

OUR VANCOUVER

OUR FUTURE 2045



CLIMATE VULNERABILITY ASSESSMENT

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1. Summary and Introduction

Purpose

The Pacific Northwest including Vancouver is experiencing extreme heat, drought, extreme precipitation, flooding, and exposure to wildfires, especially smoke. These climate impacts affect Vancouver's people, places, and infrastructure.

This Vancouver Climate Vulnerability Assessment report supports the [OUR VANCOUVER 2045 COMPREHENSIVE PLAN](#) periodic update. In particular, it informs the development of the resilience sub-element of the newly required climate change and resilience element under HB 1181. Vancouver anticipates an integrated element addressing "Climate, Environment, Community Health, Sustainability and Resiliency."

Scope and Context

This vulnerability assessment considers the Washington Department of Commerce *Climate Element Planning Guidance*, December 2023, and evaluates the potential for climate exposure to community assets as well as potential health and environmental sensitivities to climate change impacts. The capacity of Vancouver's people, places, and infrastructure to adapt to climate change is also addressed, along with potential strategies to enhance Vancouver's adaptive capacity.

The chapters of the report include:

1. Summary and Introduction
2. Climate Change in Vancouver
3. Residents Vulnerable to Climate Change Impacts
4. Planning for Climate Change
5. Vulnerability & Risk Assessment

This Chapter 1 Summary and Introduction provides an overview of findings of the report. Chapter 2 describes climate change trends that affect Vancouver and Clark County. Chapter 3 describes residents with socioeconomic or health conditions or disparities that are potentially vulnerable to climate change impacts. Chapter 4 describes Vancouver's plans, strategies, and related initiatives addressing climate adaptation and mitigation. Chapter 5 evaluates vulnerability and risk through eleven sectors including:

- Agriculture and Food Systems
- Buildings & Energy
- Cultural Resources & Practices

- Economic Development
- Emergency Management
- Health & Well-being
- Ecosystems
- Transportation
- Waste Management
- Water Resources
- Zoning & Development

This report builds on Vancouver’s extensive work to address climate change mitigation and adaptation, including, but not limited to:

- Vancouver Climate Action Framework (2022)
- Vancouver Climate Adaptation Strategy (2022)
- Vancouver 2023 Inventory of Community and Government Operations Greenhouse Gas (GHG) Emissions (2024)
- Vancouver Equity Index (2022)
- Reside Vancouver An Anti-Displacement Plan (2023)
- Clark Regional Natural Hazard Mitigation Plan: Volume 2–Planning Partner Annexes, Vancouver Annex (2023)

In addition to this vulnerability assessment, related work is underway to address other aspects of the pending “Climate, Environment, Community Health, Sustainability and Resiliency Element” including:

- **Climate Resilience Policy Evaluation:** Audits policies and

DEFINITIONS

Adaptive Capacity: The ability of a person, asset, or system to adjust to a hazard, take advantage of new opportunities, or cope with change.

Assets: People, resources, ecosystems, infrastructure, and the services they provide. Assets are the tangible and intangible things people or communities value.

Climate Change: A change in the average weather patterns such as temperature and rainfall in a region over a long period of time.

Climate Resilience: The ongoing process of anticipating, preparing for, and adapting to changes in climate and minimizing negative impacts to our natural systems, infrastructure, and communities.

Exposure: The presence of people, assets, and ecosystems in places where they could be adversely affected by hazards.

Impacts: Effects on natural and human systems that result from hazards. Evaluating potential impacts is a critical step in assessing vulnerability.

Overburdened Community: A geographic area where vulnerable populations face combined, multiple environmental harms and health impacts, and includes, but is not limited to, highly impacted communities as defined in RCW 19.405.020.

Sensitivity: The degree to which a system, population, or resource is or might be affected by hazards.

Vulnerability: The propensity or predisposition of assets to be adversely affected by hazards. Vulnerability encompasses exposure, sensitivity, potential impacts, and adaptive capacity.

(Commerce, 2023) (US Climate Resilience Toolkit. 2021) (NASA. 2024)

provides recommendations to amend or add policies.

- **Climate Mitigation:** Implementing the City’s Climate Action Framework, the City has inventoried GHG emissions and will use a similar approach to evaluate Vancouver’s growth strategies called “land use possibilities.” The City is also reviewing vehicle miles traveled (VMT) reduction through active trip potential.
- **Environment:** An Environmental Impact Statement is evaluating Vancouver 2045 Land Use Possibilities.
- **Health:** A Health Impact Assessment of the Vancouver 2045 land use possibilities has been developed to evaluate the Periodic Update land use possibilities and other policy issues.

Climate Impacts in Vancouver

Vancouver is feeling the effects of climate change including the following Pacific Northwest trends (Chang, 2023):

- **Warming and Extreme Heat:** The annual number of extremely hot days and warm nights in the Northwest has been above the long-term average over the past decade, and the annual number of extremely cold nights over the same period has been below the long-term average. Future warming in the region is expected to exacerbate regional heatwave intensities. It is particularly magnified on impervious areas in urban areas like Vancouver.
- **Extreme Precipitation Events:** The frequency and intensity of extreme precipitation events are projected to increase across the region. A greater number of strong atmospheric events and fewer moderate and weak events are projected to occur and are projected to reach farther inland. In Vancouver, major flooding along rivers and streams is less likely due to flood control structures and greenways but there is a risk along the Port and other areas that are low lying, and there is a risk of urban flooding elsewhere.
- **Flooding and Infrastructure:** Riverine flooding as well as localized urban flooding is a growing concern in Vancouver due to aging stormwater infrastructure, particularly in older neighborhoods with combined sewer systems. These systems are increasingly overwhelmed by intense rainfall events, leading to surface flooding and sewer overflows.
- **Decreasing Summer Precipitation and Increasing Drought:** Summer precipitation is projected to decline. Observed lower stream flows in summer are expected to decrease. This could affect fish and other aquatic life in Vancouver’s streams.
- **Increasing Wildfire Likelihood and Smoke:** An increase in wildfires in the Pacific Northwest could expose people in Vancouver and the broader region to more wildfire smoke. Increased wildfire smoke events are straining indoor air quality in public facilities. Many community centers and senior centers lack adequate HVAC systems or filtration, limiting their ability to serve as clean air shelters during smoke events.

See [Chapter 2 Climate Change in Vancouver](#) for additional information about climate impacts in Vancouver.

Climate Vulnerability Index

Vancouver also developed a Climate Vulnerability Index (CVI) in parallel with this assessment to evaluate over 30 indicators of climate vulnerability, scaled to US Census block groups, to identify areas and populations more vulnerable to extreme heat, flooding and extreme precipitation, and air quality/smoke. The CVI allows Vancouver to compare areas within the city to itself. The CVI does not compare Vancouver to other areas across the county or state.

Vulnerability is defined as the sum of exposure to climate shocks and stresses, the sensitivity of people or environment to the shock, and the capacity of the community and place to cope with consequences of the climate event. (UKAID, 2011) (US Climate Resilience Toolkit, 2021)

$$\text{Vulnerability} = \text{Exposure} + \text{Sensitivity} - \text{Capacity to Adapt}$$

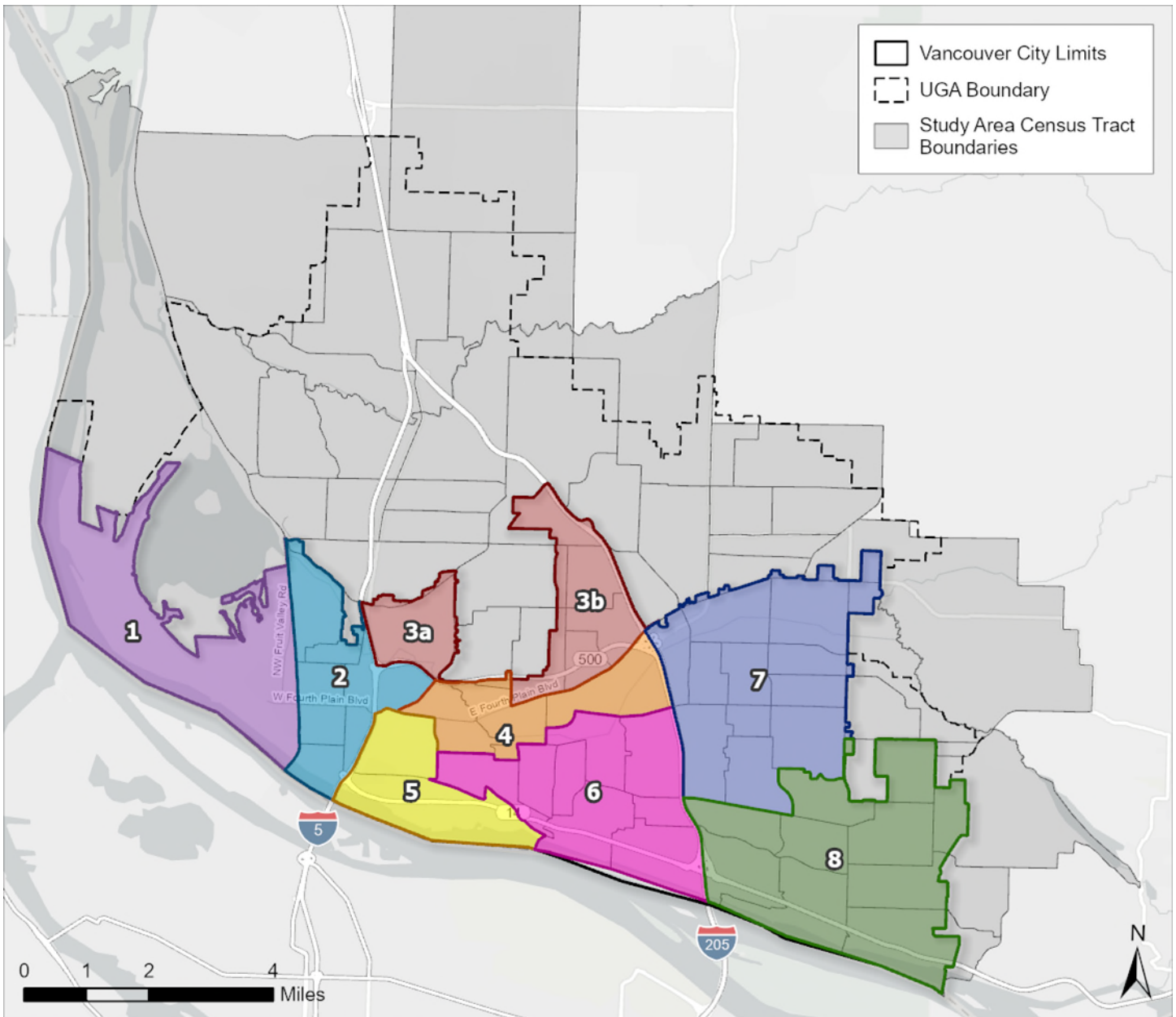
The Vancouver CVI presents a series of indices and bivariate intersections including Vancouver's first index regarding Climate Exposure. The CVI includes a bivariate view of Exposure in relation to the City's Equity and Displacement indices which have elements of sensitivity and adaptive capacity. In addition, a Vancouver Health Index was prepared with components of population health sensitivity, and an Exposure x Health bivariate map was created.

Vulnerable Places and Communities

Parts of Vancouver are more vulnerable to the impacts of climate change than others. For example, there are particular areas in the city – such as “heat islands” with more pavement and fewer trees, floodplain and landslide hazard areas, and areas with limited access to transit – that may experience larger effects from climate change. In addition, some communities and populations – including older adults, individuals living alone, and people with low incomes, disabilities, and/or limited English proficiency – may be more sensitive to climate impacts and require special consideration when planning for climate resiliency.

This study references areas in west, central, and east Vancouver in eight study areas, and identifies vulnerable places and communities. See [Exhibit 1](#).

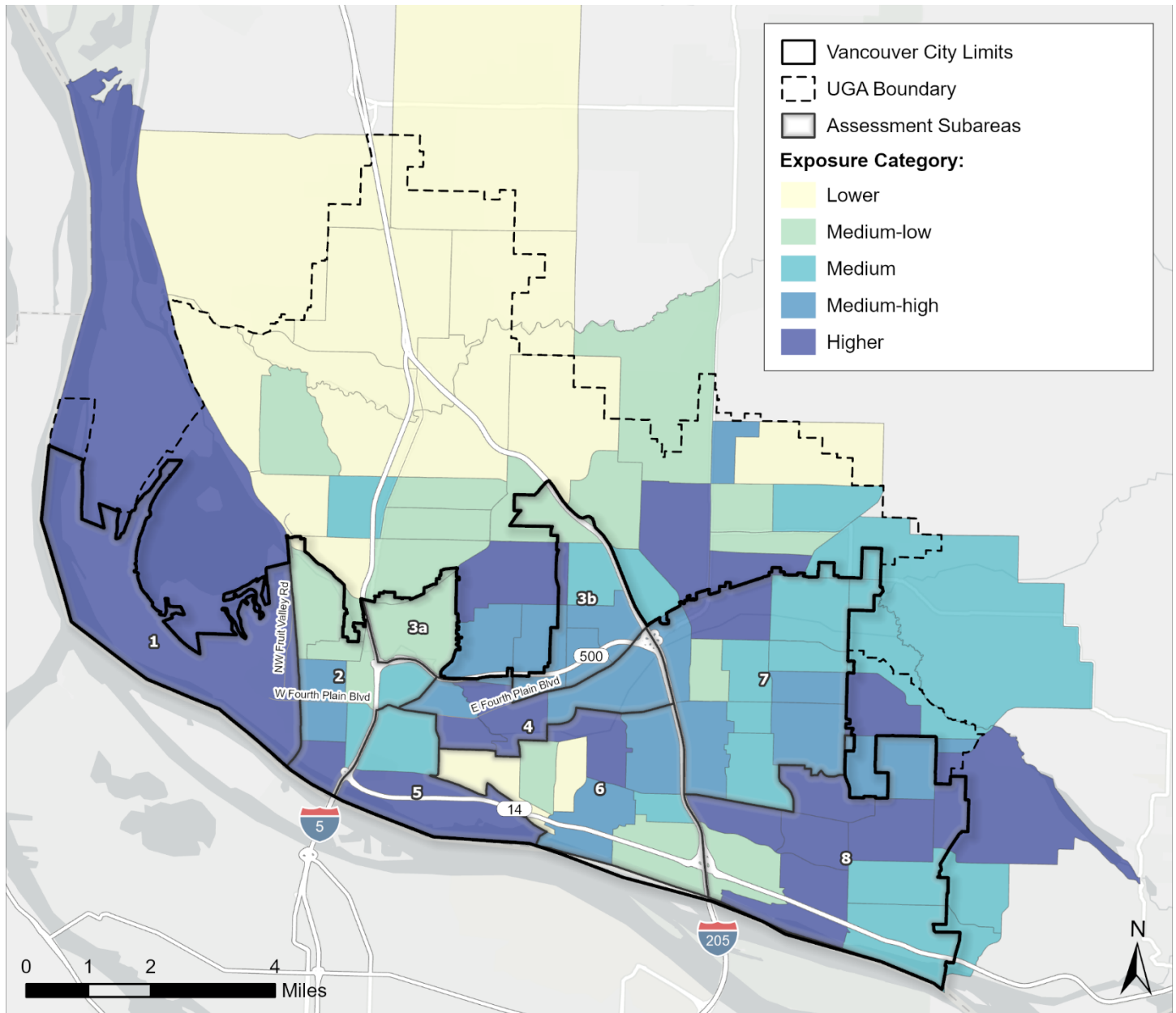
Exhibit 1: Vancouver Areas of Focus



Source: City of Vancouver, BERK 2025.

The Vancouver CVI Exposure Index identifies the following areas at risk of exposure to climate impacts including extreme heat, flooding, or air quality/smoke: Area 1 west of NW Fruit Valley Road, southern edges of Areas 2 and 5 along the Columbia River, Areas 4 and 7 along E Fourth Plain Boulevard, and Area 8 in southeast Vancouver. See [Exhibit 2](#).

Exhibit 2: Exposure Index



Source: BERK 2025.

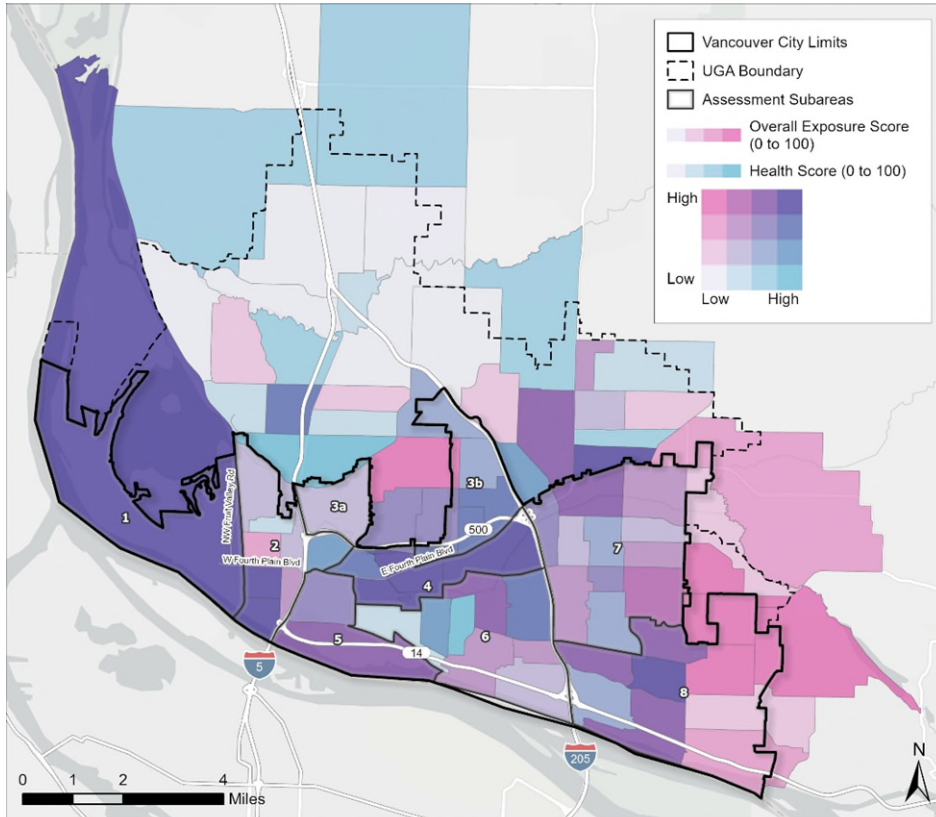
Combining Vancouver’s Climate Exposure Index plus its Health Index shows populations with vulnerabilities exposed to climate impacts in similar locations in Areas 1, 2, 4, and 8. Census block groups with higher Exposure and higher Equity disparities are found in Areas 1, 2, 4, 7, and 8. See [Exhibit 3](#).

[Exhibit 4](#) and [Exhibit 5](#) provide a table and map with Census tracts having with higher exposure and higher equity or health disparities, and are priorities to address climate adaptation and improve areas that have low or moderate adaptive capacity.

Exhibit 3: Exposure with Health and Equity

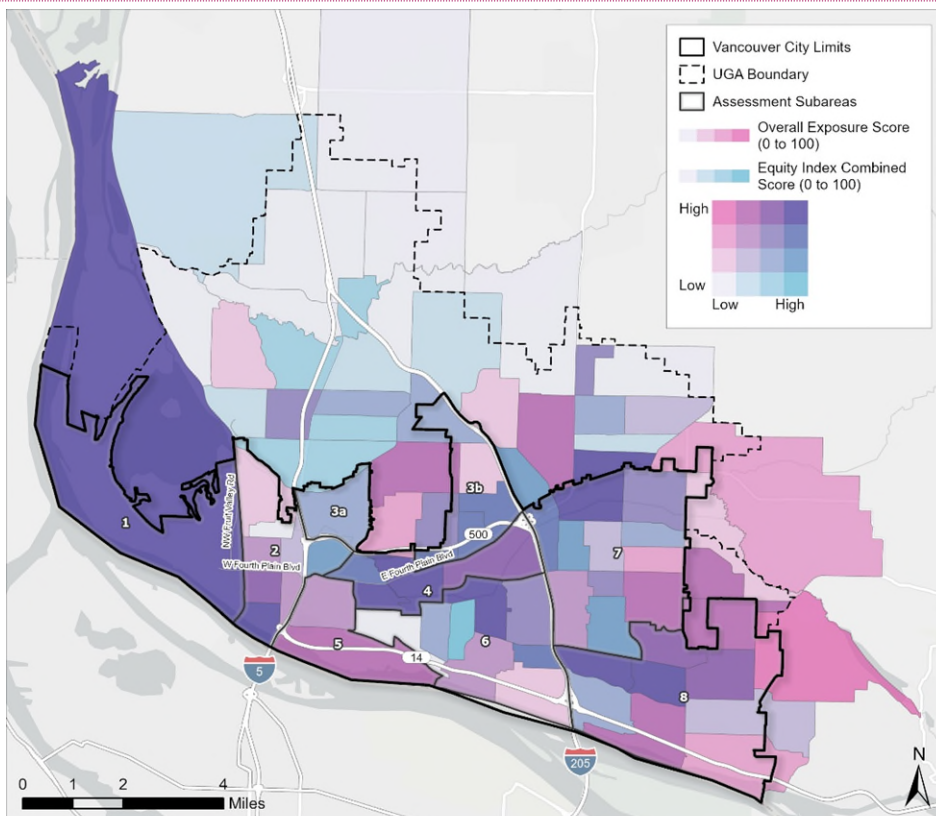
Exposure x Health

Locations of higher exposure and health-sensitive populations: West and Central parts of Vancouver along East Fourth Plain Blvd.



Exposure x Equity

Locations of higher exposure and overburdened communities: Vancouver Lake and NW Fruit Valley Road, blocks south of SR 500 and along Fourth Plain Blvd, and Mountain View and Cascade Highlands in East Vancouver.



Source: BERK 2025.

Exhibit 4: Census Tracts with Higher Vulnerabilities to Climate Impacts

Census Tracts	Subarea	Percent of Tract in City Limits	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Disparities Index	Priority	Adaptive Capacity
53011041005	1	34.9%	Medium-high	Higher	Lower	Higher	Higher	Higher	A	Moderate (Lake)
53011042300	2	100.0%	Medium	Medium-high	Higher	Medium-high	Higher	Medium-high	C	
53011042400	2	99.3%	Higher	Higher	Medium	Higher	Higher	Higher	A	
53011041111	3b	97.1%	Medium-high	Medium	Medium	Medium-high	Higher	Higher	C	Moderate (Tree)
53011041113	3b	100.0%	Higher	Medium-high	Medium-low	Medium-high	Higher	Higher	C	Moderate (Tree) Moderate SMAP
53011041114	3b	100.0%	Higher	Medium	Medium-low	Medium-high	Higher	Higher	C	Moderate (Tree) Moderate SMAP
53011041600	4	99.6%	Medium-high	Higher	Medium	Higher	Higher	Higher	A	Low (Tree) ATP*
53011041700	4	100.0%	Medium	Higher	Medium	Medium-high	Higher	Medium-high	C	Low (Tree) ATP*
53011042700	4	100.0%	Medium-high	Higher	Medium	Higher	Higher	Higher	A	Low (Tree)
53011041205	6	100.0%	Medium-high	Higher	Medium-high	Higher	Medium-high	Higher	B	Moderate SMAP ATP*
53011041206	6	100.0%	Higher	Medium-low	Medium-high	Medium-high	Higher	Medium-high	C	Low (Tree) Moderate SMAP ATP*
53011040706	7	7.4%	Higher	Medium-high	Medium-low	Higher	Higher	Higher	A (-)	
53011041312	7	100.0%	Higher	Higher	Medium-low	Higher	Medium-high	Higher	B	
53011041320	8	100.0%	Higher	Medium	Medium-high	Higher	Medium-high	Medium-high	C	ATP*
53011041322	8	100.0%	Higher	Medium	Medium-high	Higher	Medium-high	Higher	B	
53011041323	8	100.0%	Higher	Medium	Medium-high	Higher	Medium-high	Higher	B	ATP*
53011041329	8	100.0%	Higher	Medium	Higher	Higher	Lower	Medium-high	C	

A=Higher Overall Exposure and Higher Health and Equity Disparities

B = Higher Overall Exposure and either Higher Health Disparities or Higher Equity Disparities

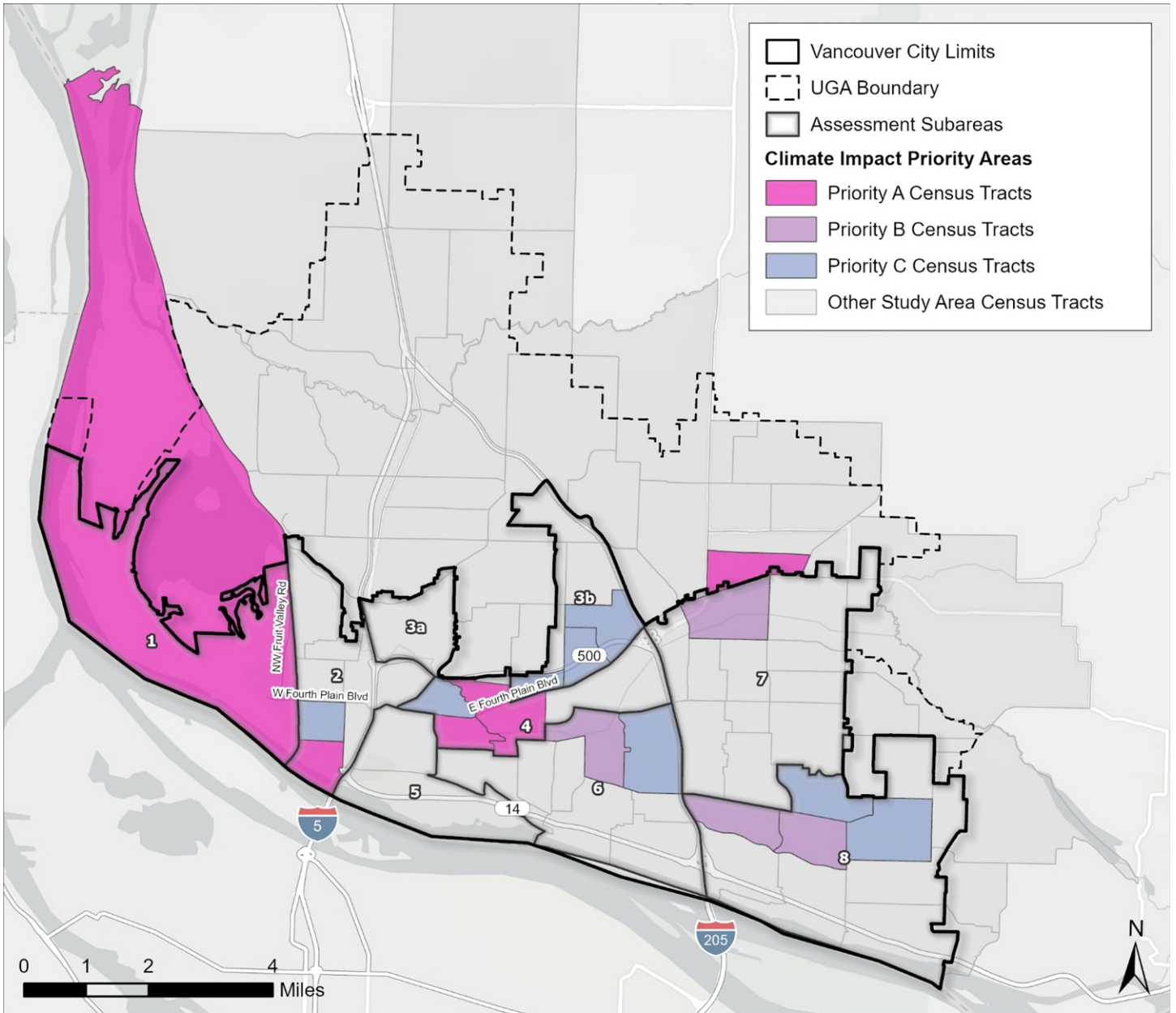
C = Medium High or Higher in one or more exposures and either Health or Equity Disparities

(-) County Unincorporated

*Active Trip Potential (ATP): locations where short vehicle trips could convert to e-bike, bike, or walking trips with more supportive infrastructure; or where more development could build on existing strengths.

Source: See Chapter 2. BERK, 2025.

Exhibit 5: Map of Census Tracts with Higher Vulnerabilities to Climate Impacts



A=Higher Overall Exposure and Higher Health and Equity Disparities
 B = Higher Overall Exposure and either Higher Health Disparities or Higher Equity Disparities
 C = Medium High or Higher in one or more exposures and either Health or Equity Disparities
 Source: See Chapter 2. BERK, 2025.

Climate Planning Engagement

Vancouver Climate Adaptation Strategy, 2022

In 2022, Vancouver engaged Hatch Planning and Toulan School of Urban Studies and Planning at Portland State University to prepare a *Vancouver Climate Adaptation Strategy*, which included a community engagement process. (Hatch Planning and City of Vancouver, 2022)

- a community-wide survey with 140 responses
- six pop-up events in different locations, and
- five small group conversations

The populations targeted for engagement are similar to those living in areas considered highly vulnerable in **Exhibit 5**, and included:

- Communities of color, particularly Hispanic or Latino
- High-poverty groups
- Linguistically isolated groups (Spanish, Russian or Eastern European language-speakers)
- Youth, particularly those in informal daycare
- Older adults, particularly those living alone
- Houseless people, including Safe Stay communities
- Manual or outside laborers, especially farmers, landscapers, and trades organizations
- People with disabilities
- Transit-dependent residents

Engagement findings are summarized below and throughout **Chapter 5 Vulnerability & Risk Assessment**. This 2025 Climate Vulnerability Assessment carries forward from this 2022 effort which recommended a comprehensive vulnerability assessment.

Exhibit 6: Vancouver Climate Adaptation Strategy Engagement Findings

<p>1 Most community members had negative experiences during severe weather events – the wildfire smoke of 2020 and heat wave of 2021. Negative experiences were due to a loss of work time, discomfort and health issues, the canceling of events, and more.</p>	<p>2 Aside from severe heat and wildfire smoke, participants also worried about snowy and icy weather events, and particularly the power outages and difficulty of travel that comes with those events.</p>
<p>3 Participants identified several circumstances that made it more difficult to deal with severe weather events. These include:</p> <ul style="list-style-type: none"> • Lack of air conditioning or air purification • Lack of access to a car 	<ul style="list-style-type: none"> • Lack of communication regarding preparedness • Need to work outside during severe weather events • Lack of resources for people with disabilities

4 While many residents do feel prepared for future heat waves and other events, they expressed serious concerns about the safety and well-being of their neighbors and community.

5 Many participants had ideas for how the city can help them in the future, including providing resources to help households have alternative energy sources in the event of power outages, the creation of cooling and warming shelters, creating community-led disaster drills to help people understand how to stay safe and prepared, and prioritizing low-income or houseless people in city policy to ensure their safety.

6 Some physical elements that community members would like to see include water features such as splash pads, urban gardens and fruit trees, more tree coverage, and community centers or public spaces for neighbors to connect with one another.

7 Participants cited the need for community education on environmental issues and sustainability through programming and incentives, including conferences, talks, and videos that share the importance of sustainability as well as other educational materials. Participants, particularly those in small group conversations, also saw a need for increased public engagement about this issue.

Source: (Hatch Planning and City of Vancouver, 2022)

Resilience Rising, 2025

As part of the City of Vancouver’s ongoing climate resilience planning efforts, a series of *Resilience Rising* community events were hosted in late May and early June 2025 in partnership with Fourth Plain Forward, the Southwest Washington Equity Coalition (SWEC), and Washington Conservation Action. These events focused on elevating local voices and experiences around climate-related risks and responses in neighborhoods most impacted by extreme heat, wildfire smoke, and flooding.

The gatherings were designed to complement this 2025 Climate Vulnerability Assessment and a related Adaptive Capacity Assessment (see following section) by grounding technical recommendations in lived experience. A total of 76 residents participated across three events in Fruit Valley, Fourth Plain, and Mountain View, each selected due to their high climate risk scores and social vulnerability indicators.

At each event, there was an interactive mapping exercise which invited participants to identify local assets, risks, and resilience opportunities in their neighborhoods. Participants used stickers, markers, and post-it notes to annotate the maps in both English and Spanish, with bilingual facilitators on hand to support discussion. A common theme throughout was the desire for more equitable access to climate-resilient infrastructure—including safe gathering spaces, localized food and resource hubs, and culturally relevant emergency response strategies.

Engagement results are highlighted in **Exhibit 7** and throughout this study.

Exhibit 7: Resilience Rising Engagement Summary

Climate Risks Are Experienced Unequally.

Participants noted that extreme heat, flooding, and wildfire smoke have disproportionate impacts across the city, especially for residents in East and Central Vancouver. Barriers include:

- Transportation limitations for seniors, youth, and people with disabilities
- Fear or mistrust of federal-linked spaces among undocumented communities
- Lack of signage or public awareness of available resources

Schools, Religious Facilities, and Businesses as Anchors.

Participants were enthusiastic about repurposing underused or privately owned spaces to provide cooling, clean air, and resource distribution during future climate events. Specific suggestions included equipping schools with air filtration and backup power, training church volunteers, and leveraging local businesses to help spread emergency information.

Food Security and Local Food Systems. Several participants expressed interest in expanding community food forests, edible landscaping, and culturally relevant gardens to increase food access and resilience. Many attendees pointed to successful local examples—including fruit tree gleanings programs and community partnerships—that show potential for scaling.

Community-Led Solutions and Trusted Messengers. Residents expressed a strong interest in building neighbor-to-neighbor networks and empowering local leaders to help organize emergency response. Ideas included community phone trees, CERT team recruitment, and creating preparedness flyers with the contact information of trusted local point people.

Gaps in Infrastructure and Communication. Participants identified several physical and procedural gaps that hinder preparedness and resilience: limited cooling centers with adequate space and signage, public transit challenges during storm events, lack of emergency information in multiple languages, and difficulty navigating scattered resources.

Desire for Action and Accountability. While attendees appreciated the opportunity to provide input, some were skeptical about whether tangible changes would result. Still, most remained hopeful and urged the City and its partners to prioritize the ideas that came directly from community voices, especially those grounded in lived experience and local expertise.

Source: (City of Vancouver, 2025)

Adaptive Capacity Assessment 2025

The City of Vancouver met with an interdepartmental team and with regional emergency management agencies to develop more specific asset mapping and adaptive capacity recommendations overlaying locations of critical facilities and places of assembly on top of maps of exposures such as extreme heat, flooding, and wildfire/smoke including:

- Fire and Police Stations
- Libraries, Senior Centers, and Community Centers, often serving as warming or cooling shelters
- Schools
- Parks and Trails
- Transit Stops
- Water, Sewer, and Stormwater

The asset maps help to pinpoint the most pressing areas for investment. Results are included in relevant sector evaluations in [Chapter 5 Vulnerability & Risk Assessment](#), and in the Appendix.

Vulnerability and Risk Summary by Sector

Across 11 sectors, [Chapter 5 Vulnerability & Risk Assessment](#) considers vulnerable places and communities and risk of impacts (probability and magnitude). A summary of the results for the 11 sectors is shared in [Exhibit 6](#).

Sectors most at risk across multiple climate impacts, with the greatest potential for loss and affecting vulnerable communities include:

- Buildings & Energy
- Emergency Management
- Health and Wellbeing
- Transportation
- Water Resources





Exhibit 8: Vulnerability and Risk Summary by Sector

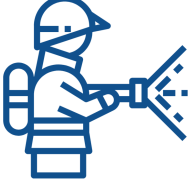



Sector	Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected									
	Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most	1	2	3A	3B	4	5	6	7	8	
Agriculture and Food Systems																							
Buildings & Energy																							
Cultural Resources & Practices																							
Economic Development																							
Emergency Management																							
Health & Well-being																							
Ecosystems																							
Transportation																							
Waste Management																							
Water Resources																							
Zoning & Development																							

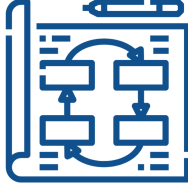


Sources: See Chapter 5. Compiled by BERK, 2025.

Vancouver has planned for climate action and hazard management planning. However, new or more extensive resilience strategies could be implemented to address gaps or opportunities. See **Exhibit 7**. These are further described in **Chapter 5 Vulnerability & Risk Assessment**.

