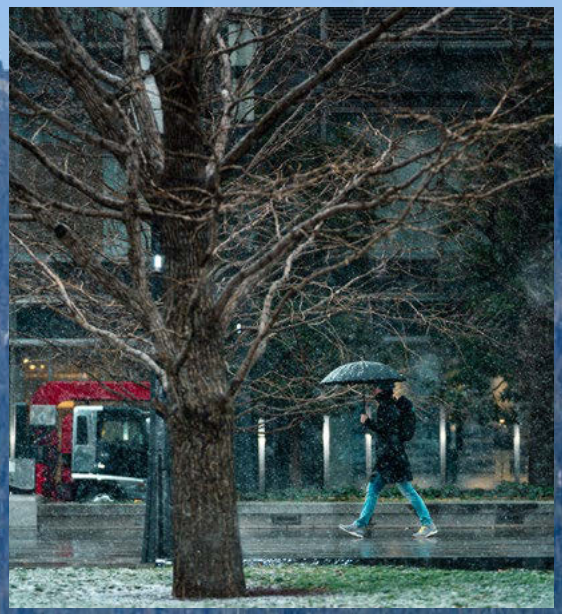
increased risk of summer drought

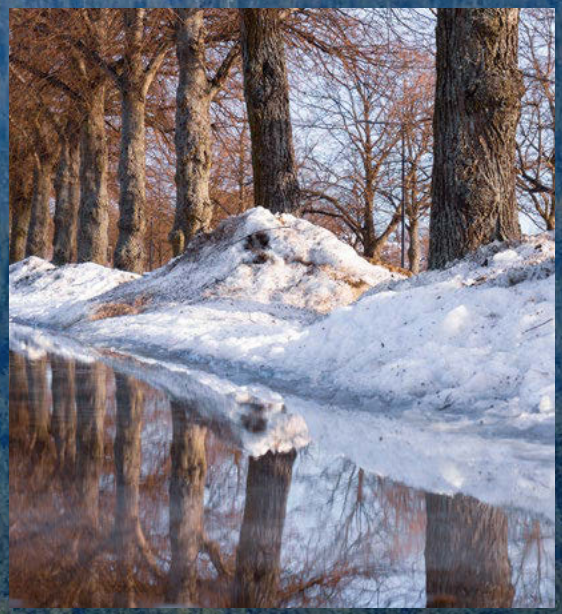
minimum temp goes up by 4.8°

29% reduction in home heating needs

increased risk of coastal flooding

because of king tides and stormy weather





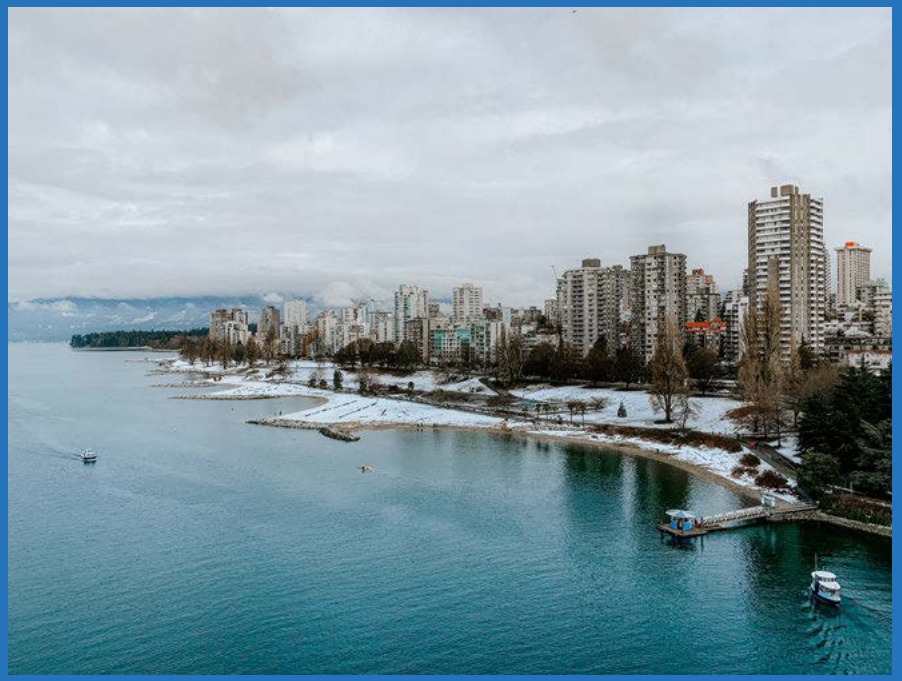
What to expect

Anticipated challenges and opportunities

- Increased frequency and intensity of rainfall may cause flooding, damaging public and private buildings and infrastructure.
- Increased frequency and intensity of rainfall may cause an increase in the number of sewer backups.
- Longer growing seasons provide the opportunity to grow more food.
- Warmer winters mean lower heating bills (may be offset by additional cooling bills in the summer).
- Warmer winters include more invasive species and pests.
- Higher risk of stream erosion and landslides due to heavier rain.
- More rain and less snow on the North Shore mountains may limit snow sport options and mean less water availability in reservoirs later in the summer.
- Increased "wild weather" and storms, in the short term, leading to power outages, infrastructure damage and safety risks.

What you can do to prepare:

- Adopt a catch basin to help reduce localized street flooding.
- Reduce impervious surfaces to decrease the amount of runoff from your property.
- Install a rain barrel or rain garden to collect water for use during dry periods.
- Understand your flood risk and the insurance available.
- Prepare for flooding.
- Prepare to shelter in place as needed during storms.
- Plant a food garden.

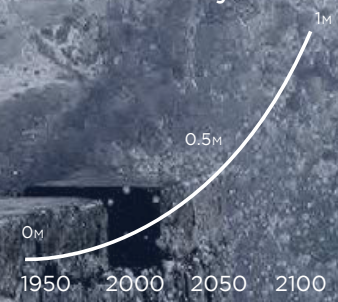


By the 2050s Vancouver will have

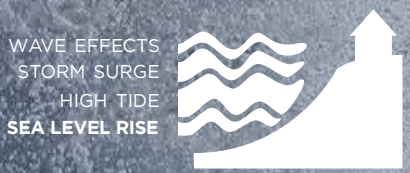
RISING SEA LEVELS

MAJOR IMPACTS:

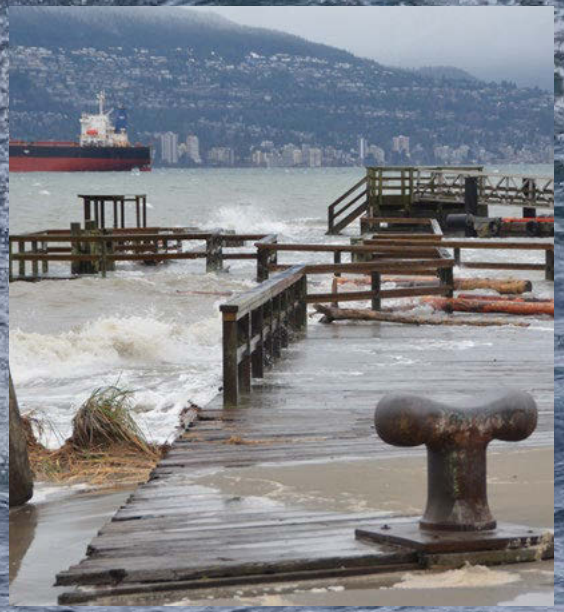
Sea levels may rise 0.5 metres by 2050



Sea level rise contributes to increased flood risk



Coastal habitat for birds and fish may shrink



What to expect

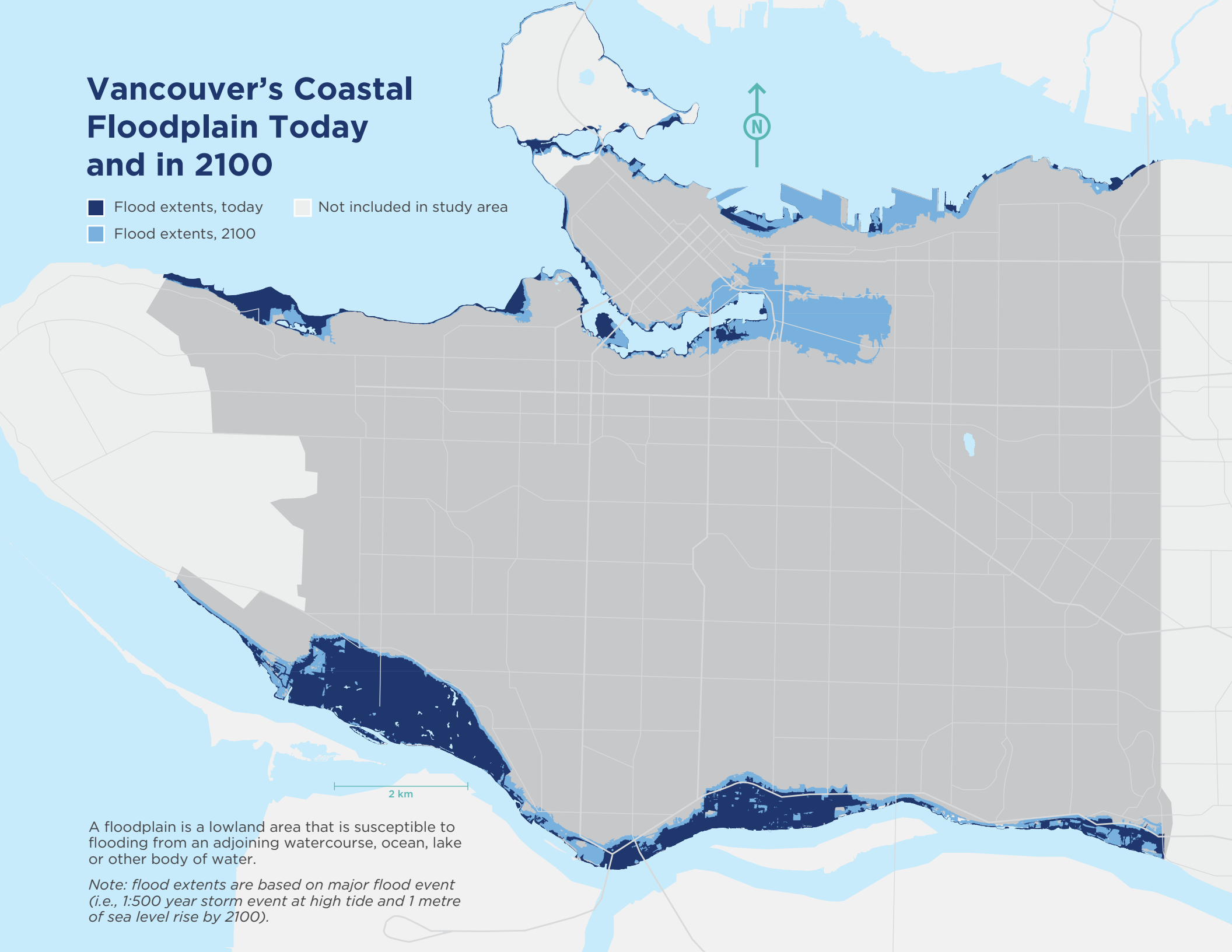
Anticipated challenges and opportunities

- Increased coastal and Fraser River flooding due to a combination of high winter tides, intense rains, and storm surge. Infrastructure, homes, parks, trails and habitat will be impacted.
- Long term risk of inundation of low-lying areas of the city and coastal squeeze of beach areas if no action is taken.
- As coastal flooding occurs, there will be more salt water impacts to shoreline habitat and vegetation as well as corrosion of infrastructure.
- Sea level rise will exacerbate drainage in low-lying areas, leading to more urban flooding.

What you can do to prepare:

- Get involved! Watch vancouver.ca/sealevelrise for updates on activities and events related to sea level rise.
- Understand coastal flood risk in the city.
- Understand building and development requirements for building on the floodplain (visit Land Use Development Policies and Guidelines).
- Investigate insurance products now available for flood hazard if you live in an at risk area.
- Prepare for flooding.

Vancouver's Coastal Floodplain Today and in 2100



A floodplain is a lowland area that is susceptible to flooding from an adjoining watercourse, ocean, lake or other body of water.

Note: flood extents are based on major flood event (i.e., 1:500 year storm event at high tide and 1 metre of sea level rise by 2100).