Exhibit 9: Sectors, Priorities, and Resilience Strategies

Sector	Potential Concerns/Priorities	Who is Most Affected?	Highlighted Resilience Strategies
Agriculture & Food Systems	Urban agriculture and local food systems, community gardens, food banks	Residents in poverty or in food deserts Community garden users	 <p>Increase Food Resilience & Access</p>
Buildings and Energy	Naturally occurring affordable housing New housing development, new business spaces	Residents in older housing stock, particularly those who are cost burdened New construction, commercial or residential	 <p>Building Retrofits/Design Renewable Energy</p>
Cultural Resources	Historic and archaeological site protection Critical areas protection Food sovereignty	Tribes Historic property owners	 <p>Natural Infrastructure</p>
Economic Development	Outdoor jobs Recreation events Transportation system interruption	Outdoor workers Tourism/recreation oriented businesses Health care providers Commuters	 <p>Green technology, circular economy, connected city Complete/ Sustainable Communities Local Businesses Support Emergency Response</p>

Sector	Potential Concerns/ Priorities	Who is Most Affected?	Highlighted Resilience Strategies
Emergency Management	Cooling and clean air centers, storm management, redundant functions	Persons with health sensitivities Emergency personnel	 <p>Disaster Management and Service Continuity Partner with Community Based Organizations</p>
Health & Well-being	Tree canopy equity Health services access Access to cooling and clean air centers due to lack of transportation, lack of awareness, or mistrust	Persons with health sensitivities Unsheltered persons	 <p>Improve transportation access to facilities and services CBOs as Essential Resilience Partners Neighborhood specific community preparedness and pilot projects</p>
Ecosystems	Trees, riparian areas, stream flows, water quality	Neighborhoods with high impervious areas, and limited green or blue infrastructure	 <p>Urban Forest</p>
Transportation	Regional and local commuting, acute stormwater flooding, heat and transit	Transit dependent populations such as those with disabilities or lower incomes	 <p>Infrastructure Upgrades</p>

Sector	Potential Concerns/ Priorities	Who is Most Affected?	Highlighted Resilience Strategies
Waste Management	Heat, smoke and outdoor workers; extreme weather and debris	Outdoor workers Neighborhoods with extensive/older tree canopy	 <p>Debris management plan, smoke protections Planning to Reduce Exposure & Monitoring Risk</p>
Water Resources	Demand on stormwater system Water system resilience Wastewater Plant fortification	Neighborhoods with high impervious areas, and limited green or blue infrastructure	 <p>Natural Infrastructure</p>
Zoning	Tree canopy, infill housing and business nodes with multimodal mobility	Households with cost burdens, areas with low connectivity, park gap areas, low active trip areas, communities with disparities in tree canopy	 <p>Complete/ Sustainable Communities</p>

Policy Recommendations

A [Climate Resilience Policy Evaluation](#) under separate cover is summarized by sector in [Chapter 5](#). Strengthening policies in the new Climate, Environment, Community Health, Sustainability and Resiliency Element will give purpose and direction to climate actions and strategies.

Use of Report

This Climate Vulnerability Assessment has provided a foundation for developing climate resilience policies and adaptive capacity strategies with city departments and the community.

This report, in conjunction with a related Climate Resilience Policy Evaluation, has helped the City prepare a Climate Element of the Comprehensive Plan Periodic Update.

2. Climate Change in Vancouver

Regional Climate Trends

The Pacific Northwest including Vancouver are experiencing extreme heat, extreme precipitation, drought and reduced summer stream flows, and exposure to wildfires, especially smoke. Key findings of the Fifth National Climate Assessment, Northwest chapter, (Chang, 2023) include the following for Washington, Oregon, and Idaho:

- Warming and Extreme Heat:** Annual average air temperatures in the region have risen by almost 2°F since 1900. Washington and Idaho have warmed by nearly 2°F, and Oregon has warmed by 2.5°F. Relative to 1900–2020, the annual number of extremely hot days and warm nights in the Northwest has been above the long-term average over the past decade, and the annual number of extremely cold nights over the same period has been below the long-term average. Future warming in the region is expected to exacerbate regional heatwave intensities.
- Extreme Precipitation:** The frequency and intensity of extreme precipitation events are projected to increase across the region. Long, narrow bands of atmospheric water vapor transport, commonly known as atmospheric rivers (ARs), are associated with extreme precipitation in the western United States, where they contribute an average of 30%–45% of total winter precipitation. A greater number of strong AR events and fewer moderate and weak events are projected to occur. ARs are projected to reach farther inland.
- Summer Precipitation and Drought:** Summer precipitation is projected to decline under all scenarios, although it will be variable, contributing to more frequent, longer, and more severe regional drought conditions that increase wildfire risk and decrease water availability. Observed lower stream flows in summer are expected to decrease even further due to reduced snow storage, increased evapotranspiration, and longer lags between summer precipitation events.

...Some scientists have described the 2021 heat dome as a 1,000-year event made 150 times more likely by climate change. Instead of being a rare anomaly, events like the heat dome could occur every five to 10 years with 2 degrees C of global warming, they say.



... An estimated 1,400 deaths in the United States and Canada were attributed to the heat dome. Shellfish and other marine animals experienced mass die-offs. Crops were lost, sections of Interstate 5 buckled, and Portland's Max commuter train shut down when its attached power lines melted.




~ (Kramer, 2024)

The University of Washington Climate Impacts Group has developed a climate resilience mapping tool addressing climate hazards, indicators, and impacts for each county in the

state, including Clark County. Some of the data is available at a smaller scale than the county. Information from the tool has been gathered for the year 2050 using the Representative Concentration Pathway (RCP) 8.5 GHG concentration level, which is a very high GHG scenario. The GHG scenarios do not differ significantly prior to 2050. The year 2050 is similar to the 2045 Comprehensive Plan periodic update horizon. See **Exhibit 9**.

Exhibit 10: Climate Change by Year 2050 (Change 2040–2069 compared to Historic 30 Years, Typically 1980–2009, RCP 8.5)

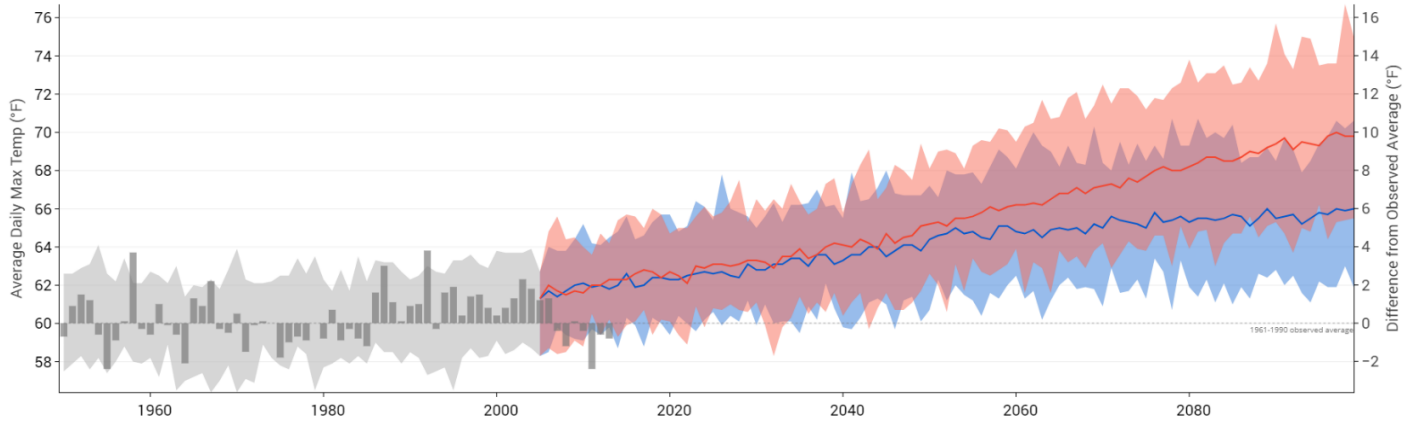
Climate Hazard	Potential Impacts	Climate Data for Clark County
 <p>Extreme Heat</p>	<p>Warmer summers are expected to increase the potential for heat stress on plants and trees and ecosystems, and increase demand for irrigation.</p> <p>Warmer summers are expected to increase concentrations of air pollutants, such as ozone and some vector-borne illnesses, such as West Nile virus.</p> <p>Warmer stream temperatures have the potential to reduce water quality and habitat quality for fish and wildlife.</p> <p>Extreme heat is anticipated to increase the demand for building cooling, increase concentrations of air pollutants, and increase health impacts for sensitive populations.</p>	<p>+6 °F change in average summer (June - August) maximum temperature</p> <p>+ 39 days in annual 90°F maximum humidex days (heat + humidity)</p> <p>Average August stream temperature:</p> <ul style="list-style-type: none"> • 20.9 °C Burnt Bridge Creek • 18.4 °C Fisher Creek • 23.1 to 23.6 °C Columbia River
 <p>Drought</p>	<p>In freshwater ecosystems, less summer precipitation will contribute to lower stream flows, reduce water quality, and increase water temperatures. In terrestrial ecosystems, less summer precipitation will contribute to drought stress and reduce the growth and productivity of some plants.</p> <p>More frequent and severe droughts due to low summer precipitation are expected to increase the need for emergency services to plan, prepare, and respond to water shortages.</p> <p>Increases in annual precipitation have the potential to increase groundwater recharge. Changes in the timing and intensity of precipitation and increases in water demand and evaporation are expected to offset increases in groundwater recharge due to more annual precipitation.</p>	<p>34% chance in 2050 that summer precipitation is at or below 75% of normal</p> <p>-5%, Burnt Bridge Creek, and -21% on Columbia River, percent change in low streamflow in summer (June-September)</p> <p>9.3% average percent change in total annual precipitation</p> <p>-17.9% change in average July 15 - September 15 total precipitation</p>

Climate Hazard	Potential Impacts	Climate Data for Clark County
 <p>Wildfire & Smoke</p>	<p>More frequent wildfires have the potential to reduce forest habitat for some wildlife and increase establishment of invasive species. More frequent wildfires have the potential to increase runoff and sediment to streams.</p> <p>More days with high wildfire danger are expected to affect businesses through more frequent closures of recreation areas and restrictions on outdoor activities during the wildfire season.</p> <p>Poor air quality due to more wildfire smoke can cause adverse respiratory health effects.</p>	<p>In Vancouver 37% chance the average likelihood of climate and fuel conditions being conducive to wildfire (Countywide average is 9%).</p> <p>Change in high fire danger days, 9 days in Vancouver (8 days for Clark County average).</p>
 <p>Extreme Precipitation</p>	<p>Heavier precipitation is expected to intensify flooding in low-lying areas and require higher capacity storm water drainage systems.</p> <p>This could reduce the suitability of some areas for certain land uses and require relocation of some development.</p> <p>More disruptions to business operations and damage to infrastructure including transportation.</p>	<p>13% increase in the total precipitation of the 2-year storm.</p> <p>14% change in the total precipitation of the 25-year storm.</p>
 <p><small>Created by Adrien Coquet from the Noun Project</small></p> <p>Flooding</p>	<p>Higher stream flows are expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains.</p> <p>Higher stream flows reduce the availability of slow-water habitat and can increase sedimentation that affects habitat quality.</p> <p>Higher stream flows are expected to increase riverine flooding, which can damage roads, bridges, and railways and overwhelm drainage structures, such as culverts.</p>	<p>14% change, along Burnt Bridge Creek, in the annual maximum streamflow</p> <p>-5% Columbia River in the annual maximum streamflow</p> <p>Frequency in high streamflow Burnt Bridge Creek, 9.0 years; Columbia River 21.1 years; instead of every 25 years</p>

Source: (Raymond, Climate Mapping for a Resilient Washington, 2022)

Other climate change trends available from the US Climate Toolkit Climate Explorer shows increases in extreme heat are clear at either RCP 4.5 or RCP 8.5. See **Exhibit 10 and Exhibit 11**.

Exhibit 11: Average Daily Max. Temp. (°F) – Historic and Projected Trends – Clark County, WA



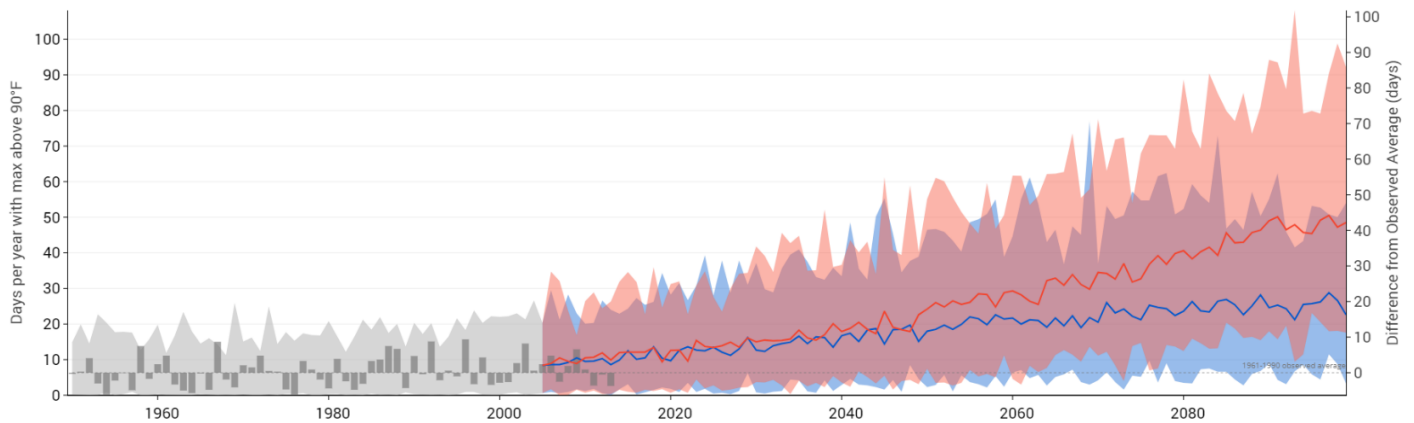
Note: For the contiguous US, graphs and maps for 1950 - 2013 show averages of observations recorded at individual climate and weather stations. Data are available from NOAA's National Centers for Environmental Information. Graphs in Climate Explorer show results generated by global climate models for the Coupled Model Intercomparison Project Phase 5 (CMIP5). For the contiguous US, the climate model data were statistically downscaled using the Localized Constructed Analogs method (LOCA; Pierce et al. 2014).

Source: (US Climate Resilience Toolkit, 2024)

Average Daily Maximum Temperatures are projected to rise to over 64 °F by 2040.

- 1961–1990 observed average: 60 °F
- 2005 observed: 61.3 °F
- Projection Higher Emissions RCP 8.5: 2040 64.4 °F | 2050 65.6 °F
- Projection Lower Emissions RCP 4.5: 2040 63.8 °F | 2050 64.7 °F

Exhibit 12: Days with Max. Temp. > 90°F – Historic and Projected Trends – Clark County, WA



Note: For the contiguous US, graphs and maps for 1950 - 2013 show averages of observations recorded at individual climate and weather stations. Data are available from NOAA's National Centers for Environmental Information. Graphs in Climate Explorer show results generated by global climate models for the Coupled Model Intercomparison Project Phase 5 (CMIP5). For the contiguous US, the climate model data were statistically downscaled using the Localized Constructed Analogs method (LOCA; Pierce et al. 2014).

Source: (US Climate Resilience Toolkit, 2024)

Days w/ maximum temp > 90°F are projected to increase by at least 17 days by 2040 and 20 days by 2050.

- 1961–1990 observed average: 6.3 days with maximum above 90
- 2005 observed: 8.7 days
- Projection Higher Emissions RCP 8.5: 2040 19.5 days | 2050 26.4 days
- Projection Lower Emissions RCP 4.5: 2040 17.2 days | 2050 20.2 days

CLIMATE MODELS

Climate models are mathematical representations of processes important in the Earth’s climate system. The Representative Concentration Pathways (RCPs) describe four different 21st century pathways of GHG emissions and atmospheric concentrations, air pollutant emissions and land use; they include a stringent mitigation scenario (RCP2.6), a low scenario (RCP 4.5), an intermediate scenario (RCP4.5), and one scenario with very high GHG concentration (RCP8.5). Scenarios without additional efforts to constrain emissions lead to pathways ranging between RCP6.0 and RCP8.5. RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures. See Intergovernmental Panel on Climate Change (IPCC), 2021: https://ar5-syr.ipcc.ch/topic_futurechanges.php.

Climate projections are typically based on historical trends (e.g., 1980–2009). The projections are mid-points of 30 year periods and the average of multiple global climate models. The higher GHG scenario (RCP 8.5) causes more warming by the end of the century compared to the moderate (A1B) and lower (RCP 4.5) scenario, but the scenarios do not differ significantly prior to 2050. For near-future applications, the choice of GHG scenario is less important than for late century applications. See: <https://cig-wa-climate.nkn.uidaho.edu/>.

Climate Vulnerability Evaluation

Climate vulnerability is defined as the sum of exposure to a changing climate and the inherent sensitivity of people or environments to a changing climate, minus capacity of the community and place to cope with impacts of a changing climate. See **Exhibit 12 and Exhibit 13**. For example, there are areas that are more vulnerable due to extreme heat, such as “heat islands” with more pavement and less trees, or areas with a higher concentration of older residents (health sensitivity). There are areas that are vulnerable to extreme precipitation such as floodplains and landslide hazard areas, along with populations that live alone or have less access to a vehicle (low adaptive capacity). (US Climate Resilience Toolkit, 2021)

Exhibit 13: Elements of Climate Vulnerability

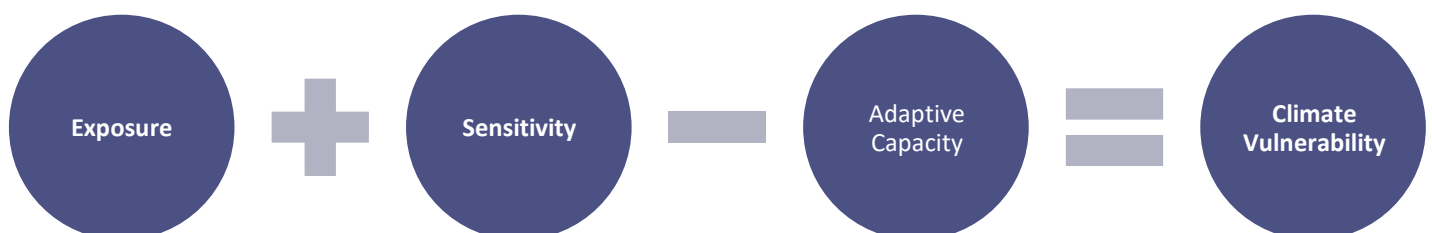


Exhibit 14: Definitions of Climate Vulnerability and Indicators

Exposure	Sensitivity	Adaptive Capacity	Vulnerability
The presence of people, assets, and ecosystems in places where they could be adversely affected by hazards	The degree to which a system, population, or resource is or might be affected by hazards.	The ability of a person, asset, or system to adjust to a hazard, take advantage of new opportunities, or cope with change.	The propensity or predisposition of assets to be adversely affected by hazards. Vulnerability encompasses exposure, sensitivity, potential impacts, and adaptive capacity.
<u>Common Indicators</u> Extreme Heat Extreme Precipitation Flooding Wildfire Smoke and Danger Air Pollution	<u>Common Indicators</u> < 5 years old > 65 years old Steep slopes / geologic hazards Waterbodies on 303d list Diabetes Asthma Respiratory disease Heart Disease	<u>Common Indicators</u> People of Color Poverty Less than high school degree Linguistic Isolation Living Alone Housing Cost Burden Access to Vehicle Housing Condition Population Density Urban Heat Island Impervious Surface Unemployment Outdoor Professions Population no health insurance Tree canopy coverage Access to Open Space	Common Indicators Combination of exposure, sensitivity and adaptive capacity indicators

Source: (US Climate Resilience Toolkit, 2021) (Yu, 2021)

Through the climate vulnerability assessment process, this study produced a Climate Vulnerability Index (CVI). The goal of the CVI is to create a geospatial tool that synthesizes key climate, environmental, and community data to inform the City’s land use and climate planning work. The CVI is designed to identify areas within Vancouver that are more vulnerable to climate change.

The Vancouver CVI presents a series of indices and bivariate intersections. The Exposure Index represents the City’s first index regarding Climate Exposure. In addition, to support the CVI, a Vancouver Health Index was also prepared with components of population health sensitivity. The CVI also makes use of the City’s Equity Index which considers facets of sensitivity and adaptive capacity, particularly socioeconomics. Altogether the following intersections were made:

- **Climate Exposure** intersection with **Vancouver Equity Index** analysis
- **Climate Exposure** intersection with **Community Health Metrics**

CLIMATE INDEX DESCRIPTION AND SCORING

Building an index is the process of standardizing or normalizing data to allow for ‘apples-to-apples’ comparisons between dissimilar datasets. The data is summarized at the block group level for each block group in the planning area (Vancouver + UGA). After each block group contains the summarized metric for each of the exposures, z-score standardization is used to rank each exposure indicator. Z-scores represent how many standard deviations from the mean a given value is. These allow us to understand how a given indicator value for a block group relates to the rest of the dataset. For example, looking at urban heat islands, if a block group had a z-score value of -1.5, that would mean that urban heat island exposure in that block group is relatively low compared to the rest of the planning area. On the other hand, if it had a score of +1.5, that would mean exposure is relatively higher in that block group compared to the rest of the planning area. Once z-scores are calculated for each block group and each indicator, they are considered standardized, and because they are all representing the same metric (number of standard deviations away from the mean), they can be averaged together to create multidimensional metrics or indices.

Climate Exposure, Equity, and Health

Exhibit 14 details the datasets used to analyze exposure to heat, precipitation/flooding, and smoke/air quality. These datasets provide for the greatest granularity and spatial resolution for use in an index. Notably, this list excludes climate projections for the region produced by the University of Washington Climate Impacts Group, as they do not have high enough spatial resolution to show geographic variability across the City of Vancouver.

Exhibit 15: Exposure Index Metrics and Data Sources

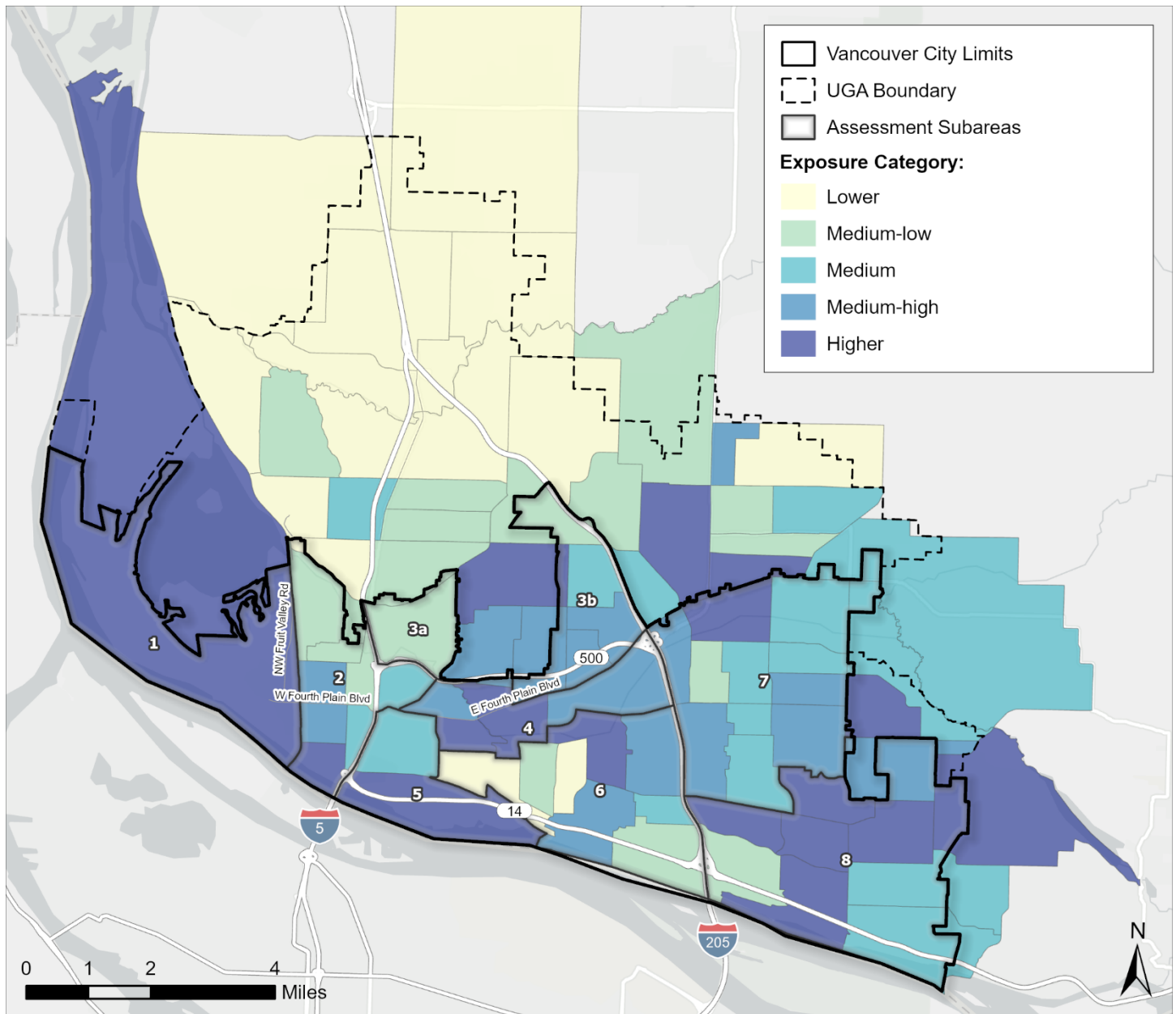
Category	Metric	Description	Source	Data Year(s)
Heat	Land Surface Temperature - Urban Heat Islands	Average Land Surface Temperature	LANDSAT8 / BERK Consulting	2019-2023
Heat	Heat Wave Exposure - Hazard Type Risk Index Score	Heat Wave Exposure - Hazard Type Risk Index Score	FEMA National Risk Index for Natural Hazards	2023
Heat	Low Tree Canopy	Percent of Tract NOT Intersecting Tree Canopy	City of Vancouver / WDFW High Resolution Change Detection	2019 / 2017
Flooding / Precipitation	100- and 500-yr Floodplains	Percent of Tract Intersecting 100- or 500-yr Floodplains (excluding the actual waterways from which floods originate)	FEMA FIRM Floodplains	2021

Category	Metric	Description	Source	Data Year(s)
Flooding / Precipitation	Urban Flooding - Impervious Surfaces	Percent of Tract Comprised of Impervious Surfaces	City of Vancouver / WDFW High Resolution Change Detection	2019 / 2017
Flooding / Precipitation	Riverine Flooding Exposure - Hazard Type Risk Index Score	Riverine Flooding Exposure - Hazard Type Risk Index Score	FEMA National Risk Index for Natural Hazards	2023
Smoke / Air Quality / Fire	Wildland Urban Interface	Percent of Land Area Intersecting WUI Intermix or Interface	WA DNR	2019
Smoke / Air Quality / Fire	Proximity to High Traffic Volume	Average Annual Daily Traffic at Major Roads Within 500 meters of Census Block Centroid	EJ Screen	2020
Smoke / Air Quality / Fire	Ozone Concentration	Average Ozone Concentration	NW-AIRQUEST Regional Background Design Values, 2014-2017 estimates	2014-2017
Smoke / Air Quality / Fire	Ozone Concentration	Ozone annual mean top 10 of daily maximum 8-hour concentration in air	EJ Screen / US EPA	2019
Smoke / Air Quality / Fire	PM2.5 Background Concentration	Average PM2.5 Concentration	Field PM2.5 2014 - 2017 estimates from the Washington State Department of Ecology	2014-2017
Smoke / Air Quality / Fire	PM2.5 Background Concentration	PM 2.5 levels in air measured using an annual average	EJ Screen / US EPA	2019

Sources: Compiled by BERK, 2025.

Combining indicators of extreme heat, extreme precipitation/flooding, and wildfire danger/smoke, a unified index is presented below. The areas with the highest exposure to climate change are identified west of I-5 around Vancouver Lake and along NW Fruit Valley Rd, between I-5 and I-205 in central Vancouver south of SR 500, along Fourth Plain Blvd and E 18th St, and in east Vancouver along SE Mill Plain Blvd. See **Exhibit 15**.

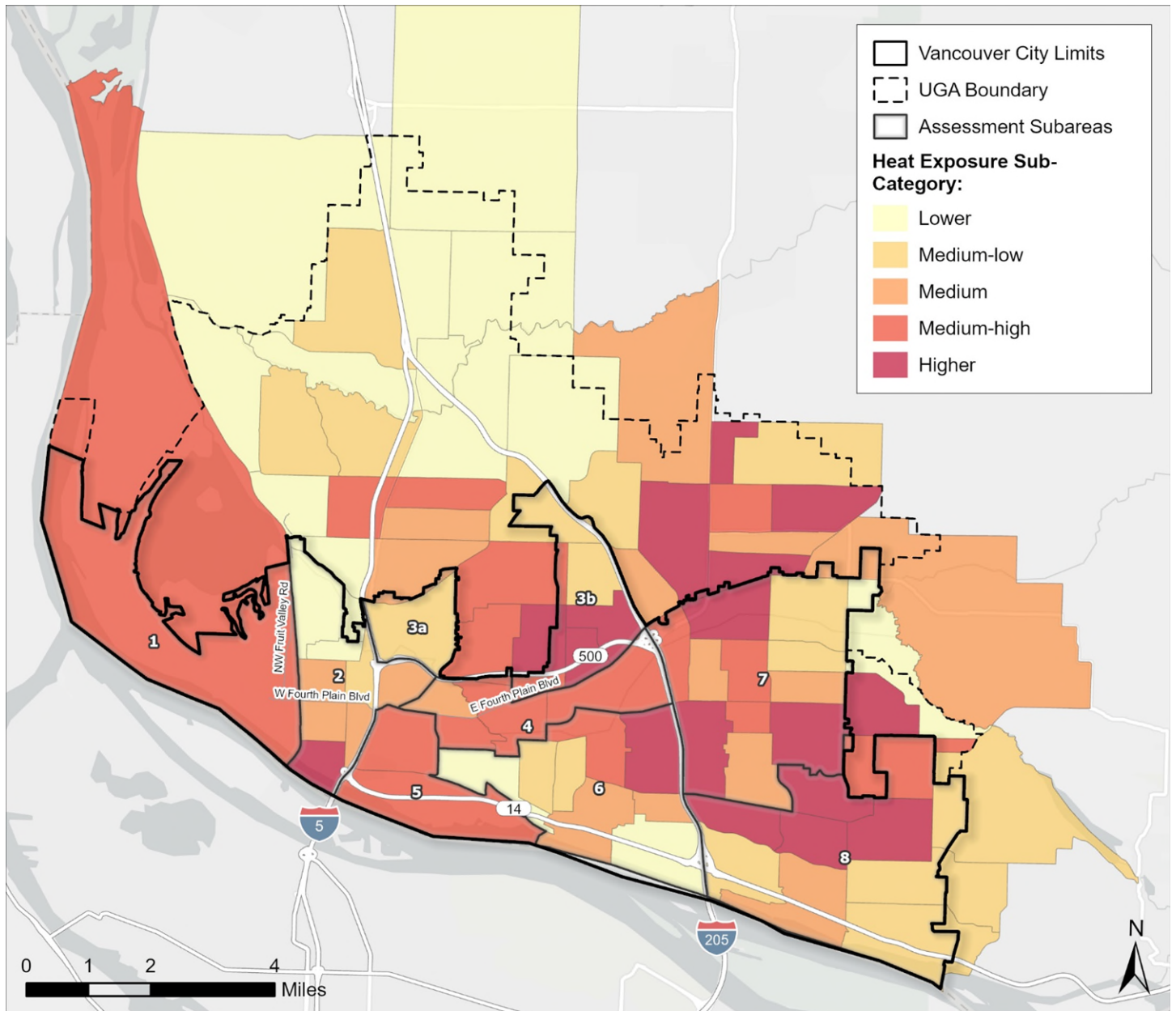
Exhibit 16: Vancouver Climate Exposure Index



Source: BERK Consulting, 2025.

Extreme heat is a driver of climate exposure east of I-205 and along SE Mill Plain Blvd, as well as areas in the UGA. Medium high exposure to extreme heat is found around Vancouver Lake and in other areas in east Vancouver. See [Exhibit 16](#).

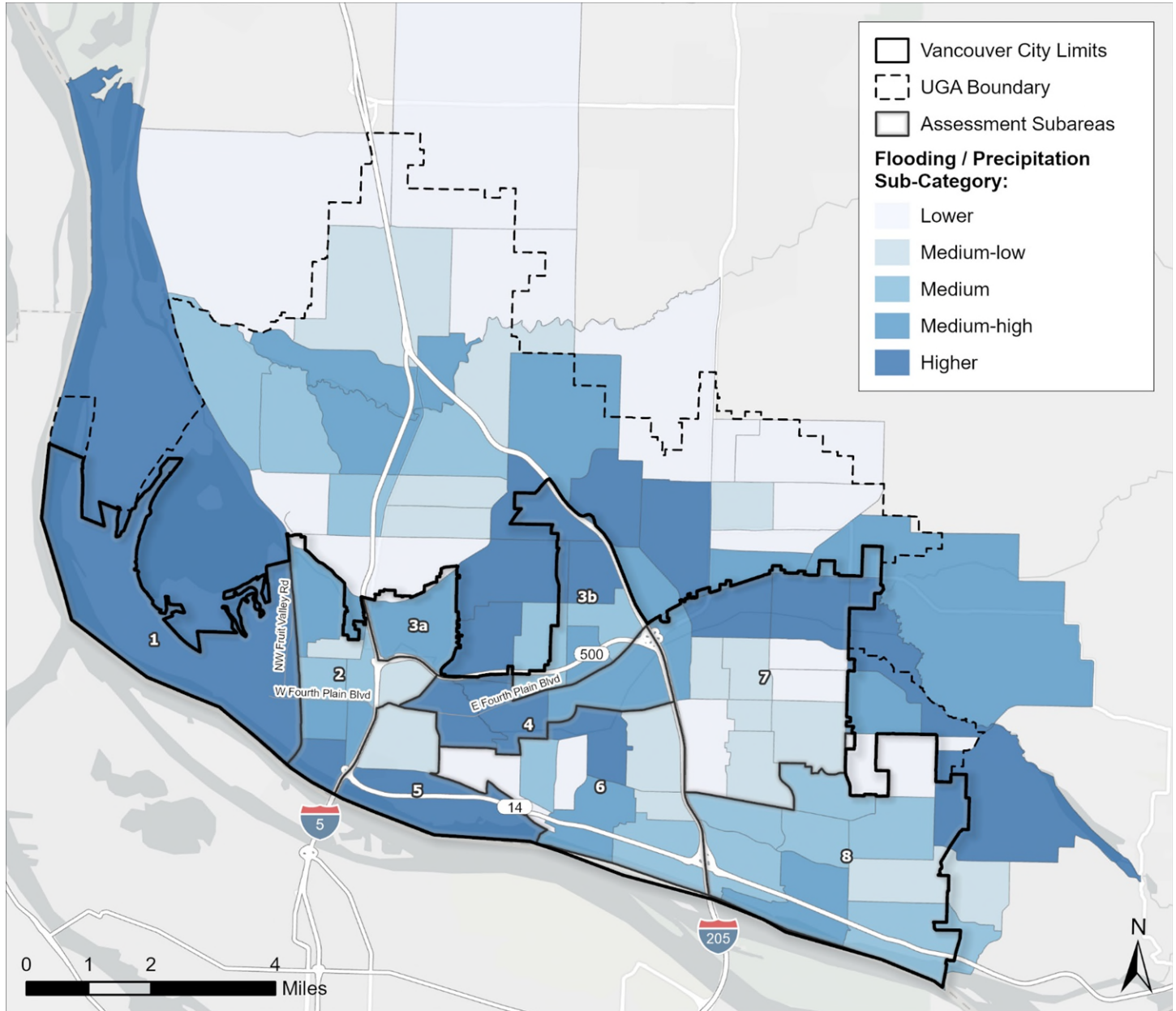
Exhibit 17: Extreme Heat Exposure Index



Source: BERK Consulting, 2025.

Higher exposure to flooding and extreme precipitation is identified around Vancouver Lake and in central Vancouver around Burnt Bridge Creek. See [Exhibit 17](#).

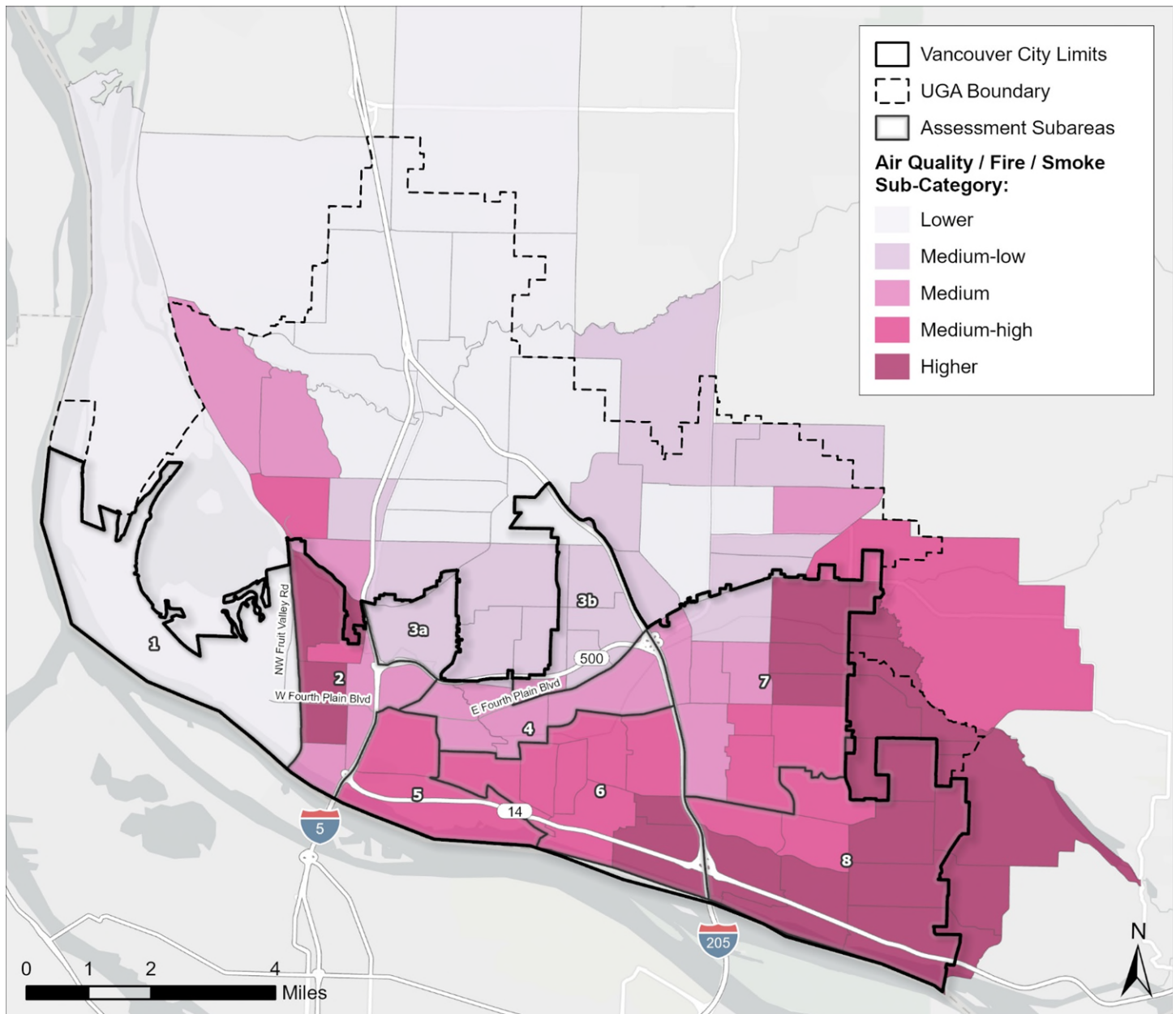
Exhibit 18: Flooding and Precipitation Exposure Index



Source: BERK Consulting, 2025.