Other Preparedness Strategies

Social connection and celebration

- Block Parties
- On the Table
- Community Gardens
- Street Gardens
- Neighbourhood Book Exchanges
- Neighbourhood Walking Tours: see Janeswalk and Neighbour Lab for examples
- Parklets
- Outdoor Murals
- Buddy-Up Board
- Hey Neighbour

Some examples of groups and tools that support sustainability, preparedness and climate action at the neighbourhood level include:

- Neighbour Lab
- The Thingery
- Evergreen's Project Green Bloc
- Citizen's Coolkit on Climate Change and Urban Forestry
- Suzuki Elders
- Society Promoting Environmental Conservation

Personal and family preparedness

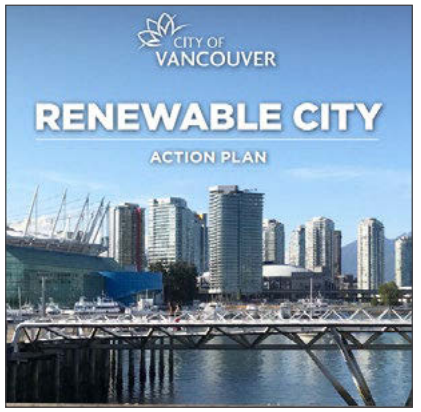
- Plan for an emergency with your family – Create a family plan so you and your family can stay together and stay safe during an earthquake or other emergency.
- Emergency planning for people with disabilities and special needs – Emergencies can present additional challenges for seniors and people with special needs. By planning ahead, you can be more confident about protecting yourself in any emergency.
- Pet emergency preparedness – Learn how to prepare your pets for an earthquake or other natural disaster in Vancouver.
- Vehicle emergency preparedness – Learn how to drive safely in a disaster. Assemble a vehicle emergency kit.
- Identify possible hazards in your home – Learn to identify and remove potential hazards in your home, so you stay safe during an earthquake or other disaster.
- Prepare your home for an earthquake – Follow these simple tips to keep yourself, your belongings, and your home safe during an earthquake.
- Make an emergency kit – Learn to make evacuation and emergency supply kits, and be self-sufficient for up to three days during an emergency.
- Emergency food, water, and sanitation – Learn how to store the food and water you and your family will need if they are not readily available after an emergency.

Introduction

Street flooding during heavy rains and heat during the summer are not new challenges in Vancouver, and we have strategies for responding to them. However, climate change will shift the frequency, intensity, and timing of these events, and what we now consider an extreme event will become the new normal. As well, new impacts are being experienced, such as longer summer dry periods, sea level rise, and poor summer air quality. Preparing communities for the coming changes in climate, especially those communities that are predisposed to greater impacts due to systemic vulnerabilities and inequities (frontline communities) has also become more imperative.

In 2016, the Global Economic Forum rated failure of climate mitigation and adaptation as the highest global risk above water crises and large-scale involuntary migration and it has been ranked high-risk since then. A key message in the October 2018 Intergovernmental Panel on Climate Change (IPCC) special report[3] was that we are already seeing changes such as increased extreme weather, diminishing Arctic sea ice, sea level rise, etc., as a result of the 1°C temperature rise over pre-industrial levels. Limiting temperature rise to 1.5°C through climate change mitigation efforts such as energy efficient buildings and low carbon transportation options is more important than ever.

Vancouver's Greenest City Action Plan and Renewable City Action Plan are two examples of initiatives working to reduce the city's contribution to global climate change. These initiatives will change how we build, heat, and power buildings, as well as change how we get around. These actions will reduce our greenhouse gases. The Renewable City Action Plan targets a transition to 100 per cent renewable energy and an 80 per cent reduction in carbon pollution by 2050. Canada's Changing Climate Report released in April 2019 states that even at the lowest future emissions scenario, warming is unavoidable and so adaptation is a required complement to mitigation.



The City of Vancouver formalized a plan to prepare and adapt to climate change – the Climate Change Adaptation Strategy adopted by City Council in 2012. The Strategy's vision focuses on a livable and prosperous city in the face of increasing climate shocks and stresses. All nine priority actions and the supporting actions are underway or have been completed.

[3]IPCC, 2018: Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

Continuous learning and re-navigation is essential for adaptation planning given the underpinning of uncertainty and extended timelines prevalent with many climate drivers and impacts. What follows is an update to the 2012 Climate Change Adaptation Strategy based on new climate science, advances made by the City, a changing policy landscape, and best practices applied in peer cities. The refreshed strategy includes a new action plan to be initiated between 2018 and the next refresh in 2023. In Vancouver - since the last iteration of the strategy, we have experienced king tide flooding, heavy rainfall causing street flooding and drier than normal summers with consistent air pollution advisories due to forest fires burning outside the region.

We have also seen adaptation strategies implemented by cities and partners around the region, including Metro Vancouver.

This City's updated strategy focuses on both the direct actions that will improve the climate resilience of city infrastructure, buildings, green spaces and communities (Core Actions), and on the actions required to build capacity and enable continued integration of adaptation into daily business and decision-making (Enabling Actions). In other words - not just the "what" but also the "how" – institutionalizing the capacity to do adaptation planning.

Changes Since 2012

Vancouver's Climate Context

Since the first Adaptation Strategy was adopted in 2012, Vancouver has experienced several climate-related shocks and numerous stresses. A few examples include:

- In December 2012, a one in 50-year return period storm coincided with one of the highest tides of the year (king tide). Rare flooding occurred along the coastline including seawater inundating Kitsilano Pool and the Jericho Sailing Centre. The levels reached by the water during this flood event are a foreshadowing of where everyday high tide levels may be in the future with sea level rise.
- On July 5, 2015, very high levels of fine particles were measured in Metro Vancouver air due to smoke from wildfires outside the region. Fine particulate matter reached 300 ug/m^3. Normal levels are less than 15 ug/m^3. In total, wildfire smoke degraded air quality for eight days during the summer of 2015, an unprecedented total of 19 days in 2017 and 22 days in 2018.
- The BC Centre for Disease Control collected data illustrating some of the health impacts associated with increased air pollution. Daily doctor visits for asthma and prescriptions filled for Ventolin (asthma relief medication) increased to far above average numbers coincidental with the poor air quality days. Significant health impacts were reported among populations more sensitive to heat impacts.
- Drought predominated three of the last four summers. 2015 was the most significant drought of recent memory with very dry, and extremely dry conditions on the South Coast between the end of June and end of August. In 2017, we experienced a delayed drought from the beginning of August to mid-October and in 2018 very dry conditions prevailed between the end of July and beginning of September.

On August 29, 2015 a rain and windstorm caused the single largest power outage in BC Hydro's history affecting half of their customers. The power remained out for several days for many residents of Metro Vancouver.

Local Climate Change Projections

In 2013, the Intergovernmental Panel on Climate Change (IPCC) released new Representative Concentration Pathways (RCPs), which describe four future scenarios for greenhouse gas emissions for the purposes of application in climate research and modelling.

Pacific Climate Impacts Consortium (PCIC) at the University of Victoria downscaled the climate data for Vancouver averaging across 12 global climate models. The projections presented are the anticipated changes in the 2041 to 2070 (2050s) time range relative to the baseline time range (1971-2000).

The models used the IPCC highest emissions scenario RCP 8.5 which is recognized as best reflecting our current global trajectory. Recent commitments, including the 2015 COP21 Paris Agreement, correspond with the IPCC's lowest scenario (RCP 2.6). This scenario requires substantial and sustained reductions of greenhouse gas emissions that we are not yet seeing (e.g., extensive adoption of biofuels and vegetarianism along with carbon capture and storage needs to occur to achieve RCP 2.6). It is prudent to plan for RCP 8.5 until global mitigation actions begin to catch up with commitments.

Hotter, drier summers: It is anticipated that there will be more than a doubling in the number of summer days above 25°C to about 43 days per year in the 2050s. Days above 30°C that happen once a year now will happen 12 times per year. The hottest days will be about 4°C hotter. Summers will have an average 19 per cent decrease in precipitation and 23 per cent increase in consecutive dry days. Summer temperatures are expected to drive greater cooling requirements to 250 degree days per year by 2050. In comparison, this is about 25 per cent more than Portland, Oregon's historical average.

Warmer, wetter winters: The 2050s will see a modest increase in winter precipitation with the largest increase of 12 per cent coming in the fall. However, extreme rainfall events are expected to become increasingly common and intense with 33 per cent more rain on very wet days and 63 per cent more rain on extremely wet days. Rare rain events that occur an average of one in every 20 years now are projected to increase in intensity by 36 per cent. The coldest winter nights will become almost five degrees warmer. For our region's water supply watersheds as a whole, the April 1 snowpack is projected to decrease by 58 per cent.

Sea level rise: Projections for sea level rise vary widely after the year 2050 from sixty centimetres over current levels to more than six metres over current levels by 2100. The Province of B.C. currently recommends using half a metre for planning to 2050, one metre to 2100 and two metres to 2200. The largest uncertainty in 21st century sea level projections stems from possible collapse of the West Antarctic Ice sheet. The provincial recommendations are expected to be updated in 2022 based on the most current IPCC report.

Review of Impacts

The table below provides a reminder of some of the anticipated impacts Vancouver may face as a result of the projected climate changes discussed above.

Table 2. *Examples of Climate Change Impacts in Vancouver*

	Hotter, drier summers (including higher frequency and intensity of heat waves)	Warmer, wetter winters (including higher frequency and intensity of rain and storms)	Sea level rise
Human Systems (Community)	• Increased health and safety risks, especially to frontline communities during extreme heat events and air quality events • Water supply shortages felt in late summer due to a decreased spring snow pack and higher summer temperatures could result in increased costs for water and imperative conservation measures • Decreased thermal comfort in buildings in the summer due to lack of air conditioning or increasing electricity costs with air conditioning	• Increased health and safety risks for frontline communities including those in lower quality housing, homeless population and seniors • Increases in private property sewer back-ups in combined sewer areas due to high rainfall volume in sewer system • Increased costs for response actions and clean-up after heavy rain events • Reduced energy use to heat buildings • Increasing vectors for disease	• Increased flooding along the coast and Fraser River as sea level rises and the storm surge and waves breach height of land • Gradual inundation of low lying land along the coast and the Fraser River • Increasing costs of flood insurance where available for floodplain areas
Natural Systems	• Increased tree loss, especially newly planted trees due to drought • Changing invasive plants and pests affecting existing ecosystems and the services they provide • Water quality affected by temperature and increased combined sewer overflow from heavy rain events	• Increase in impacts to urban forests, green spaces and trees from temperature extremes and wind storms resulting in increased maintenance and replacement costs and changes to aesthetics and use	• Increase in shoreline erosion affecting natural environment and public amenities such as parks, trails and access to the water • Shoreline habitat squeeze resulting from rising water and hard infrastructure solutions (dikes)
Built Environment (Buildings and Infrastructure)	• New and existing buildings may be maladapted as the climate changes in terms of thermal comfort, water ingress, wind durability, rain on snow loads, etc. • Increasing stress on green infrastructure in the summer time	• Increased duration and occurrence of power outages causing impacts to interdependent systems • Increased surface water flooding from ponding of rainfall in low lying areas or heavy rainfall overcoming the capacity of drainage system • Increase in landslide risk affecting public infrastructure and private property • Increased volume of third party liability claims against the city from major rain events	• Increased damage to structures (seawalls) and shoreline resulting in greater discontinuity of use • Reduced gravity drainage of the existing drainage system, resulting in more frequent back-ups and localized flooding • Saltwater intrusion in built up areas affecting the longevity of underground infrastructure and pump stations

Changing Policy Landscape

Vancouver's 2012 Climate Change Adaptation Strategy was the first of its kind in Canadian municipal adaptation. In six years, the landscape has quickly evolved to include adaptation planning throughout all levels of government. Related changes have also been initiated in the Canadian insurance industry and municipal bond market.

Internationally, the Paris Agreement signed in 2015, strengthened the adaptation pillar of climate change calling for stronger adaptation commitments from governments and transparent mechanisms to assess adaptation progress. The United Nations Sustainable Development Goals, 2015, include taking urgent action to combat climate change and its impacts. The 2017 UN New Urban Agenda which directs efforts around urbanization for a wide range of actors also includes measures to increase climate change adaptation efforts.

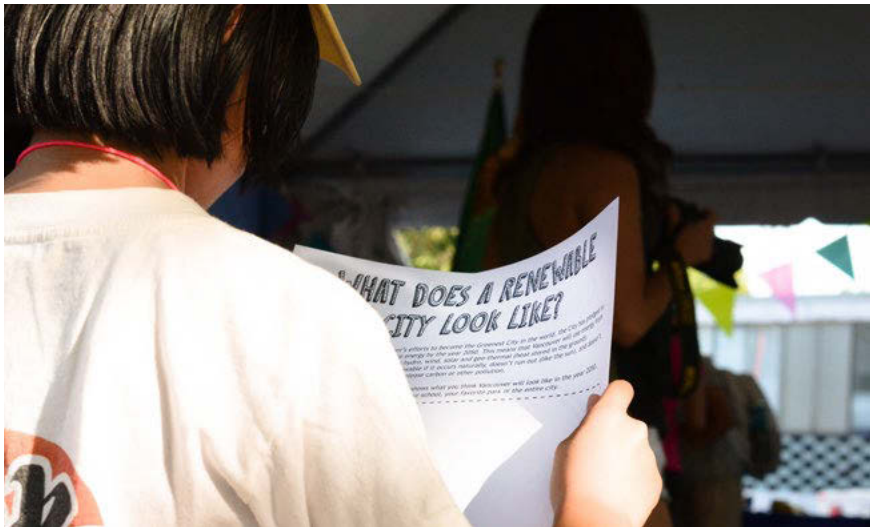
The Pan-Canadian Framework on Clean Growth and Climate Change was developed in 2015 with a focus on resilient infrastructure; building design and development; health impacts from climate change; and areas particularly vulnerable to climate change such as the coasts. The objective of the Framework is to help Canadians understand the impacts climate change has on their quality of life and assist them to develop the necessary tools to adapt effectively.

The BC Government published the B.C. Climate Leadership Plan in 2016 which included mandating 10-year adaptation plans for public sector operations and supporting more resilient infrastructure. In 2018, the Auditor General's report on B.C.'s adaptation efforts was released with a failing grade and strong recommendations for supporting local government adaptation efforts. The three biggest climate hazards for B.C. were identified as flood, wildfire and drought.

Metro Vancouver is developing the Climate 2050 Strategic Plan[5] that sets out a 30-year vision and goals for Metro Vancouver's climate policy and actions. The 'issues area roadmap' includes three issue areas relating to adapting to climate change: Nature and Ecosystems; Infrastructure; and Health, Safety and Emergency Management. Land use, growth management, and agriculture cut across mitigation and adaptation themes.

The insurance industry in Canada has not historically issued residential overland flood insurance – flooding from extreme rainfall, or a river or ocean flooding dry land. Sewer back-ups have generally been covered. With heavier rainfall, changing freshet timing, and sea level rise, the insurance industry has recently started issuing flood insurance. As this field matures, it can be expected to have far reaching implications for adaptation actions.

In April 2019, the City of Vancouver was the first municipality in Canada to follow the Task Force on Climate-related Financial Disclosure's guidelines and disclose climate-related risks in the 2018 Statement of Financial Information.



[5]*Climate 2050 Strategic Framework (Sept 2018) is available on Metro Vancouver's website.*

In Vancouver

Vancouver is recognized internationally for efforts in sustainability implemented through the Greenest City Action Plan (GCAP) and for climate action. The Climate Emergency Response outlines the City's ambitious targets to derive 100 per cent of the energy used in Vancouver from renewables sources, and to achieve community-wide carbon neutrality, both before 2050.

This Adaptation Strategy specifically addresses how the City can better offer services, build and maintain infrastructure, and design programs and policies that take advantage of, or prepare for the anticipated high risk climate change related impacts. The Strategy relies on a range of existing City and community strategies and plans that aim to improve the overall resilience of the community to shocks and stresses, and to address inequities and systemic vulnerabilities that challenge resilience.

The Adaptation Strategy is intrinsically linked to a web of programs and plans that exist or are under development. Governance supporting the institutionalization of climate change adaptation will ensure it is embedded as a foundational consideration and integrated across plans.

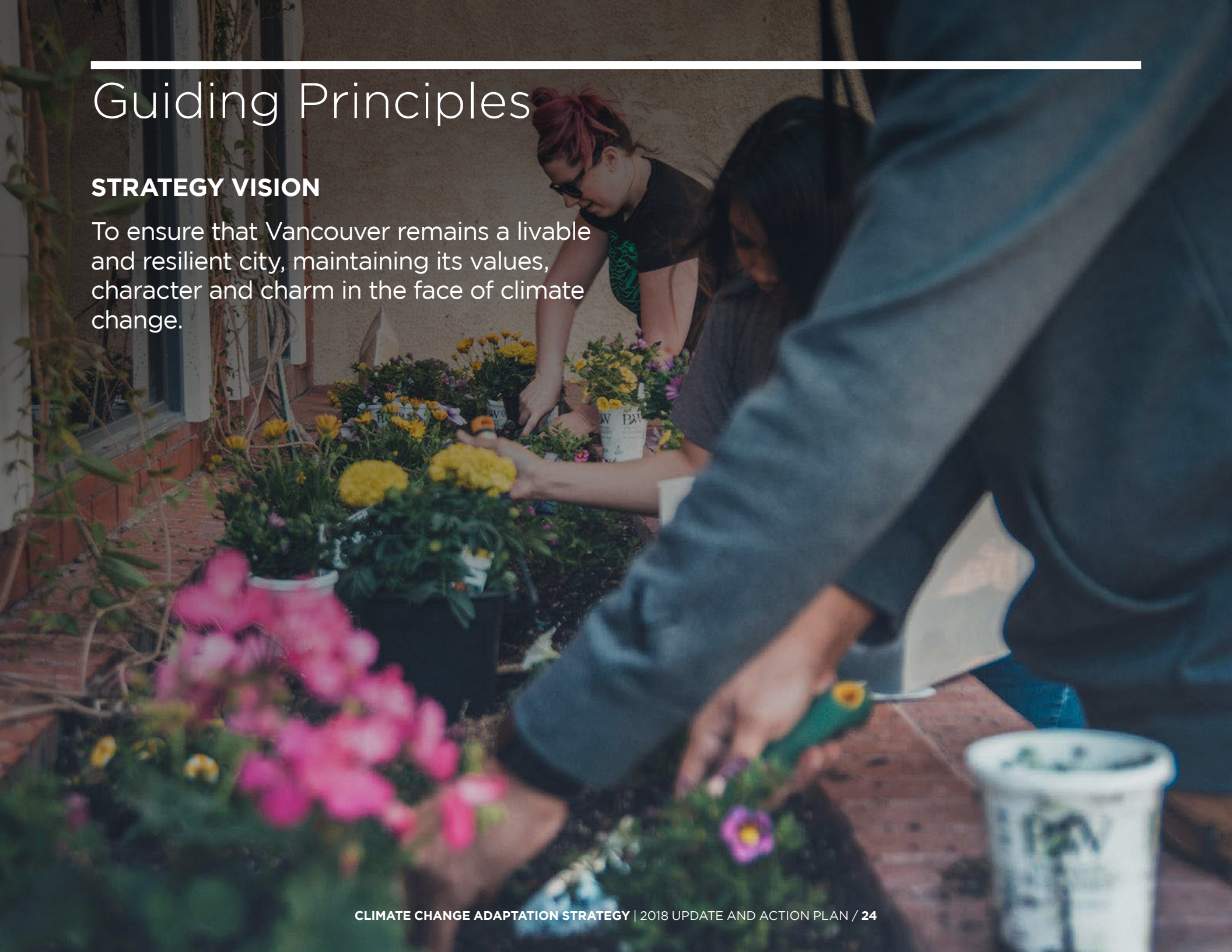
Table 3. *Example of the Integration of Various Vancouver Plans and Programs (by Kari Dow)*

Greenest City Action Plan	Resilient City Strategy	Healthy City Strategy
Zero Emissions Building Plan	Resilient Neighbourhoods Program	Housing Vancouver
Green Building Policy for Rezonings	Resilient Neighourhood Design	A City of Reconciliation
Renewable City Strategy	Climate Change Adaptation Strategy	Creative City
Electric Vehicle Ecosystem Strategy	Coastal Flood Risk Assessment	Major's Task Force on Mental Health and Addictions
Rezoning Policy for Sustainable Large Developments	Earthquake Preparedness Strategy	Mayor's Engaged City Task Force
Rain City Strategy	Disaster Support Hub Initiative	Social Infrastructure Plan
Water Conservation Strategy		Vancouver Economic Action Plan
Biodiversity Strategy		
VanPlay		
Transportation 2040		

Guiding Principles

STRATEGY VISION

To ensure that Vancouver remains a livable and resilient city, maintaining its values, character and charm in the face of climate change.



GUIDING PRINCIPLES

- **Evidence-based:** Use the best, most up-to date science available
- **Adaptable:** Promote flexible and adaptive management approaches that leave a range of future options available
- **Integrated:** Give priority to adaptation strategies that build on existing programs or policies and provide co-benefits with other community priorities
- **Relevant and transparent:** Collaborate with community partners
- **Comprehensive:** Mainstream adaptation into day-to-day City business
- **Equitable or fair:** Prioritize equitable outcomes

GOALS

- Integrate a climate change adaptation lens into local policies, strategies and planning
- Improve climate resilience of built systems, natural systems and human systems
- Improve awareness, knowledge, skills and resources of City staff – enhancing capacity for transformative change
- Enhance opportunities for coordination and cooperation through the development of networks and partnerships

OBJECTIVES

- Maximize climate resilience of infrastructure and buildings
- With a focus on equity, minimize the health and safety impacts of climate change on communities and maximize their preparedness
- Maximize the health and vigor of natural systems in the face of climate change
- Develop shoreline resilience to sea level rise and storm surge
- Maximize enabling factors within the organization that build adaptive capacity

Achievements (but there is more to do)

Strong initial steps have been taken in Vancouver to prepare for the impacts of climate change but continued momentum is needed.

The 2012 Adaptation Strategy is responsible for, or became the main driver of, the implementation of over 50 actions across the city, increasing our preparedness for climate change. Beyond specific Strategy actions, consideration of adaptation to climate change has been incorporated in diverse projects ranging from the technical detail of new wharf designs to climate resilience principles in community plans. Slowly but steadily over the last six years, the knowledge and capacity to include adaptation in day-to-day work (mainstreaming) is increasing, but there is still far more we can do. Celebrating our achievements, we highlight a few actions here; coastal flood risk assesment, rainwater management and the Urban Forest Strategy.

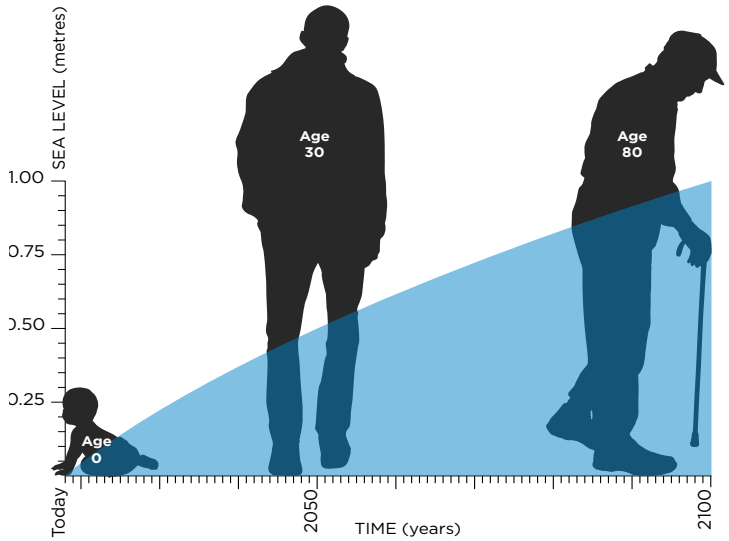
Coastal Flood Risk Assessment

Vancouver is not alone in facing the challenges of sea level rise and coastal flooding. According to the United Nations, about 40 per cent of the world's population lives within 100 kilometres of the coastline. As a result, coastal cities and communities all over the world are increasingly vulnerable to flooding and shoreline erosion.

Vancouver's sea level rise program is a multi-phase undertaking to determine the risk and vulnerability of Vancouver to future sea level rise and storm surge scenarios. Trying to anticipate the hazards of future flooding is a complex and technically challenging undertaking. Our sea level rise program first modelled different sea level rise scenarios with a corresponding range of potential storm surge events (i.e., different intensities of storms) for different periods in the future. This work helped us to better understand our flood risks and associated vulnerabilities by establishing flood hazard zones.

The second phase of the city's sea level rise work, researched a variety of potential solutions and adaptation options for each of the identified flood hazard zones. Future phases will begin throughout 2019, and will refine emerging options with the public, local communities, experts and city staff (see below).

Figure 1. *Projected Sea Level Rise*



2012 - 2014 ····· VULNERABILITY ASSESSMENT
· Flood hazard areas identified

2014 - 2016 ····· PRELIMINARY ADAPTATION OPTIONS
· Adaptation options identified for each flood hazard area

2014 ····· FLOOD CONSTRUCTION LEVEL
· A new flood construction level is adopted for the floodplain area

2017 - 2019 ····· ENGAGEMENT & EARLY ACTIONS
· Beginning with areas most at risk, collaborate with the community on design options and first steps

2020 - beyond ····· DESIGN CONVERSATIONS
· Technical analysis and feasibility
· Community input
· Implementation

This work will be undertaken through a design challenge process focused on the Fraser River shoreline and False Creek, as these are the two largest flood-vulnerable areas in the city. There will be multiple opportunities for public engagement to shape this work. Although the timeline for visible sea level rise impacts appears long, Vancouver is taking action now through community planning, capital planning, City operations and maintenance work.