Areas of higher Air Quality/Smoke/Wildfire exposure are east of NW Fruit Valley Rd, along SR 14 and in southeast Vancouver. While some data sources suggest wildfire risk around Vancouver Lake, the block has very low ozone scores and low to average PM2.5 scores. The Wildland Urban Interface for that area also is not as high as for other blocks in East Vancouver. See [Exhibit 18](#).

Exhibit 19: Air Quality/Smoke/Wildfire Exposure



Source: BERK Consulting, 2025.

Equity Index + Climate and Equity

The City created an Equity Index with a number of metrics meant to

“translate the self-expressed values and local knowledge of underrepresented or underserved community members into a data-driven mapping exercise. The results of the mapping exercise can be used in multiple ways. For example, to identify priority investment areas; to tailor programmatic offerings into specific communities; or to simply better understand the dynamics of social vulnerability across a geographic landscape.”

Metrics include aspects of sensitivity (age) and adaptive capacity (socioeconomics) such as race, language, poverty, renter households, and education. See [Exhibit 19](#).

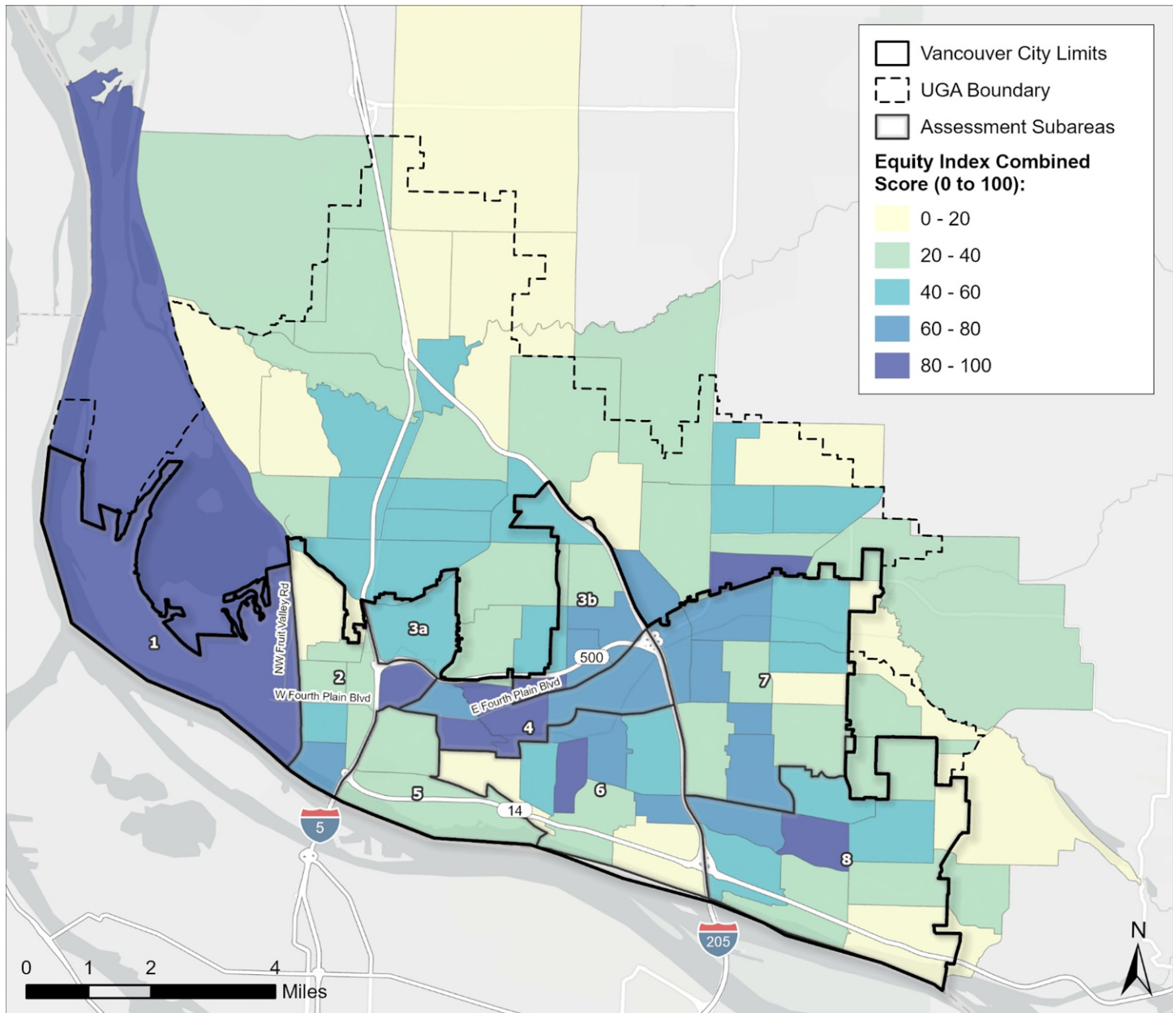
Exhibit 20: Equity Index Metrics

Metric	Source 2010–2020	Relationship to Vulnerability
People of color	ACS B03002	Adaptive Capacity
People below 200% poverty	ACS C17002	Adaptive Capacity
Renter households	ACS B25003	Adaptive Capacity
Adults without a 4-yr degree	ACS B15002	Adaptive Capacity
Households with limited English proficiency (LEP)	ACS C16002	Adaptive Capacity
Persons with disabilities	ACS B18101	Adaptive Capacity
Youth (0-17)	ACS B01001	Sensitivity
Older adults (65+)	ACS B01001	Sensitivity

Source: (City of Vancouver, 2022)

The Equity Index results show communities with higher Equity disparities along Fourth Plain Boulevard such as Maplewood, Meadow Homes, and Baley Downs neighborhoods. See [Exhibit 20](#).

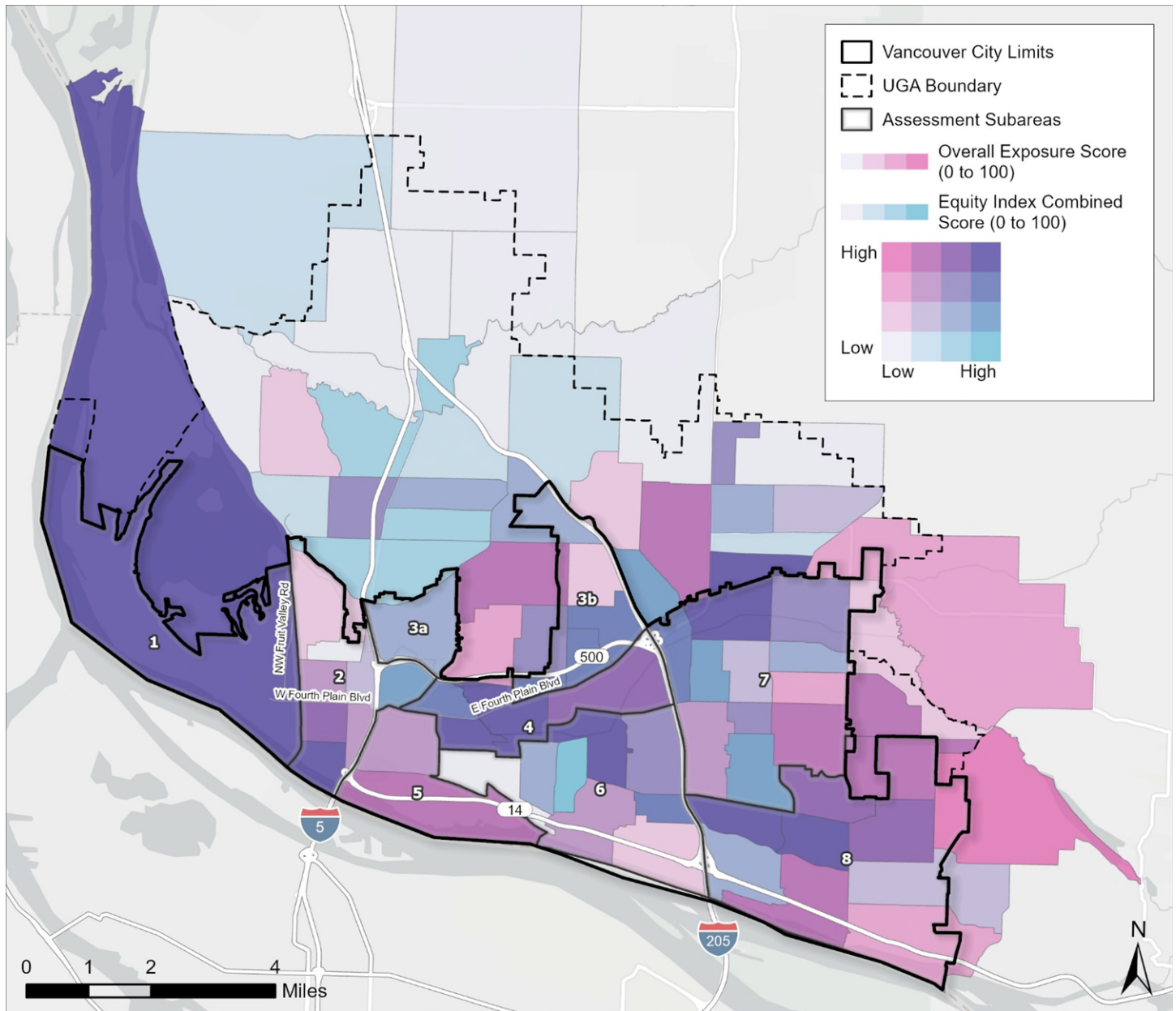
Exhibit 21: Equity Index Score for Vancouver



Source: (City of Vancouver, 2022); BERK 2025.

Considering both climate exposure and equity, the bivariate analysis shows areas with higher scores on both indices. A closer review of conditions and strategies include locations such as Vancouver Lake and NW Fruit Valley Road, Census tracts south of SR 500 and along Fourth Plain Boulevard as well as neighborhoods in southeast Vancouver. See [Exhibit 21](#).

Exhibit 22: Climate Exposure + Equity Index



Source: (City of Vancouver, 2022); BERK 2025.

Health Index + Climate and Health

Some attributes shown in the literature to correlate to higher sensitivity are asthma, chronic obstructive pulmonary disorder (COPD), diabetes, heart disease, poor physical health, and poor mental health. These data points were available at the tract-level from the Centers for Disease Control (CDC Places). See [Exhibit 22](#).

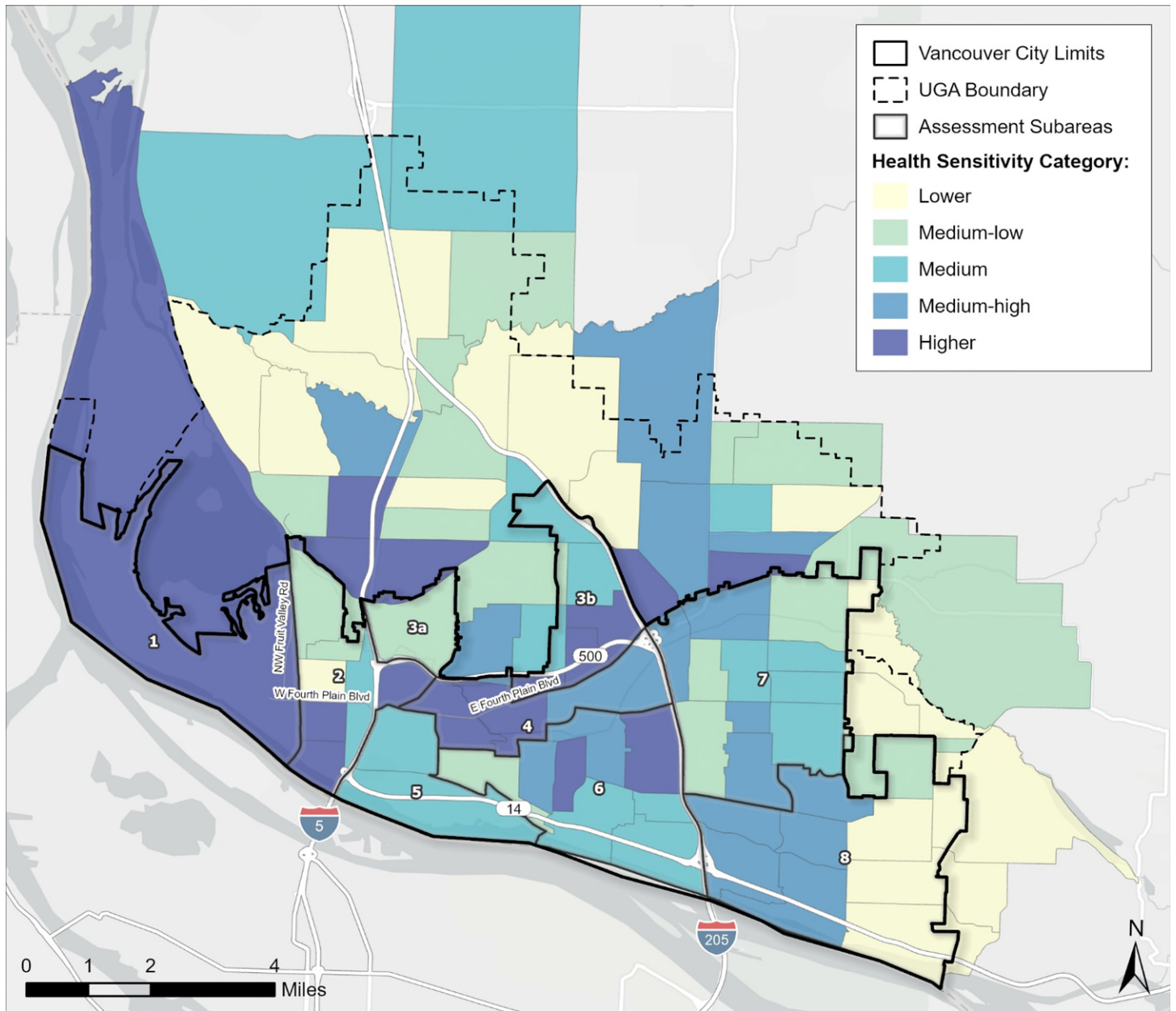
Exhibit 23: Health Data Considered in Health Index

Indicator	Variable Name	Definition
Health Insurance Access	CDC Places	Model-based estimate for crude prevalence of current lack of health insurance among adults aged 18-64 years, 2021
Hypertension	CDC Places	Model-based estimate for crude prevalence of high blood pressure among adults aged ≥ 18 years, 2021
Asthma	CDC Places	Model-based estimate for crude prevalence of current asthma among adults aged ≥ 18 years, 2021
Coronary Heart Disease	CDC Places	Model-based estimate for crude prevalence of coronary heart disease among adults aged ≥ 18 years, 2021
COPD	CDC Places	Model-based estimate for crude prevalence of chronic obstructive pulmonary disease among adults aged ≥ 18 years, 2021
Diabetes	CDC Places	Model-based estimate for crude prevalence of diagnosed diabetes among adults aged ≥ 18 years, 2021
Poor Mental Health	CDC Places	Model-based estimate for crude prevalence of mental health not good for ≥ 14 days among adults aged ≥ 18 years, 2021
Poor Physical Health	CDC Places	Model-based estimate for crude prevalence of physical health not good for ≥ 14 days among adults aged ≥ 18 years, 2021

Source: CDC Places, 2021.

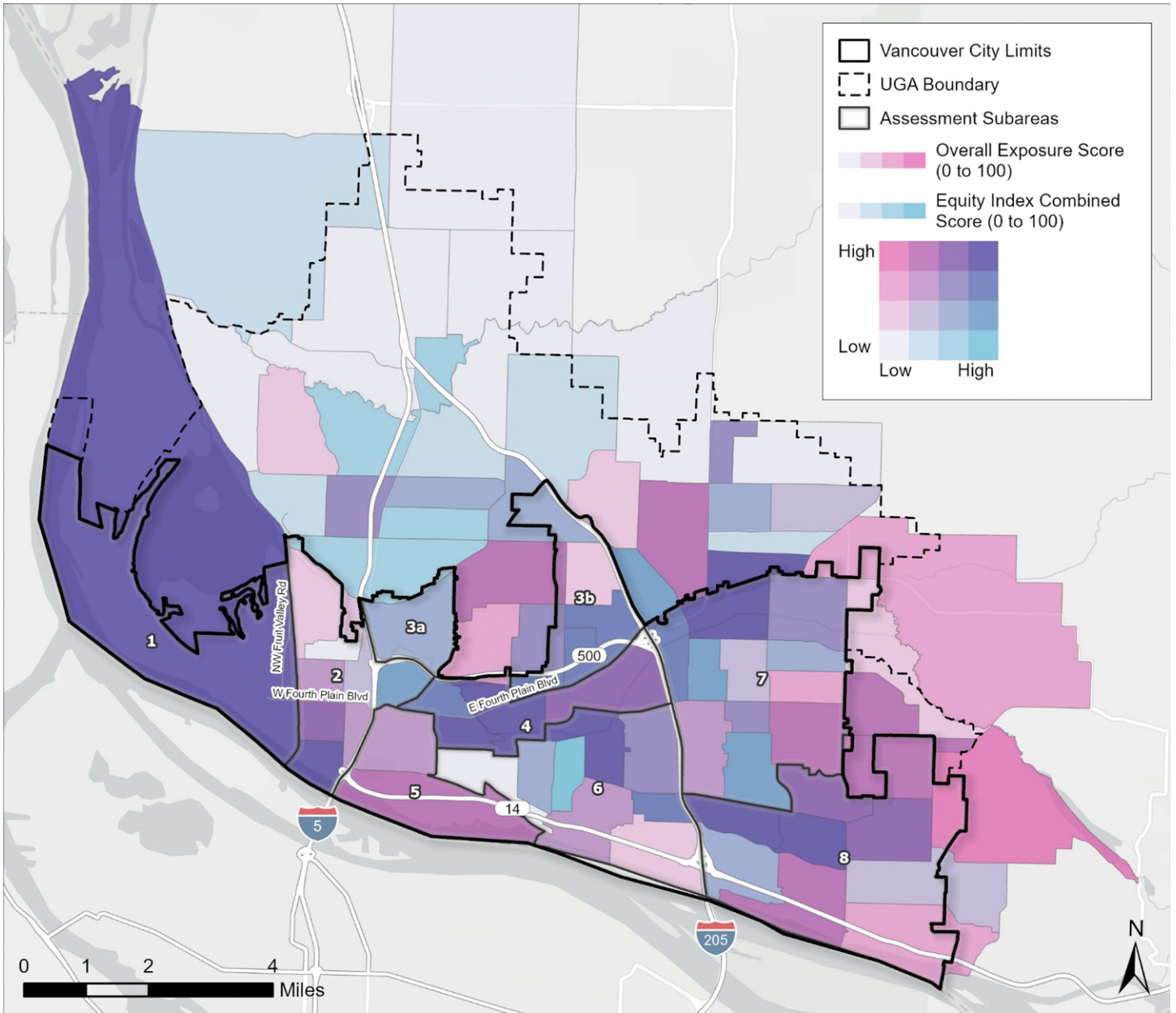
Health Index results are similar to Equity Index results with populations having more sensitive health conditions in west and central parts of Vancouver. See **Exhibit 23** for the Health Sensitivity Index and **Exhibit 24** for a bivariate Exposure and Health Sensitivity map.

Exhibit 24: Health Index – Vancouver



Source: CDC Places, 2021; BERK Consulting, 2025.

Exhibit 25: Exposure and Health Index – Bivariate Map



Source: BERK Consulting, 2025.

3. Residents Vulnerable to Climate Change Impacts

People Vulnerable to Climate Change

Vancouver is home to 202,600 residents (OFM 2024). It is a growing community along the Columbia River and the Portland Metro area. While vibrant with opportunities, some socioeconomic factors may result in Vancouver communities having more challenges when coping with climate hazards and impacts:

- Over 15% experience poverty
- About 15% identified that they have a disability
- 8.3% are without health insurance
- 1 out of 5 speak a language other than English at home
- 32.5% are non-White residents

Source: ACS 2017–2021 per [OUR VANCOUVER Equity Analysis](#), March 2024

Vancouver’s share of populations with these characteristics are higher than the shares for Clark County and the State of Washington.

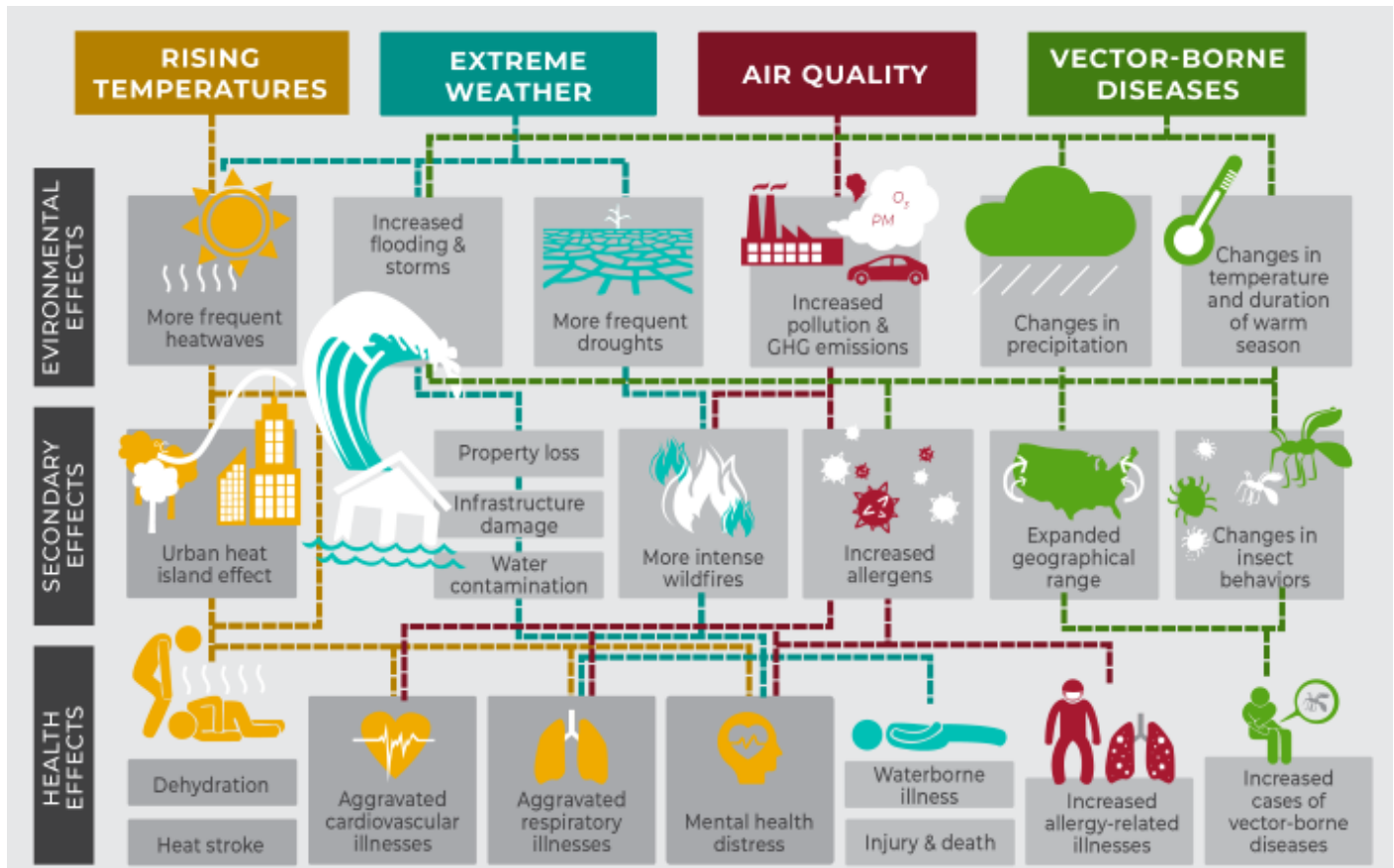
Communities that tend to be more vulnerable to climate change related impacts are those that are already at health, social, and economic risk, including older people, children, low-income families, persons of color, and immigrant communities. (EPA, 2021)

- Persons that are elderly may have more limited mobility or preexisting health conditions, and children under 5 years old may have a harder time regulating temperature and may have underdeveloped immune systems.
- Low-income households may be more susceptible to illnesses and have limited resources to adapt or respond to climate change.
- Communities of color may have cumulative exposures to pollution and health and social disparities.
- Persons that speak English less than very well may have more difficulties during evacuation and difficulties accessing post-disaster funding.

Sources: (Yu, 2021) (Hayden, 2023)

A graphic summary of how climate change affects health is in [Exhibit 25](#).

Exhibit 26: How Climate Change Affects Health



Source: (American Public Health Association, 2024)

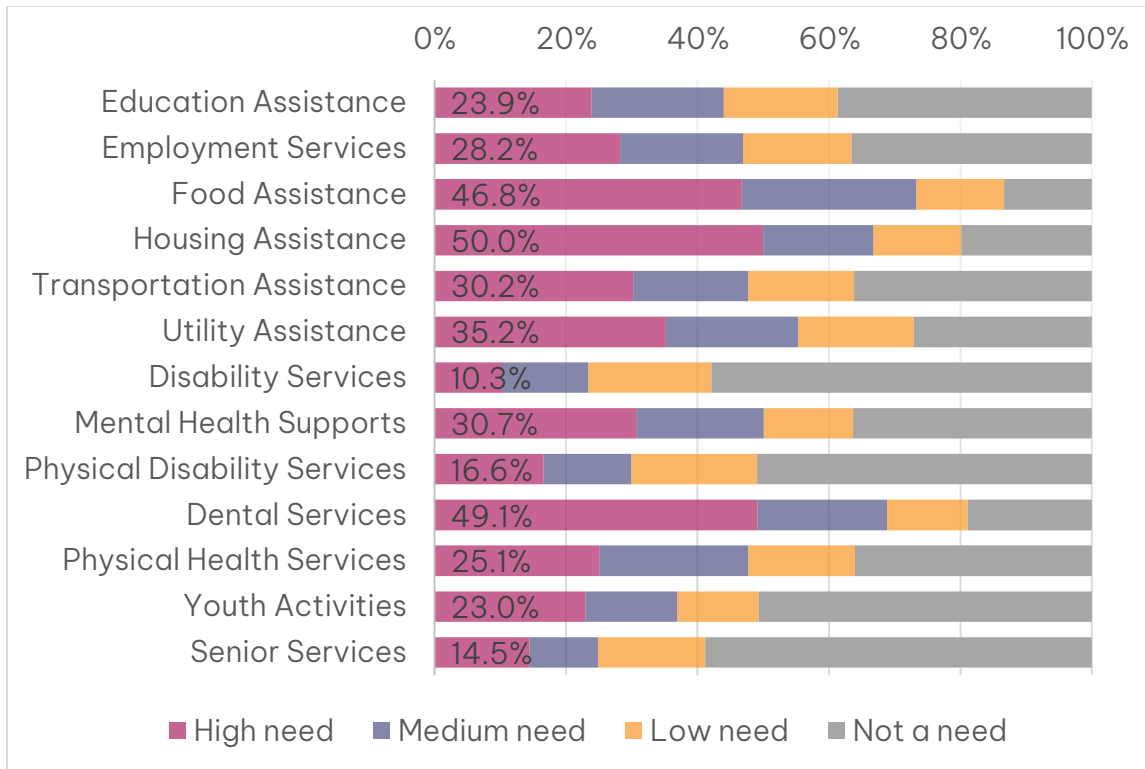
Health Sensitivities

Some health attributes that correlate to higher sensitivity are asthma, chronic obstructive pulmonary disorder (COPD), diabetes, heart disease, poor physical health, and poor mental health. Using the Centers for Disease Control (CDC) Places information at a census tract level, a health index was developed for the purposes of this study. See **Exhibit 23** in the prior chapter. These persons may be more vulnerable to climate change hazards.

Vancouver residents participated in a Clark County Health community needs assessment in 2023-2024. See **Exhibit 26**. Results showed the types of economic and physical challenges that predispose populations to climate vulnerability and offer areas of focus to improve resilience:

- Higher needs – assistance with housing, food, transportation, and utilities
- Moderate needs – support with dental, mental, and physical health services

Exhibit 27: Clark County Needs Assessment Survey 2024: Vancouver Respondent Findings



Source: Clark County Public Health, March 2024

Capacity to Adapt and Equity

Populations in Vancouver with potential socioeconomic disparities include persons in poverty, persons with disabilities, renter households, persons with high school or less education, and persons of color. These populations may have less resources to prepare for or respond to climate impacts. For example, in the Northwest United States, an EPA study in 2021 found that those with lower incomes are much more likely than those with higher incomes to have the highest labor hour losses among weather-exposed workers. BIPOC populations were more likely to have new asthma diagnoses due to particulate air pollution which can be exacerbated by climate change. (EPA, 2021) Vancouver’s Equity Index considers the relative concentrations of these populations by Census block. Areas with populations that may have Equity disparities include Fruit Valley and Fourth Plain Blvd. See [Exhibit 20](#) in the prior chapter.

Engagement with underserved community members could help surface priorities for investment in public services as well as locations needing more investment in amenities like parks, tree canopy, services, stormwater treatment, sidewalks, and others.

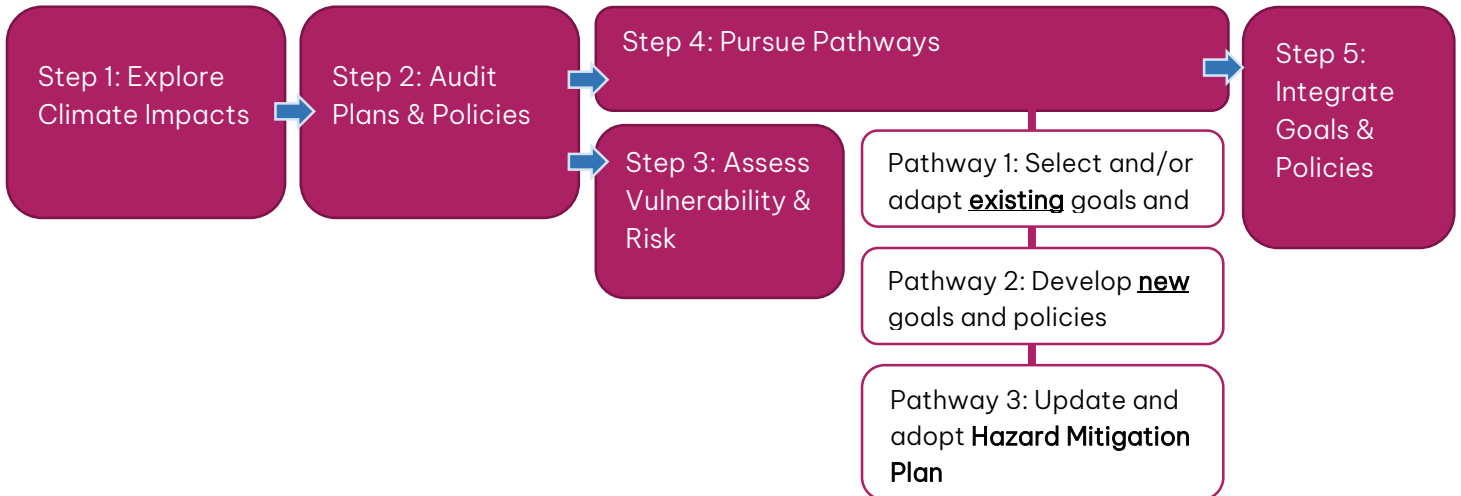
4.Planning for Climate Change

Growth Management

The State legislature passed HB 1181 requiring a Climate Change & Resiliency Element. The element is to provide actions to reduce GHG emissions and per capita VMT. The element also must “equitably enhance resiliency to, and avoid or substantially reduce the adverse impacts of, climate change in human communities and ecological systems through goals, policies, and programs.” The goals, policies and programs should be based on the best available science and credible climate projections and impact scenarios. Both the GHG reduction sub-element and the resiliency sub-element must prioritize GHG reductions and climate resilience actions that benefit overburdened communities.

The State of Washington Department of Commerce has developed guidance (Commerce, 2023) to develop the climate element including both GHG reduction and resiliency sub-elements. This document provides a Vancouver Climate Vulnerability Assessment consistent with Steps 1 through 3. A separate policy evaluation recommends adapting existing or proposing new goals and policies to address Steps 2 and 4. See **Exhibit 27**.

Exhibit 28: Climate Resilience Sub-Element Steps – Washington Department of Commerce



Source: (Commerce, 2023)

This Vulnerability Assessment addresses Resilience sub-element step 3. Regarding the GHG sub-element, the City has developed GHG emission reduction goals in a Climate Action Framework and has inventoried GHG emissions. The City is in the progress of developing per capita VMT goals with the Comprehensive Plan periodic update.

Related Vancouver Climate Planning Efforts

Climate Action Framework (2022)

In December 2022 Vancouver adopted a 2040 goal to be carbon neutral. A range of strategies was developed to address GHG reductions across energy, transportation, solid waste, and land use sectors, and build capacity with the city government as well as engage equitably with the community. Strategies are listed below. A wide range of actions were identified to implement each strategy.

- Strategy EQ-1. Enhance resilience of overburdened communities
- Strategy EQ-2. Build a more community-driven, circular economy
- Strategy EQ-3. Support growth of the green technology workforce
- Strategy BE-1. Increase use and storage of renewable energy while reducing consumption
- Strategy BE-2. Decarbonize homes, businesses, and other buildings
- Strategy TLU-1. Create neighborhoods that support clean modes of transportation
- Strategy TLU-2. Shift driving trips to clean, active modes of transportation
- Strategy TLU-3. Decarbonize and electrify vehicles
- Strategy TLU-1. Create neighborhoods that support clean modes of transportation
- Strategy TLU-2. Shift driving trips to clean, active modes of transportation
- Strategy NS-1. Increase carbon storage in trees, vegetation, and soil
- Strategy NS-2. Improve ecosystem resilience
- Strategy NS-3. Conserve Water Resources
- Strategy SW-1. Require recycling and organic material management
- Strategy SW-2. Zero out wastewater emissions
- Strategy GOV-1. Mainstream sustainability at the City, including staff capacity

The City is implementing the strategies and actions and monitoring GHG emissions to achieve the ambitious overarching goal of carbon neutrality.

Climate Adaptation Strategy (2022)

The Vancouver Climate Adaptation Strategy was developed for the City by Hatch Planning associated with Portland State University. The report was intended to guide climate adaptation policies, and with the results of engagement – a survey, six pop-up events, and five focus groups – identified the following recommendations:

- 1. Climate-Ready Communities** – Provide essential services for communities to increase resiliency, and expand and increase inclusive access to services. Cultivate community connections to build resilient communities.

2. Communication and Education – Increase community-wide awareness of climate adaptation strategies and available resources. Foster communication and collaboration between the City and residents, and among residents and community organizations.

3. Green Infrastructure – Bolster green infrastructure in the urban environment that reduces urban heat island effects and mitigates poor air quality. Install green infrastructure in the built environment to increase the resiliency of structures.

4. Land Use and the Built Environment – Implement sustainable land use policies to address changing climate conditions. Promote building and development standards for public and private facilities.

5. Food Security – Increase equitable access to food in the face of rising food prices and insecurity. Promote self-sufficiency through local food production.

6. Governance – Institutionalize climate adaptation strategies among City departments.

Equity and Displacement Indices

Vancouver has developed the Vancouver Equity Index to understand communities and places that have had less investment and are underserved. This can inform policy, budgets, and programs. In addition, Vancouver developed a Displacement Index to identify places in Vancouver experiencing or likely to experience displacement due to redevelopment or due to the expense of housing. This tool is used to inform the City's Comprehensive Plan to avoid impacts where possible and to develop anti-displacement policies.

The Reside Vancouver, Anti-Displacement Strategy, contains four strategies: people, preservation, production, and prosperity. Underneath these strategies are the following recommended actions:

- Manufactured Dwelling Park (MDP) Zoning
- Right of First Refusal
- Anti-Displacement Impact Assessments
- Rental Registration Program
- “Qualified” Local Small Businesses in Public Procurements
- Joint-Labor Management and Job Training Partnerships
- Community Investment Trusts

Some Reside Vancouver strategies could support economic development and zoning and development climate strategies, such as green technology jobs and building quality housing that meets environmental health standards. (Thread Community Planning, 2023)

OUR VANCOUVER - COMPREHENSIVE PLAN 2045 – Climate Planning

The City is currently updating its comprehensive plan to encourage a connected and accessible. Per the City’s approach (City of Vancouver, WSP, 2024) this means the following:

- Accessibility focuses on universally designed places, and the ability for all residents regardless of physical or neural capabilities or incomes to be well served by their built environment.
- Connectivity is intended to communicate how people are connected to services and amenities in neighborhoods, as well as how neighborhoods connect and inter-relate to one another.