Some actions include:

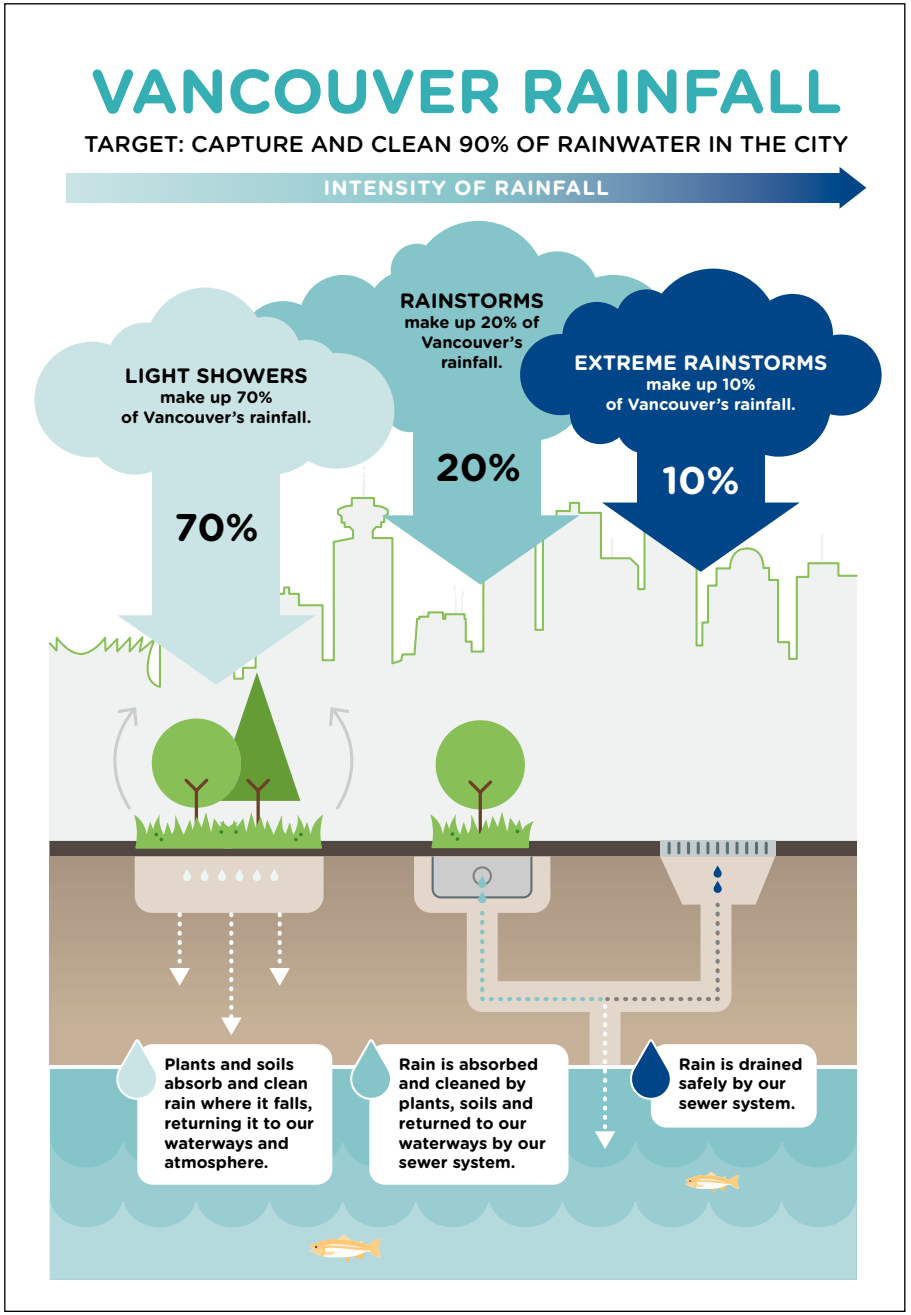
- Incorporating flood-resilient design standards into the Vancouver Building By-law for flood hazard areas.
- Regulating sub-division and development located in at-risk areas to avoid increasing flooding vulnerability.
- Minimizing the construction of City-owned critical infrastructure in at-risk areas.
- Raising the physical height of City utilities (e.g., roads, water, sewers) during regularly planned infrastructure renewal projects.

Rainwater Management

Vancouver is known for its rainfall and unfortunately more rain is expected with climate change (heavy rain events become 35 per cent more intense in Vancouver by 2050). The 2012 Adaptation Strategy prioritized developing a city-wide Integrated Rainwater Management Plan (IRMP) with an adaptation lens. This work influenced changes to the City's sewer design and formation of a new "Green Infrastructure" team to create and implement the Rain City Strategy. The Rain City Strategy reimagines and transforms how we manage rainwater with the goals of improving water quality, resilience, and livability through creating healthy urban ecosystems. The strategy will implement sustainable rainwater management across the city with a goal of using rainwater as a resource rather than a waste product.

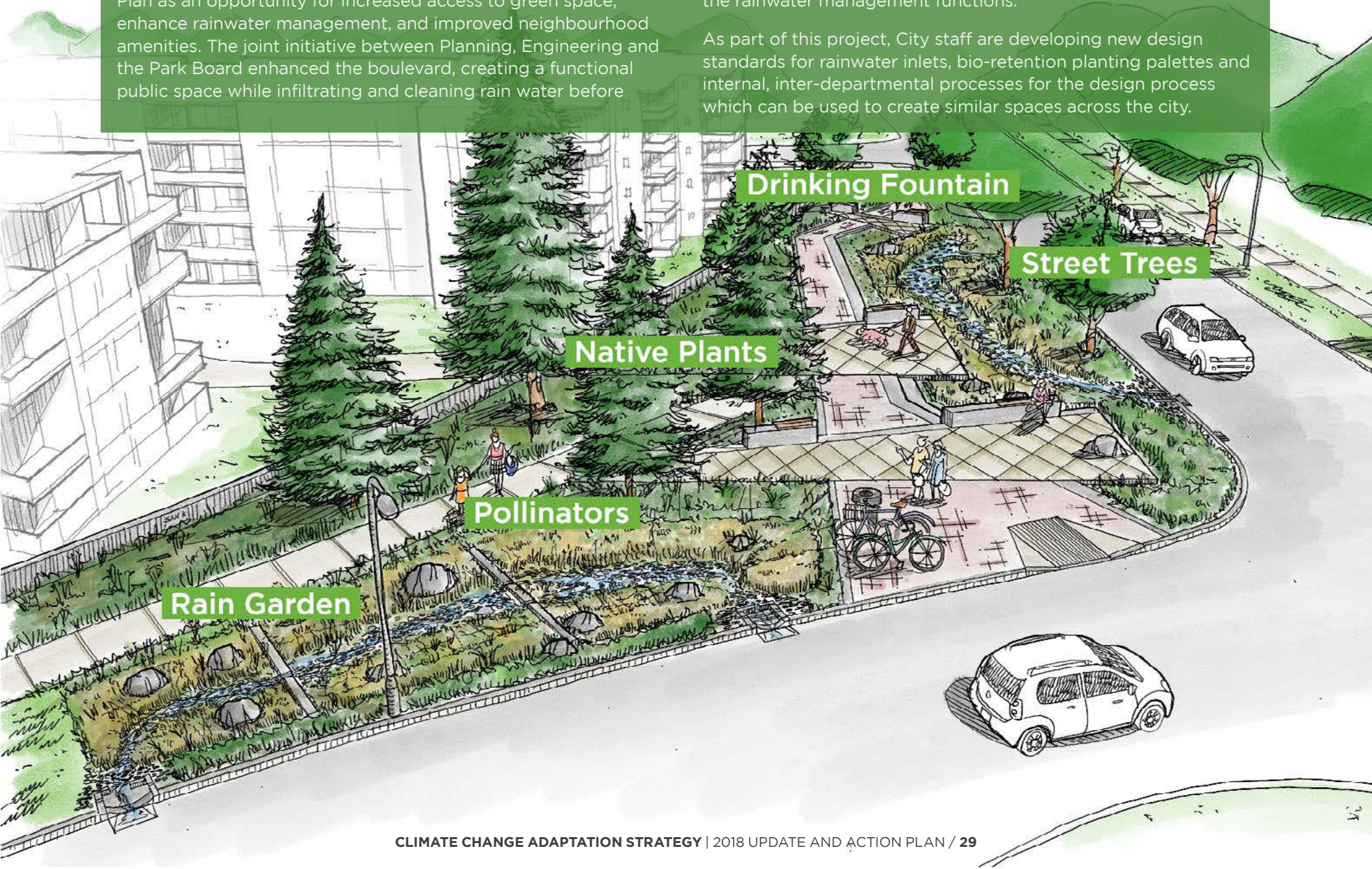
- Vancouver was one of the first municipalities to integrate climate change projections into the intensity, duration, frequency (IDF) curves used to design stormwater management systems. The standard available curves are based on historical data, yet the systems built today will experience quite different precipitation patterns including increased frequency and intensity of rainfall. Vancouver's curves were updated to reflect current data and future-cast to take into account precipitation projections to the 2050s and beyond.
- In October 2017, Vancouver launched the Adopt a Catch Basin Program to empower Vancouver residents to name one or more of the city's 45,000 catch basins and commit to keeping it free of leaves and debris. The goal was the adoption of 1,000 basins which was achieved within three weeks with over 600 volunteers. The key messages of the program are to help protect the environment, minimize flooding, and support a healthy, vibrant and clean Vancouver.

ADOPT a CATCH BASIN



An example of the Rain City Strategy is the sustainable urban rainwater management project located at 63rd Avenue and Yukon Street. This area was identified in the Marpole Community Plan as an opportunity for increased access to green space, enhance rainwater management, and improved neighbourhood amenities. The joint initiative between Planning, Engineering and the Park Board enhanced the boulevard, creating a functional public space while infiltrating and cleaning rain water before returning it to our waterways. The project also includes bike racks, a public water fountain and utilized a variety of native, non-native and pollinators species in the landscape in addition to the rainwater management functions.

As part of this project, City staff are developing new design standards for rainwater inlets, bio-retention planting palettes and internal, inter-departmental processes for the design process which can be used to create similar spaces across the city.



Urban Forest Strategy

Another priority action of the 2012 Adaptation Strategy was the development and implementation of the Urban Forest Strategy (UFS). The initial strategy was presented to Council in 2014 with the action plan adopted in May 2018. The plan includes a range of actions to reduce the urban heat island effect and ensure urban forests continue to provide ecosystem services including cleaning the air, absorbing rain water, providing bird habitat and improving social health and well-being.

The UFS changed the Protection of Trees By-law extending conditions which required permits for tree removal on private property. This was an important action to support the increase of city-wide canopy cover.

An example of an equity lens applied to climate adaptation is the UFS Action Plan's target neighbourhoods for doubling tree density. Health Canada funded a project by Simon Fraser University to identify where high population vulnerability to heat intersects with areas of high surface and air temperatures. Three neighbourhoods were identified for priority tree planting – those with low tree density, high temperatures and high vulnerability to heat.

Building on Our Approach - New Focus

Compared to the state of practice in 2011 when the first plan was developed, climate change adaptation planning is now well established at the local government level. Surveys of both Canadian[6] and American[7] government adaptation practitioners, as well as the recent Auditor General's report on British Columbia's climate adaptation progress, report that while plans and methods abound, greater implementation and capacity building are the necessary next steps. These assessments include recommendations such as taking an integrated approach and mainstreaming adaptation into existing tools and planning. Successful adaptation also requires governments to establish a continuous learning and implementing cycle and governance that supports good mainstreaming and integration.

[6]Adams, S. et. al. 2016. Regional Governance for Climate Action. Institute for Sustainable Communities. http://icleicanada.org/images/Making_Strides_on_Community_Adaptation_Final.pdf
[7]Vogel, J. et. Al. 2016. Climate Adaptation The State of Practice in U.S. Communities. The Kresge Foundation http://www.bcauditor.com/pubs/2018/managing-climate-change-risks-independent-audit

Enabling Actions

A learning from implementation of the 2012 Strategy is that enabling factors are required to change how we do things, not just what we do. Adaptation is not a one-off effort but requires building the capacity within a given organization and community to continue learning, collaborating and innovating over years.

The adaptation community is increasingly referring to transformational adaptation versus incremental adaptation. The 2012 Strategy included many incremental actions (doing things better with existing logic) such as choosing different tree species to plant or continuing to separate the sewer system. More transformational adaptation requires reframing problems and practices to understand them from a new or different perspective. For example, reconsidering the coastline as potentially hazardous or using a fit-for-use lens in water supply management. These shifts require a change in how we do things from work culture to capacity building.

A clear example of moving from incremental to transformational adaptation is taking place in Vancouver as we move from traditional grey infrastructure solutions to fully integrated grey and green infrastructure combinations through the Rain City Strategy. This shift requires more than implementing rain gardens and infiltration bulges within the existing drainage system. It necessitates a new way of thinking about, and modeling water flow in the city. New working partnerships, staff capacity and early resources are needed to create the setting for a successful shift.

Elements that enable moving from incremental to transformational actions include: the capacity for systemic inquiry, leadership, and learning from practice; and governance systems that emphasize integration, flexibility, monitoring, continual learning and knowledge sharing[8, 9].

[8]*The International Institute for Sustainable Development and the University of Winnipeg, 2017. Building a Climate Resilient City: Transformational Adaptation.*
[9]*VUKCIP: https://www.ukcip.org.uk/*

Integration of Climate Adaptation with Other City Efforts

The Resilient Vancouver Strategy adopted in April 2019 overlaps with climate adaptation efforts. The Resilience strategy defines resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience." The term "shocks and stresses" is used to encompass both one-off events such as an earthquake and ongoing stressors, such as poverty. While climate adaptation work focuses on climate-related shocks (windstorm) and stresses (hotter, drier summers), integration with the Resilient Vancouver Strategy offers opportunities for co-benefits and synergies that increase the overall resilience of the city.

In addition to close integration with the Resilient Vancouver Strategy, low carbon resilience (LCR) must be a focus moving forward. LCR refers to climate change strategies that "integrate and achieve co-benefits between carbon pollution reductions (mitigation) and planning designed to reduce vulnerability to climate change impacts (adaptation)"[10]. Co-beneficial actions are prioritized such as installing heat pumps for heating and cooling, heat recovery ventilators important for improving energy efficiency and improving indoor air quality, and increasing the health and area of natural assets. Through greater coordination and mainstreaming, adaptation and mitigation will become foundational considerations across City work.

Social, economic and environmental sustainability plans and policies are all linked to the vision and guiding principles of this Adaptation Strategy. Civic decision-making will benefit from increased integration and identification of projects that have co-benefits that contribute to multiple City goals and values. Wherever possible, Core and Enabling Actions in this Strategy promote work taking place under other banners that contribute to climate resilience. During implementation, all actions should be integrated with other City initiatives where possible.

Equity in Climate Adaptation

The City of Vancouver defines equality as the equal provision of services to all; equity is about providing equal access to opportunities and services or equal possession of basic needs, based on equal outcomes. In the climate change context, being part of a frontline community or equity seeking population should not translate to less resilience to climate change.

Climate change shocks and stresses do not affect all groups in the community equally. Frontline communities and those that have been affected by systemic vulnerabilities and inequities (including racialized communities/people of colour, lower income communities, immigrant and refugee communities, people with disabilities and older adults) are often at greater risk from the impacts of climate change and often have the fewest resources to respond. Those with existing health issues, young children and pregnant women can also have an increased risk to extreme events and poor air quality.

There are many Vancouver strategies that focus on alleviating the underlying conditions which make frontline communities more vulnerable to climate impacts. These strategies are very important to support resilience across the community. In the Adaptation Strategy, there is a focus on actions that reduce risk and enhance resilience for these frontline communities.

[10] *ACT, 2016. Low Carbon Resilience: Transformative Climate Change Planning for Canada.*

Adaptation Action Plan

Core Actions and Enabling Actions

The action plan is divided into Core and Enabling Actions.

Core actions come from the common adaptation process shown in the inner circle of Figure 2. They are the "what": actions we can take to continue to move toward climate resilient services, infrastructure and neighbourhoods. They are divided into the five categories listed on the following page.

Enabling actions are in the outer circle in the diagram. They are divided into four areas as shown.

Working on these two areas in parallel will support taking a more integrated, systemwide approach navigating toward more innovative city building and transformational adaptation.

Figure 2. *Action Plan Framework – Core Actions stem from the adaptation process in the internal circle and four categories of enabling actions support them.*

How The Plan Was Refreshed

In order to review and update the plan, two phases of work were carried out: review and gap analysis, and new action planning. The review phase included reviewing the best practices in adaptation globally, speaking with international colleagues and identifying areas where the City could strengthen its approach. With these gaps in hand, interviews were carried out with staff to develop actions to fill gaps. New action planning occurred across a variety of engagement styles including: a workshop with cross-departmental staff, one on one interviews and meetings with staff, and working with partners such as BC Housing and Vancouver Coastal Health.

Core Action Priorities

Priority actions for each category are included in this chapter with other actions found in Appendix A – Adaptation Actions.

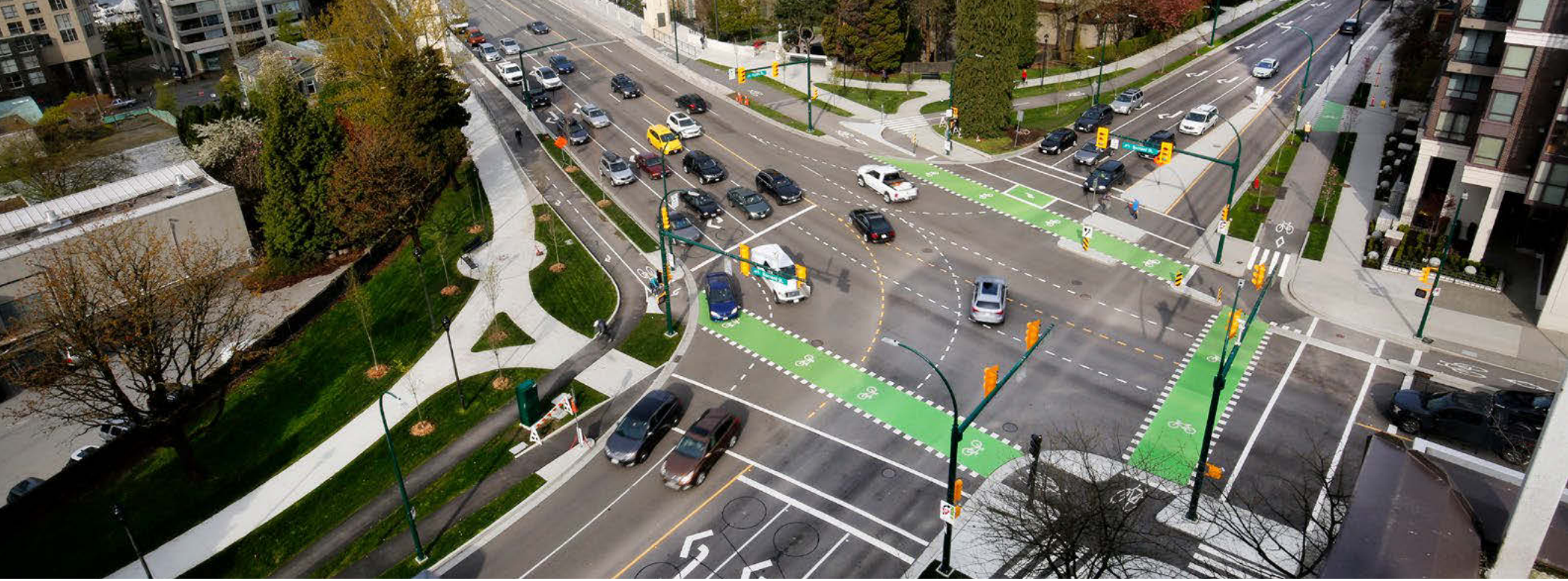
① **Climate Robust Infrastructure**

② **Climate Resilient Buildings**

③ **Healthy and Vigorous Natural Areas and Green Space**

④ **Connected and Prepared Communities**

⑤ **Coastline Preparedness**



1

Climate Robust Infrastructure

Infrastructure designed today will service significantly different conditions during its lifespan. Given the uncertainty associated with climate change, it makes sense to design robust infrastructure; able to function well across a range of future scenarios. The Pacific Climate Impacts Consortium (PCIC) has clearly shown in their research that even with uncertainty, designing with future projections in mind better predicts future conditions than using historical data. The City is moving towards holistic integrated infrastructure planning that will support enhanced systems resilience through redundancy and diversity and asset management that considers new risks such as climate change.

INTEGRATE WITH:

1) Critical Infrastructure Interdependency Analysis
2) Rain City Strategy
3) Engineering Integrated Utility Planning
4) Resilient Vancouver Strategy

SPECIFIC OBJECTIVES:

- Plan infrastructure to be robust across a range of future climate scenarios.
- Minimize unintended rainfall related flooding and consequences.

PRIORITY ACTIONS:

- Complete integrated modeling of water in the city (pipe system, surface water and groundwater).
- Prioritize watersheds to be modeled to support City objectives such as combined sewer overflow elimination, Rain City Strategy, growth planning and preliminary watershed assessments.
- Leverage modeling to complete overland flood route mapping and take an integrated approach to drainage systems including public realm, grey and green rainwater infrastructure systems, coastal flood protection, and parks.
- Complete comprehensive information gathering to support system modeling, catchment prioritization, and early implementation of the most effective, resilient water management actions (Rain City and Integrated Utility Management Planning). Early investment will ensure an option analysis of new approaches to servicing is timely.
- Utilize the current pipe system, green infrastructure and other rainfall storage strategies to attenuate water from catchments that drain into floodplain areas. The aim is to mitigate peak flows and total flow volume at the runoff source reducing stormwater draining to low lying areas. This will result in the appropriate timing and investment of stormwater pumping facilities.
- Continue water conservation and efficiency actions; develop regulations to support the use of alternative water sources including groundwater, graywater and blackwater for non-potable demand. The fit-for-purpose approach for water end-use will reduce pressure on the regional supply and delivery of treated drinking water.
- Undertake a drainage study of the low-lying Southlands area to include an assessment of the existing dike network and pump stations. Create a list of and recommend improvements for the drainage system as needed.
- Support the Resilient Vancouver Strategy development and implementation of an approach to define and analyze Vancouver's Critical Infrastructure. The Critical Infrastructure assessment will identify priority assets to risk manage, define a criticality framework and approach, and evaluate and test the approach.

2 Climate Resilient Buildings

Buildings are one of the main focuses of climate change mitigation action due to their high greenhouse gas emission production. New buildings are currently designed to higher energy efficiency and seismic standards. Regulations and policy are beginning to reflect design elements which increase climate resilience and general resilience for inhabitants. Our aim is to have the correct stock of climate resilient buildings in the future. This includes consideration of materials and systems but also the climate information used in design, the passive survivability of the building if the power is interrupted, back-up power, and how the building caters to community connections and sheltering in place. Retrofits of existing buildings can provide opportunities for co-beneficial climate adaptation upgrades.

INTEGRATE WITH:

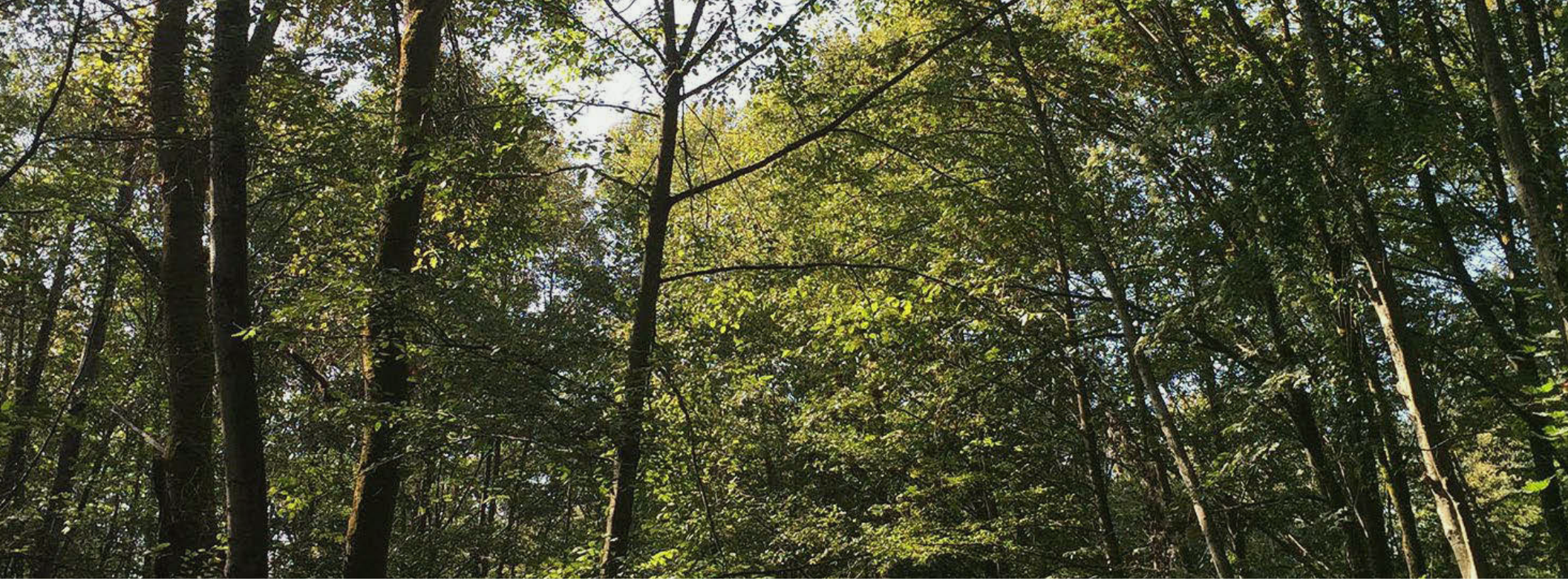
1) Green Buildings programs such as Zero Emissions Building Plan and Resilient Buildings
2) Renewable City Strategy
3) MBAR (BC Housing led Mobilizing Climate Adaptation and Resilience in Buildings Design and Renovations in B.C.)
4) Hey Neighbour Program

SPECIFIC OBJECTIVES:

- Design robust built form to do well in a range of climates while providing co-benefits such as seismic resilience, energy efficiency, accessibility, and supporting health and well-being.