The plan will review active trip potential to improve connectivity and increase bicycle and pedestrian trips. The City is evaluating these growth strategies for their ability to provide lower per capita GHG emission and VMT. The land use plan will be supported by a climate change and resilience element per HB 1181.

Community Health

Overburdened Communities Highly Impacted by Air Pollution

Communities across Washington State are exposed to air pollution from stationery, mobile, and other environmental sources. Vancouver was identified as a potentially overburdened community by the Washington State Department of Ecology in its 2023 report due to the city’s proximity to major interstates like I-5 and I-205, the nearby industrial uses in the City of Portland, exposure to state-wide and regional wildfire smoke, and socioeconomic and demographic factors that exacerbate negative health outcomes. (Washington Department of Ecology, 2023) (Ecology W. D., 2024)

Poor air quality has been linked to negative health outcomes and in overburdened communities. The following impacts are more common in overburdened communities and can be linked to high concentrations of criteria pollutants:

- Heart and lung disease at higher rates than state average
- 2.4 year lower life expectancy than state average
- Older adults in overburdened communities highly impacted by air pollution were twice as likely to die from illnesses linked to breathing fine particles (PM_{2.5}) from human-caused sources than the statewide average.

- Older adult people of color have a higher risk of death from breathing fine particles (PM_{2.5}) compared to older white adults in the same area. (Washington Department of Ecology, 2023)

Climate change can directly degrade air quality such as during extreme heat events, causing ozone levels to be higher. Higher PM 2.5 pollution levels could also occur during heatwaves, Increasing wildfires would result in smoke and PM 2.5 exposure. (West, 2023) See **Exhibit 28**.

Exhibit 29: Climate Change Impacts on Ozone and PM 2.5 over the United States



Wildfires
Ozone: +
PM_{2.5}: +

Increasing wildfires will degrade air quality.



Heatwaves
Ozone: +
PM_{2.5}: +

High temperatures and clear skies can increase pollution.



Temperatures
Ozone: +
PM_{2.5}: +

Overall, pollution concentrations will increase as temperatures rise.



Drought
Ozone: +
PM_{2.5}: +

Drought will decrease uptake of ozone by vegetation and increase dust PM_{2.5}.



Biogenic emissions
Ozone: +
PM_{2.5}: +

Warmer temperatures will increase pollutant sources from vegetation and soil.



Precipitation
Ozone: Little change
PM_{2.5}: -

Higher precipitation may wash out PM_{2.5}.



Regional transport
Ozone: ?
PM_{2.5}: ?

Transport of pollution may change, but the trends are unclear.



Humidity
Ozone: -
PM_{2.5}: +

Higher humidity will reduce ozone but increase PM_{2.5}.



Stagnation
Ozone: ?
PM_{2.5}: ?

Pollutants accumulate during stagnant periods, but trends in stagnation are uncertain.

CAPTION: Climate change is projected to alter concentrations of two key US air pollutants, ozone and PM_{2.5}, through several processes. Red icons signify increased ozone and PM_{2.5}, and the blue icon denotes decreased PM_{2.5}. Plus and minus signs indicate the expected pollutant response to climate-driven changes in meteorology. Question marks and purple icons denote uncertainty in either the response or in how the meteorological process will change with climate change. Given uncertainties and regional differences in pollution responses, the magnitude of these responses is not presented. Source: (West, 2023)

Ecology intends to place air monitors in overburdened communities and publish biennial reports on community criteria pollution levels, greenhouse gas emissions, and health impacts. The Climate Commitment Act also requires Ecology to develop standards and strategies to reduce the criteria air pollution in overburdened communities highly impacted by air pollution.

Vancouver can coordinate with Ecology as it monitors pollutants and as it implements its Climate Action Framework to reduce greenhouse gas emissions.

Adaptive Capacity Assessment

This report is also in conversation with the City's **Adaptive Capacity Assessment (2025)**, which focused on understanding the systems, resources, and conditions that enable communities to respond to climate hazards. Findings from the Adaptive Capacity Assessment have been integrated—helping to illuminate where and why vulnerability varies, and what additional actions may be needed to support at-risk populations and infrastructure. (City of Vancouver, 2025)

Health Impact Assessment

The City prepared a Health Impact Assessment (HIA) that considers how the growth alternatives studied as part of the **OUR VANCOUVER** Comprehensive Plan periodic update may benefit and impact health in Vancouver as it relates to the built environment.

The HIA also analyzes health-related conditions around these themes:

- Physical Activity
- Food Access
- Community Connections
- Exposure to Health Hazards
- Housing and Financial Security

The HIA addresses impacts from gaps in the built environment for secure and active lives, and access to services important for day to day living, as well as a range of health hazards. Analysis of these conditions has provided a basis for improved policies addressing community health.

Some sectors addressed in this Vulnerability Assessment overlap with the Health Impact Assessment such as Agriculture and Food Systems, Health and Well-being, and Zoning and Development.

Health and climate resilience are considered together in the Comprehensive Plan Update policies.

5. Vulnerability & Risk Assessment

Introduction

This report provides a planning level evaluation of climate impacts in Vancouver. It describes communities, places, and infrastructure that may be more or less vulnerable. It describes current or potential new strategies to enhance Vancouver's resilience. This assessment informs new or amended policies in the Comprehensive Plan periodic update. Data, policies, and implementation strategies would be updated and evolve over time.

The climate impacts and strategies are reviewed across 11 sectors in the following order:

- Agriculture & Food Systems
- Buildings & Energy
- Cultural Resources & Practices
- Economic Development
- Emergency Management
- Health & Well-being
- Ecosystems
- Transportation
- Waste Management
- Water Resources
- Zoning & Development

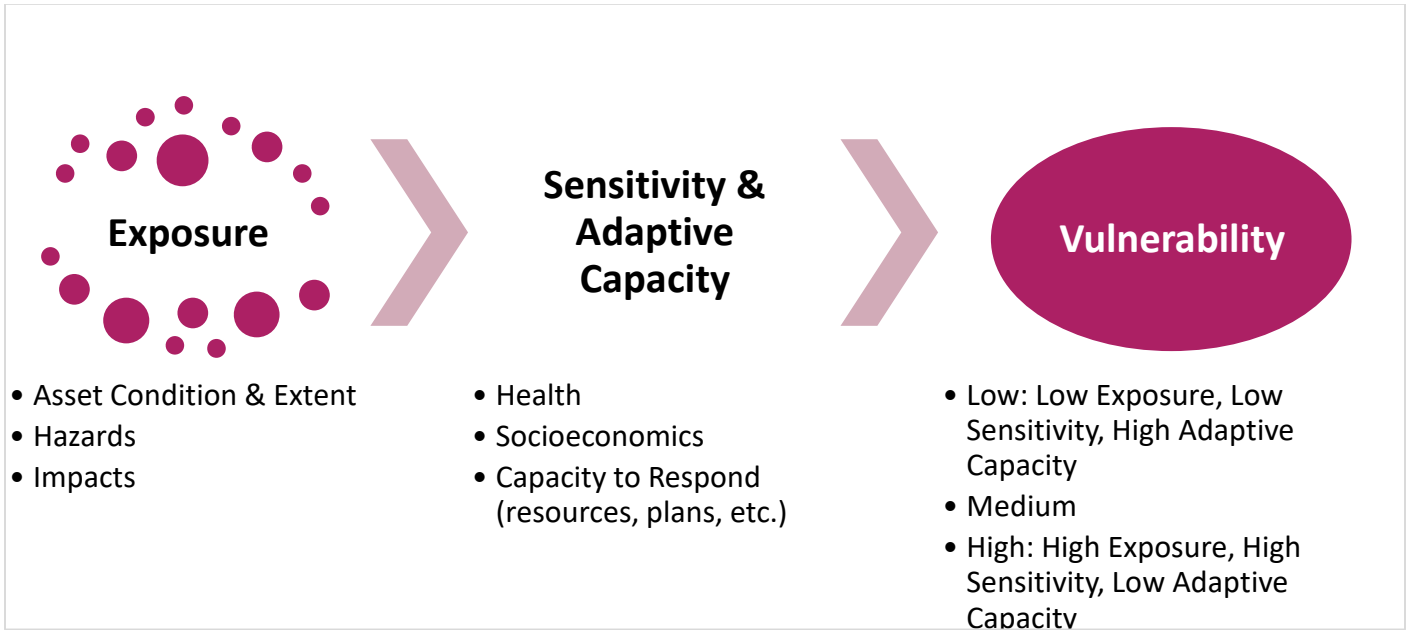
For each sector, the following information is provided:

- Sector Overview and Assets
- Potential Climate Impacts
- Adaptive Capacity
- Vulnerability Summary
- Gaps and Opportunities

The Vulnerability Summary is based on criteria described below.

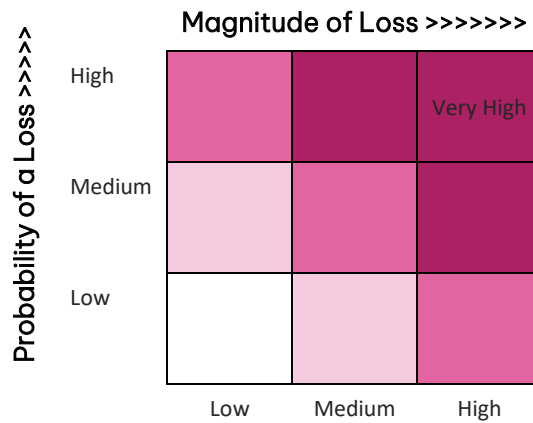
Vulnerability Criteria: Under each sector, the Census tracts or Areas (1 through 8) with higher exposure, higher sensitivity, or lower adaptive capacity are identified. Key indicators or assets that are most impacted are also considered. See [Exhibit 29](#). These planning level considerations of vulnerability and risk can help Vancouver identify and prioritize policies and development regulations. Also see a [Climate Resilience Policy Evaluation](#) available under separate cover.

Exhibit 30: Assessment of Climate Vulnerability



Source: (US Climate Resilience Toolkit, 2024), BERK 2025.

Risk Criteria: Under each sector, a summary of Risk is provided considering likely climate impacts in 10+ years, magnitude of loss, extent of City responsibility, and effect on vulnerable communities. (See sidebar on following page.)



RISK: PROBABILITY AND MAGNITUDE

Probability is the potential that the impact would occur during the 20-year planning period, and is informed by the Natural Hazards Mitigation Plan (Clark Regional Emergency Services Agency, 2023), University of Washington Climate Impacts Group resiliency mapping tool (Raymond, Climate Mapping for a Resilient Washington, 2022), and other literature.

Probability is based on whether climate impacts have occurred or are possible during the short term (5 years), medium term (10 years), and long term (20 years).

- All sectors would be impacted by extreme heat and wildfire smoke or worsening air quality, and these impacts have occurred and are most likely to occur in the next 5-10 years making them a medium or high probability.
- Severe flooding in the 100-year floodplain is a lower probability given the limited floodplain and flood protection infrastructure, but urban stormwater impacts are more likely at least with a medium probability in the next 10 years.

Magnitude would vary across the landscape and by sector, and considers:

- The potential for multiple climate impacts.
- The City's responsibility for system management or recovery needs.
- Whether costs would broadly affect vulnerable populations (extent or numbers) including those with health sensitivities or low resources (adaptive capacity).



Agriculture & Food Systems

Sector Overview and Assets

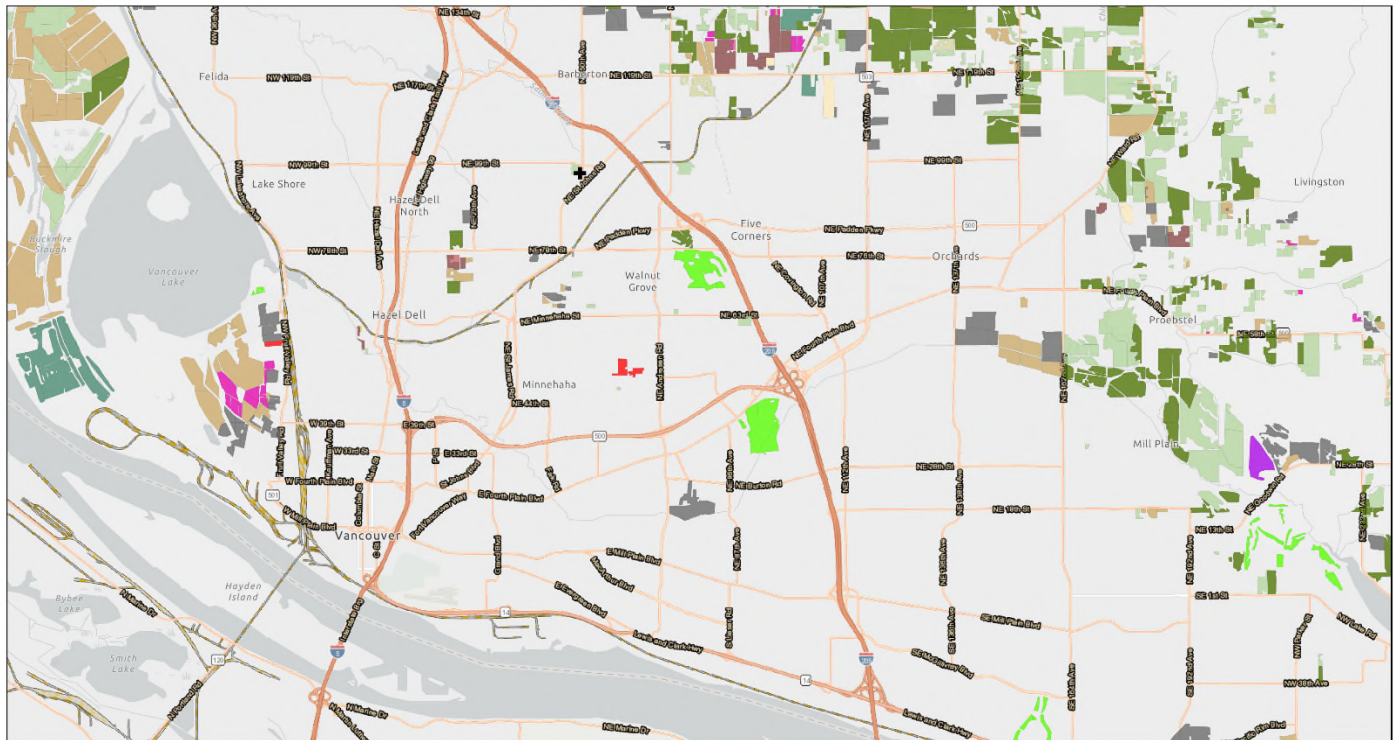
The food system in Vancouver is comprised of various sites and services: places to buy food, such as grocery stores and farmers markets; services combating food insecurity, such as food pantries and free and reduced school lunches; opportunities for food growing and urban foraging, such as gardens and fruit-bearing trees; and the supply chain systems that transport and process food. There is only a small amount of urban agriculture within Vancouver, but Clark County has an active farming community that serves the city through area farmer's markets and community supported agriculture programs, where households can buy a share of produce during the growing season.

The Clark County Community Needs Assessment survey, conducted by Clark County Public Health in 2024, found that food assistance and access to fresh and healthy foods were among the top physical health services needs for Vancouver respondents (Clark County Public Health, 2024).

Key assets for agriculture and food systems in Vancouver include:

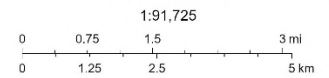
- A small amount of urban agriculture, mostly located near Vancouver Lake (Area 1) and along NE Fourth Plain Boulevard (Area 7) (see [Exhibit 30](#))
- Farmer's markets, including the Downtown Market (year-round) and East Vancouver Market (seasonal)
- Community Supported Agriculture (CSA) programs (generally offered by farms outside of city limits)
- City community gardening program (five sites across the city including Areas 1, 4, 5, 6, 7)
- Grocery stores (see [Exhibit 31](#))
- Food pantries (operated by Clark County Food Bank and partner organizations—see [Exhibit 32](#))
- Food transportation and supply chain
- School lunch programs, including free and reduced school lunches
- Home gardens
- Fruit-bearing trees in the right-of-way and in parks

Exhibit 31: Agricultural Inventory – Vancouver Vicinity



3/17/2025, 7:54:25 AM

- World_Transportation
- WSDAOrganicLocations2023
- WSDACrop_2023
 - Berry
 - Cereal Grain
 - Commercial Tree
 - Hay/Silage
 - Nursery
 - Oilseed
 - Orchard
 - Other
 - Seed
 - Turfgrass
 - Vegetable
 - Vineyard
 - Developed
 - Pasture



County of Clark, Oregon Metro, Bureau of Land Management, State of Oregon, State of Oregon DOT, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METRANSA, NGA, EPA, USDA, State of Oregon GEO, Esri, HERE. Sources: Esri,

Web AppBuilder for ArcGIS
WSDA

Source: (Washington State Department of Agriculture, 2023)

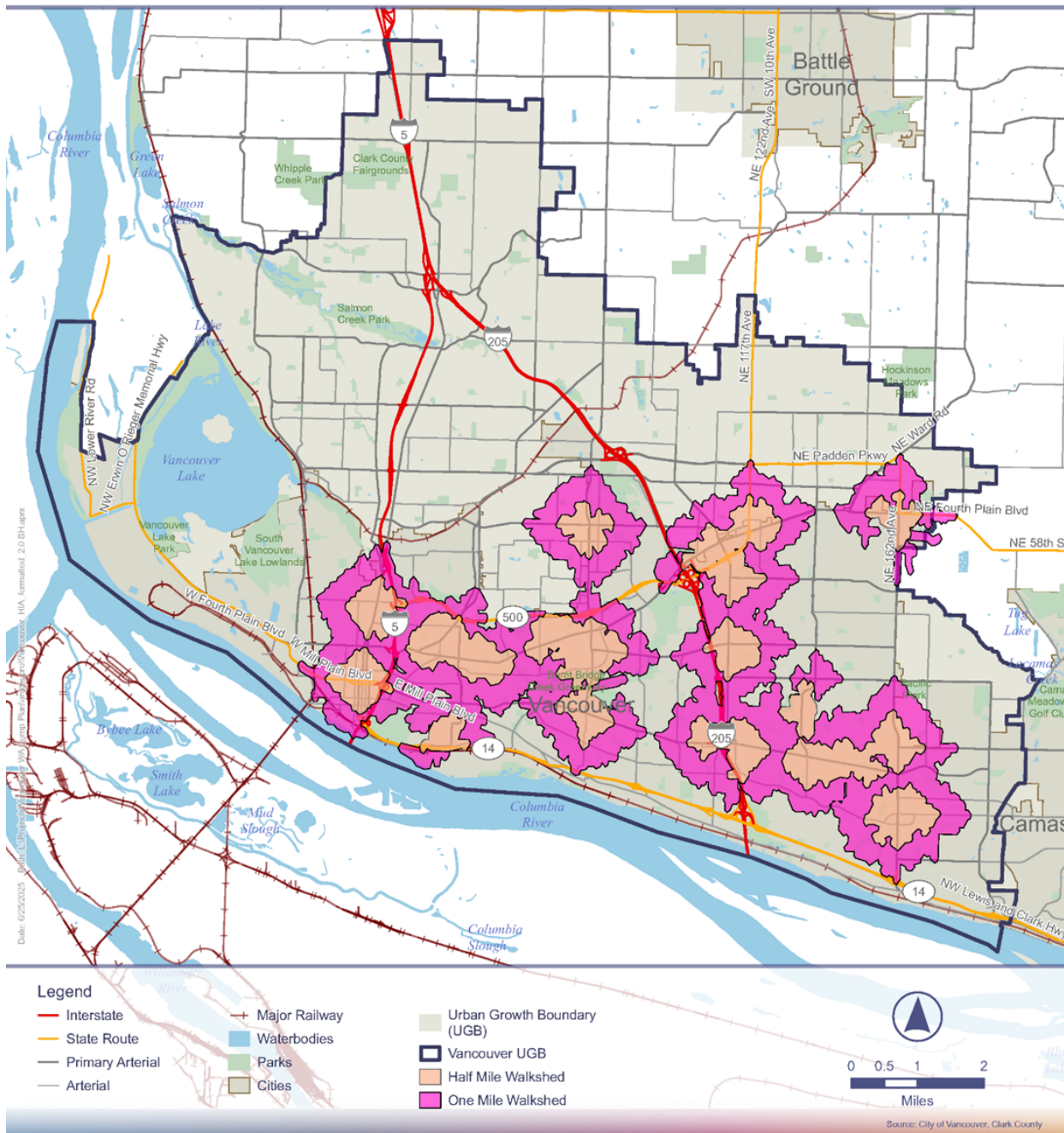
Exhibit 32: Supermarket Access

OUR VANCOUVER

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Access to Supermarkets

Half-mile and 1-mile service areas (city only)



Source: WSP 2024, BERK 2024.

Exhibit 33: Clark County Food Pantry Sites



Source: (Clark County Food Bank, 2024)

Potential Impacts

Heat, extreme precipitation, flooding, drought, wildfire, and smoke are all expected to impact food systems in Vancouver, including crop viability and watering costs, health of farmers and gardeners, demand for food banks and other resources, costs for operating grocery stores, logistics for the transportation of food, and farmers market operations.

- Extreme heat and drought can stress plants in farms and gardens, as well as public fruit-bearing trees, affecting yields, viability of urban agriculture, and availability of some local food items. Watering costs also increase in such events, impacting producers and possibly resulting in higher food prices. Extreme precipitation and flooding events could also result in crop loss. While much of the city is likely to be exposed to similar levels of drought and extreme heat, agriculture is highly sensitive and primarily located on the west side. The west and central areas of the city are also more exposed to extreme precipitation and flooding.

- Extreme heat can increase the cost of food refrigeration for businesses and households. This can impact several links of the food system, including harvesting, transportation, distribution, and household use.
- Unsafe temperatures and smoke can impact the work and wellbeing of farmers, gardeners, and city maintenance staff, who work outside. These events can also result in cancelled outdoor farmers markets, and food banks may become more crowded as extreme weather refuges for those who are experiencing housing insecurity. Individuals without a vehicle may also be unable to safely travel to get food.
- Wildfire and flooding may affect some food transportation routes at a regional level, impacting the logistics of food businesses in Vancouver. Local flooding could also impact household access to grocery stores.
- Areas near Vancouver Lake and on the eastern edge of the city are within the wildland urban interface and may be susceptible to wildfire, including the city's primary area for urban agriculture on the west side.
- Assets like grocery stores may be less sensitive to climate impacts than agriculture, which is highly dependent on predictable weather patterns and less able to recover from shocks. Therefore, the west area of the city, where most of the urban agriculture is located, may be more sensitive than other areas.

Adaptive Capacity

Adaptive capacity of food systems in Vancouver varies by asset type.

Food banks, SNAP support, and free and reduced school lunch programs already see a lot of demand in Vancouver: 15.5% of households receive Supplemental Nutrition Assistance Program (SNAP) support (American Community Survey, 2022). In the 2021–2022 school year, 48% of students in Vancouver received free and reduced lunch (Design Workshop, 2024). If food costs increase due to the impacts of climate change on agriculture, many households will struggle to keep up with the rising prices. The Clark County Food Bank has recently completed a new facility, which could allow them to expand their programs.

The City's **community gardening program** and other programs that support **hyperlocal food production and distribution** could make communities more resilient to supply chain shocks, and resulting cost increases, from regional, national, and international climate impacts. Slow Food Southwest Washington has an Urban Abundance program, which supports Vancouver and nearby communities in creating publicly-accessible food-scapes and gleaning and donating food that would otherwise go to waste (Urban Abundance, 2024).

Climate events that impact **transportation**, such as by making it unsafe to walk or wait at a bus stop, would be harder to adapt to for parts of the city that do not have access to grocery stores within one mile. See **Exhibit 31**.

Food production in Vancouver may have more flexibility to adapt to drought conditions, by increasing watering, than extreme heat, smoke, and extreme precipitation.

Vulnerability Summary

Hazards affecting the citywide food system include extreme heat, drought, flooding and extreme precipitation, and wildfire smoke. While the whole city is exposed to these hazards, urban agriculture is generally more sensitive to climate events than assets such as grocery stores. See Exhibit 33 for a summary of vulnerability to agriculture and community gardens.

Area 1 has urban agriculture and a community garden (Fruit Valley) and is exposed to a higher risk of extreme heat and flooding. Area 4 has a community garden (Campus) but no known commercial agriculture; it has a medium-high risk of exposure. Other areas with the presence of community gardens include Areas 2 (Marshall), 5 (Fort Vancouver) and 7 (LeRoy Haagen). Areas 3b and 7 also have limited agriculture. However, the Census tracts in areas 3b, 5, and 7 have less exposure to hazards.

Exhibit 34: Vulnerability by Census Tracts – Agriculture and Community Gardens

Census Tracts	Area	Heat	Flooding/ Precipitation	Smoke/ Air Quality	Overall Exposure	Health Conditions	Equity Index	Agriculture, Community Garden
53011041005	1	Higher	Higher	Lower	Higher	Higher	Higher	Ag, Gar
53011041800	2	Medium-low	Medium-low	Medium-low	Medium-low	Higher	Higher	Gar
53011041107	3b	Medium	Lower	Medium-low	Medium-low	Lower	Medium-low	Ag, Gar
53011041600	4	Medium	Medium-high	Medium-high	Medium-high	Higher	Higher	Gar
53011042602	5	Medium	Medium	Medium	Medium	Medium	Medium-low	Gar
53011041207	6	Medium	Medium	Medium	Medium	Medium	Higher	Gar
53011041326	7	Lower	Medium	Medium	Medium-low	Medium-low	Medium	Ag
53011041337	7	Medium-low	Lower	Medium-low	Medium-low	Medium-high	Medium-high	Gar

Legend: Ag = Agriculture, Gar = Garden

Source: See **Chapter 2** for indicators and methods. BERK, 2025.

In summary, the area most affected with agricultural assets and heat and flooding exposure is Area 1 as described above. Area 1 contains some vulnerable communities and abuts other

vulnerable communities in Area 2. Area 3b has exposed agricultural and garden assets but medium low or lower populations with health sensitivity or equity disparities; thus, Area 3b is not highlighted in the summary of risk.

Exhibit 35: Risk Summary – Agriculture Sector

Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Strategies to Improve Adaptive Capacity

Based on the Asset Mapping Assessment and climate planning engagement, following are some strategies to address agriculture and food systems:

- Pilot edible rain gardens or de-paving projects near NE Fourth Plain to support food access and manage stormwater runoff (City of Vancouver, 2025)
- Provide food forests or edible landscapes in heat-impacted neighborhoods. (City of Vancouver, 2025)
- Consider opportunities to combine adaptation and food security efforts, such as through increasing the urban tree canopy with plantings of fruit and nut trees when/where appropriate. Plantings should be coordinated with fruit and nut tree maintenance education programs (e.g. plantings on public school properties) to relieve burden on Public Works. (Hatch Planning and City of Vancouver, 2022)

Discussion: City staff who maintain fruit and nut trees on public property could be a source of information on the City’s current inventory of food-producing trees, how the food is harvested and used, and resilience considerations for these assets. The school district could also be a connection point as many children in Vancouver qualify for free and reduced school lunches, making school a key food source.

Policies

A policy audit of City plans to support the [OUR VANCOUVER 2045](#) periodic update showed limited policies addressed agriculture and food systems in the context of climate hazards. The audit suggested policy revisions such as:

- Address affordability of healthy food and support of healthy food in schools or other programs.
- Add more specific policy language about actions to support food security.
- Address resilience of plants and trees that support local fruit and nut production on public property.

The **OUR VANCOUVER 2045** effort is developing policies incorporating these concepts to address these findings in the Climate Vulnerability Assessment and the related Health Impact Assessment:

- Expanding access to community gardens and incentivizing urban agriculture to improve food security and increase healthy food options. (Draft Policy 80)
- Incentivizing and removing regulatory barriers to locating grocery stores and neighborhood markets near housing and in underserved neighborhoods. (Draft Policy 80)

Another policy that supports stormwater management and de-paving, which is also an opportunity for the co-benefit of food security with edible raingardens, includes:

- Focus on improving water quality and prevent flooding through managing stormwater flows, encouraging natural filtration of precipitation to ground water, reducing runoff, mitigating flood risks by advancing systems that manage stormwater effectively, and enhancing local water quality in the watershed. (Draft Policy 10)



Buildings & Energy

This section addresses energy generation, transmission, and consumption in buildings with a focus on resilience. This section used information from the City of Vancouver Community Profile, Community Atlas, Climate Action Framework, and Climate Adaptation Strategy Policy as well as the County Assessor building data.

Sector Overview and Assets

Buildings

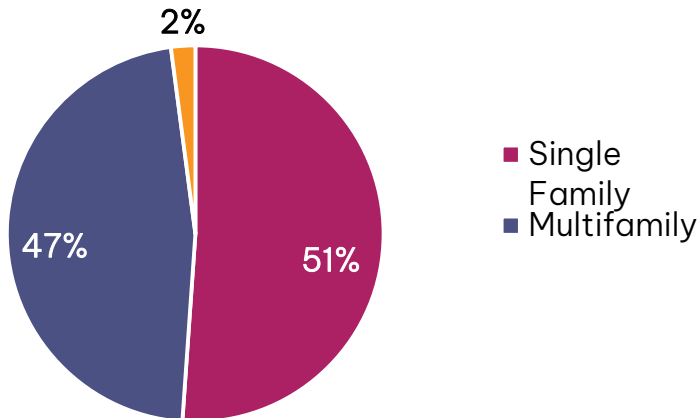
Based on 2024 County assessor data, Vancouver has 57,119 total buildings. Out of that, 93.4% are residential buildings, 4.7% are commercial, and 1.9% are industrial (**Exhibit 35**). However, 62.3% of total square footage of all Vancouver buildings are residential, while commercial and industrial buildings make up a greater percentage of total square footage than percentage of buildings, at 24.7% and 13.0% respectively (Clark County, 2024). In 2021, there were 83,868 housing units in Vancouver, a 32% increase from 63,620 in 2010 (City of Vancouver, 2022). Out of these housing units, 51.1% are single-family units, 46.8% are multifamily units, and 2.1% are mobile homes (**Exhibit 36**).

Exhibit 36: Number of Buildings and Square Footage by Residential, Commercial, and Industrial, 2024

	Buildings		Square Footage	
	Number	Percent	Square Footage	Percent
Residential	53,354	93.4%	111,889,986	62.3%
Commercial	2,690	4.7%	44,366,622	24.7%
Industrial	1,075	1.9%	23,259,751	13.0%
Total	57,119		179,516,359	

Source: Clark County Housing Assessor Data, 2024

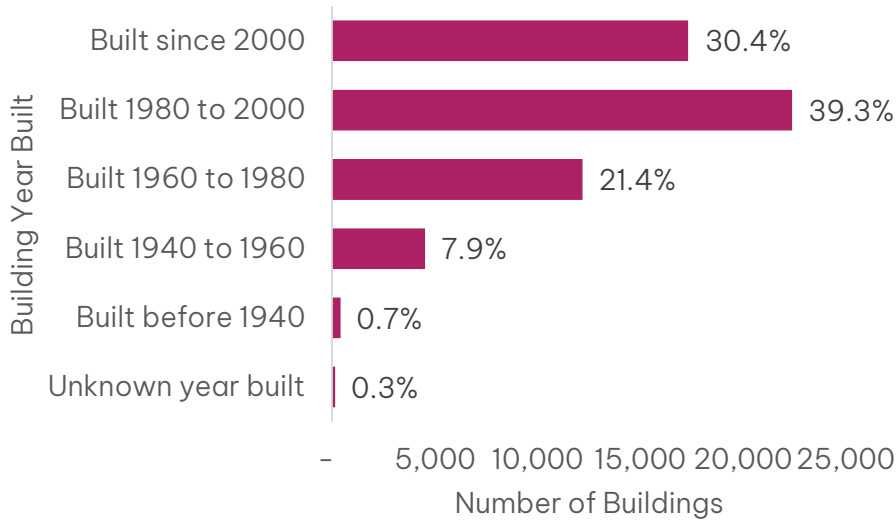
Exhibit 37: Housing Units by Type, 2024



Sources: Postcensal Estimates of Housing Units, Washington State Office of Financial Management, 2024; BERK, 2024.

Vancouver’s housing stock is fairly young, as shown in **Exhibit 37**. The largest percentage of buildings were constructed between 1990 and 1999, and the median year of construction is 1985 (Design Workshop, 2024). 39.3% of all buildings were built between 1980 and 2000, 30.4% were built after 2000, and 21.4% were built between 1960 and 1980. The remaining 8.9% of buildings were built before 1960 or have an unknown age (Clark County, 2024). A share of the housing stock built prior to 1980, about 30% of Vancouver’s housing stock, is likely in need of energy efficiency updates as the State Energy Code was adopted in 1985 (Design Workshop, 2024).

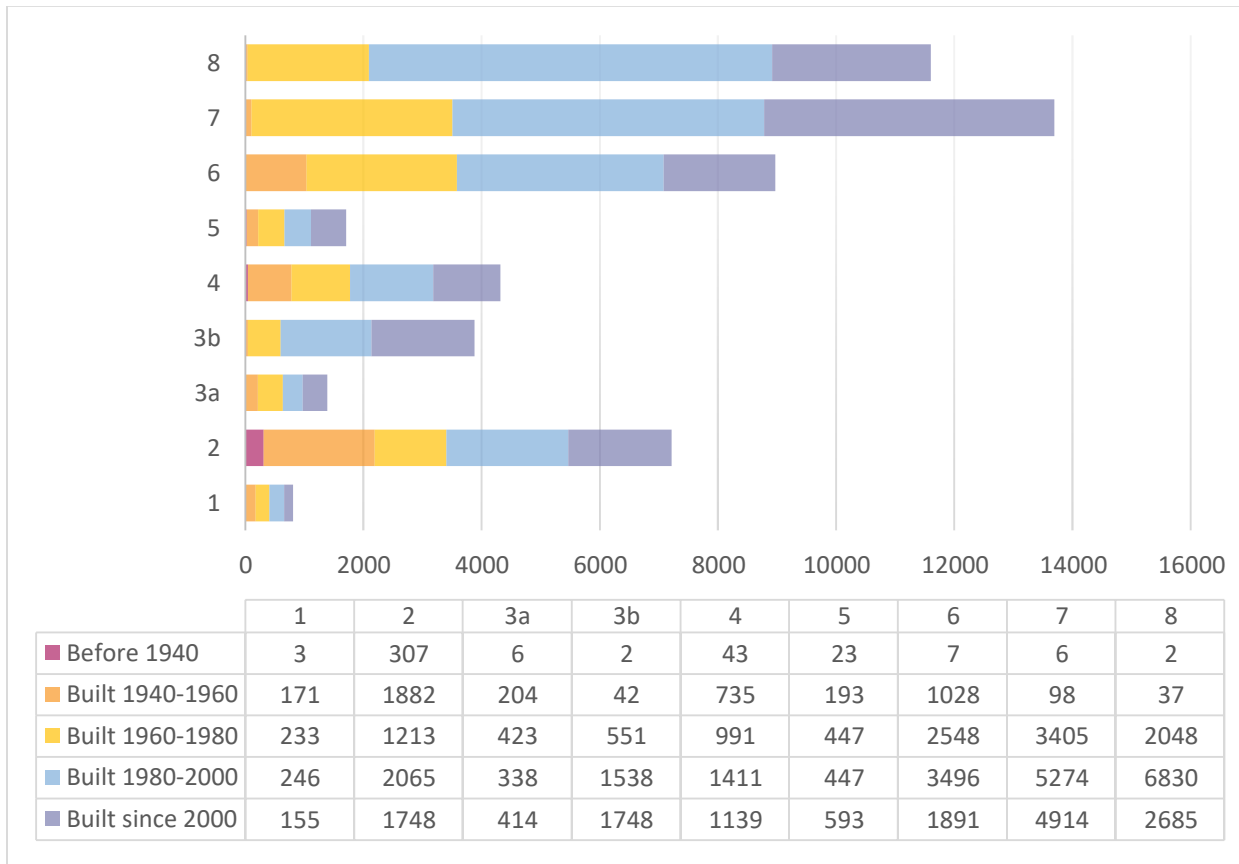
Exhibit 38: Building Age, Residential and Non-Residential, 2024



Sources: Clark County Housing Assessor Data, 2024; BERK, 2024.

Older housing stock is found primarily in 2 and 6, but all areas have housing built prior to 1980. Generally, newer housing has been developed on the east side of the city. Older structures may not be weatherized to address cooling and ventilation. See [Exhibit 38](#).