PRIORITY ACTIONS:

- The upcoming Deep Retrofit Strategy (Renewable Buildings 2050) supports enhanced built form resilience in a number of important ways: low carbon cooling, improved envelopes and insulation, seismic upgrades and lowering fire risk. Address potential regulatory barriers through adjustment of requirements and process for existing buildings to support enhancement of resilience.
- Evaluate and integrate where possible new standards and guidelines from the Canadian Standards Association (CSA) and National Research Council (NRC) for enhanced resilience of buildings. Adopt the new climate loads into the Vancouver Building By-law when available (currently under review).
- Under the Zero Emissions Building Plan, new buildings without active cooling must meet new limits to prevent overheating. Heat pumps present an opportunity for all new buildings to provide active cooling at little or no incremental cost while also providing energy efficiency benefits. The City will explore ways to encourage the use of heat pumps, and to reduce cooling demand in new contruction.
- City staff will work with industry partners to refine and enhance the limits on overheating, and to develop more detailed guidance for industry, with the objective of maintaining year-round comfort in new buildings.
- The City's Energy Modelling Guidelines have been updated to reflect recent weather (1984-2014), and staff will work with the University of British Columbia on designing climate resilient Multiple Unit Residential Buildings (MURBS) project to explore using future projected weather data for building design and modelling. Staff will review the outputs of this project and develop recommendations on using future projections in building policy or bylaw.
- As part of the Zero Emissions Building Plan, staff will explore opportunities to use operational data from recently constructed buildings to inform future updates to building policy or bylaws.
- Continue as an active partner in the BC Housing - led Mobilizing Climate Adaptation and Resilience in Buildings Design and Renovations in BC (MBAR) project.



3

Healthy and Vigorous Natural Areas and Green Space

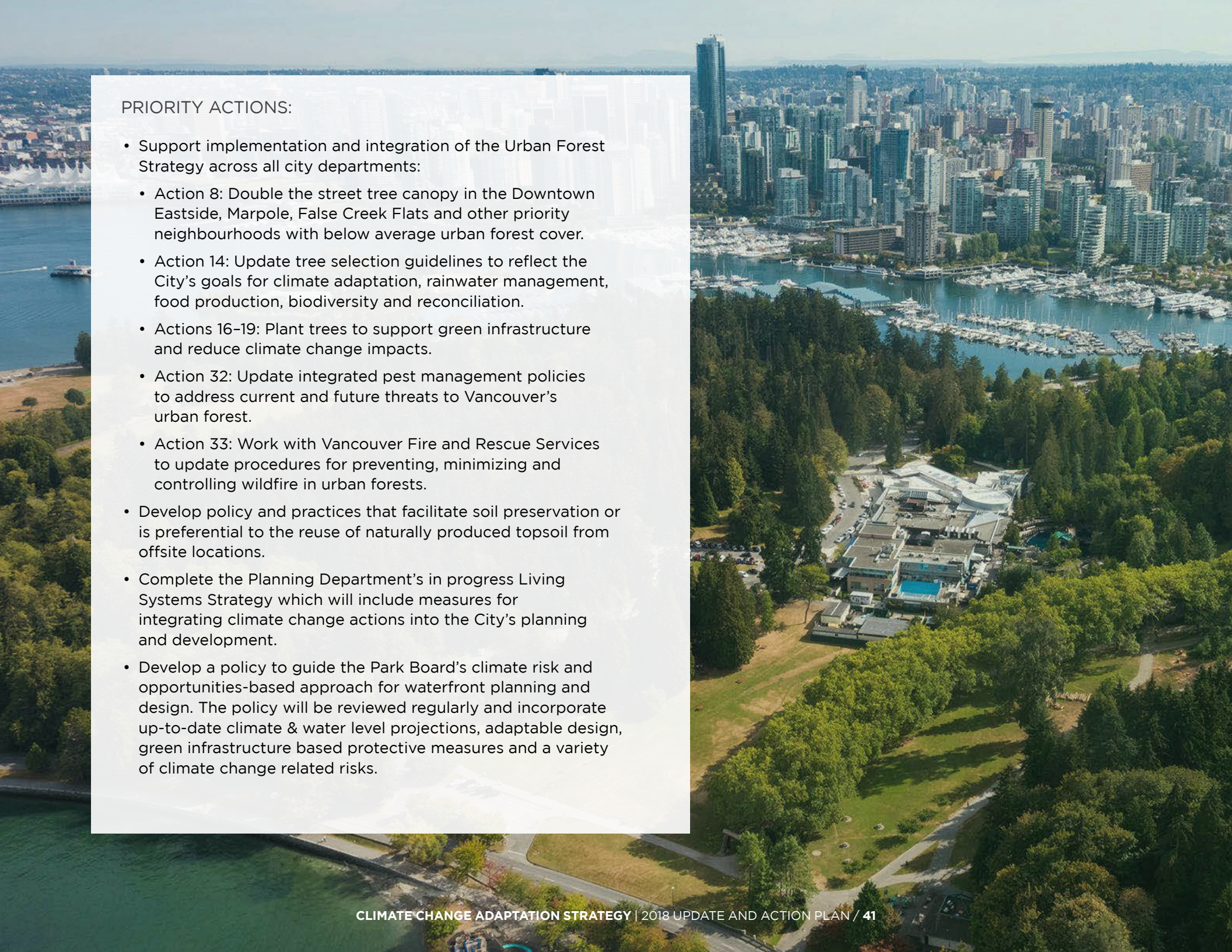
Our natural systems are garnering increasing focus given the ecosystem services they provide, including a role in climate change adaptation and mitigation. Natural assets can significantly reduce the urban heat island effect and they play a part in reducing stormwater runoff. Natural systems can also be used to help mitigate the impacts of climate change such as storm surge or provide detention areas for floodwaters. They are also threatened by more extreme weather, increased impacts to forest health and coastal squeeze.

INTEGRATE WITH:

1) Urban Forest Strategy
2) Rain City Strategy
3) Biodiversity Strategy
4) Living Systems Strategy
5) Coastal Flood Risk Assessment
6) Bird Strategy
7) Rewilding Vancouver
8) VanPlay – Vancouver Parks and Recreation Master Plan

SPECIFIC OBJECTIVES:

- Enhance the long-term health and vigor of blue spaces, green spaces, trees and biodiversity.
- Increase the canopy cover in the city.
- Improve water quality of local water bodies.



PRIORITY ACTIONS:

- Support implementation and integration of the Urban Forest Strategy across all city departments:
  - Action 8: Double the street tree canopy in the Downtown Eastside, Marpole, False Creek Flats and other priority neighbourhoods with below average urban forest cover.
  - Action 14: Update tree selection guidelines to reflect the City's goals for climate adaptation, rainwater management, food production, biodiversity and reconciliation.
  - Actions 16–19: Plant trees to support green infrastructure and reduce climate change impacts.
  - Action 32: Update integrated pest management policies to address current and future threats to Vancouver's urban forest.
  - Action 33: Work with Vancouver Fire and Rescue Services to update procedures for preventing, minimizing and controlling wildfire in urban forests.
- Develop policy and practices that facilitate soil preservation or is preferential to the reuse of naturally produced topsoil from offsite locations.
- Complete the Planning Department's in progress Living Systems Strategy which will include measures for integrating climate change actions into the City's planning and development.
- Develop a policy to guide the Park Board's climate risk and opportunities-based approach for waterfront planning and design. The policy will be reviewed regularly and incorporate up-to-date climate & water level projections, adaptable design, green infrastructure based protective measures and a variety of climate change related risks.

4 Connected and Prepared Communities

Climate change impacts will affect neighbourhoods and people differently, with varying levels of severity. All Vancouverites will benefit from prepared and connected communities. Isolated seniors, young children, those already affected by illness or those with lower means to recover from a severe event are more vulnerable. Social cohesion and connections within a community have been shown to be important for a number of wellness factors, including resilience.

INTEGRATE WITH:

1) Healthy City Strategy
2) Resilient Vancouver Strategy
3) Equity Framework (Poverty Reduction Strategy)
4) Resilient Neighbourhoods Pilot Program
5) Hey Neighbour Program
6) Housing and Homelessness Strategy
7) Disaster Support Hub Initiative
8) Business and Employer Emergency Preparedness program (BEEP)
9) Vancouver Volunteer Corps
10) Neighbourhood Emergency Preparedness Program

SPECIFIC OBJECTIVES:

- With a focus on equity; minimize the negative health and safety impacts of climate change on communities and maximize their preparedness.

PRIORITY ACTIONS:

- Work with Vancouver Coastal Health (VCH), BC Housing, social housing providers and others partners to develop short-term and longer-term strategies for health and safety during heat waves in non-market housing and the surrounding neighbourhoods.
- Complete project with Evergreen to engage non-market housing providers, and tenants, and seniors groups to begin understanding how best the City can provide support during heat waves and poor air quality events.
- Across disciplines, address mitigating the urban heat island effect (UHIE) through street and building design, vegetation and trees, and green roofs. As in the Urban Forest Strategy, prioritize neighbourhoods for UHIE mitigation activities that have high surface and air temperature and frontline communities.
- Refresh personal preparedness communication and programming away from a focus just on earthquakes to a message of "what you can do to be more self-sufficient, prepared and resilient" across a range of shocks.
- Support climate resilience and adaptation activities in the Resilient Neighbourhood Pilot Program. Support the continuation and scaling-up of this program as well as programs that focus on neighbourhood resilience through social connections (e.g., Hey Neighbour Program).
- Address wildfire smoke events through proactive planning for communications, filtered air assessment and pilot clean air shelters, and worker safety. Work with VCH on the co-benefits of filtered air for wildfire events and traffic-related air pollution (TRAP).
- Integrate with the Resilient Vancouver work on facilities to begin a collaborative conversation about utilizing our facilities and community centres to collectively support people during extreme weather - heat, poor air quality, etc.
- Work with the Province, Metro Vancouver and other partners to complete work necessary to integrate effective food system climate change adaptation strategies within City policies and strategies.

5 Coastline Preparedness

Vancouver, like other coastal cities around the world, will experience sea level rise over the coming decades and centuries due to climate change. Using current projections of 1 metre of sea level rise and a major storm surge event (0.2 per cent AEP or 1/500 year storm surge event), approximately 13 sq. km of land and buildings valued at $7B (2013 land value assessment) is vulnerable to flooding in Vancouver. To protect these vulnerable areas it is estimated that Vancouver will need to invest $1 billion in flood management infrastructure by 2100.

The Coastal Flood Risk Assessment (CFRA) program was recommended as the top priority for action in the 2012 Adaptation Plan (see pages 26 and 27). Staff have worked in partnership with the Musqueam First Nation in early work along the Fraser River and will continue to collaborate with the Musqueam, Squamish and Tsleil-Waututh as all coastline areas are addressed. Public engagement is the next focus and designing and implementing adaptation options using the tools and information gained through the CFRA program.

INTEGRATE WITH:

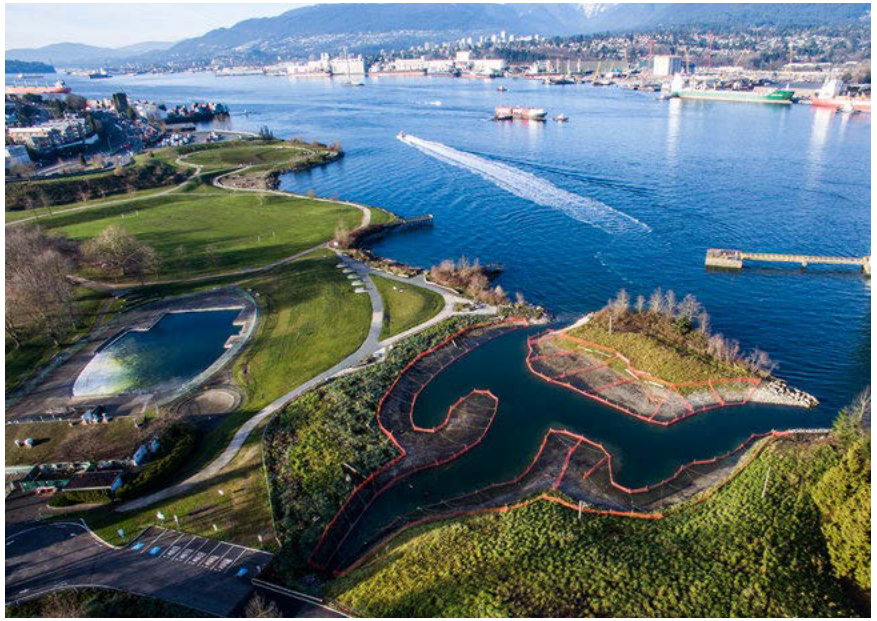
1) Greenest City Action Plan
2) Biodiversity Strategy
3) Resilient City Strategy

SPECIFIC OBJECTIVES:

- Minimize risk related to coastal flooding and inundation from sea level rise over time through proactive planning, engagement and collaboration.
- Improve resilience to coastal flooding and inundation by incorporating water level projections into all City projects, policies and regulations.

PRIORITY ACTIONS:

- Amend the Zoning and Development By-law to ensure that flood plain development is done in a manner that protects people, property, and the natural environment from the consequences of flood hazards and enables future flood management infrastructure.
- Host a city-wide sea level rise engagement and design competition to raise awareness and support for the design and implementation of holistic flood management infrastructure.
- Complete conceptual design of preferred adaptation approaches for the Fraser River shoreline.
- Complete a study of climate change impacts, including coastal processes related to sediment transport, water chemistry and erosion, and sea level rise, for Vancouver parks and natural areas. The study should identify the current state, trends, and projections as well as informative global adaptation case studies. This document should be updated every five years and inform all site planning and design.



Enabling Actions

Mainstream Effectively

The City worked with the Chartered Professional Accountants Canada (CPA) and the City of Toronto on disclosing climate-risk related finances[11]. The City is committing to assessing major capital projects against known climate hazards and risks which is a key next step. The Engineering Project Management Office is spearheading a new asset management framework that will include climate risks alongside other risks. The City is also finding opportunities to include climate resilience as a foundation in land use planning and development.

Build Capacity and Knowledge

The City of Vancouver needs to enhance capacity building and knowledge about climate change adaptation for all staff. A City Learn course will be developed to help educate city staff on our climate risks and vulnerability assessment methods to ensure these tools reach all members of our organization. By empowering staff with this knowledge we hope that departmental adaptation champions will be identified with job descriptions reflecting their role.

Improve Data and Information

Centralization and coordination of data availability will need to be improved, ensuring all departments have access to this critical information. Increasing the cooperation between departments will also be imperative for ensuring that all windows of opportunity are utilized to deliver co-benefits and increase climate resiliency across the city.

Strong Leadership, Partnership and Governance

Continue to work with partners and expand partnerships and networks in the Lower Mainland and globally. Collaborate with Resilient Vancouver on future governance for resilience.

[11]See the City's 2018 Financial Statement for climate-related risk disclosure.

Plan Monitoring and Reporting

Vancouver's 2012 Adaptation Plan included possible indicators in the appendices and monitored for implementation progress but not for actual outcomes toward a more resilient city. Adaptation to climate change is challenging to measure for a number of reasons. For example, when defining success the city must decide if it's a single outcome that can be achieved or an ongoing set of processes. Lengthy time horizons also pose challenges when interpreting if actions have reduced our risk (as with sea level rise). Changes in baseline conditions during the monitoring period can also alter the clarity of the results/outcomes. Counterfactual indicators are common but difficult to measure and inaccurate such as the dollars of flood damage prevented compared to not taking flood mitigation action. Adaptation indicators are also frequently proxy measures as measuring the true goal is impossible and it is challenging to tell when measures have negative unintended consequences[12].

There are various types of indicators from those that measure inputs to those that measure efficiency of a project or process. The focus of the indicators (listed in Appendix B) is to build a program that over time ensures the actions taken are making the City of Vancouver more climate resilient. Another set of indicators the city will monitor over time are explanatory indicators, or those that support why we are doing this work. *For example, how many days of air quality alerts there are each summer.*

There are a range of existing indicators measured across the City already and more to come through the Resilient Vancouver Strategy, Rain City Strategy, Greenest City Action Plan (GCAP) refresh and others. Many of these provide indications of how well we are doing on adaptation. For example, the Rain City Strategy will include targets for infiltrating or detaining rain water. A preliminary list of indicators and targets are listed in Appendix B. If they are existing indicators as marked, they will be measured on the existing basis. If new indicators, they will be measured twice per Adaptation Strategy review cycle (five years). Staff aim to return to finalize indicators following completion of the aforementioned plans which are under development at the time of writing. Strategy implementation progress reporting will continue to be included in the GCAP annual update.

Plan Implementation and Review

The Adaptation Strategy will be implemented throughout the City of Vancouver to maximize its effectiveness and establish new standards within each department. Sustainability staff will continue to track and support implementation of the strategy to ensure the city is prepared for the impacts of climate change.

The review cycle for the Strategy should be in step with the Intergovernmental Panel on Climate Change (IPCC) five-year reporting process. The next IPCC AR6 report is scheduled to be published in early 2023. Upon release of the next IPCC report, climate projections will be downscaled to address the City of Vancouver context. As this new information becomes available the City will review and update our Adaptation Strategy. The City aims for a five-year review cycle of the Adaptation Strategy and associated action plan, with the next one due to Council in late 2023 or early 2024.

The City will complete a risk and vulnerability assessment every 10–15 years, to capture any changes. and support action plan updates.

[12] *USDN Indicators Guidebook*

Appendix A: Adaptation Actions

CORE ACTIONS

Priority actions are highlighted in grey at the beginning of the tables.

ACCS – Arts, Culture and Community Services
Comms. – City of Vancouver Communications
Eng. IUP - Integrated Utility Planning (new department)
Env Serv. – Environmental Services
GIS - GIS and CADD Services
OEM – Office of Emergency Management
PB – Park Board
PDS (UD) – Urban Design Group
REFM – Real Estate and Facilities Management
RM - Risk Management
SUS - Sustainability

1 Climate Robust Infrastructure

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
I.1	Complete integrated modeling of water in the city (pipe system, surface water and groundwater). • Prioritize watersheds to be modeled to support City objectives such as combined sewer overflow elimination, Rain City Strategy, growth planning and preliminary watershed assessments. • Leverage modeling to complete overland flood route mapping and take an integrated approach to drainage systems including the public realm, grey and green rainwater infrastructure systems, coastal flood protection, and parks.	Eng. IUP	ongoing
I.2	Complete comprehensive information gathering to support system modeling, catchment prioritization, and early implementation of the most effective, resilient water management actions. Early investment will ensure an option analysis of new approaches to servicing is timely.	Eng. IUP	2020
I.3	Utilize the piped system, green infrastructure and other rainfall storage strategies to attenuate water from catchments that drain into floodplain areas prone to coastal flooding. The aim is to reduce stormwater draining to low-lying areas to mitigate peak flows and total flow volume at the runoff source. This will result in the appropriate timing and investment of stormwater pumping facilities.	Eng. IUP	ongoing
I.4	Continue water conservation and efficiency actions; develop regulations to support the usage of alternative water sources including groundwater, graywater and blackwater for non-potable demand. The “fit for purpose” approach to water end use will reduce pressure on the regional supply and delivery of treated drinking water.	Eng. Water	2023
I.5	Undertake a drainage study for low-lying Southlands area to include an assessment of the existing dike network and pump station. Provide improvement recommendations for the drainage system as needed.	Eng. Sewers	2020

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
I.6	Support the Resilient Vancouver team's development and implementation of an approach to define and analyze Critical Infrastructure, to identify priority assets to risk management, define a criticality framework and approach, and evaluate and test the approach.	CRO, RM	2020
I.7	Increase City departments' capability to manage a business disruption in the event of an emergency. Complete a list of department's critical services and develop tools and templates for each department to manage and prepare their critical services for continuity of operations.	RM	2023
I.8	Develop a groundwater management strategy and/or protection plan.	Eng. Water	2023
I.9	Update the Private Side Standards for stormwater retention, detention and reuse to reflect 2100 precipitation projections (IDF curve), and 2050 growth and climate scenarios.	Eng. IUP	2020
I.10	Continue the sewer separation program to support combined sewer overflows elimination.	Eng.	ongoing
I.11	Investigate and implement pervious pavement where appropriate.	Eng. Streets	ongoing
I.12	Develop regulation for non-potable water reuse in the Vancouver Plumbing Code.	Eng. Water	2020
I.13	Complete identification of areas at potential risk of landslide with increased rain and risk mitigation actions (from 2012 plan).	SUS	2020
I.14	Add climate change and resiliency considerations to utility design standards and specifications. Continue to build and specify guidelines as standards are updated.	Eng.	2018 ongoing
I.15	When completed investigate and adopt appropriate elements of National Research Council's (NRC) updated design climate data for reference by codes and standards.	Eng.	2020
I.16	Support application of the Envision climate risk section to the two pilot projects and propose any improvements to the scope/deployment of Envision.	Eng.	2020
I.17	When completed investigate and adopt appropriate elements of NRC's guidelines for the adaptation of existing roads to climate change.	Eng.	2020
I.18	Complete the Coastal Sanitary Pump Station System Resiliency Upgrade Project .	Eng.	2023

2 Climate Resilient Buildings

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
B.1	Within the upcoming Deep Retrofit Strategy (Renewable Buildings 2050) adjust requirements and process for existing buildings to support enhancement of resilience to climate and other hazards.	SUS	2020
B.2	Evaluate and integrate where possible the new Canadian Standards Association (CSA) standards and National Research Council guidelines for buildings related to climate change hazards in the Vancouver Building By-law where possible, including new climate loads.	SUS	2023
B.3	Continue to incorporate new summer normals related to active cooling and thermal comfort in building policy and bylaws: encourage heat pumps, reduce cooling demand in new building, detailed thermal comfort guidance, exploration of future weather data for building design and modelling, etc.	SUS	2023
B.4	Build on phase 1 of the MBAR project with a study and report on potential building requirements and design options to "future-proof" buildings. Review outputs and develop recommendations for potential updates to building policy or by-law.	SUS	2023
B.5	Streamline the heat pump permitting process and provide clarity on requirements.	SUS	2020
B.6	Consider updating the Vancouver Building By-law to cap the amount of summer solar heat gain in residential units.	SUS	2023
B.7	Research opportunities within existing buildings to require consideration of solar heat gain.	PDS	2023
B.8	Work with partners to research opportunities to include thermal comfort as part of Certified Rental Building Program and also work to increase the capacity of landlords to address thermal comfort in their buildings.	SUS, Eng. Water	2023
B.9	Include climate resilience indicators and considerations, including solar heat gain, in Urban Design's Resilient Neighbourhood Design Framework (Resilient Vancouver).	PDS (UD), CRO	2020
B.10	Track cooling energy demand intensity in new construction applications, and explore including limits in building policy and by-law.	SUS	2021

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
B.11	Explore opportunities to refine and enhance limits on overheating, and develop guidance for industry.	SUS	2019
B.12	Review future climate data and develop recommendations for use in building policy or by-law.	SUS	2019
B.13	Explore opportunities to use measured building data to inform updates to building policy or by-law.	SUS	ongoing
B.14	Review results of BC Housing MBAR project and develop recommendations for use in building policy or bylaw.	SUS	2021
B.15	Introduce requirements for, or facilitate an increase in application of green roofs.	Building	2020
B.16	Provide guidance and clarify permit requirements for the installation of electrochromic glass. Work with planning and building staff to ensure a shared understanding and support.	SUS	2021
B.17	Include resilience checklist in large site rezoning. Evaluate and move toward more guidelines and standards.	SUS	2018
B.18	When available, incorporate the new CSA standard for residential basement flooding into building inspections and new building checklists for planning and development.	SUS	2020

3 Healthy and Vigorous Natural Areas and Green Space

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
NA.1	Support implementation and integration across departments of the Urban Forest Strategy Action Plan, especially those actions for climate resilience: 8,14,16,32,34.	PB	2023
NA.2	Develop policy and practices that facilitate soil preservation or is preferential to the reuse of naturally produced topsoil from offsite locations.	PB	2023
NA.3	Complete the Planning Department's in progress Living Systems Strategy which will include measures for integrating climate change actions into city planning and development.	PDS	2020
NA.4	Develop a policy to guide a Park Board climate risk and opportunities-based approach to waterfront planning & design. The policy will be reviewed regularly and address up to date climate & water level projections, adaptable design, green infrastructure based protective measures and a variety of climate change related risks.	PB	2023
NA.5	Continuous improvement on Stanley Park Fire Preparedness and Fire Fuel Management programs.	PB	ongoing
NA.6	Move urban forest maintenance from a reactive to a proactive standard for excellence.	PB	2020
NA.7	Collaborate with and support Downtown Eastside Business Improvement Area's (BIA) and community stewardship of street trees in line with the Urban Forest Action Plan action of doubling the street canopy in this area.	PB,PDS, Eng.	ongoing
NA.8	False Creek Water Quality Working Group lead Master Planning for False Creek with a focus on water quality outcomes.	Env Serv.	2023
NA.9	Build on the False Creek management focused working group to advance knowledge and monitoring of marine waters related to pollution, hydraulics and ocean acidification.	SUS	2023
NA.10	Develop a fact sheet on urban heat island effect for staff and developers. Develop communication that focuses on the economic and co-benefits of trees.	Comms., PDS	2020
NA.11	Monitor and report out on environmental aspects of new Large Sustainable Sites Policy.	SUS	2023
NA.12	Expand forest naturalization projects in areas such as Everett Crowley Park as recommended in the Biodiversity Strategy and Urban Forest Strategy.	PB	ongoing