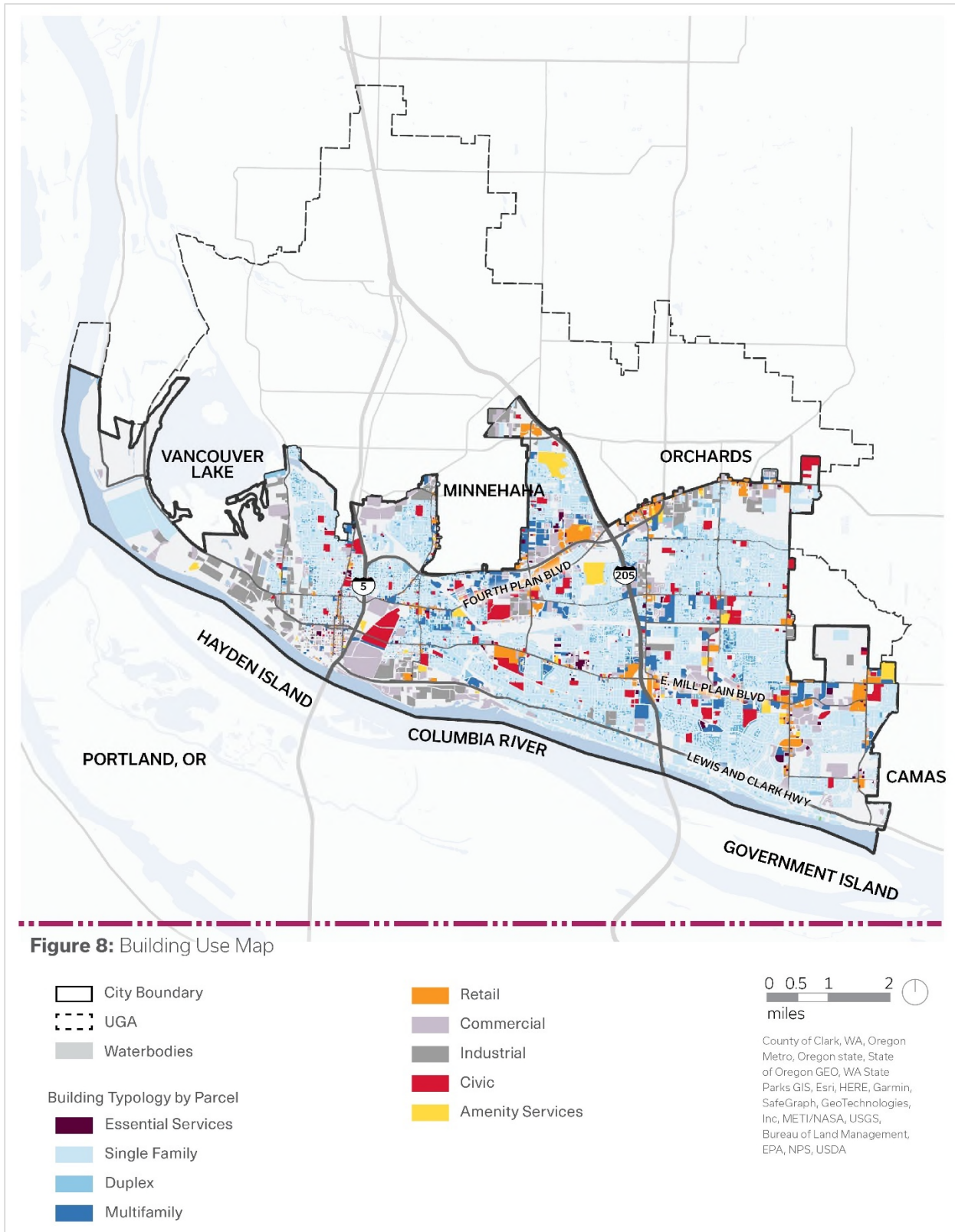
Exhibit 39: Relative Age of Residential and Non-Residential Buildings by Area in Vancouver



Sources: Clark County Housing Assessor Data, 2024; BERK, 2025.

Buildings in Vancouver include residential uses (single-family, duplex, multi-family), essential services, retail, commercial, industrial, civic, amenity services, and parks and recreation. As indicated in the building use map, the predominant portion of parcels are residential uses, either single-family or duplex residences. However, there are concentrations of multi-family units along the Fourth Plain corridor and to the north and south of the Mill Plain corridor (Design Workshop, 2024). See **Exhibit 39**.

Exhibit 40: Building Use Land Map, 2024



Source: (Design Workshop, 2024)

Centers and corridors that have a high-level of essential service provision include Fourth Plain, Vancouver City Center, Central Park and Columbia Tech Center. Areas that are otherwise identified as areas for concentrated growth on the City's 2011 Comprehensive Plan and are still in progress include 112th Avenue Corridor, Fruit Valley, Evergreen and Grand Commercial Corridors, the Heights District, Riverview Gateway, Lower Grand Employment Area, and Section 30.

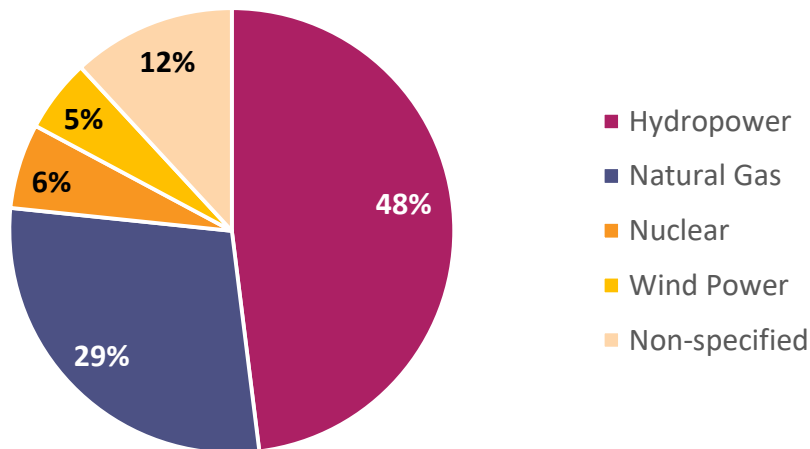
Energy

Energy sources for Vancouver are hydropower, natural gas, nuclear, and some renewable energy. Bonneville Power Administration and Clark Public Utilities serve the city. Clark Public Utilities specifically sources energy from the following:

- 48.03% is hydropower purchased from the Bonneville Power Administration (BPA).
- 28.61% is natural gas produced at Clark Public Utilities River Road natural gas-fired generating plant. This facility is located in Vancouver.
- 6.17% is produced by nuclear electricity (BPA purchases the output of the Columbia Generating Station located in Richland, Washington).
- 5.30% is wind power generated at the Combine Hills II wind farm near Milton Freewater, OR.
- 11.89% is market-purchased power from non-specified sources.

As of January 2020, Clark Public Utilities reported facilitating 1,489 individual privately-owned generating systems, primarily rooftop solar, totaling 10.414 megawatts of installed distributed generation capacity (Clark Public Utilities, 2020). Clark Public Utilities also have constructed two Community Solar projects that offer “virtual net metering” for participants benefiting from the two large solar arrays constructed (Clark Public Utilities, 2024). These projects include a total of 1,118 kilowatts of solar capacity. The projects are both fully utilized, and 199 kilowatts were reserved for low-income customers. See [Exhibit 40](#).

Exhibit 41: Clark County Energy Sources, 2022.



Source: Clark Public Utilities Integrated Resource Plan, 2022; BERK, 2024.

Vancouver's nearly 30 electrical substations are distributed evenly across the City (Clark County, 2024).

In 2023, the buildings and energy sector made up 37% of Vancouver community-wide emissions, second to transport and travel. Out of that 37%, 15% was residential energy, 13% was commercial energy, and 9% was industrial energy (City of Vancouver, 2024). This was an increase in energy use for the community from 2019. However, GHG emissions decreased, likely due to the increased clean energy within the Clark Public Utilities resource mix. The buildings and facilities sector made up 23% of Vancouver government operations emissions, a 9% decrease from 2019. (City of Vancouver, 2024).

Potential Impacts

Vancouver's buildings and energy are expected to be mainly impacted by extreme heat, wildfires, and wildfire smoke. The potential impacts could involve increased energy demands, urban heat island effects, extreme heat exposure health risks, shuttered energy systems, and damage or loss of both energy infrastructure and buildings.

- Energy demand is expected to increase for air conditioning and industrial cooling systems in summer when regional hydropower supply is expected to decrease.
- Demand for air conditioning and infrastructure with cooling systems is expected to increase where it does not exist. Older buildings are less equipped with air conditioning systems or are less efficient, and the residents of these buildings will be more at risk to extreme heat. Lower income communities of color tend to live in these older buildings. The cost of using cooling systems during peak demand could also not be affordable for lower income households (Duque, 2023).

- Power cables have been known melt during extreme heat, such as during a heat wave in 2021 in Portland, OR (Fischels, 2021).
- There may be shuttered power generating stations or transmission corridors to reduce wildfire risk.
- Greater potential to affect energy transmission by extreme weather damaging infrastructure and interrupting transmission and distribution. The Natural Hazards Management Plan identifies extreme weather as a risk.
- Expected building and infrastructure damage and loss.
- Poor air quality due to wildfire smoke could increase demand for air filtration systems in buildings. A recent example took place in August 2023, when the Air Quality Index measured at “unhealthy” ranges in Vancouver (Ellenbecker, 2023).

Exposure of buildings to increases in extreme heat, urban heat island impacts, and energy demand for cooling system can depend on tree canopy level. Vancouver has a current tree canopy cover of 19% with a goal of reaching 28% by 2030 (City of Vancouver, 2024). However, tree canopy coverage is higher in the east and west areas of Vancouver, than central Vancouver. Central Vancouver therefore has a higher risk of potential impacts. These central neighborhoods are prioritized for tree canopy improvements (City of Vancouver, 2024).

Adaptive Capacity

Clark Public Utilities offers many rebates and programs to incentivize energy efficiency. They offer rebates for the installation of heat pumps and ductless heat pumps. They also offer a home weatherization program, a heat pump water heater program, a solar energy program, multi-family property programs, new construction programs, electric vehicle programs, and an electric vehicle managed charging program.

The City of Vancouver’s initial efforts in this sector have focused on transitioning to renewable energy, reducing government building emissions, reducing community-wide energy consumption, and decarbonization. In September 2023, the City purchased a 10-kW share (the maximum amount allowed) of Clark’s PUD’s Community Solar East project. In October 2023, the City also started to identify energy efficiency improvement projects and opportunities to swap gas-powered systems for lower-emission electric systems in City facilities. City facilities were also being reviewed for compliance with WA Clean Building Standards.

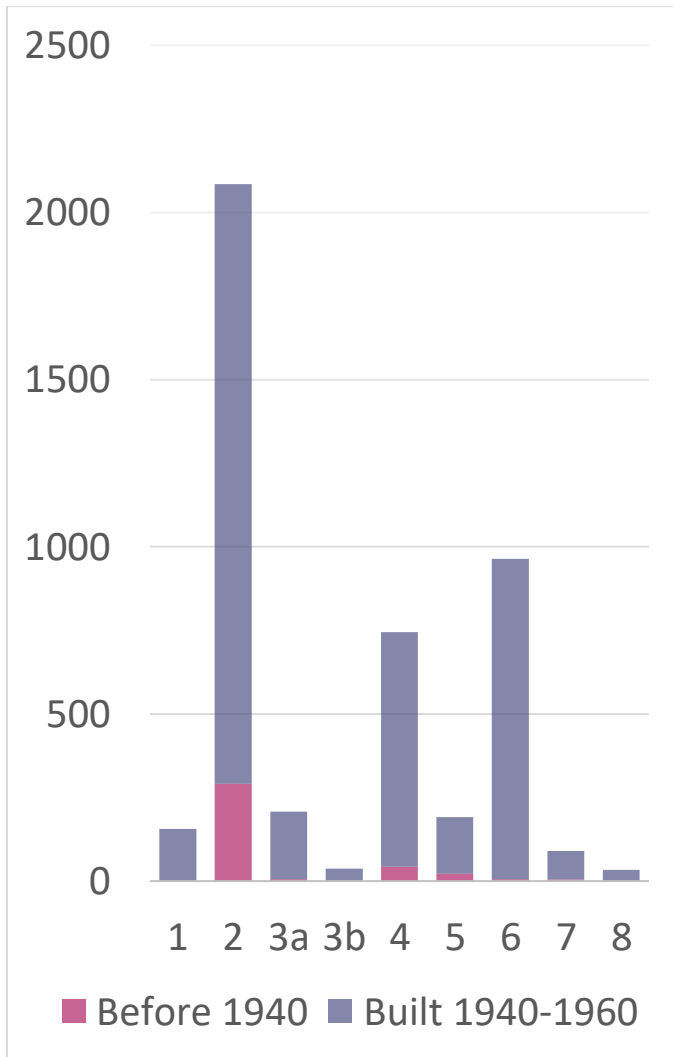
The City of Vancouver is in the process of developing Vancouver’s first Green Building Policy. The policy and associated building code updates were discussed with the City Council at the end of 2024. Work is expected to continue to 2026 to account for voter initiatives in 2024.

Vulnerability Summary

Most structures in Vancouver are residential, which are sensitive uses for air quality and heat. Based on age of housing stock, Areas 2 and 6 have older buildings built before 1960, which are less likely to have cooling or air filtration, and these areas have higher or medium-high levels of exposure to heat or smoke. Area 4 has the third highest number of older homes, and a medium-high exposure to heat. See [Exhibit 41](#) and heat and smoke/air quality maps in [Chapter 2](#). Other areas have more homes built later which may have cooling systems but may not have air filtration systems.

These findings align with the Adaptive Capacity Assessment, which also emphasizes the importance of modern HVAC systems, backup power, and clean air shelters—especially in socially vulnerable neighborhoods—to ensure residential resilience under worsening climate conditions.

Exhibit 42: Vulnerability by Area: Residential Structures Built before 1960



Sources: Clark County Housing Assessor Data, 2024; BERK, 2025.

The probability of extreme heat and smoke in the planning period, and the need to retrofit older homes are drivers of vulnerability and risk. See [Exhibit 42](#).

Exhibit 43: Risk Summary – Building Sector

Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most	1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Strategies to Improve Adaptive Capacity

Climate adaptation and engagement results highlighted a number of strategies to improve the community's adaptive capacity associated with buildings and energy, both public and private:

- Increase the adaptability of public buildings. (Hatch Planning and City of Vancouver, 2022)
- Update building and development codes to increase adaptability of non-public buildings. (Hatch Planning and City of Vancouver, 2022)
- Promote renewable energy within the built environment. (Hatch Planning and City of Vancouver, 2022)
- Implement an uninterruptible power supply and backup generator for critical facilities (e.g. wastewater treatment plant). (City of Vancouver, 2025)
- Pilot hybrid energy systems and microgrid readiness at critical facilities to ensure service continuity. (City of Vancouver, 2025)

Policies

The current Comprehensive Plan, last updated in 2011, has limited policies on energy, focused on conservation. Amendments could be made to catch the Comprehensive Plan up to the extensive work the City has done regarding climate action and energy.

Vancouver plans to transition to 100% clean energy with Clark Public Utilities ahead of the state's Clean Energy Transformation Act (CETA) requirements, and before 2045. There are opportunities for Vancouver to develop concrete policies to work with businesses, property owners, and nongovernmental partners and prevent displacement of low-income residents and ensure the costs and benefits of energy efficiency upgrades are shared equitably. This is promoted in the Climate Action Framework Action #1: Community energy efficiency incentives.

The Vancouver Urban Forestry Management Plan offers opportunities to bolster green infrastructure, reducing the urban heat island effect, and increasing the resiliency of structures. See [Ecosystems](#) and [Zoning & Development](#) for more discussion.

The City could also lead with the Green Building Policy that is currently being developed and adopt it for all municipal buildings. The Climate Action Framework actions 7 and 8 address green building policies for public and private development.

The Climate Adaptation Strategy also recommends energy efficiency measures such as retrofitting buildings with passive and active cooling, promoting renewable energy

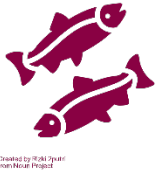
production and storage projects in the case of power outages, and researching built environment climate resilient materials. Many of these considerations are part of the Climate Action Framework. The City could model by retrofitting older city-owned buildings with cooling systems. The City or Clark Public Utilities could also implement programs and incentives for renewable energy production and storage projects, and fund or partner with organizations researching climate-resilient alternative materials.

The Vancouver Climate Action Framework also highlights key actions that would improve climate adaptability, such as promoting solar incentives and to reduce dependency on the energy grid and enhance resilience during disruptions, increasing energy efficiency through electrification and retrofits to reduce overall energy demand.

Battery energy storage systems (BESS) are used to store renewable energy from solar or wind power to ensure more reliability and match it to customer demands. BESS can be of any size and are modular and may only require “a concrete pad to sit on and a connection to the electric grid.” As a result, the BESS can be built anywhere including near existing commercial and residential uses and present concerns regarding safety, aesthetics, noise, odor, and environment impacts. Cities and counties are beginning to address such uses in zoning codes. Vancouver may wish to develop a policy and development regulations addressing these uses as well. (Twitchell, 2023)

Policies developed for [OUR VANCOUVER 2045](#) address energy resilience and reduction of greenhouse gas emissions, such as:

- Ensure that buildings contribute to the City’s greenhouse gas reduction goals, protect occupants from climate hazards and extreme weather, and minimize harm to wildlife and natural ecosystems. (Draft Policy 6)
- Expand community solar access for low income homeowners and renters. (Draft Policy 7)
- Encourage new renewable energy infrastructure, promote development of storage systems, and work with Clark Public Utilities to promote demand-response strategies and programs to ensure a stable, resilient, and sustainable energy grid. (Draft Policy 16)
- Support on site decentralized systems that reduce reliance on centralized infrastructure. Support local energy and water solutions while strengthening community adaptability to environmental, social, and economic changes. (Draft Policy 24)



Cultural Resources & Practices

Sector Overview and Assets

Originally inhabited by peoples of the Chinook and Cowlitz tribes for thousands of years, Vancouver was established as a trading post for the British Hudson's Bay Company and military fort in the 1800s. (Design Workshop, 2024) See **Exhibit 43**. A non-native community was founded in 1825 and the city incorporated in 1857. From an 1890 census population of 3,545 (OFM) Vancouver is home to 202,600 persons as of 2024.

Exhibit 44: Fort Vancouver Garden – In use historically and today

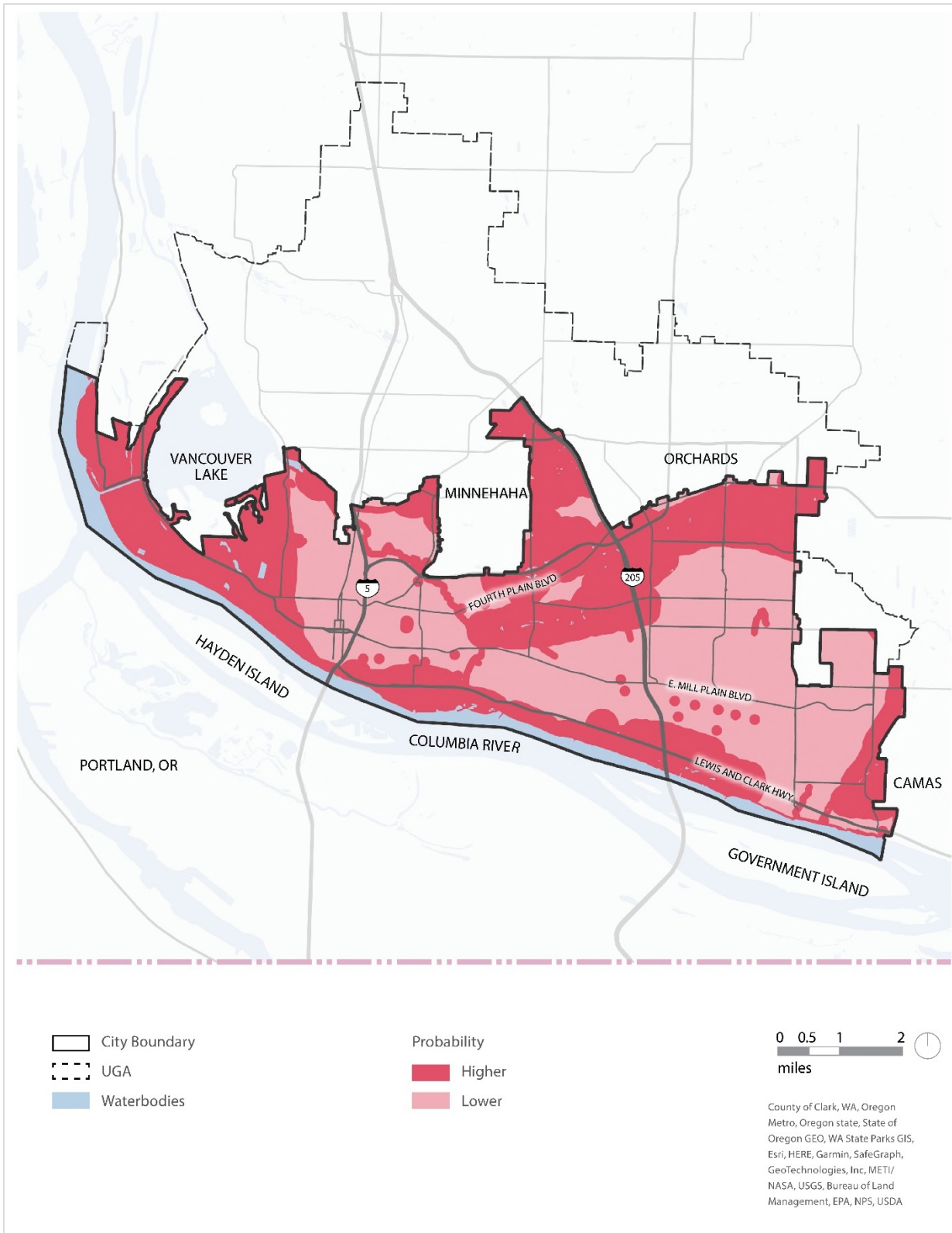


Historically, the Fort Vancouver Garden was a place of rest for the fort's officers and visitors, and provided food for the Chief Factor's House table. Today's reconstruction at Fort Vancouver National Historic Site is tended by volunteer gardeners.

Source: (National Park Service, 2022)

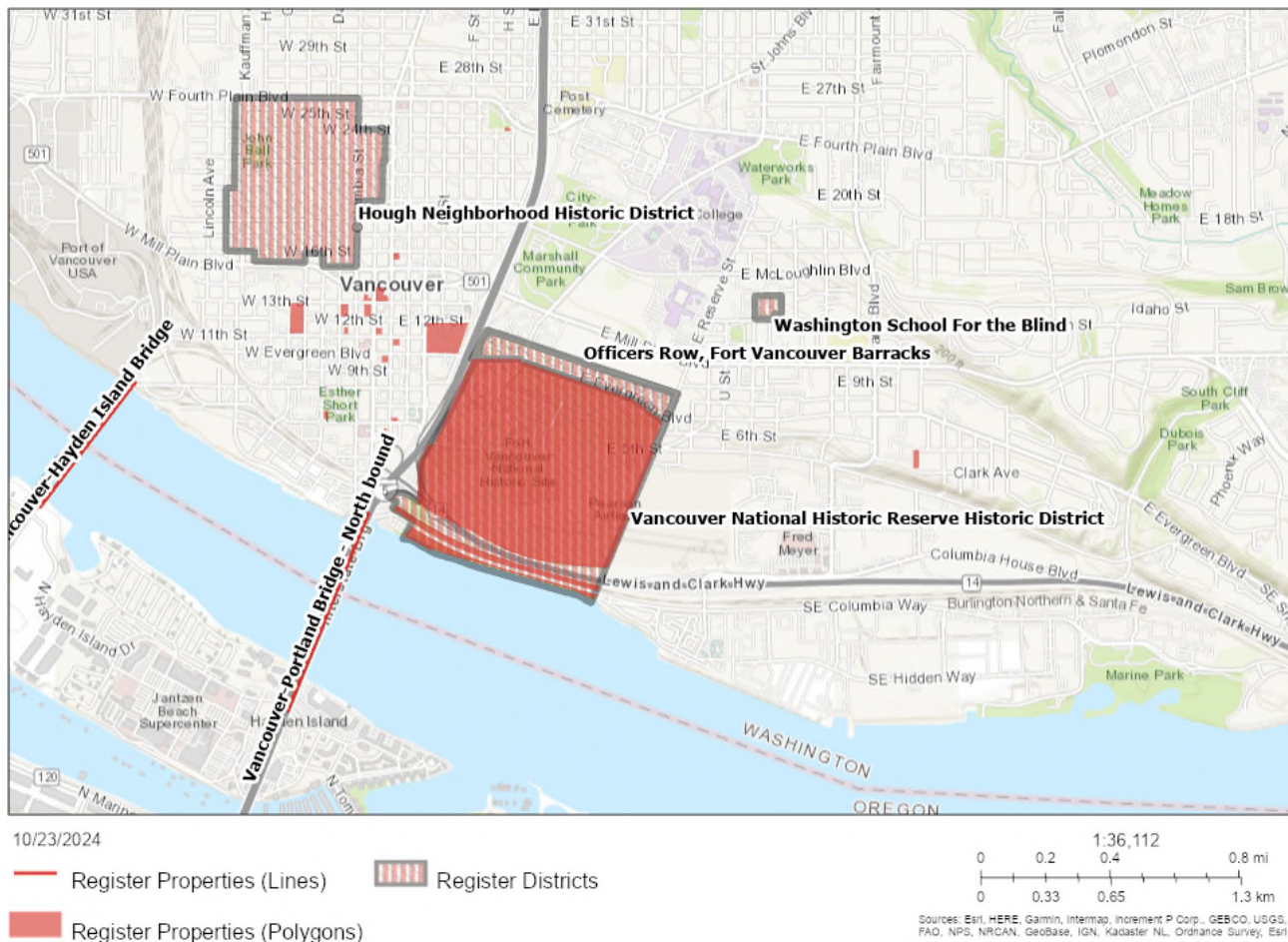
The original historic and walkable downtown is connected to residential areas by an arterial system and is more suburban in character as it expanded to the east. Maps of archaeological resources and historic resources are shared in **Exhibit 44** and **Exhibit 45**. There is a higher probability of archaeological resources along the Columbia River, Vancouver Lake, and Burnt Bridge Creek.

Exhibit 45: Archaeological Probability Map



Source: (Design Workshop, 2024)

Exhibit 46: Historic Resources Map



Source: DAHP, 2024.

Potential Impacts

Vancouver’s Hazard Mitigation Plan identified concerns with extreme weather and urban flooding, but less so flooding in the 100-year floodplain. However, Clark County notes flood stage measured at the Port of Vancouver is at 16 feet, and there have been 25 historic crests, most recently in 2011 and 2017. Extreme heat is a likely occurrence in the VANCOUVER 2045 planning period.

Climate change could impact archaeological, historic, and other cultural resources.

- Loss of cultural sites due to more frequent and intense severe weather events. The location of cultural archaeological sites along rivers and streams and the expected increase in extreme precipitation and flooding could put assets at risk. Adapting cultural resources to climate change impacts can be challenging because many are unique, irreplaceable, and location based.

- Due to their historic nature and the associated limitations on structural adaptation some historic structures have very constrained adaptive capacity. However, while there are some historic sites along water bodies like the Columbia River, most historic properties such as in downtown are at low risk of flooding due to building locations and existing flood control structures. An exception could be the Vancouver National Historic Reserve Historic District that fronts the river in part. The site also contains priority habitats.
- Loss of locally grown, temperature-sensitive foods that are culturally important (berries, salmon, etc.). Hot dry summers are projected to reduce stream flow volumes and increase instream temperatures. This stressor is compounded by extreme precipitation events, flooding, and erosion. Watershed plans and evaluations for the City's critical areas ordinance highlight declining water quality and fish habitat and a need to improve riparian areas along streams and shorelines.

Adaptive Capacity

Priority habitats like prairies and Oregon white oaks are found in some parts of the city such as the Fort Vancouver National Historic Site and along stream corridors and greenways. (Sound Oaks Initiative, 2024) Remnant wetlands, riparian and non-riparian habitat areas continue to be found along streams and lakes, parks, and transportation rights of way. (WSP USA, 2023) These habitats can support, or be restored or enhanced to support, plants and fish species important for tribal customs, medicines, and foods.

The Cowlitz Indian Tribe members have indicated an interest in Food Sovereignty. (Cowlitz Indian Tribe, 2022) Protecting and restoring habitats and adapting to climate stressors can help sustain culturally important habitats, foods, and practices.

The City is supporting updated riparian buffers based on site potential tree height which could improve shading, stream temperature, and other functions of buffers. In addition, the City has an Urban Forestry Management Plan that is meant to improve management of existing canopy and expand it inside and outside of critical areas.

Vulnerability Summary

A summary of vulnerability for cultural resources is provided in **Exhibit 46** below. Habitat is found along lakes and streams throughout the city. Extreme heat, drought, and flooding are anticipated to affect culturally important plants and wildlife and require adaptation measures (enhancement, restoration) along streams, lakes, and other sites. Throughout but particularly areas 1, 2, and 5, archaeological and historic sites could require adaptation (flood management measures, retrofits for energy and air filtration).

Exhibit 47: Vulnerability by Census Tracts – Cultural Resources

Census Block	Area	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index	River, Lake, or Creek	Register Properties
53011041005	1	Medium-high	Higher	Lower	Higher	Higher	Higher	X	X
53011042400	2	Higher	Higher	Medium	Higher	Higher	Higher	X	X
53011041105	3b	Medium-high	Higher	Medium-low	Higher	Medium-low	Medium	X	
53011041600	4	Medium-high	Higher	Medium	Higher	Higher	Higher	X	
53011042700	4	Medium-high	Higher	Medium	Higher	Higher	Higher	X	
53011042601	5	Medium-high	Higher	Medium-high	Higher	Medium	Medium	X	X
53011041205	6	Medium-high	Higher	Medium-high	Higher	Medium-high	Higher	X	
53011041312	7	Higher	Higher	Medium-low	Higher	Medium-high	Higher	X	

Source: See Chapter 2 for indicators and methods. BERK, 2025.

Based on the evaluation, cultural resources risks and vulnerabilities are noted below.

Exhibit 48: Risk Summary – Cultural Resources

Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

As part of social vulnerability and asset mapping efforts, engaged community members about their important places. Strategies identified through climate engagement includes:

- Food: Expand culturally relevant gardens as a way to increase food access and resilience. (City of Vancouver, 2025)

The City could similarly engage Tribes about ecosystems, habitats, and foods/plants that should be considered when planning for climate resilience. Direct engagement can help

ensure that culturally significant landscapes, species, and materials are not overlooked in technical assessments of risk and adaptation.

One parks and habitat strategy relevant to Tribes identified through the Adaptive Capacity Assessment includes:

- Park Resilience: Incorporate traditional ecological knowledge if working with local Indigenous groups for habitat restoration in parks to handle climate changes. (City of Vancouver, 2025)

Additional strategies can be elicited through consultation and collaboration with Tribes.

Policies

Vancouver's cultural resources policies are primarily found in the Shoreline Master Program,. Current policies address general protection of archaeological and historic resources. Some address engagement with tribes in restoration of habitat.

The City could add policies covering cultural resources adaptation to extreme heat and flooding and Tribal consultation, similar to examples in the Washington Department of Commerce's Climate Policy Explorer. Accordingly, the [OUR VANCOUVER 2045](#) plan includes the following:

- Foster meaningful partnerships with tribal communities and land stewards, integrating their knowledge, priorities, and cultural perspectives into local decision-making processes. (Draft Policy 101)
- Protect and preserve significant cultural, historic, archeologic, and ecologic community resources. Promote preservation, restoration, and rehabilitation of historic and architecturally significant structures. (Draft Policy 107)



Economic Development

Sector Overview and Assets

Vancouver has approximately 99,057 jobs as of 2021. (US Census Bureau, 2021) There are approximately 7,840 businesses in Vancouver. In certain neighborhoods, including Fourth Plain, at least one-third of businesses are minority owned or cater to communities of color. (Design Workshop, 2024)

Approximately 27% of all parcels in the City are zoned for commercial uses. Another 17% of all parcels in the City are zoned for industrial uses. (Design Workshop, 2024) The City is planning for growth of at least 38,000 new housing units and 43,100 new jobs by 2045.

Potential Impacts

Job Sectors in Vancouver

While flooding, wildfire, and drought are relatively lower risk in Vancouver (Clark Regional Emergency Services Agency, 2023), severe weather including extreme heat and extreme precipitation could impact businesses and employees. Wildfire smoke in the region could also affect businesses and employees for those who work outdoors.

Health care (19%), retail and wholesale trade (15.3%), and manufacturing/transportation/utilities (12.2%) are notable sectors in Vancouver’s local economy. (US

Census Bureau, 2021) Top employers in the county are often based in Vancouver including health care – Peace Health, Vancouver Clinic, Legacy Health, Kaiser Permanente – and education or government – Vancouver Public Schools, Evergreen Public Schools, as well as the City and County employees. See **Exhibit 48**.

Sectors under stress during extreme climate related hazards include health care (e.g., adverse health with extreme heat or wildfire smoke) or utilities (BPA, Clark Public Utilities) with potential power demand spikes (extreme heat) or outages (extreme storms). Exposure

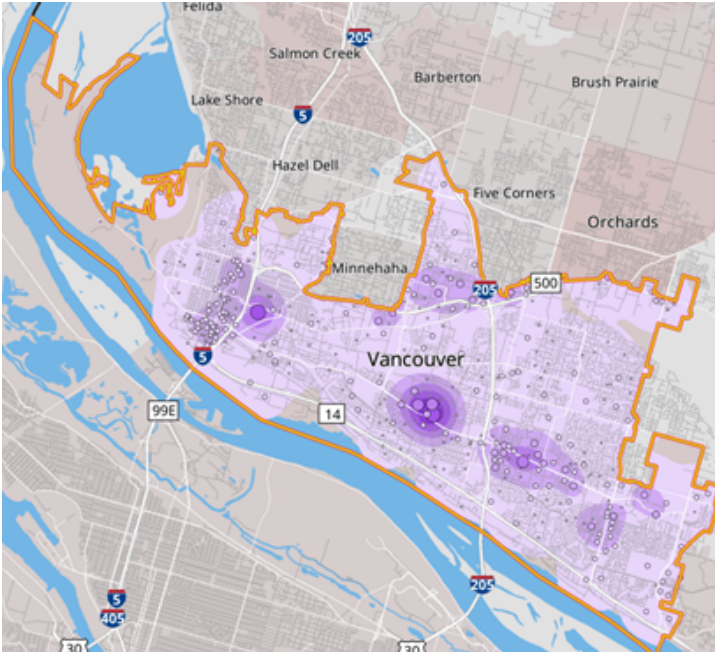
Exhibit 49: Clark County, Washington, Top Employers

Company	Clark County Employees
1 Peace Health	4,908
2 Vancouver Public Schools	3,300
3 Evergreen Public Schools	2,599
4 Vancouver Clinic	2,305
5 Legacy Health	1,800
6 Clark County	1,570
7 Ilani	1,500
8 City of Vancouver	1,480
9 Clark College	1,417
10 Zoom Info	1,374
11 Bonneville Power Administration	1,367
12 Battle Ground School District	1,313
13 HP	1,000
14 Kaiser Permanente	1,000
15 SEH America	950

Source: CREDC Research (Accessed September 2024)

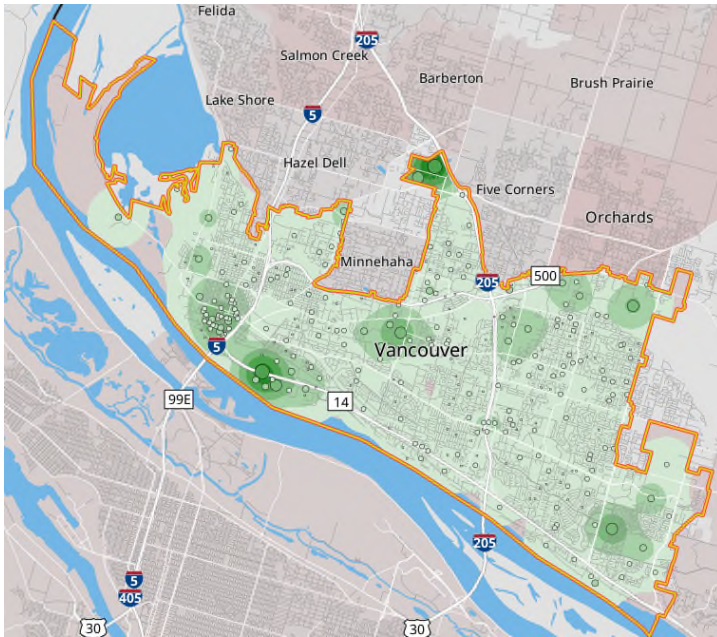
of health care facilities to poor air quality or power disruption could reduce continuity of operations during critical events. Healthcare employment density is highlighted in **Exhibit 49**.

Exhibit 50: Location of Health Care Employment, 2022



Source: Census on the Map, 2022

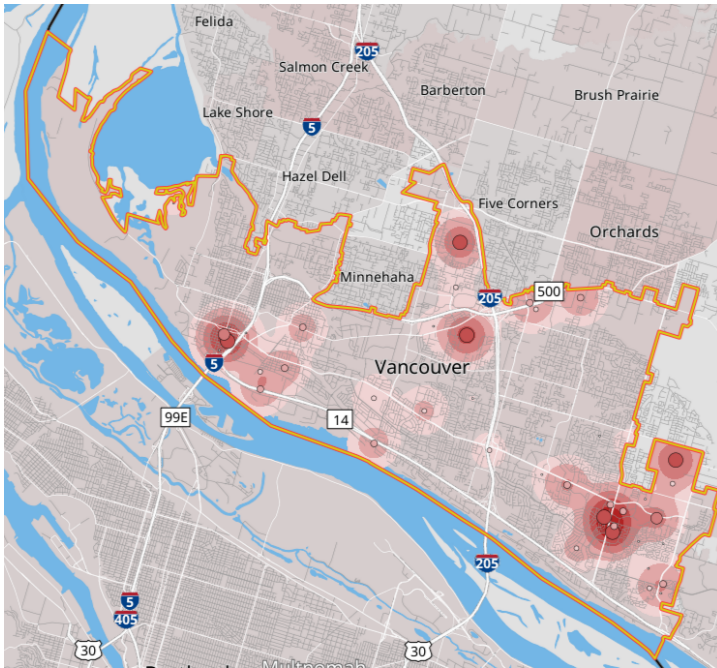
About 6.2% of Vancouver's jobs relate to construction, likely outdoors and potentially exposed to extreme heat and wildfire smoke. (US Census Bureau, 2021) The concentration of construction jobs is illustrated in **Exhibit 50** below. These workers face increased health and productivity risks during climate extremes, particularly in areas lacking tree canopy or shade infrastructure.

Exhibit 51: Location of Construction Jobs, 2022

Source: Census on the Map, 2022

Arts and entertainment venues that are outdoor, such as Esther Short Park and the Farmers Market or Vancouver Volcanos Home Games, could be more vulnerable and lose revenue during heat or smoke events and indoor facilities such as museums and performing arts or movie theaters with cooling and filtration such as could see greater demand for services. Investment in HVAC upgrades and air filtration systems in indoor venues could support both public health and local economic resilience. Concentrations of arts and entertainment jobs are shown in [Exhibit 51](#).

Exhibit 52: Arts & Entertainment Jobs, 2022



Source: Census on the Map, 2022

Commuters

Almost two-thirds of residents work outside of Vancouver though most work within 10 miles of home. See [Exhibit 52](#) and [Exhibit 53](#). Employers and commuters in and out of Vancouver could be impacted by climate related events such as extreme precipitation and flooding affecting roads or extreme heat affecting transit.

In Washington, the heat caused sections of Interstate-5 and State Route 162 to buckle, causing some lanes to be closed. In Portland, the heat exceeded the design limits of the TriMet MAX system, melting train power lines and shutting down trains for a day. (USDA Northwest Climate Hub, 2024)

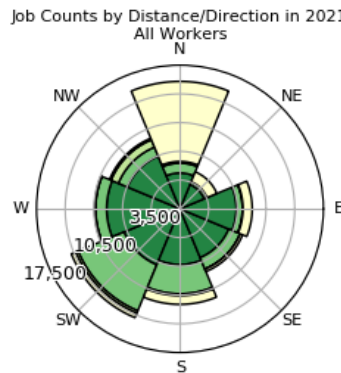
Exhibit 53: Commute Flow

	Count	Share
Living in the Selection Area (Vancouver)	83,157	100.0%
Living and Employed in the Selection Area (Vancouver)	28,447	34.2%
Living in the Selection Area (Vancouver) but Employed Outside	54,710	65.8%

Source: (US Census Bureau, 2021)

Exhibit 54: Home to Work Distance/Direction (2021)

	Count	Share
Total All Jobs	83,157	100.0%
Less than 10 miles	50,945	61.3%
10 to 24 miles	15,942	19.2%
25 to 50 miles	1,860	2.2%
Greater than 50 miles	14,410	17.3%



Source: (US Census Bureau, 2021)

Adaptive Capacity

Vancouver has an Emergency Operations Plan that considers severe weather, forest/wildland fire, flooding, and energy shortages. (City of Vancouver, 2018) The City also coordinates with Clark County and cities through the Clark Regional Emergency Services Agency (CRESA) on emergency planning, such as the 2023 *Natural Hazard Mitigation Plan*. (Clark Regional Emergency Services Agency, 2023)

During severe weather such as extreme heat, Vancouver advertises places to cool off including Community Centers and Libraries serving in effect as cooling centers and quasi-resilience hubs. (City of Vancouver, 2024) Regarding transit access, during extreme heat, C-TRAN will take anyone riding to a cooling center.

A regional initiative is defining emergency transportation routes and updating a 2006 plan between Clackamas, Columbia, Multnomah and Washington counties in Oregon and Clark County in Washington. The effort is addressing wildfires, landslides, floods, extreme weather events, and impacts of climate change as well as earthquakes and volcanic eruptions. In addition to state routes, a number of arterials in the city limits and port vicinity are defined as regional emergency transportation routes. Some are at risk of floods and other hazards. Ensuring access along these routes during emergencies is critical for maintaining economic function, particularly for industrial areas and essential service workers. A current phase (2024-2026) is prioritizing an updated network. (RDPO, 2024)

Vulnerability Summary

Based on the locations of workers and venues described in **Job Sectors in Vancouver** above and **Climate Exposure, Equity, and Health** in **Chapter 2**, the areas with greatest exposure are shared in Exhibit 54.

Exhibit 55: Vulnerability by Area – Economic Development

Area	Outdoor Workers	Health Care	Arts & Entertainment
Type of Impact	Exposure & Risk of Lost Business or Wages	Increased Demand	Exposure & Risk of Lost Business or Increased Demand
1			
2		X	X
3A			
3B	X		X
4			X
5		X	X
6		X	
7	X		
8	X		X

Source: BERK, 2025.

Outdoor workers, health care providers serving those with health sensitivities, and outdoor recreation and events workers would be vulnerable to extreme heat and smoke events that are more probable in the planning period and more widespread in their effect. Flooding from extreme precipitation could be more focused in its location but impact many commuters. In neighborhoods with higher social and health vulnerability, these disruptions may be compounded by limited access to protective infrastructure or recovery support. The potential magnitude of loss to the economy from one or more events could be more than moderate and require City investment in recovery. See **Exhibit 55**.

Exhibit 56: Risk Summary – Economic Development



Source: BERK, 2025.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

Resilience Rising results identified some adaptive strategies especially related to emergency hubs and information:

- Potential of existing neighborhood institutions—including gyms or grocery stores—to serve as hubs during emergencies. (City of Vancouver, 2025)
- Leveraging local businesses to help spread emergency information. (City of Vancouver, 2025)

The Adaptive Capacity Assessment identified examples of collaborative programs including with businesses, noting that in some cities, local businesses have sponsored bus shelters with cooling features, in exchange for modest advertising. (City of Vancouver, 2025)

The City could also continue to work through regional bodies to understand commute patterns and risks as well as learn about concerns from residents commuting across lifeline networks. Additional engagement could focus on minority- and immigrant-owned businesses, who may face barriers to accessing recovery resources following climate disruptions.

Policies

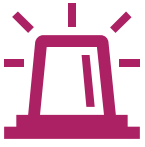
A policy evaluation, available under separate cover, identified topics that could be integrated into the updated plan to further address economic development such as:

- Address green technology/jobs opportunities.
- Bring in strategies from Climate Action Framework such as building a more community-driven, circular economy.
- Promote business continuity planning in climate-sensitive sectors such as construction, transportation, healthcare, and logistics.
- Prioritize infrastructure upgrades in areas where economic activity overlaps with high exposure and vulnerability.

Example policy concepts in the Our Vancouver 2045 plan include:

- Build a resilient economy: Encourage business growth, retention, and expansion, with an emphasis on family-wage jobs and foster resilience within Vancouver's economy. (Draft Policy 113)

See also [Emergency Management](#).



Emergency Management

Climate change presents a threat to the City's emergency response due to increased frequency and severity of extreme weather events. The City has updated its emergency management plan to reflect the hazards posed by climate change, but this increase could strain capacity and challenge current approaches to mitigation, preparedness, response, and recovery.

Local resources reviewed for this section include the following:

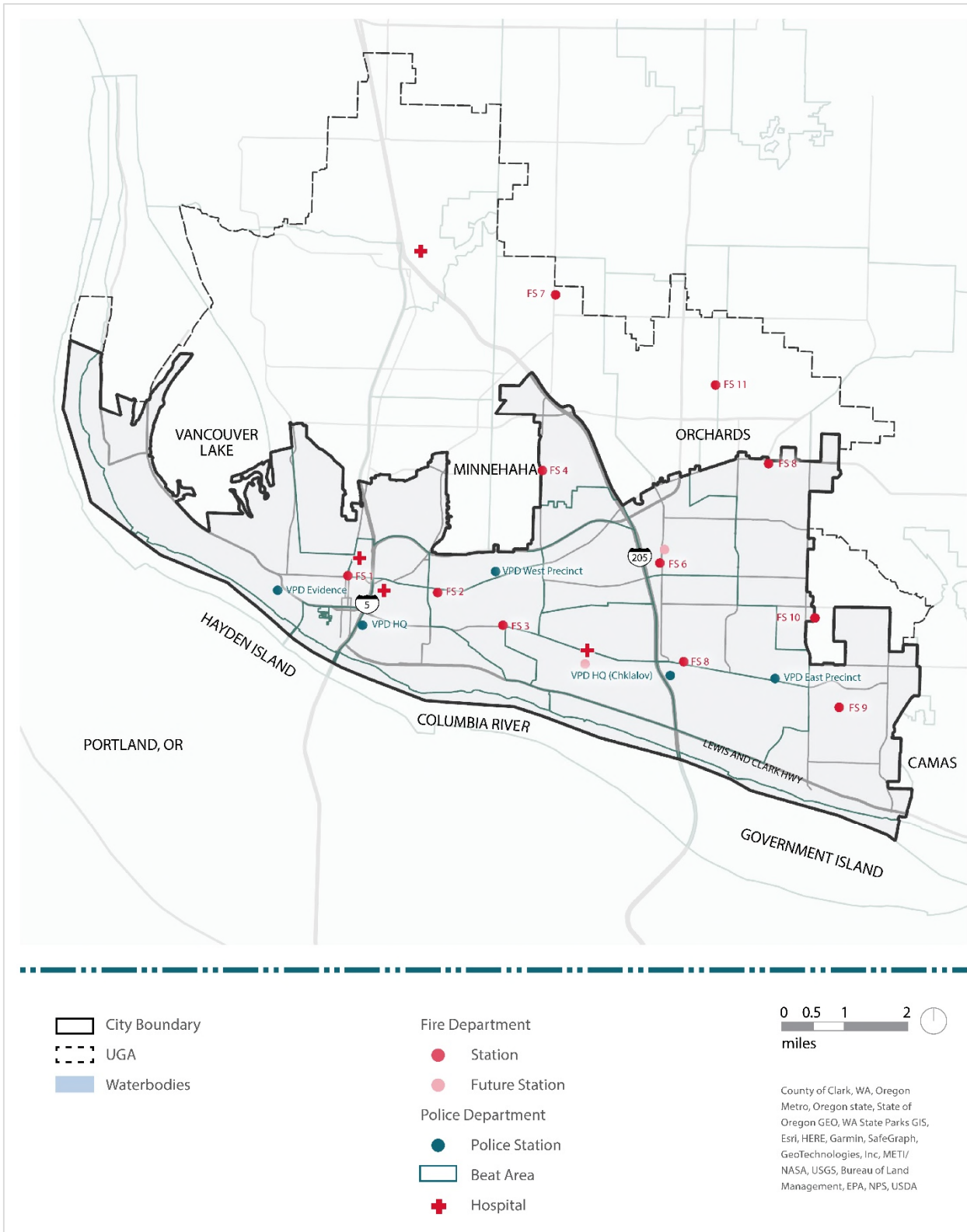
- Chapter 2.12 VMC, Emergency Management
- City of Vancouver Emergency Operations Plan, 2018
- City of Vancouver Climate Adaptation Strategy, 2022
- Clark Regional Emergency Services Agency (CRESA), 2023 Clark County Natural Hazard Mitigation Plan, Volume 2 Planning Partner Annexes, March 31, 2024
- State of Washington Comprehensive Emergency Management Plan and Program – Updated, 2019
- Vancouver Police Department Policy Manual Policy 206

Sector Overview and Assets

Vancouver's emergency management priorities are to eliminate major threats to life and safety, stabilize the incident situation, provide basic human needs, maintain/restore essential services, and protect critical infrastructure and the environment. (City of Vancouver, 2018) Many departments respond to and work to mitigate potential hazards and emergencies through planning, regulation, and capital improvements. The departments that manage day-to-day emergency response are Fire, Police, and EMS, while larger emergencies can require disseminating information, coordinating resources, and activation of an interdepartmental Emergency Operations Center (EOC) as well as the Clark Regional Emergency Services Agency (CRESA) that provides 911 dispatch, technology services and emergency management. Recovery involves damage assessment, conducting repairs to capital facilities, and aiding impacted people and organizations.

Emergency facilities in Vancouver include about eight fire stations, two police precincts, three major hospitals, three community centers, and several mobile EMS units provided through a contract with American Medical Response. Hospitals are located predominantly in the western and central parts of the city. See [Exhibit 56](#). Additional emergency facilities are evenly distributed throughout the city to meet the needs of residents. Emergency facilities are unevenly distributed with greater concentrations of hospitals and EMS resources in the central and western parts of Vancouver. In contrast, eastern neighborhoods may face slower response times, particularly if transportation networks are disrupted by heat or flooding.

Exhibit 57: Emergency Services Locations in Vancouver



Source: (Design Workshop, 2024)

Potential Impacts

Vancouver's emergency management system would likely be affected by heat and wildfire smoke events. Extreme heat events would lead to acute heat related illness and hospitalizations and put severe strain on emergency medical service personnel within the Vancouver Fire Department and the paramedics from American Medical Response (AMR). (City of Vancouver, 2018) (Hayden, 2023) Areas of the city with more tree canopy cover are likely to experience lower, safer temperatures during extreme heat events and reduce damage to roadways. Vancouver has a current tree canopy cover of 19% with a goal of reaching 28% by 2030 (TreeCAP, 2024). However, canopy cover varies greatly across the city. See [Zoning & Development](#) for more information.

Wildfire smoke can lead to both chronic and acute pulmonary health impacts that can also strain emergency management resources (Ecology W. S., 2023). In the event of both extreme heat events and wildfire smoke events, community spaces may be strained for capacity as they serve as either explicit or de facto clean air and cooling shelters. According to regional assessments, many existing facilities do not meet the ventilation or filtration standards necessary for sustained clean air shelter function. (City of Vancouver, 2025) Groups especially vulnerable to both of these hazards are older adults, individuals experiencing homelessness, undocumented immigrants, low-income individuals, and individuals with limited English proficiency as these group may be socially isolated and therefore less likely to seek emergency services or community shelter (City of Vancouver, 2022). Based on demographic analysis of the city, these vulnerable populations are more prevalent in the west and central portions of the city and less so in the east area of the city; see [Exhibit 20](#). The potential health impacts of these specific climate hazards are also detailed in the [Health & Well-being](#) section of this document.

Additionally, extreme precipitation, roadside brush fires, and extreme heat may impact the transportation infrastructure that is necessary for emergency response for all departments. The 2025 Adaptive Capacity Assessment suggests the fire department collaborate with transportation departments to identify and fortify the critical routes used by fire engines and ambulances. (City of Vancouver, 2025) Extreme heat events can lead to cracking and buckling of roads or damage to transit infrastructure (Fischels, 2021). Roadside brush fires can damage roads and make them temporarily impassable until the fire is adequately suppressed especially in the west and the northeast/east portions of the city which have been identified as part of the Wildland Urban Interface (WUI, 2024). Emergency vehicle access in these areas may also be impaired by narrow roadways or lack of redundancy in evacuation routes.

The Vancouver Fire Department serves residential, commercial, and industrial uses, and protects 22 miles of shoreline. (City of Vancouver, 2025) Urban flooding may simultaneously increase demand for emergency services to manage impacts including but not limited to hazardous materials contamination and potential structural collapse while also makes it very challenging to reach individuals facing these emergencies due to roadway flooding (FEMA, 2021). Even moderate localized flooding can trigger cascading service impacts, including delays to emergency response, reduced access to healthcare, and temporary power outages that affect communication and traffic control systems.

While flood events have been experienced in Vancouver, the risk is considered low, except for urban flooding with extreme weather. (Clark Regional Emergency Services Agency, 2023) In the event of urban flooding from extreme precipitation, the same vulnerable populations mentioned in the previous section may be unable to effectively navigate the city and reach medical care or social services. Examples of urban flooding have been identified in climate planning efforts including:

- On the Fourth Plain BRT line, which runs through some older, low-lying neighborhoods, chronic street flooding has already been noted at certain intersections – these incidents are likely to worsen with climate change. (City of Vancouver, 2025)
- Fruit Valley residents described frequent flooding and clogged storm drains. (City of Vancouver, 2025)

Both the **Transportation** and **Health & Well-being** sections of this document also address these concerns.

Adaptive Capacity

Aspects of the emergency management system with adaptive capacity include:

- The City of Vancouver in coordination with Clark Regional Emergency Services Agency (CRESA) has identified and advertised several cooling shelters such as Vancouver community library, Vancouver Mall Library, Firstenburg Community Center, Marshall/Luepke Community Center, Water Resources Education Center and provides no cost C-TRAN bus service to and from cooling centers in the event of extreme heat. (City of Vancouver, 2024)
- The City is also able to open temporary cooling centers during extreme events, in collaboration with area churches and other organizations. Additional coordination with culturally specific organizations could increase participation from immigrant and refugee communities that face heightened barriers to accessing city resources.

- CRESA, in coordination with the City of Vancouver, provides recommendations for actions to take during smoke events but does not have specific facilities or strategies to combat poor air quality caused by wildfires.
- Facilities necessary for citywide emergency response are typically equipped with emergency generators to ensure continuity of services during power disruptions. However, greater frequency of power outages due to increased energy use during heat events could lead to increased cost and dependency on these generators during emergencies. Backup power remains uneven across critical facilities. Clean energy resilience strategies—such as solar+storage—may offer co-benefits in energy savings and emissions reduction.
- The Vancouver emergency operations plan identifies localized flooding from extreme precipitation as a “Major Emergency” and specifies effective response to all major emergencies including this specific hazard. (City of Vancouver, 2018) (Clark Regional Emergency Services Agency, 2023) The 2025 Adaptive Capacity Assessment has recommended that Vancouver’s ongoing regional planning for an emergency transportation network (2024–2026) should explicitly incorporate flood, landslide, and wildfire scenarios. (City of Vancouver, 2025)

Vulnerability Summary

The City of Vancouver Emergency Management Program and the associated service providers are particularly vulnerable to the impacts of extreme heat and wildfire smoke as those are the types of hazards that are more likely to impact service provision as climate conditions worsen. These hazards require the most emergency services and facilities to help alleviate potential human health impacts. Extreme precipitation could interfere with infrastructure, power, and emergency responses, but would be more likely along water bodies or areas with poor drainage.

Census tracts in almost every area have more than one higher climate exposure and either higher health sensitivity or higher equity disparity, which could require a greater emergency response. Areas with a combined higher exposure and higher health sensitivity or higher equity disparity include **Areas 1, 2, 4, 6, 7, and 8**. Area 3b has higher heat but exposure to other climate impacts is less than “higher.” See **Exhibit 57**.

Exhibit 58: Vulnerability by Census Tracts – Emergency Management

Census Tract	Area	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index
53011041005	1	Medium-high	Higher	Lower	Higher	Higher	Higher
53011042300	2	Medium	Medium-high	Higher	Medium-high	Higher	Medium-high
53011042400	2	Higher	Higher	Medium	Higher	Higher	Higher
53011041113	3b	Higher	Medium-high	Medium-low	Medium-high	Higher	Higher
53011041114	3b	Higher	Medium	Medium-low	Medium-high	Higher	Higher
53011041600	4	Medium-high	Higher	Medium	Higher	Higher	Higher
53011041700	4	Medium	Higher	Medium	Medium-high	Higher	Medium-high
53011042700	4	Medium-high	Higher	Medium	Higher	Higher	Higher
53011041205	6	Medium-high	Higher	Medium-high	Higher	Medium-high	Higher
53011041206	6	Higher	Medium-low	Medium-high	Medium-high	Higher	Medium-high
53011041207	6	Medium	Medium-low	Higher	Medium	Medium	Higher
53011041312	7	Higher	Higher	Medium-low	Higher	Medium-high	Higher
53011041322	8	Higher	Medium	Medium-high	Higher	Medium-high	Higher
53011041323	8	Higher	Medium	Medium-high	Higher	Medium-high	Higher

Source: See [Chapter 2](#) for indicators and methods. BERK, 2025.

A summary of risks is shared below in [Exhibit 58](#).

Exhibit 59: Risk Summary – Emergency Management

Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Certain actions can be taken to mitigate the risks of these hazards and the overall adaptive capacity to manage these hazards is high due to the clear instructions, strategies, and chain of command laid out in the Emergency Management Plan. Hazards may put stress on personnel and facilities and increase the need for resources; the City can build upon its current emergency services as a foundation and increase services as climate related hazards worsen and increase in frequency.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

Currently, the City of Vancouver provides several online materials for emergency preparedness and resiliency. About 1 in 5 households speak a language other than English at home such as Spanish, Indo-European, and Asian and Pacific Island languages.

Understanding the best formats and venues to receive and share information in appropriate languages could be helpful in engagement around community assets and needs. There are physical and procedural gaps that hinder preparedness and resilience: limited cooling centers with adequate space and signage, public transit challenges during storm events, lack of emergency information in multiple languages, and difficulty navigating scattered resources. (City of Vancouver, 2025)

Resilience Rising engagement (pages 6 and 7) identified the following strategies that could be implemented to improve information, communication, and facilities:

- Build formal partnerships with community-based organizations that already serve vulnerable populations during emergencies. Fund their preparedness outreach, include them in emergency planning and drills, and ensure they have access to real-time updates and supplies.
- Develop neighborhood-scale pilot projects such as mobile clean air/cooling units in areas lacking brick-and-mortar shelters.
- Provide resilient public assets in East Vancouver since there are currently long travel distances to cooling centers and limited transit options.
- Incorporate accessibility and equity into facility design, such as signage and wayfinding in multiple languages, and proximity to public transit and walking paths.

In addition, the Asset Capacity Assessment identified improvement strategies such as:

- Provide backup power and HVAC resilience audits for all essential service facilities and shelters.
- Ensure that future planning efforts address WUI-specific fire risk, especially in relation to mobility constraints and critical facility access.

Other Climate Adaptation Strategy recommendations were to:

- Improve and increase access to cooling centers, clean air quality centers, and other resource centers during extreme climate events.
- Coordinate with the County to incorporate projected climate risks into future hazard plans.

- Support safe environments at home and work during extreme climate events. (Hatch Planning and City of Vancouver, 2022)

Policies

A policy audit suggested Comprehensive Plan policy revisions and additions similar to those identified in the strategies above, as well as:

- Adopting additional policies to the Public Facilities and Services Element that include emergency operations.
- Incorporating strategies from the Natural Hazard Mitigation Plan into the Comprehensive Plan, such as determining critical government functions and establishing redundancy for these functions.
- Integrating the Vancouver 2018 Emergency Operations Plan strategies such as EMS, Fire, Police, and Debris Removal.

The [OUR VANCOUVER 2045](#) plan includes the following policy ideas:

- Develop plans and resources to ensure effective emergency response and equal access to emergency services and recovery resources mitigating risks from extreme weather, climate-related hazards, and social hazards. (Draft Policy 3)
- Support public safety through investment in emergency services, facilities, and coordinated preparedness efforts that strengthen community resilience and response. (Draft Policy 116)
- Coordinate with the Vancouver Fire Department and Vancouver Police Department to plan for expected growth, provide adequate facilities to equitably serve the community, and maintain the established levels of service. Communicate with service providers when planning transportation projects that may affect emergency vehicle access. (Draft Policy 130)



Health & Well-being

Sector Overview and Assets

There are various factors in the built environment, natural environment, and public services that affect public health, many of which are likely to be impacted by climate change to some extent. Cross connections to other sectors reviewed in this assessment include **Agriculture & Food Systems** (food access), **Buildings & Energy** (safe and healthy housing), **Economic Development** (financial stability), **Water Resources** (water quality), Transportation (active transportation and air quality), and **Zoning & Development** (tree canopy and parks access). The Human Health sector itself is focused on healthcare services as well as the general health and wellbeing of residents.

Population health statistics for adults in Vancouver are similar to that of Clark County as a whole, with slightly higher rates of poor mental health and asthma and slightly lower rates of hypertension and diabetes than the county population. See **Exhibit 59**. With hypertension affecting almost a third of adults in Vancouver, poor mental health affecting almost a fifth, and asthma affecting more than a tenth, many individuals may be particularly sensitive to the health impacts of climate change, particularly extreme heat and extreme precipitation. (Hayden, 2023) (EPA, 2021)

Exhibit 60: Health Data for Vancouver and Clark County

Measure	Vancouver (% of adults)	Clark County (% of adults)
Hypertension (High Blood Pressure)	28.1%	29.2%
Asthma	11.5%	10.8%
Coronary Heart Disease	5.1%	5.3%
Chronic obstructive pulmonary disease (COPD)	6.3%	6.1%
Diabetes	8.8%	9.2%
Poor Mental Health (mental health not good for 14 days or more)	17.5%	15.8%
Poor Physical Health (physical health not good for 14 days or more)	11.7%	11.2%

Source: (CDC, 2024)

Individuals living with disabilities may also be more sensitive in a climate event due to health and medication needs, mobility challenges, and information accessibility. (Hayden, 2023) Approximately 9.7% of Vancouver residents are living with a disability (Design Workshop, 2024).

Children and older adults also tend to have more medical needs and be more sensitive to air quality, heat, and other climate impacts. 22% of the population is children and youth under age 18, including 6% of the population under age 5, and 16% of the population is over age 65 (Design Workshop, 2024).

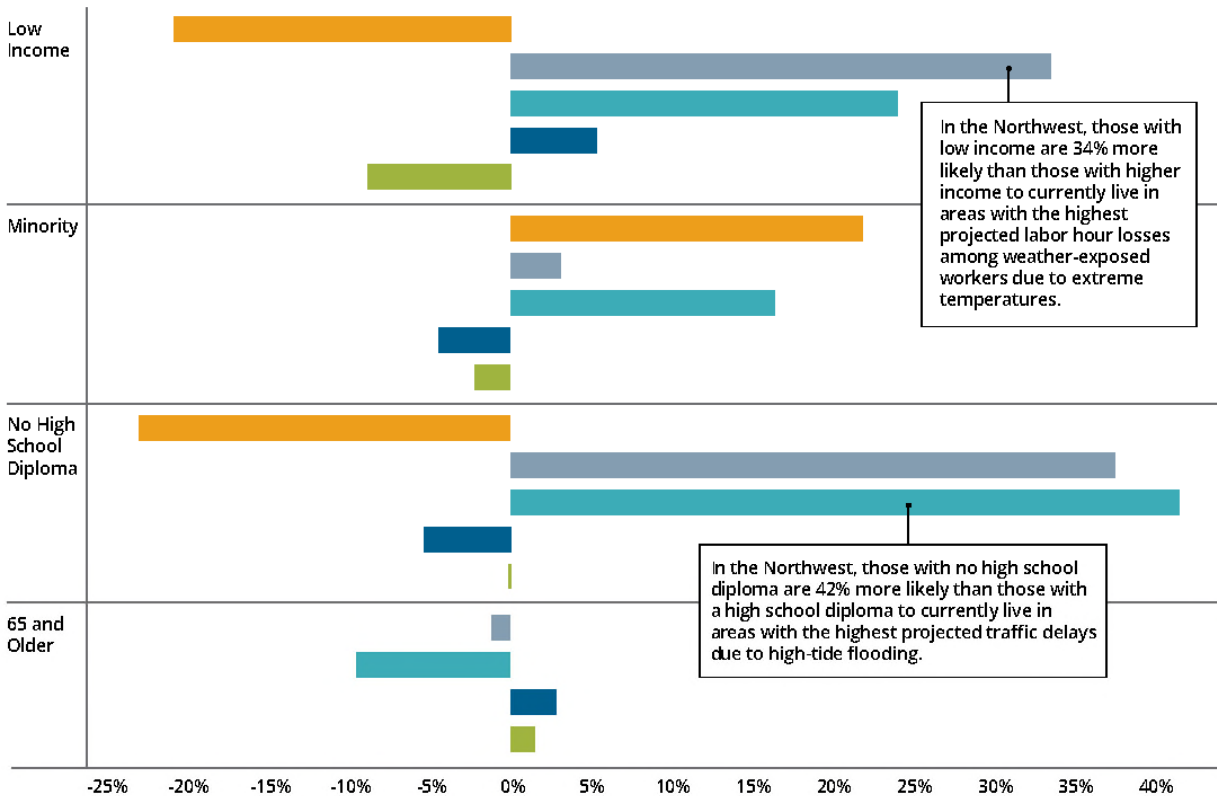
Another key factor in human health is access to health insurance. The CDC estimates that 9% of adults aged 18-64 in Vancouver do not have health insurance, which is slightly lower than the national estimate of 11% (CDC, 2024).

Different parts of the Vancouver population are likely to experience varying health impacts due to climate change, based on existing health concerns and sensitivities, as shown in **Exhibit 23**.

Low income and non-White residents and residents with less than a high-school diploma are more likely to experience greater impacts due to climate change. This includes labor hour losses to extreme heat, traffic delays due to flooding, and new asthma diagnoses especially in children due to exacerbated air pollution. (EPA, 2021) See **Exhibit 60** illustrating these conditions with a focus on Northwest populations.

Exhibit 61: Differences in Risks to Socially Vulnerable Groups in the Northwest Relative to Reference Populations with 2°C of Global Warming

The estimated risks for each socially vulnerable group are relative to each group’s “reference” population, defined as all individuals other than those in the group being analyzed. The estimated risks presented in the chart are for scenarios with 2°C of global warming (relative to the 1986-2005 average) or 50 cm of global sea level rise (relative to 2000). For the inland flooding analysis, the baseline is 2001-2020. Results for additional scenarios are provided in the respective chapters and appendices.



AIR QUALITY AND HEALTH*

New asthma diagnoses in children due to particulate air pollution.



EXTREME TEMPERATURE AND LABOR

Lost labor hours for weather-exposed workers.



COASTAL FLOODING AND TRAFFIC

Traffic delays from high-tide flooding.



COASTAL FLOODING AND PROPERTY

Property inundation due to sea level rise.



INLAND FLOODING AND PROPERTY

Property damage or loss due to inland flooding.

*Impacts not estimated for 65 and Older.

Source: (EPA, 2021)

Air quality is a health issue of particular concern in Vancouver. The Washington State Department of Ecology has identified Vancouver as an overburdened community due to elevated levels of PM_{2.5} compared to the rest of the state, as well as rates of poverty, linguistic isolation, and unaffordable housing. (Washington Department of Ecology, 2023) Poor air quality has been linked to negative health outcomes in overburdened communities, including heart and lung disease, lower life expectancy, and older adult mortality.

The healthcare system in Vancouver includes two hospitals in Area 2 (PeaceHealth and Vancouver VA Medical Center), and one in Area 6 (PeaceHealth Southwest Medical Center) as well as clinics across the city. Pharmacies and health-related human services are also located throughout Vancouver.

Assets for human health in Vancouver include:

- Community wellbeing
- Healthcare system
- Hospital
- Pharmacies
- Clinics
- Health-related human services

Source: (Design Workshop, 2024)

Potential Impacts

Heat, wildfire, and smoke are the climate impacts most relevant to human health, per the UW Climate Impacts Group (UW Climate Impacts Group, 2024). Certain groups are more sensitive to these impacts than others. Healthcare infrastructure is also likely to be affected due to demands on the power grid and increases in medical needs, putting pressure on existing resources.

- The Health Sensitivity to Climate Index (see [Exhibit 23](#)) suggests the west and central areas are more sensitive than the east area.
- Equity scores (see [Exhibit 20](#)) vary across the city, with somewhat lower equity scores generally in the West area (with the exception of the Fruit Valley neighborhood, which has high equity scores or greater equity concerns). Equity scores are mixed throughout the rest of the city. High equity scores may indicate greater sensitivity to health impacts of climate change.
- Warmer summers are expected to increase concentrations of air pollutants, such as ozone and some vector-borne illnesses. This could amplify existing air quality concerns in Vancouver.

- An increase in the number of days with a maximum humidex above 90°F and increase in the number of nights with minimum humidex above 65°F are expected to increase heat-related deaths, illness, and hospitalizations. This directly affects public health as well as healthcare systems.
- More frequent wildfires in the region could reduce human health through loss of life, injury and reduced mental health associated with displacement. Poor air quality due to more wildfire smoke can cause adverse respiratory health effects. Increased healthcare needs during such events could put pressure on medical facilities and staff.
- Individuals with existing health conditions, children, and older adults are likely to be more sensitive to heat and smoke events.
- Renters may be more susceptible to heat and smoke risks given less control over making improvements to their homes, such as insulation and air conditioning systems.
- People living in lower-quality housing with minimal insulation will be less able to cool their homes during heat events and may be more susceptible to smoke exposure. Households with lower incomes are likely to be affected more by the cost of increased energy needs for cooling. Adaptive strategies such as air conditioners and air filtration systems may also not be affordable to them.
- Regional assessments have found that many existing community facilities do not meet the filtration or ventilation standards necessary to serve effectively as clean air shelters (Adaptive Capacity Assessment, 2025).
- Individuals experiencing homelessness are especially vulnerable to heat and smoke as they have limited access to safe shelter.
- Individuals with disabilities and mobility challenges may experience barriers to accessing cooling centers or other refuges during heat and smoke events.
- Workers in outdoor professions, such as construction, agriculture, and outdoor recreation, are likely to be more exposed to heat and smoke and have little flexibility in addressing those conditions (see **Economic Development**).
- High energy demand for cooling could strain the power grid and contribute to outages, which would directly expose more people to heat as their cooling systems go unpowered.
- Households with limited English proficiency may not receive important information about heat and smoke events and available resources if messages are not translated into their primary language.

Adaptive Capacity

Existing programs and conditions in Vancouver can support adaptive capacity to heat, wildfire, and smoke events in the context of human health.

As energy demands go up to cool homes and preserve indoor air quality, home energy efficiency will be increasingly important to the physical and financial health of Vancouver households. Clark Public Utilities offers various rebate and incentive programs for energy efficiency improvements. The Weatherization Assistance Program (WAP) is also a resource available to low-income families to reduce energy costs through improved efficiency.

Several resources already exist to meet immediate needs during heat and smoke events, including community centers and libraries, which can serve as unofficial cooling centers and hubs during heat and smoke events, and temporary cooling centers in collaboration with area churches and other organizations. C-TRAN does not turn anyone away riding to a cooling center. If passengers tell the driver they are going to a cooling center, fares are not enforced. Buses also have air conditioning.

Southwest Clean Air Agency monitors air quality and issues advisories when air quality is poor during smoke events. This connects communities with information they can use to better protect themselves.

Areas of the city with more tree canopy cover are likely to experience lower, safer temperatures during extreme heat events. According to Tree Equity Score, canopy cover varies greatly across the city, with some areas having as low as 8% cover while others have almost 50% cover (Tree Equity Score, 2024). The City's urban forest strategy proposes to increase tree canopy citywide and in equity priority areas. (City of Vancouver, 2023) The City's Treefund and the nonprofit Friends of Trees both provide low-cost trees for planting on private property. (City of Vancouver, 2024)

Hospitals are typically equipped with emergency generators to ensure continuity of services during power disruptions. However, greater frequency of power outages due to increased energy use during heat events could lead to greater emergency energy needs at medical facilities.

Vulnerability Summary

Communities with higher health conditions are expected to have higher vulnerability to extreme heat as well as smoke. Blocks with the combined higher heat and higher health conditions are a greater priority and are found in Areas 2, 3b, 4, and 6. The east side has greater tree canopy cover, which may provide some relief in extreme heat. See **Exhibit 61**.

Exhibit 62: Vulnerability by Census Tracts – Health & Well-being

Census Tract	Area	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index
53011041005	1	Medium-high	Higher	Lower	Higher	Higher	Higher
53011042400	2	Higher	Higher	Medium	Higher	Higher	Higher
53011041111	3b	Medium-high	Medium	Medium	Medium-high	Higher	Higher
53011041113	3b	Higher	Medium-high	Medium-low	Medium-high	Higher	Higher
53011041114	3b	Higher	Medium	Medium-low	Medium-high	Higher	Higher
53011041600	4	Medium-high	Higher	Medium	Higher	Higher	Higher
53011042700	4	Medium-high	Higher	Medium	Higher	Higher	Higher
53011041206	6	Higher	Medium-low	Medium-high	Medium-high	Higher	Medium-high

Source: See [Chapter 2](#) for indicators and methods. BERK, 2025.

Areas 5 and 6 also have hospitals that would feel the effects of greater demand for services; see [Economic Development](#).

Exhibit 63: Risk Summary – Health & Well-being

Likely Climate Impacts in next 10+ years				Magnitude Of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

A previous survey as part of the Clark County Community Needs Assessment found that getting to services, including physical health services, was among the top barriers to social services access (Clark County Public Health, 2024). Climate planning engagement found similar concerns about access to facilities during emergencies due to infrastructure challenges, lack of information or neighborhood connection, and identified improved strategies:

- Increase public awareness of health and safety precautions in the event of extreme climate events. (Hatch Planning and City of Vancouver, 2022)
- Coordinate with local health departments to address impacts of poor air quality on frontline communities. (Hatch Planning and City of Vancouver, 2022)

- Work with community-based organizations and local leaders to organize neighborhood specific community preparedness, through providing meeting spaces, direct funding, information sharing or other mechanisms. (City of Vancouver, 2025)
- Residents suggested spaces (schools, churches, vacant commercial buildings) that would function best as resilience hubs based on community trust and accessibility. (City of Vancouver, 2025)
- In high-risk neighborhoods (e.g. Fruit Valley in the west, the Fourth Plain corridor in the central city, and parts of east Vancouver), the City's Homeless Assistance and Resources Team (HART) team can partner with public health and community organizations to conduct wellness checks on at-risk residents during heat waves or smoky wildfire days. They should also assist with disseminating climate emergency alerts – heat warnings, evacuation orders, air quality advisories – making sure these reach non-English-speaking populations and those with limited access to media. (City of Vancouver, 2025)

See also [Emergency Management](#) and [Transportation](#) for additional strategies to support and connect communities to essential services.

Policies

A policy audit of the Comprehensive Plan and other City plans showed some policies addressed human health in the context of climate hazards. The audit suggested policy revisions such as:

- Add more language around climate justice and equitable distribution of cooling centers, clean air quality centers, and other resources.
- Explicitly address climate resiliency of assets such as trails and green infrastructure.