4 Connected and Prepared Communities

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
C.1	Work with partners Vancouver Coastal Health, Evergreen, social housing providers and others to develop short-term and longer-term strategies for health and safety during heat waves in non-market housing and the surrounding neighbourhoods.	SUS, ACCS	2020
C.2	Address mitigation of urban heat island effect across disciplines prioritizing neighbourhoods with high temperature and frontline communities.	PDS	ongoing
C.3	Refresh personal preparedness communication and programming away from a focus just on earthquakes to a message of what you can do to be more self-sufficient, prepared and resilient across a range of shocks.	OEM	2020
C.4	Support climate resilience lens and climate adaptation activities in Resilient Neighbourhood Pilot Program. Support continuation and scaling-up of this program and programs like it that focus on neighbourhood resilience through social connections (i.e., Hey Neighbour).	CRO, SUS	2020
C.5	Address wildfire smoke events through proactive planning for communications, filtered air assessment and pilot clean air shelters, and worker safety.	ACCS, REFM, SUS	ongoing
C.6	Integrate with the Resilient Vancouver work on facilities to begin a cross-disciplinary conversation about using our facilities and community centres to collectively support people in increasing and different ways – extreme weather, heat, poor air quality, etc,. Continue to engage regional partners to this end as well.	CRO, SUS, PB, ACCS	2020
C.7	Work with the Province, Metro Vancouver and other partners to complete work necessary to integrate effective food system climate change adaptation strategies within City policies and strategies.	SUS, ACCS	
C.8	Re-establish the Extreme Heat Planning Committee. First order of business: reassess triggers and thresholds for Extreme Heat Initial Response Guideline (IRG) to add more levels of triggers and actions and include poor air quality events to address potential public alert fatigue.	OEM, SUS	ongoing
C.9	Improve information available for homeowners in terms of preparing for various types of flooding.	Comms., Eng.	2020
C.10	Develop planning, response, and recovery tools and resources for Disaster Support Hubs and increase public awareness of these sites. Expand range of facilities beyond solely Vancouver Park Board and Vancouver Public Library facilities.	CRO	2020
C.11	Complete an assessment of non-market housing buildings with the goal of identifying short- and long-term cooling options. Address air filtration where possible.	ACCS, REFM	2020
C.12	Develop public facing material push ahead of wildfires addressing both fire risk in Stanley Park and air quality risks and related mitigation efforts.	Comms., SUS	2019

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
C.13	Choose several pilot cooling facilities to be designated clean air shelters for use during poor air quality events during the summer. Evaluate how they are used and program needs moving forward.	SUS, REFM	2019
C.14	Continue to add public access to water fountains and where appropriate other water related cooling such as misting stations and Vancouver Fire Rescue Services ad hoc cooling.	Eng.	ongoing
C.15	Design public spaces and bike routes with natural or built shade.	PB, Eng.	ongoing
C.16	Continue with adopt a catch basin program – increasing participation each year.	Eng.	ongoing
C.17	Support the development of a Train the Trainer Program for community to advance engagement around climate and seismic resilience within neighbourhoods and with harder-to-reach groups.	CRO, SUS	2020
C.18	Ensure heat mapping data from the 2015 Simon Fraser University project and floodplain mapping data is included in the Risk Profiler tool being developed for Resilient Vancouver by Natural Resources Canada.	SUS	2020

5 Coastline Preparedness

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
S.1	Amend the Zoning and Development By-law to ensure that flood plain development is done in a manner that protects people, property, and the natural environment from the consequences of flood hazards and enables future flood management infrastructure.	SUS, Planning	2020
S.2	Host a city-wide sea level rise engagement and design competition to raise awareness and support for the design and implementation of holistic flood management infrastructure.	SUS	2021
S.3	Complete conceptual design of preferred adaptation approaches for the Fraser River shoreline.	PDS, SUS, Eng.	2021
S.4	Complete a study of climate change impacts, including coastal processes related to sediment transport, water chemistry and erosion, and sea level rise for Vancouver Parks and natural areas.	PB	2023
	City-wide Actions		
S.5	As part of the City-wide Plan, support the development of flood management and adaptation policy and planning to improve coastal preparedness at a city scale.	SUS, PDS	2020
S.6	Continue to collaborate with Musqueam, Squamish and Tsleil-Waututh on governance, studies, communications & engagement related to adaptation and coastal preparedness.	SUS, Eng., PB	ongoing
S.7	Develop bylaws, regulations and policies to guide the design of engineered shoreline flood protection such that it is adaptable and built to a consistent performance standard.	Eng.	2020
S.8	Develop a long-term funding strategy to support implementation of coastal flood protection.	SUS, Finance	2020
	Zone Specific Actions		
S.9	Using the tools from Coastal Flood Risk Assessment III initiate public engagement on sea level rise and adaptation approaches for the Kitsilano flood hazard zone.	SUS	2023
S.11	Support adaptation approaches for the Waterfront Road flood hazard zone in coordination with broader planning of the Central Waterfront area.	Eng.	ongoing
S.12	Support adaptation and resilience design as part of planning for the St. Paul's hospital precinct.	SUS, PDS, Eng.	ongoing
S.13	Jericho Beach pier design and renewal to improve access to disabled sailors and accommodate sea level rise.	PB	Design: 2019

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
S.14	Support the design and development of the North East False Creek shoreline from Science World, including the decking south of Science World, to the western Concord site to incorporate flexible flood management design.	PDS, PB, Eng., SUS	2023
S.15	Work with Provincial and Regional partners to plan and implement Phase 2 of Vancouver's sea level monitoring program.	SUS	2020
S.16	Develop a flood hazard response plan for the Fraser River.	OEM, SUS	2023
S.17	Cambie sheet pile wall design and replacement as part of the development of South East False Creek.	Eng.	2023
S.18	Stanley Park Seawall adaptation pilot projects as funding is made available.	PB, Eng., SUS	2023

ENABLING ACTIONS

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
	MAINSTREAMING EFFECTIVELY		
	FINANCE		
E.1	Begin incorporating climate-related financial disclosure in City financial planning in 2019. Work with partners like the City of Toronto and CPA Canada in their Task Force on Climate-related Financial Disclosures - Guidance for Cities Project.	Finance	2020
E.2	After several years of climate-related financial disclosure explore adding a specific climate assessment to large capital plan projects.	Finance	2021
E.3	Incorporate a scan of major projects against hazard and risk mapping to identify where staff risk experts should be involved early in the project.	Finance, SUS, CRO	2023
	PROJECT MANAGEMENT		
E.4	Add climate change considerations to the sustainability addendum of the engineering project management framework.	Eng. PMO	2020
E.5	Support application of the Envision climate risk section to the two pilot projects and propose any improvements to the scope/deployment of Envision.	Eng. PMO, SUS	2020
	ASSET MANAGEMENT		
E.6	Add climate projections and information to multi-hazards risk assessment in the new engineering asset management framework.	Eng. PMO	2020
	PLANNING		
E.7	Continue to develop the Resilient Neighbourhood Design Framework.	PDS (UD), CRO	2020
E.8	Incorporate climate change adaptation as a foundational element in the upcoming City Plan.	PDS	2023
E.9	Work with planners to increase understanding of new floodproofing guidelines and related zoning regulation changes.	PDS, SUS	2020
E.10	Integrate spatial hazard and utility planning as a foundational element of land use planning by including it as a core element in job descriptions.	PDS, Eng.	2023

ACTION #	ACTION DESCRIPTION	PROJECT LEAD	TIMELINE
	BUILD CAPACITY AND KNOWLEDGE		
E.11	Develop City Learn course to share climate risk and vulnerability assessment methods.	SUS	2020
	IMPROVE DATA AND INFORMATION		
E.12	Hazard mapping available for staff and for public. Message out more broadly about existing staff map layers and ensure climate related hazards and associated projections are included in the Risk Profiler tool under development for the Resilient Vancouver Strategy.	CRO, SUS, GIS	2020
E.13	Support Resilient Vancouver team in identifying and implementing mechanisms to better coordinate and update all hazard information and data for hazard planning across the City.	CRO, SUS, OEM	2023
E.14	Make climate projections widely available across the city. Increase knowledge of the projections and engage staff with respect to other climate projections and tools that would be useful.	Comms, SUS	2023
E.15	Develop and maintain a database of climate change adaptation funding available from different levels of governments and funders. Include major local adaptation research projects (MEOPAR, MBAR).	SUS	2020
	STRONG LEADERSHIP, PARTNERSHIPS AND GOVERNANCE		
E.16	Collaborate with Resilient Vancouver Strategy team to support an exploration of distributed leadership models to improve governance of resilience, natural hazard management and climate change adaptation.	SUS, CRO	2023
E.17	Continue to work with partners and expand networks. Collaborate with Vancouver Coastal Health on a forum for regional adaptation practitioners and with the Resilient Vancouver Strategy team on a regional hub for practitioners.	SUS, CRO	2023

Appendix B: Plan Measurement

OBJECTIVE	MEASUREMENT COMPONENT OR INDICATOR	REPORTING FREQUENCY
Explanatory Indicators	Number of summer days annually with a special weather statement (heat-related) or heat alert	To the extent possible use Emergency Management's Information System, VanORCA, to track and report. Partner with OEM and Environment and Climate Change Canada where information is needed. Report at five-year Strategy review cycle
	Number of summer days annually with a special weather statement (smoke-related) or air quality advisory or both	
	Number of days annually with a special weather statement or alert for heavy rainfall	
	Number of street tree or park trees lost to a climate related impact (wind, drought, snow load, etc.)	Report at five-year Strategy review cycle
Progress Indicator	Per cent of action items in the Adaptation Strategy that have been initiated	Report annually with Greenest City Action Plan updates

OBJECTIVE	MEASUREMENT COMPONENT OR INDICATOR	REPORTING FREQUENCY
Minimize rainfall related flooding and consequences	Adopt upcoming Rain City Strategy indicators and targets where appropriate	Reported with Rain City Strategy Report at five-year Strategy review cycle
	Indicator: Number of claims against the city for flood damage **Target:** To be set at next review	Report at five-year Strategy review cycle
Design robust built form to do well in a range of climates while providing co-benefits such as seismic resilience, energy efficiency, accessibility and supporting health and well-being	**Indicator:** Floor area of newly permitted buildings that are near zero emissions **Target:** ZEB target of 100 per cent floor area in newly permitted buildings near-zero-emissions by 2030	Report at five-year Strategy review cycle
Increase resilience to coastal and riverine flooding	**Indicator:** Number of residents and prop owners engaged or receiving applicable information from the City	
	Indicator: Per cent of coastal projects using SLR information and adaptation actions Indicator: rate of new development employing flood proofing measures in floodplain areas	

OBJECTIVE	MEASUREMENT COMPONENT OR INDICATOR	REPORTING FREQUENCY
Enhance the long term health and vigor of green spaces, trees and biodiversity	**Indicator:** Increase the canopy cover in the city	Measured with targets through the Greenest City action plan annually Report at five-year Strategy review cycle
	Indicator: Street tree density in neighbourhoods with higher measured heat and vulnerability to heat	Measured with target through the Urban Forest Action Plan Report at five-year Strategy review cycle
With a focus on equity, minimize the health and safety impacts of climate change on communities and maximize their preparedness	**Indicator:** Social support network size	Measured with targets through the Healthy City Strategy. Report at five-year Strategy review cycle
	Indicator: Excess deaths or hospitalizations due to heat	As available from BC Centre for Disease Control or Vancouver Coastal Health Report at five-year Strategy review cycle
	Indicator: Percentage of City and BC Housing owned non-market housing with access to a cool room during summer months	Report at five-year Strategy review cycle
	Indicator: Number of public water fountains	Report at five-year Strategy review cycle
	Indicator: Number of City facilities open to the public that provide a MERV 13 or higher standard of air filtration during summer months	Report at five-year Strategy review cycle
Continue maximizing adaptation knowledge and mainstreaming across the organization.	**Indicator:** Number of staff that have taken the adaptation CityLearn course (to be developed)	Report at five-year Strategy review cycle
	Indicator: Number of City staff involved in a climate change risk assessment through the Infrastructure Canada Lens or Envision system	Report at five-year Strategy review cycle

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