Policies developed for the Our Vancouver 2045 plan recognize the underlying health disparities that can make communities more vulnerable to ongoing stressors as well as climate impact events such as extreme heat or adverse air pollution:

- Mitigate the impacts of air, water, heat, noise, and light pollution, with a focus on areas with high environmental health disparities. (Draft Policy 22)
- Broaden access to essential healthcare and services in underserved populations and address built environment causes of health disparities. (Draft Policy 49)



Ecosystems

Sector Overview and Assets

Extreme heat, drought, flooding, and wildfire could harm ecosystems in

Vancouver and the services that nature provides such as food, water filtration, shade, recreation, and more. Ecosystems in Vancouver including the landscape, habitats, and other critical areas are described below and mapped in [Exhibit 63](#).

An ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscapes, work together to form a bubble of life. (National Geographic, 2024)

Geologic Hazards

Vancouver is located within a geologic province called the Portland Basin, in the northern terminus of the Willamette Lowland in Oregon. The city largely has a flat terrain due to ancestral flooding along the Columbia River, although there are areas of steep slopes, landslides, erosion, and liquefaction hazard areas along portions of the Columbia River, Burnt Bridge Creek, and Vancouver Lake. (Washington Department of Natural Resources , 2024) (WSP USA, 2023)

Water Resources

Vancouver is located in the Salmon–Washougal Watershed known as Water Resource Inventory Area (WRIA) 28. Most of Vancouver is contained in the Burnt Bridge sub-basin and to a lesser degree in the Salmon and LaCamas subbasins on the north and east respectively. Within the basin, growth, agriculture, and other consumption have resulted in lower stream flows and groundwater impacting fisheries. The Department of Ecology notes: *The impacts of climate change in WRIA 28 are also yet to be fully realized. However, it is apparent that water availability is limited throughout the Salmon–Washougal Watershed.* (Ecology W. D., WRIA 28 Salmon–Washougal Watershed Water Availability, 2023)

Major surface waters in Vancouver include the Columbia River, Vancouver Lake, and Burnt Bridge Creek. Frequently flooded areas in the City are found along these major surface waters, and areas between Vancouver Lake and the Columbia River. Other streams include Salmon Creek, Love Creek, Curtin Creek, Fisher Creek, and others. (WSP USA, 2023) The Columbia River, Burnt Bridge Creek, Salmon Creek, Curtin Creek and Vancouver Lake are on the 303d list for water quality impairments such as temperature, sediment, and more.

Vancouver Lake is about 2,600 acres in size and is relatively shallow and is used for recreation. Following flood control structures being placed on the Columbia River, the lake was cut off from the river. A river connection was restored to promote flushing to improve

water quality. Despite dredging and the addition of the flushing channel in the early 1980s, water quality issues remain with algae blooms. A 2014 study helped develop water and nutrient budgets for the lake. (Foreman, 2014) An economic impact study has identified a desire for increasing algae control and flushing, allowing for watercraft passage from the Columbia River, and adding recreation facilities. (Friends of Vancouver Lake, 2020) Legislative appropriations have supported a phase 1 long-range plan (\$150,000) and a phase 2 one-time implementation effort (\$330,000). (Clark County Public Works, 2024)

Wetlands and Riparian Areas

Significant wetlands include the Water Resources Education Center Wetlands along the Columbia River, the restored wetlands in the Burnt Bridge Creek Greenway, and those near Vancouver Lake. The Port of Vancouver has established a 154-acre wetland mitigation bank.

Although there has been riparian enhancement along Burnt Bridge Creek, there are stretches that lack sufficient vegetation and shading, which can lead to increased water temperatures and reduced water quality. (City of Vancouver, 2021) (Port of Vancouver, 2024)

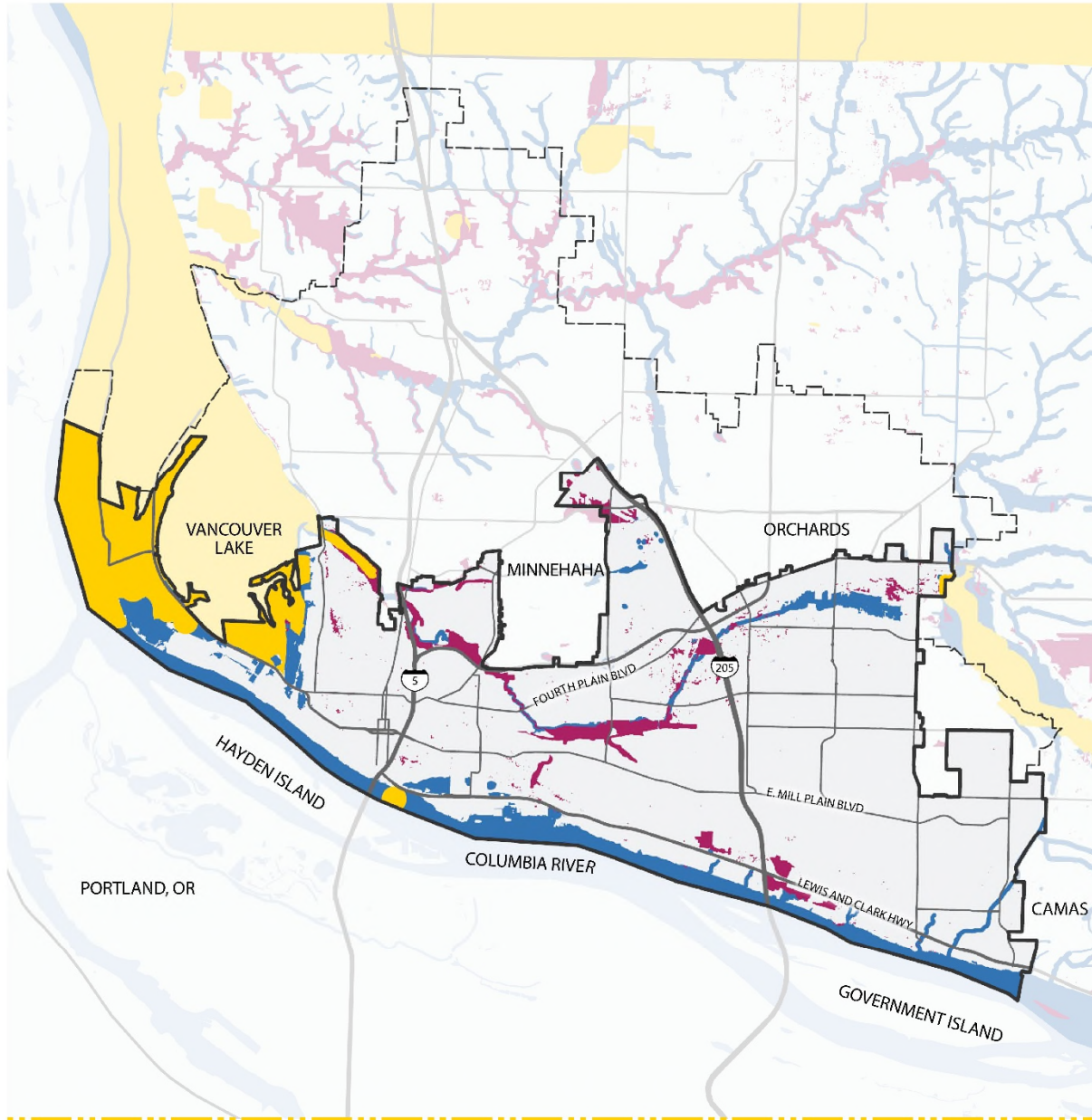
Habitats






Priority habitats in Vancouver include riparian areas, freshwater wetlands, Oregon white oak woodlands, and other biodiversity areas (primarily along Burnt Bridge Creek). (WSP USA, 2023) In or near Vancouver, the Washington Department of Fish and Wildlife has identified priority species including bald eagles, western grey squirrel, chum salmon, chinook salmon, coho salmon, steelhead, great blue heron, peregrine falcon, purple martin, and leopard dace. Bull Trout, along with chum and coho salmon and steelhead, are also listed under the federal Endangered Species Act (ESA). The Columbia River, Lake Vancouver, Burnt Bridge Creek and their shorelines are the primary habitat for most listed species. (City of Vancouver, 2021)

Tree Canopy

Trees are an important part of Vancouver's natural and urban setting. As of 2021, tree canopy currently covers 18.9% of Vancouver's land area. There is a possible planting area of 31.8%. While most neighborhoods have between 16 and 20% tree canopy, about 13 neighborhoods have between 5 and 15% canopy. The citywide goal is 28%. (City of Vancouver, 2023) While more designated habitat is located in the west and south along Lake Vancouver, Burnt Bridge Creek, and the Columbia River, tree canopy is more present in eastern Vancouver. See **Zoning & Development** for additional information on tree canopy.

Exhibit 64: Critical Areas in Vancouver



-  City Boundary
-  UGA
-  Riparian Habitat
-  Habitat Area
-  Species Area



County of Clark, WA, Oregon Metro, Oregon state, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Source: WSP, 2025.

Potential Impacts

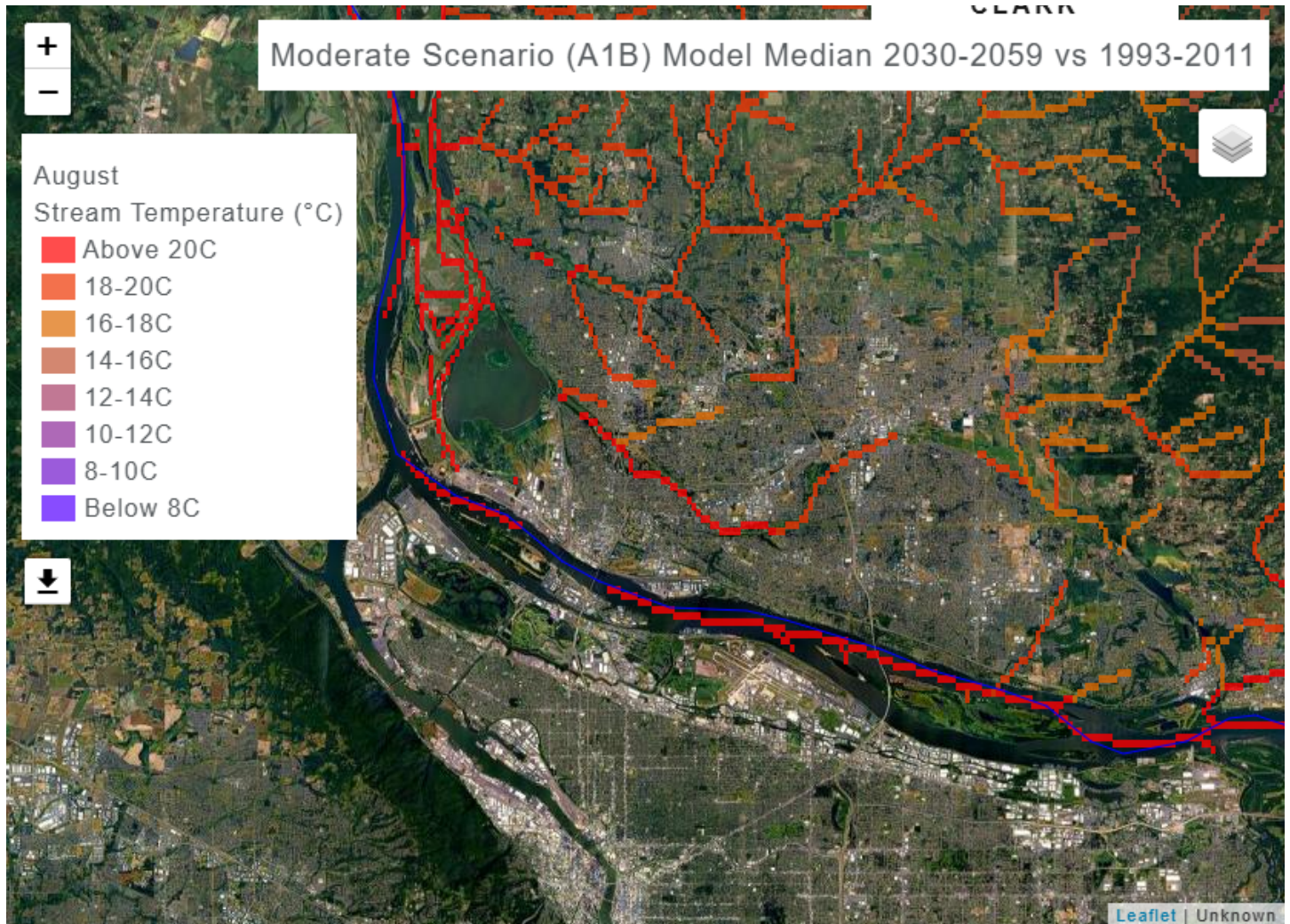
A best available science technical report (WSP USA, 2023) identified potential impacts of climate change to the City's critical areas including extreme precipitation and flooding in **existing and future floodplains**: As the impacts of climate change become more prevalent, floods are expected to become more frequent. The study recommended that Vancouver consider the future flow floodplain at buildout, the potential effects of climate change, and the effects of increasing impervious surfaces when designating frequently flooded areas (WAC 365-190-110). The study also suggested the City consider regulating severe risk channel migration zones as floodways, where new development is generally not allowed.

Increased **stream flows** can scour streams, increase sedimentation, and damage riparian areas. Wider culverts may be needed to support fish passage. Lower summer stream flows can reduce fish habitat quality. Some of the present water quality impairments could worsen, increase pathogens, and harm native cold-water fish. Algal blooms could increase in Lake Vancouver or other freshwater bodies. (Raymond, 2022) (Shirk, 2021) (Rentz, 2020)

Due to reduced summer precipitation, average August **stream temperature** is anticipated to increase in some Vancouver streams by 2040:

- 20.9 °C Burnt Bridge Creek
- 18.4 °C Fisher Creek
- 23.1 to 23.6 °C Columbia River

Exhibit 65: August Stream Temperature – 2030–2059



Source: (Raymond, Climate Mapping for a Resilient Washington, 2022)

Wetlands could be harmed by changes in the amount and timing of precipitation, or changes in peak flows where associated with floodplains. (Shirk, 2021)

Increased heat and drought can impact **tree canopy** that may not be acclimated to changing conditions. This could exacerbate the heat island effect.

Urban trees already have an uphill struggle to reach their maximum size and function due to the competition for space, elements of an urban environment, vandalism, pests and diseases, among other factors and stressors. Abnormally high temperatures and prolonged heat can have a negative impact on established trees especially those not acclimated or unable to adjust to these changes. (City of Vancouver, 2023)

Shifts in seasonal temperature and precipitation could alter the range of **Oregon white oak**, Douglas-fir and other species and lead to pest and disease outbreaks. (Mauger, et al., 2015) Oregon white oaks are tolerant to drought and periodic wildfire may facilitate sprouting of oak, but frequent fire could damage soil and allow for invasive species. (Hudec, Halofsky, Peterson, & Ho, 2019) (WSP USA, 2023)

Adaptive Capacity

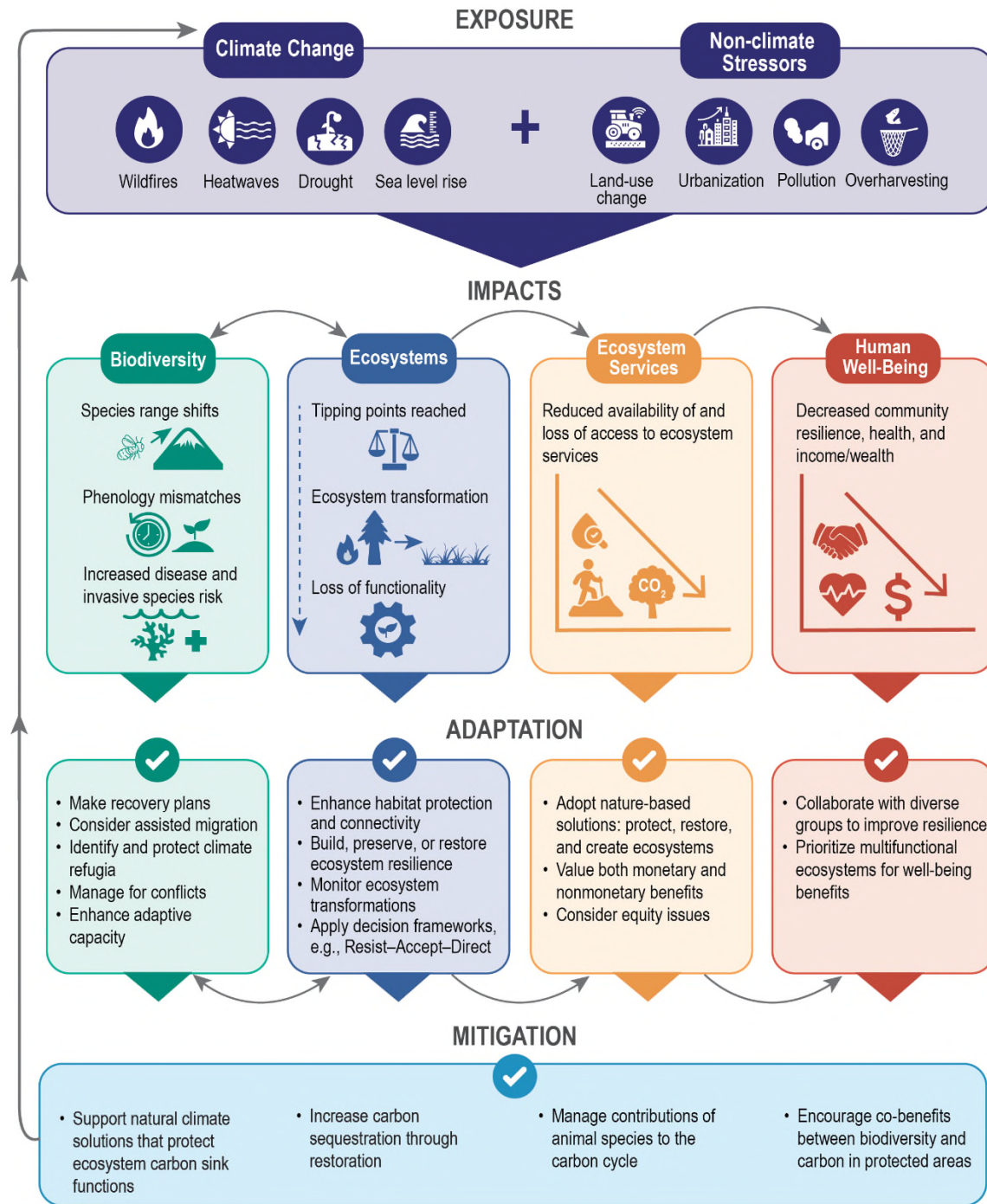
Ecosystem policies can support both adaptation and climate mitigation per **Exhibit 65**.

Similar to adaptation measures in the graphic, the City's provides robust regulations to protect ecosystems:

- The City regulates the protection of critical areas and shorelines. Vancouver is proposing to increase required stream buffers to match state recommendations regarding site potential tree height. (City of Vancouver, 2024)
- The City is proposing updated standards for wetland buffers and associated habitat corridors. (City of Vancouver, 2024) Less disturbed wetlands can support carbon sequestration to help reduce GHG emissions. (WSP USA, 2023)

The City recently updated its Urban Forestry Management Plan and last amended its tree protection regulations in 2023 (VMC 20.770). (City of Vancouver, 2023)

Exhibit 66: Climate Change and Ecosystems, Biodiversity, and Ecosystem Services



CAPTION: Species and ecosystems respond to pressures in different ways, such as shifting their locations or transforming into new, often degraded systems less able to provide ecosystem services. (Weiskopf et al. 2020) Adaptation measures can help species and ecosystems cope with some climate impacts but are not always going to be effective or feasible, requiring increasingly difficult decisions on what resources to prioritize and what changes to accept. (Prober et al. 2019) Adapted from Lipton et al. 2018. (Lipton et al. 2018) (McElwee, 2023)

Vulnerability Summary

A tract-level matrix of vulnerability for ecosystems is provided in **Exhibit 66**. Sensitive ecosystems with exposure to extreme heat, drought, or extreme precipitation include Vancouver Lake in Area 1, Burnt Bridge Creek in areas 2, 4, 6, and 7, and the Columbia River in Areas 1, 2,5, 6, and 8. For these waterbodies and shorelines, there has been progress towards enhancement and restoration but there are still water quality concerns. Vulnerability to climate change is high and the cost to improve water resource functions is also high to fulfill lake management plans, watershed plans, and stormwater plans.

In Area 3A, the exposure is considered Medium-Low and none of the individual exposures are "higher."

Oak Tree habitat is found in Area 5 at Fort Vancouver as well as scattered in other areas. Tree canopy and wildland urban interface is anticipated to be at greater risk in Areas 7 and 8. Providing for wildland urban interface policies and regulations could improve adaptive capacity.

Climate change is having variable and increasing impacts on ecosystem services and benefits, from food production to clean water to carbon sequestration, with consequences for human well-being (very likely, high confidence). Changes in availability and quality of ecosystem services, combined with existing social inequities, have disproportionate impacts on certain communities (very likely, high confidence). Equity-driven nature-based solutions, designed to protect, manage, and restore ecosystems for human well-being, can provide climate adaptation and mitigation benefits (likely, medium confidence). (McElwee, 2023)

Exhibit 67: Vulnerability by Census Tracts – Ecosystems

Census Tracts	Subarea	Heat Exposure	Flooding/Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index	Riparian Habitat	Species
53011041005	1	Medium-high	Higher	Lower	Higher	Higher	Higher	X	X
53011042400	2	Higher	Higher	Medium	Higher	Higher	Higher	X	
53011041003	2	Lower	Medium-high	Higher	Medium-low	Medium-low	Lower		X X
53011041011	3a	Medium-low	Medium-high	Medium-low	Medium-low	Medium-low	Medium	X	X
53011041107	3b	Medium-low	Higher	Medium-low	Medium	Medium	Lower	X	X
53011041203	4	Medium-high	Medium-high	Medium	Medium-high	Medium-high	Medium-high	X	X
53011041600	4	Medium-high	Higher	Medium	Higher	Higher	Higher	X	X
53011042601	5	Medium-high	Higher	Medium-high	Higher	Medium	Medium	X	X
53011042602	5	Medium-high	Medium-low	Medium-high	Medium	Medium	Medium-low	X	X
53011041205	6	Medium-high	Higher	Medium-high	Higher	Medium-high	Higher	X	X
53011041208	6	Lower	Medium	Higher	Medium-low	Medium	Lower	X	X
53011042800	6	Lower	Lower	Medium-high	Lower	Medium-low	Lower		X
53011041312	7	Higher	Higher	Medium-low	Higher	Medium-high	Higher	X	X

Census Tracts	Subarea	Heat Exposure	Flooding/Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index	Riparian	Habitat	Species
53011041313	7	Medium-high	Medium-high	Medium	Medium-high	Medium-high	Higher	X	X	
53011041334	7	Lower	Higher	Higher	Medium	Lower	Lower	X	X	X
53011041326	7	Medium-low	Higher	Higher	Medium	Medium-low	Medium	X	X	
53011041309	8	Medium-low	Medium	Higher	Medium-low	Medium-high	Medium-high	X	X	

Source: See [Chapter 2](#) for indicators and methods. BERK, 2025.

Based on the evaluation above, the risk of climate impacts to ecosystems is shared in [Exhibit 67](#).

Exhibit 68: Risk Summary – Ecosystems

Likely Climate Impacts in next 10+ years				Magnitude Of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

Some strategies that could improve ecosystem resilience were identified through climate planning efforts with the community and an interdepartmental team:

- Implement land use planning policies for flood mitigation. This included actions to review regulations such as stormwater and critical areas, and potentially addressing a flood protection overlay zone. (Hatch Planning and City of Vancouver, 2022)
- Consider controlled burns or mechanical thinning in larger natural parks to reduce accumulated fuel (in coordination with fire authorities and when weather permits safe burning) – this can actually improve ecosystem health while lowering wildfire risk. (City of Vancouver, 2025)
- Use parks as venues for climate education: interpretive signs about drought-resistant gardens, or a pilot plot showing a native meadow vs. conventional lawn and explaining water savings. (City of Vancouver, 2025)

Future engagement regarding ecosystem assets could include:

- Watershed sub-basin conditions and identifying priorities by engaging with watershed planning units.
- Prioritizing fish passage barrier removal, enhancing biodiversity corridors, and adding green infrastructure.
- Collaborating with overburdened communities to identify their priority environmental improvements. For example, Vancouver’s Resilience Rising and Adaptive Capacity Assessment identified some potential pilot projects for stormwater projects with urban greening and rain gardens (City of Vancouver, 2025) and food forests or edible landscapes in heat-impacted areas (City of Vancouver, 2025)

Policies

A number of Comprehensive Plan policies or Climate Action Framework strategies address ecosystem protection and enhancement. Amended policies could further address:

- Habitat protection for salmonids and listed species by addressing potential impacts to salmon species due to climate change.
- GHG reduction, climate-exacerbated impacts to a policy addressing air quality protection and enhancement.
- Increased frequency/risk of hazards due to climate change (e.g., extreme precipitation) to a policy addressing geologic hazards.
- Issues of insects, invasive species, and increased ecosystem impacts due to climate change related stresses.
- Risk of water quality degradation due to climate change impacts.
- Flood management with green infrastructure and setbacks and protection where necessary.

The [OUR VANCOUVER 2045](#) plan addresses many of these concepts:

- Ensure that buildings contribute to the City’s greenhouse gas reduction goals, protect occupants from climate hazards and extreme weather, and minimize harm to wildlife and natural ecosystems. (Draft Policy 6)
- Focus on improving water quality and prevent flooding through managing stormwater flows, encouraging natural filtration of precipitation to ground water, reducing runoff, mitigating flood risks by advancing systems that manage stormwater effectively, and enhancing local water quality in the watershed. (Draft Policy 10)

- Take inventory of and protect climate refugia, and fish and wildlife habitat needs for species under stress from climate change. (Draft Policy 15)
- Protect and preserve significant cultural, historic, archeologic, and ecologic community resources. Promote preservation, restoration, and rehabilitation of historic and architecturally significant structures. (Draft Policy 107)
- Support a healthy urban ecosystem by embedding pollinator habitat into public and private development, prioritizing pesticide-free landscaping, enhancing biodiversity, and connecting natural spaces across the city through pollinator-friendly plantings. (Draft Policy 107)



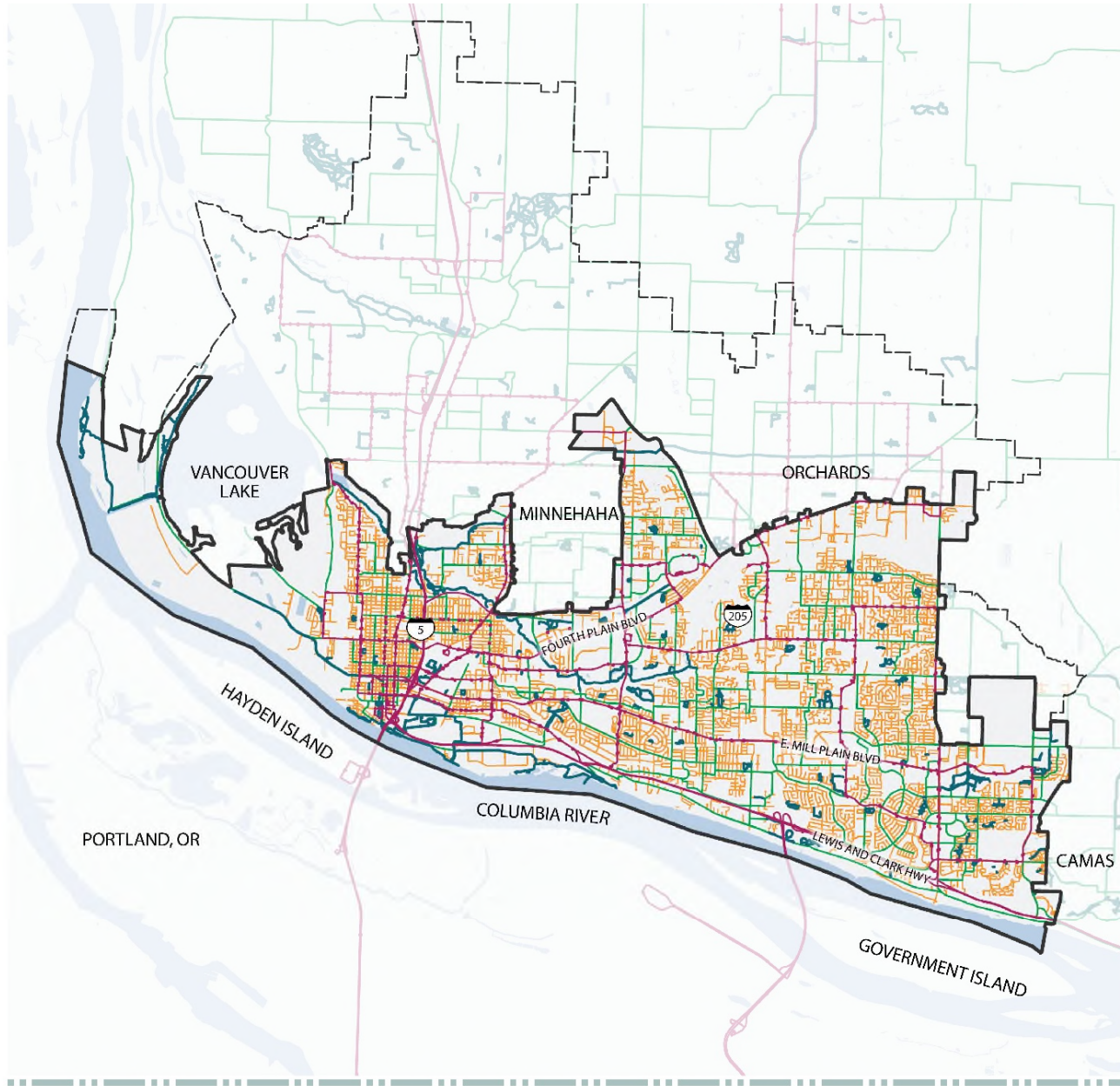
Transportation

Climate related hazards have the potential to negatively impact transportation services necessary for other sectors like **Zoning and Development, Economic Development, Emergency Services**, and more. Roads, sidewalks, bridges, and transit facilities are vital to maintain access and connectivity for a resilient transportation system.

Sector Overview and Assets

Transportation assets include three major highways such as Interstates 5 and 205 as well as Washington State Routes 14 and 500, transit centers that connect large swaths of the city with services via bus include the VA, 99th street, Fisher’s Landing, Mill Plain, and Vancouver Mall Transit Centers. See **Exhibit 68**. Major roads that are considered part of the regional emergency transportation routes are shown in **Exhibit 69** with several locations in floodplains such as Areas 1, 5, 6, and 7.

Exhibit 69: Multimodal Transportation Assets in Vancouver



- City Boundary
- UGA
- Waterbodies

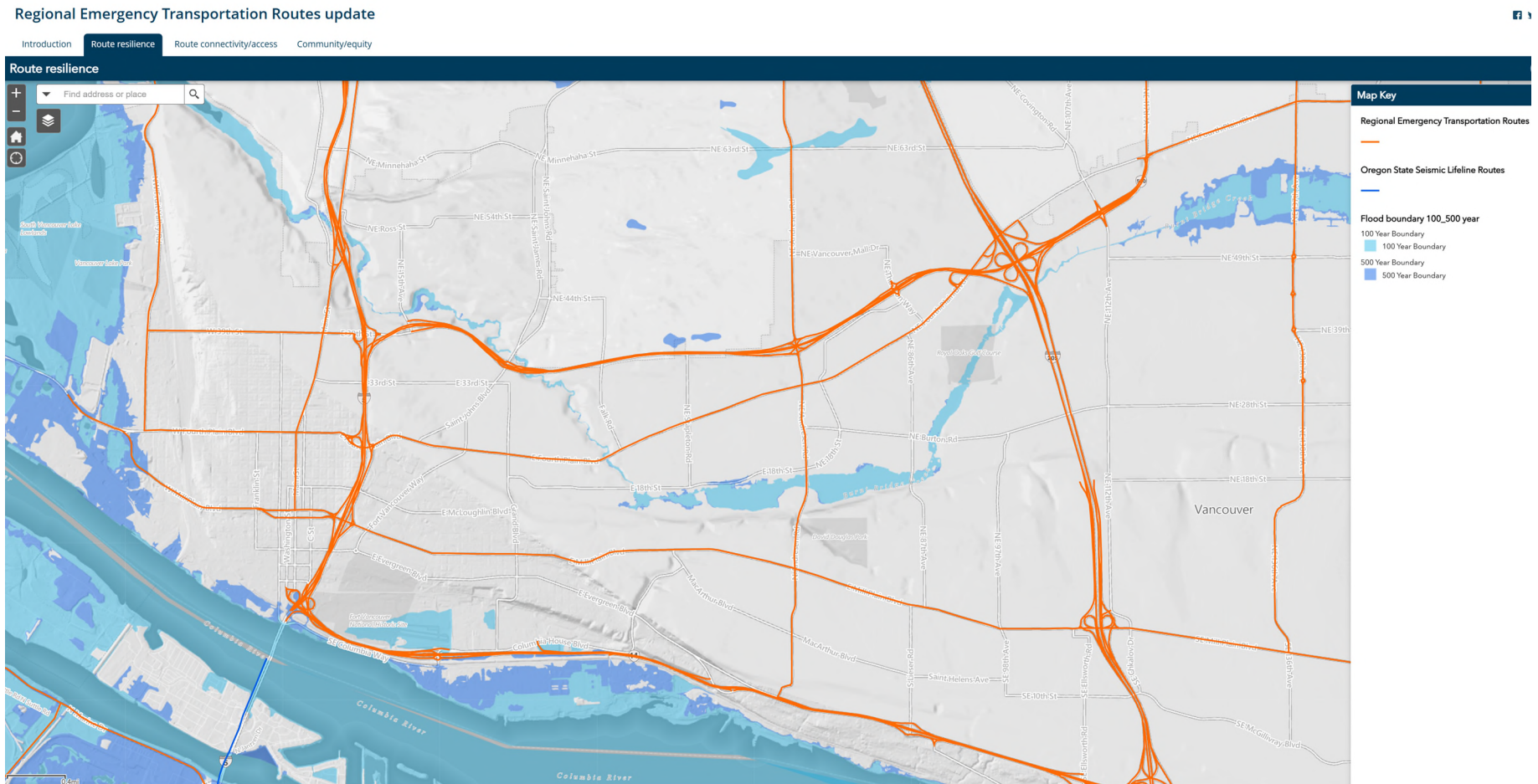
- Bus Route and Stop
- Trail
- Bike Route
- Sidewalk



County of Clark, WA, Oregon Metro, Oregon state, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Source: (Design Workshop, 2024)

Exhibit 70: Regional Emergency Transportation Routes in Vancouver Area and Floodplains

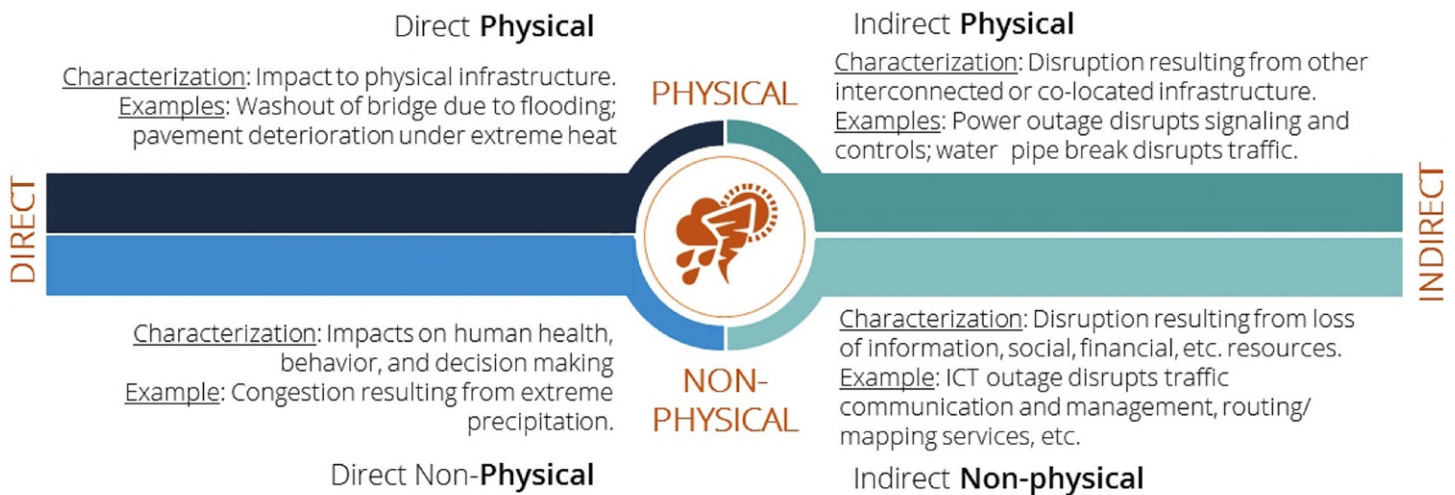


Source: (RDPO, 2024)

Potential Impacts

Bike, pedestrian, and vehicular infrastructures are susceptible to roadway flooding and damage from extreme heat and precipitation that can impact the ability of residents to reach grocery stores, hospitals, and several other vital resources during climate related events. Examples of physical and non-physical transportation system impacts are described in [Exhibit 70](#).

Exhibit 71: Direct and Indirect Climate Change Impacts to Transportation Infrastructure



Source: (Samuel A. Markolf, 2019)

Extreme precipitation can create roadway flooding hazards that have major impacts on transportation routes, damage infrastructure and increase maintenance and repair costs. These specific impacts are limited in exposure for a majority of the city per FEMA flood risk mapping (FEMA, 2021) and Vancouver’s Annex to the 2023 Clark Natural Hazard Mitigation Plan (Clark Regional Emergency Services Agency, 2023), but can more severely impact the east and central areas as shown in [Exhibit 17](#). Wildfire related hazards such as smoke and roadside brush fires could increase in likelihood and severity. These specific hazards can disrupt travel by increasing road closures from roadside brush fires near the wildland urban interface (Washington State Department of Natural Resources, 2024), and delaying time sensitive roadway maintenance for the sake of protection of outdoor workers (L & I, 2022).

Wildfire smoke events can create additional health impacts for vulnerable populations that may be dependent on transit and non-motorized transportation. In cases such as this, seeking medical attention can create additional exposures and worsen existing conditions. Additional information on wildfire smoke related health hazards can be found in the [Health & Well-being](#) section of this document. While exposure to wildfire smoke and extreme heat impact largely the same vulnerable segments of the population, there may be fewer

transportation resources and services available for vulnerable communities seeking refuge from poor air quality.

Extreme heat events may lead to roadway and sidewalk damage as a result of prolonged exposure of asphalt and concrete to extreme heat. The risk of this potential impact is low but the impact is quite high as it will increase maintenance requirements and costs while preventing effective transportation for emergency personnel or those needing to access their services (Fischels, 2021). Extreme heat can also put strain on public transportation assets during acute heat events both in infrastructure assets and in demand since public transportation is a common refuge for some low-income individuals as well as those needing to access emergency cooling shelters (City of Vancouver, 2024).

Adaptive Capacity

Vancouver's transportation network is not particularly vulnerable to climate change related hazards when compared with other sectors.

However, the transit network does have a proportionally high number of capital facilities that are vital to the connectivity, health, and safety of the City that, if damaged, could result in severe disruptions to service provision and human health.

The City is at a low risk of erosion and severe riverine flooding impacting roadways, transportation facilities, and bike lanes per the City's 2023 *Natural Hazard Mitigation Plan*. Other hazards such as extreme heat, wildfire smoke, and extreme precipitation leading to acute stormwater flooding could inequitably limit transportation to areas of the city that already have transportation challenges. One example of this is the high potential for active trips (any travel that is not a single occupancy private vehicle) in areas at the highest risk for urban heat island effects. This could damage the potential for non-drivers to reach necessary services and also limit the impact of GHG reduction goals and policies that seek to reduce the overall VMT in personal vehicles and encourage active transportation.

Commuters could be impacted by urban flooding with extreme precipitation, or a lack of power due to energy demand exceeding network capacity during extreme weather (e.g., heat dome). Emergency evacuations could disrupt both workers and residents. Regional emergency plans addressing cross county and cross state road networks are under update as described under **Economic Development**.

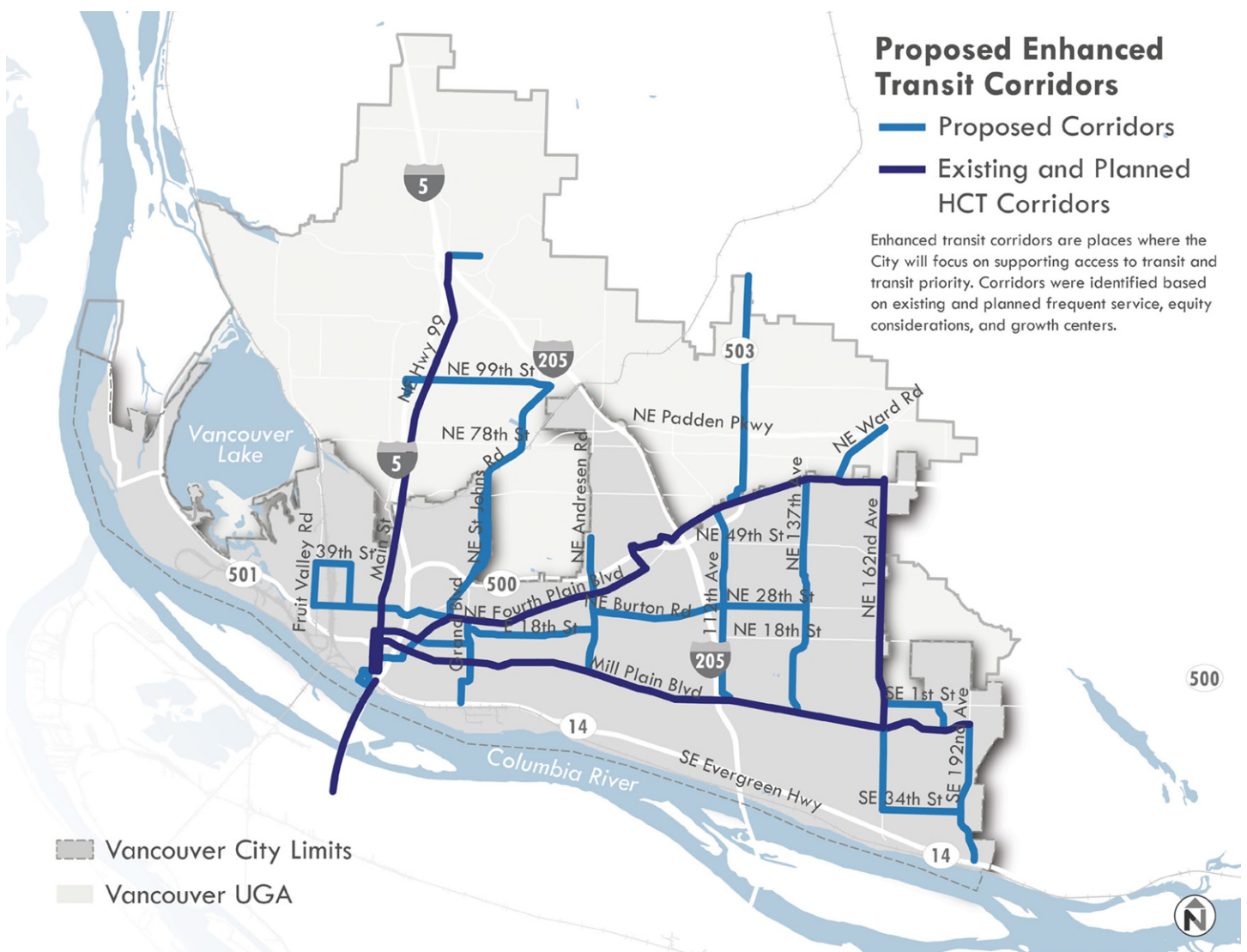
A summary of adaptive capacity (high and low) conditions are noted below:

- Transportation system access could be limited for several groups:
 - ➔ Non-drivers may be unable to access transportation infrastructure without risking exposure to climate hazards. For example, there may be public transit challenges during storm events. In addition, in East Vancouver, there are limited transit options. (City of Vancouver, 2025) Individuals with disabilities and mobility challenges may experience barriers to accessing cooling centers or other refuges during heat and smoke events without risking prolonged exposure. These challenges were reinforced through the Resilience Rising engagement in 2025, which identified inequitable access to resources like air conditioning, clean air shelters, and public cooling infrastructure in part due to transportation limitations for seniors, youth, and people with disabilities. (City of Vancouver, 2025)
 - ➔ Outdoor laborers working on transportation construction projects may have negative health impacts associated with prolonged exposure to wildfire smoke or extreme heat. As climate conditions worsen it is possible that fewer individuals are willing to work in the field of transportation construction which could increase overall costs and delay construction projects significantly without proper protections put in place.
- Plans, programs, and policies that can address climate impacts and improve resilience include:
 - ➔ Pedestrians and Bicyclists including access to transit:
 - Areas of the city such as in the east with more tree canopy cover are likely to experience lower, safer temperatures during extreme heat events. See [Zoning & Development](#) for more information by neighborhood.
 - Specific reference to “comfortable” last mile transportation to connect pedestrian and bike infrastructure with C-TRAN network to serve all communities’ transportation needs at each step of their journey even during adverse weather conditions.
 - Vancouver’s Climate Action Framework specifically seeks to mitigate inequity in C-TRAN network by shifting trips to active modes of transportation through network improvements targeted at transit dependent and historically poorly served communities in Vancouver.
 - C-TRAN has a policy of not turning anyone away riding to a cooling center.

➔ Transit System Sustainability and Resilience:

- C-TRAN has a Sustainability Policy, and a transition plan to have zero-GHG emissions by 2043 by adding more electric buses. (C-TRAN, 2022)
- Clark Regional Emergency Services Agency (CRESA) plans to partner with C-TRAN to identify climate-vulnerable infrastructure and retrofit it to ensure longevity of service and to reduce capital project needs.
- Vancouver’s Transportation System Plan identifies existing and planned transit routes. See **Exhibit 71**.

Exhibit 72: Transit Corridors, Existing and Proposed

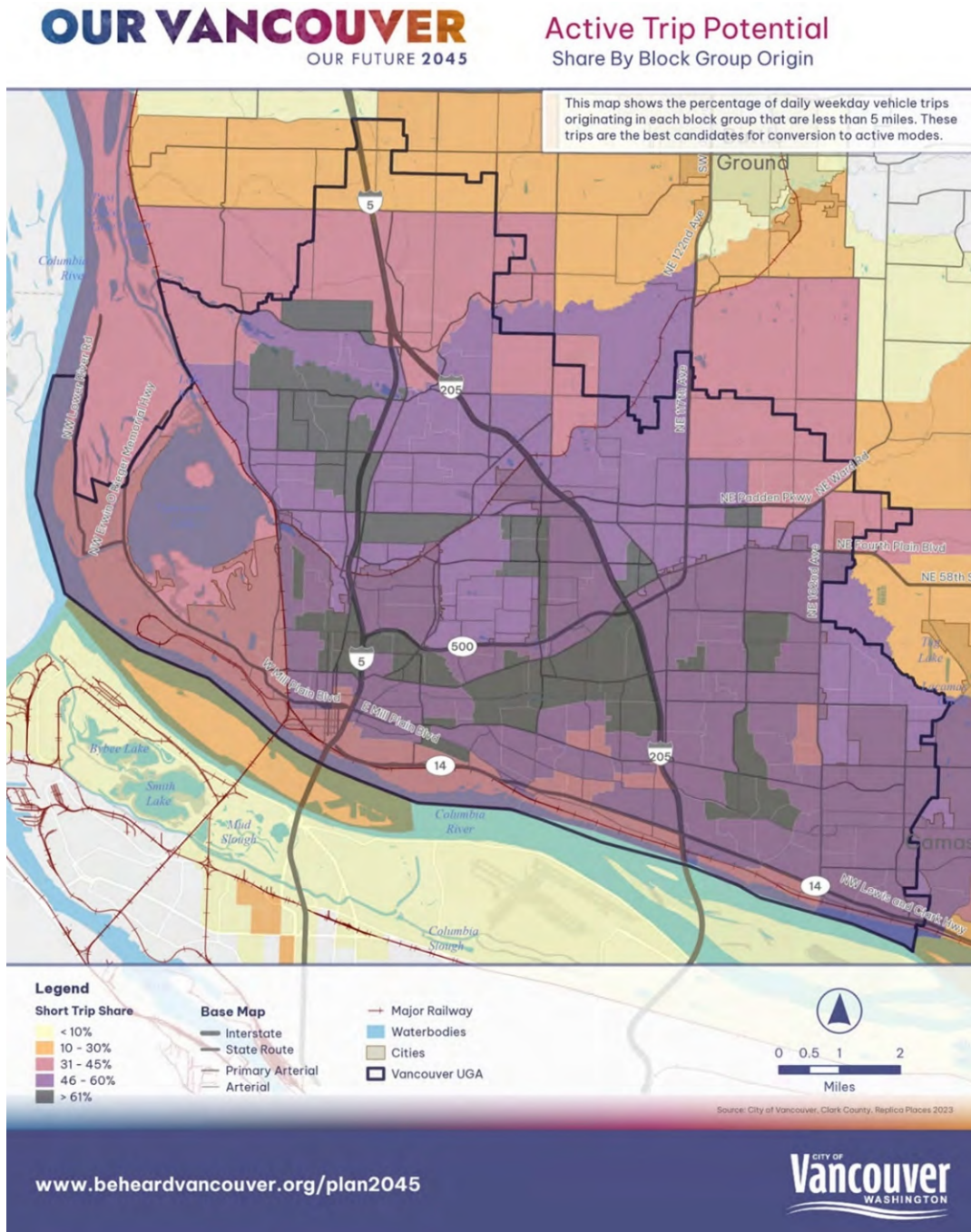


Source:

Source: (City of Vancouver, 2023)

The City has planned for improvements to its bicycle and pedestrian system in the 2023 Transportation System Plan, but more connections could be made to increase active trips. See [Exhibit 72](#),

Exhibit 73: Active Trip Potential as a Share of All Vehicle Trips



Source: Alta, 2024

The City's overall goals and strategies laid out in the Climate Action Framework (City of Vancouver, 2022) and the associated transportation sections of the Emergency Management Plan, coupled with implementation, would be adequate in alleviating the disconnect between areas with low overall access, areas with high active trip potential and areas that are more acutely impacted by climate hazards than elsewhere in the city. This contributes to high overall adaptive capacity to climate hazards both through proposed capital investments and through climate hazard risk reduction strategies.

Vulnerability Summary

A summary of vulnerability for transportation is provided in **Exhibit 73** below. Major regional transportation routes that are part of emergency evacuation routes are located in the Areas 2-8. Transit routes are more exposed to heat and smoke in Areas 2, 3b, and 6-8. Lake and river flooding is less likely to impact transportation facilities but urban flooding with extreme events could affect roadways and the residents, businesses, and commuters that rely on them in Areas 1, 2, 4, 5, 6, and 7. Newer street standards have been applied in more recently developed areas in areas 7 and 8.

All communities and businesses rely on different transportation modes and freight. Those with the most vulnerable populations due to disability or exposure to high-volume roads are highlighted below:

- Considering Census tracts with higher shares of people with disabilities who may be more dependent on transit or vehicular transportation and are in areas with higher exposure are in Areas 2, 4, and 8.
- Census tracts with higher climate exposure and proximate to high-volume roads are in Areas 5 and 8. Areas with Medium-High Exposure (including Higher Heat) along with Higher Health or Equity Disparities are in Areas 3b and 6.
- Census tracts with higher flooding potential and vulnerable populations are found in Areas 2, 4, and 8.

All Census tracts included on **Exhibit 73** have at least one emergency route, and also have potential for active trips with improved connections for walking, biking, e-bikes, that can help provide redundancy in transportation modes to improve resilience.

Exhibit 74: Vulnerability by Census Tracts – Transportation

Census Tract	Area	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index	Persons with disabilities > 20%	Potential Active Trips	Traffic Proximity Greater than Average	Regional Transportation Routes
53011041800	2	Medium	Medium-low	Medium-high	Medium	Higher	Higher		61% +	X	X
53011041900	2	Medium-low	Medium	Medium-high	Medium-low	Medium	Medium-low		61% +	X	X
53011042400	2	Higher	Higher	Higher	Higher	Higher	Higher	X	31-45%		X
53011041011	3a	Medium-low	Medium-high	Medium-low	Medium-low	Medium-low	Medium		46-60%	X	X
53011041107	3b	Medium-low	Higher	Medium-low	Medium	Medium	Lower		46-60%	X	X
53011041113	3b	Higher	Medium-high	Medium-low	Medium-high	Higher	Higher		46-60%	X	X
53011041114	3b	Higher	Medium	Medium-low	Medium-high	Higher	Higher	X	46-60%		X
53011042700	4	Medium-high	Higher	Medium-high	Higher	Higher	Higher	X	46-60%		X
53011042601	5	Medium-high	Higher	Medium-high	Higher	Medium	Medium		31-45%	X	X
53011041206	6	Higher	Medium-low	Medium-high	Medium-high	Higher	Medium-high		61% +	X	X
53011041207	6	Medium	Medium-low	Higher	Medium	Medium	Higher		31-45%	X	X
53011043100	6	Medium	Medium-high	Medium-high	Medium-high	Medium	Medium	X	46-60%		X
53011041313	7	Medium-high	Medium-high	Medium	Medium-high	Medium-high	Higher		46-60%	X	X
53011041317	7	Higher	Lower	Medium-high	Medium-high	Medium-low	Medium-low		46-60%	X	X
53011041326	7	Medium-low	Higher	Medium-low	Medium-low	Medium-low	Medium		46-60%	X	X
53011041334	7	Lower	Higher	Medium-low	Medium-low	Lower	Lower		46-60%	X	X
53011041310	8	Medium	Medium-high	Higher	Higher	Medium-high	Medium-low	X	61% +		X
53011041320	8	Higher	Medium	Medium-high	Medium-high	Medium-high	Medium-high		46-60%	X	X
53011041329	8	Higher	Medium	Higher	Higher	Lower	Medium-high		46-60%	X	X

Source: See Chapter 2 for indicators and methods. BERK, 2025.

Higher Exposure & Higher Health or Equity Disparities | Medium-High Exposure & Higher Health or Equity Disparities

A summary of risk is provided below based on the evaluation above.

Exhibit 75: Risk Summary – Transportation

Likely Climate Impacts in next 10+ years				Magnitude Of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

The Clark County *Community Needs Assessment* found that transportation barriers to social services, health services, and employment was a significant concern in climate vulnerable population throughout Clark County (Clark County Public Health, 2024).

Based on engagement for Resilience Rising and interdepartmental efforts for the Adaptive Capacity Assessment in 2025, many transportation-related strategies were identified to address climate impacts and transportation barriers:

- When implementing public facility retrofits (e.g., HVAC upgrades, power redundancy), also consider proximity to public transit and walking paths. (City of Vancouver, 2025)
- Provide amenities like water fountains or misting stations at key transit centers during extreme heat events so riders can stay hydrated and cool. (City of Vancouver, 2025)
- Making [BRT] making stations into small oases – cooler, with seating, shade, and information – will improve safety and ridership during extreme weather. Prioritize upgrades at stations in heat-prone and socially vulnerable areas (for instance, stations along E. Fourth Plain in central Vancouver, which serves lower-income communities and sees high foot traffic). (City of Vancouver, 2025)
- Identify the chronic flood spots along each BRT route and invest in stormwater infrastructure to mitigate them. This could mean enlarging street culverts, adding extra storm drains, or regrading road surfaces so water doesn't pool in the bus lanes. (City of Vancouver, 2025)
- Integrate climate resilience into all future transit planning and investments. Pursue funding for more covered stations and cooling features as standard design

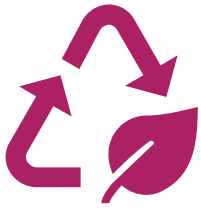
elements for new projects. The City and C-TRAN can also explore micro- transit or on-demand shuttles for extreme events. (City of Vancouver, 2025)

- Increase sheltered bus stops. By 2045, the aim is that no frequently used stop in a Category A or B tract (see **Exhibit 4**) is just a bare bench – all have some form of cover or tree shade. (City of Vancouver, 2025)
- At major transfer points or transit centers (like Vancouver Mall, downtown, or 99th Street Transit Center), provide cooling and air quality amenities. (City of Vancouver, 2025)
- Incorporate green stormwater infrastructure around bus stops to handle runoff and reduce flooding. (City of Vancouver, 2025)

Policies

Vancouver’s transportation policies are explicit about reducing VMT and would also help reduce GHG emissions and poor air quality. Some policies address the climate resiliency of transportation infrastructure in the event of climate emergencies.

Integrating the TSP policies and the Climate Action Framework objectives and strategies into the Comprehensive Plan would benefit climate mitigation, resilience, and equity as these policies were crafted with climate change in mind.



Waste Management

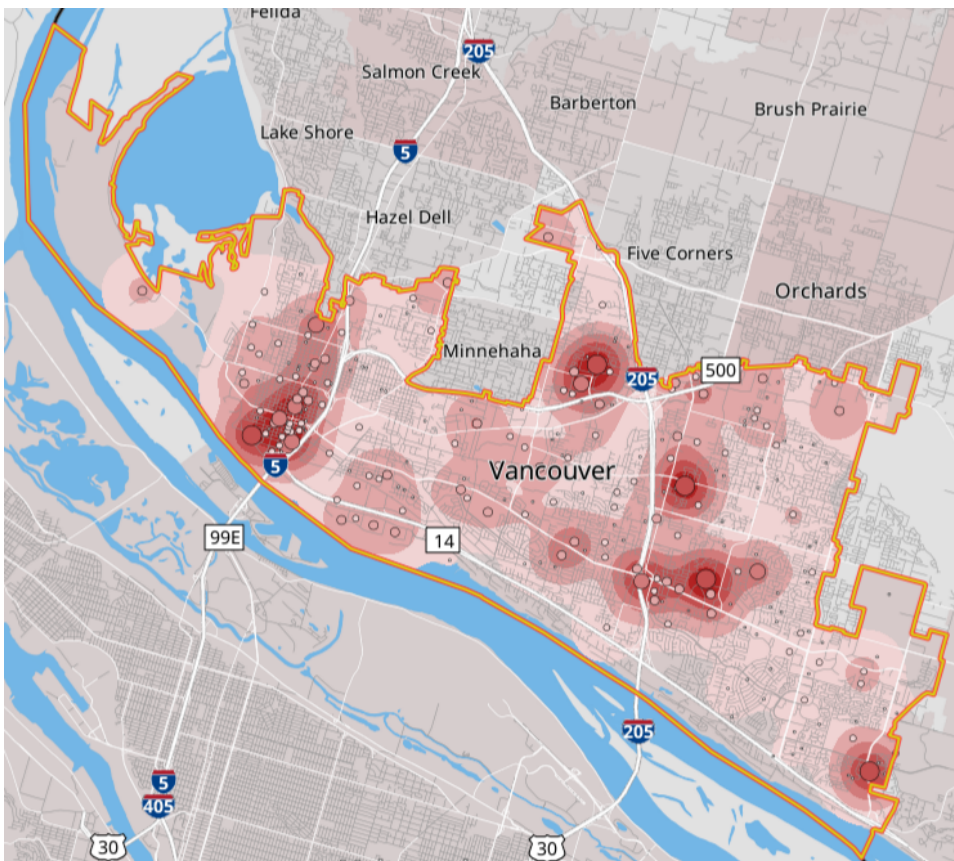
Sector Overview and Assets

The City of Vancouver waste management system is necessary for daily commercial and residential refuse collection and sorting as well as debris clearing during and after extreme weather events. Assets include waste hauling personnel, transfer stations, and heavy rail infrastructure for export from transfer stations to long term waste storage.

The City’s solid waste services are contracted to Waste Connections and requires service in all residential areas. Waste hauling requires reliable and safe transportation infrastructure to reach all solid waste customers.

Waste management-related jobs are shown in **Exhibit 76**, and are primarily found in Areas 2, 3b, and 7. The West Vancouver transfer station is located in Area 1. The Central Transfer and Recycling station is located in the UGA north of Area 7, and a third Washougal Transfer Station is found east of Vancouver.

Exhibit 76: Waste Management and Remediation Services Jobs in Vancouver, 2022



Source: Census on the Map, 2022.

Potential Impacts

Waste management providers in the city do have a low overall risk to service provision due to climate related hazards but are impacted by climate adaptation in other sectors.

Transportation network interruptions from roadway damage, flooding, and debris can hinder services and create significant workload increases following climate hazard events. The threat of extreme heat can also increase instances of roadway debris that need to be cleared as part of emergency response.

A summary of potential impacts is shared below:

- Extreme Precipitation
 - Extreme precipitation can impact roadways and other physical waste management assets throughout the city such as transfer stations and hazardous waste storage that has not yet been safely transported to a transfer station.
 - Impacts to waste collection and increases in debris clearing on roadways and on private property.
- Extreme heat
 - Though extreme heat is not directly identified as a threat to waste management assets in the city (UW Climate Impacts Group, 2024), waste haulers are predominantly outdoor laborers and extreme heat can significantly impact their ability safely and effectively service their waste collection routes
- Wildfires and wildfire smoke
 - Waste haulers are predominantly outdoor laborers and wildfire smoke can significantly impact their ability safely and effectively service their waste collection routes.
 - Related to transportation infrastructure, roadside brushfires can impact roadways and delay clearing certain debris for the safety of solid waste staff.

Adaptive Capacity

Programs that address the resilience of the waste management system include debris management elements of the City's Emergency Operations Plan.

- Debris management is included in Vancouver’s Emergency Operations Plan (City of Vancouver, 2018) and the Regional Disaster Debris Management Plan and regional Natural Hazard Mitigation Plan.

The City of Vancouver Annex outlines a strategy for managing disaster debris operations and assigns critical response roles and responsibilities. It also provides a timeline of activities based on normal, pre-event, response, and recovery time periods; and includes extensive pre-event messaging and implementing documents. Potential Debris Collection Sites have been identified and surveyed. (Clark Regional Emergency Services Agency, 2023)

- Extreme heat and wildfire smoke protections for outdoor workers provided by Washington State Department of Labor and Industries (L & I, 2022) would apply to waste management employees.
- Increases in tree canopy cover could improve outdoor worker resilience to extreme heat but could also increase roadway debris and strain existing staff and equipment resources.

Capital assets such as the transfer stations and roadway infrastructure to transport sorted solid waste to landfills and recycling plants are resilient to worsening climate hazards as they provide redundant services. This means that if one transfer station is damaged or is out of commission for a climate related hazard the other two have the capacity to service waste haulers, residential customers, and special item drop offs. There are also a large number of sorting facilities and transfer stations outside of city limits that can effectively service these customers but are not technically a part of the City of Vancouver waste system.

Vulnerability Summary

Waste facilities, including a Transfer Station, are located in Area 1 with medium-high heat exposure and higher flooding/precipitation exposure. Waste-related jobs are focused in Areas 2, 3b, and 7 with areas of medium-high and higher heat exposure. See **Exhibit 16 and Exhibit 76**. Heat in particular would affect outdoor facilities and workers. Facility vulnerability is less than for outdoor workers associated with waste management.

Exhibit 77: Risk Summary – Waste Management

Likely Climate Impacts in next 10+ years	Magnitude of Loss	City Responsibility	Vulnerable Communities	Areas Most Affected

Sources: BERK, 2025.

Gaps and Opportunities

Engagement

Engagement with communities in Vancouver is ongoing in the form of waste reduction strategies and proper waste sorting. Materials on proper waste disposal and hazardous waste are available to all residents online and several free classes exist. Engagement activities could reinforce existing programs as well as offer additional engagement helping property owners and homeowner associations understand the importance of clearing stormwater infrastructure of debris.

Policies and Strategies to Improve Adaptive Capacity

A policy audit of city and regional plans contained several explicit policies related to Waste Management. A majority of the policies address the holistic cycle of consumption and production as well as providing opportunities to reduce emissions at the consumer level from landfilled waste.

Additional waste management policies should address weather related debris management, continued service delivery, and ensured system redundancy during a climate emergency.

A broad policy could address emergency responses and services:

- Disaster Recovery and Emergency Response: Develop plans and resources to ensure effective emergency response and equal access to emergency services and recovery resources mitigating risks from extreme weather, climate-related hazards, and social hazards. (Draft Policy 3)

A recommendation of the Adaptive Capacity Assessment called for this implementation action for Policy 3:

- Institutionalize climate vulnerability data into emergency response planning— including evacuation, debris management, and contingency protocols for essential services. (City of Vancouver, 2025)



Water Resources

Sector Overview and Assets

This section addresses Vancouver’s water, wastewater, and stormwater systems relying on the City’s system plans.

Water System

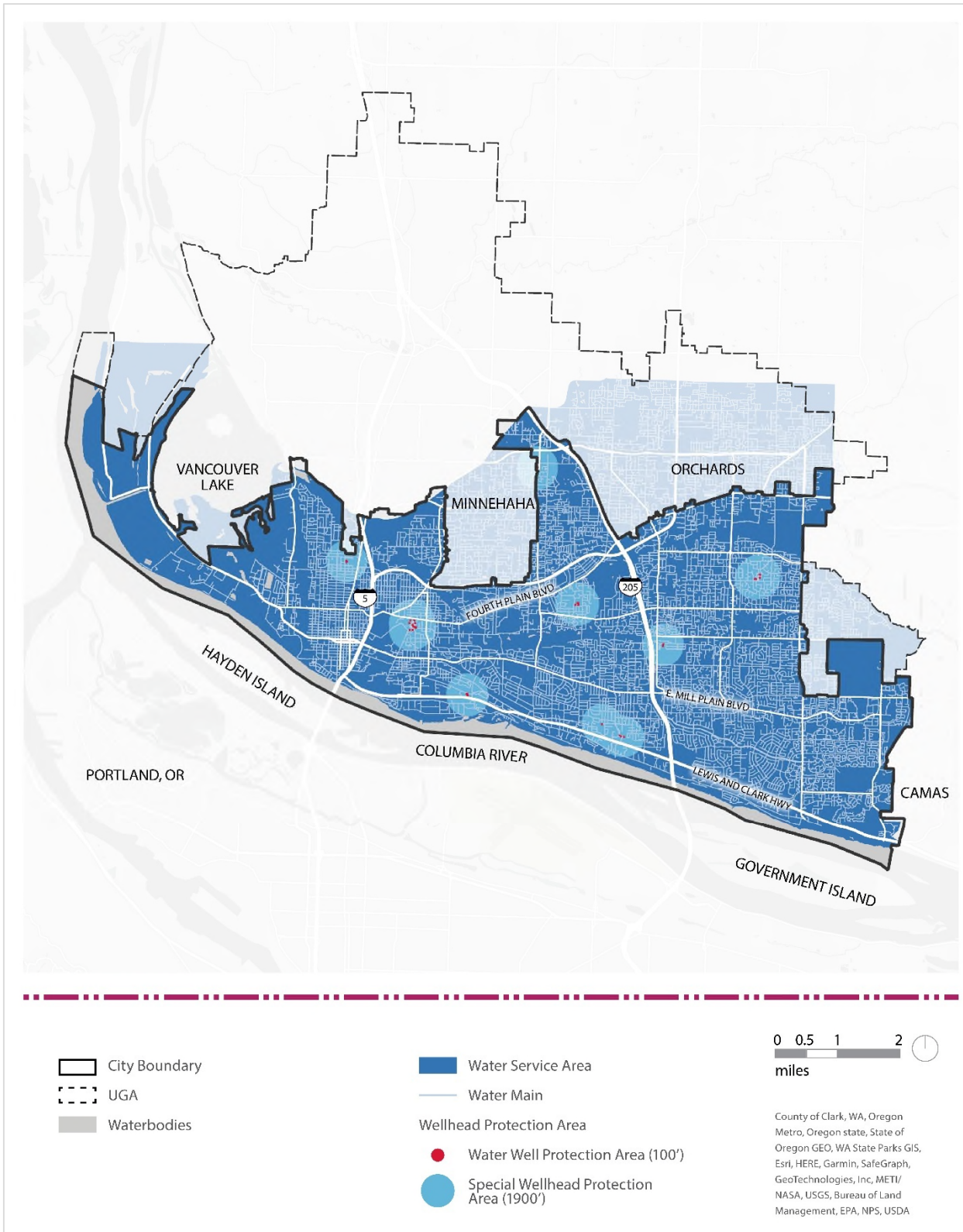
Vancouver provides water protection, treatment and management serving more than 270,000 people within the City and a portion of the urban unincorporated area, covering a 72-square-mile service area. See **Exhibit 78**. The system includes 9 water production stations, 40 wells, 52 booster pumps, more than 1,100 miles of pipes, and more than 77,000 service connections (water meters). (City of Vancouver, 2024)

Vancouver’s water supply comes from underground aquifers under the city and county. It is a sole source aquifer called the Troutdale Aquifer System Area. (US EPA, 2024) Treated groundwater is stored in reservoirs and elevated tanks. Stored water is gravity fed or pumped to pressurize the distribution system. (City of Vancouver, 2015) The City protects groundwater through a wellhead protection program and limits activities that could contaminate critical aquifer recharge areas.

While groundwater is the primary source of water, watershed plans have recommended sourcing water from the Columbia River:

Vancouver has been active in the WRIAs 27 and 28 planning effort. The Salmon-Washougal and Lewis Watershed Management Plan (WRIA Plan) was adopted in 2006. The WRIA Plan addresses a range of issues related to water resources, including water supply, stream flow management, water quality, and fish habitat. It reviews alternative approaches for managing water resources in the area and recommends select strategies for implementation. The WRIA Plan discusses Vancouver’s sources of supply and projected needs and identifies groundwater in the Vancouver Lake lowlands as a major new source of regional supply. Given this regional source of supply, the WRIA Plan recognizes that Vancouver’s regional supply may play a role in assisting other communities within Clark County to meet future demand. The WRIA Plan also encourages new developments and industrial facilities to rely on the City’s existing public water system. (City of Vancouver, 2015)

Exhibit 78: Vancouver Water System



Source: (Design Workshop, 2024)

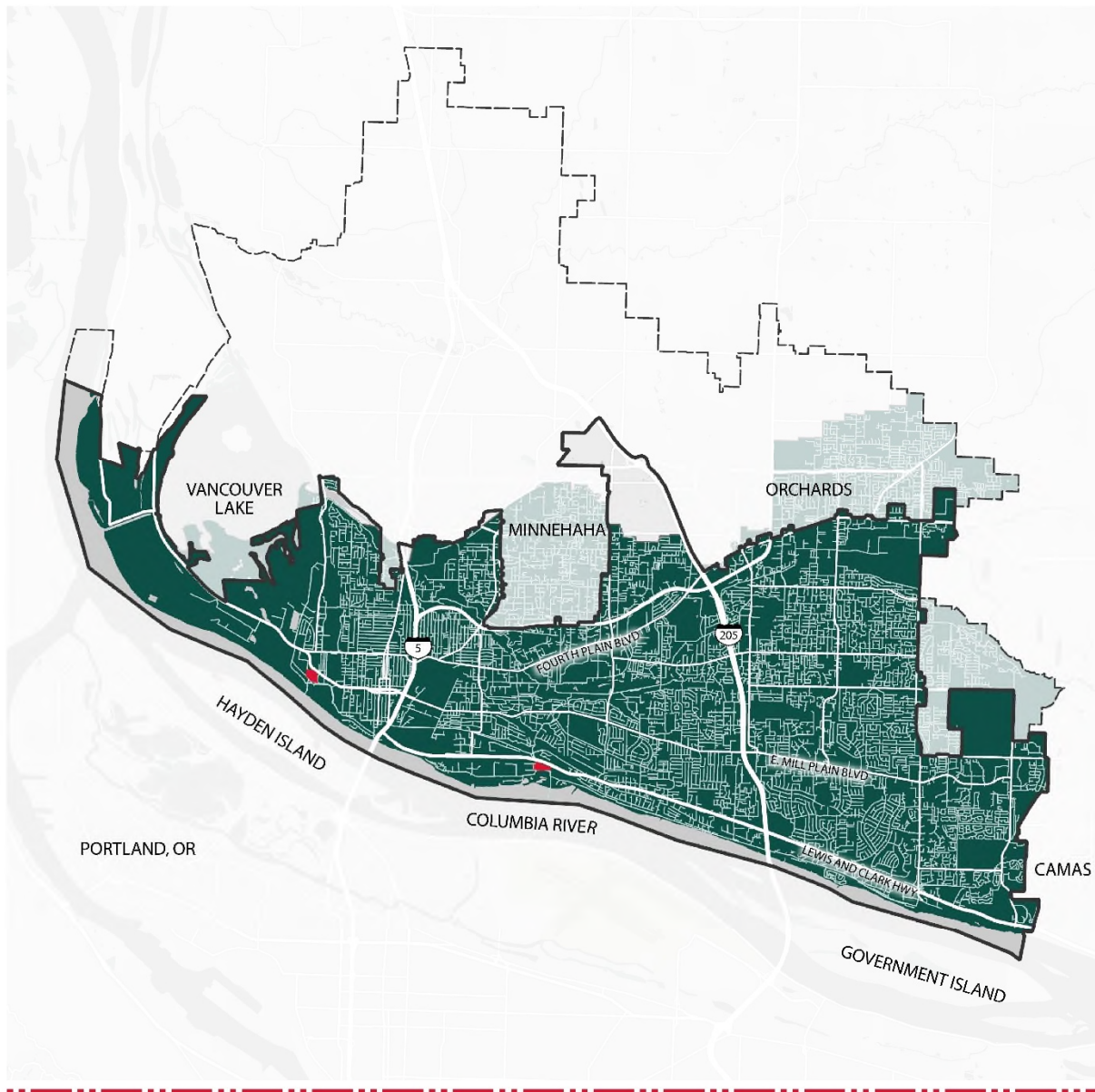
Vancouver's Water System Plan also considers watershed plan recommendations and state rules that identify subbasin closures to additional ground or surface water withdrawals:

The City is located in the Burnt Bridge Creek subbasin. Portions of the service area and UGA are located in the Salmon Creek and Lacamas Creek subbasins. Instream flows have been set in each of the City's three subbasins. The subbasins have been closed to further surface water and groundwater withdrawals, except limited situations provided in WAC 173-528-080 and the designated "regional supply areas." The Vancouver Lake Lowlands Area has been designated a "regional supply area." The City has a small (0.2 cfs) reservation of water in Burnt Bridge creek for future use. (City of Vancouver, 2015)

Wastewater System

Vancouver provides a wastewater collection system serving 244,000 residents in a 58.6 square mile area, with 791 miles of sewer lines and 48 pump stations. See **Exhibit 79**. The City also has two wastewater treatment facilities. The City has partnered with the Clark Regional Wastewater District. Even with an extensive system some properties are still using septic systems and the City offers incentives to hook up to sewers with affordable financing, which can help improve water quality. (City of Vancouver, 2024) The Climate Action Framework calls for reducing per capita water usage and operate the wastewater treatment system more efficiently. (City of Vancouver, 2022)

Exhibit 79: Vancouver Wastewater System



- City Boundary
- UGA
- Waterbodies

- Wastewater Service Area
- Sewer Main
- Sewer Treatment Plant



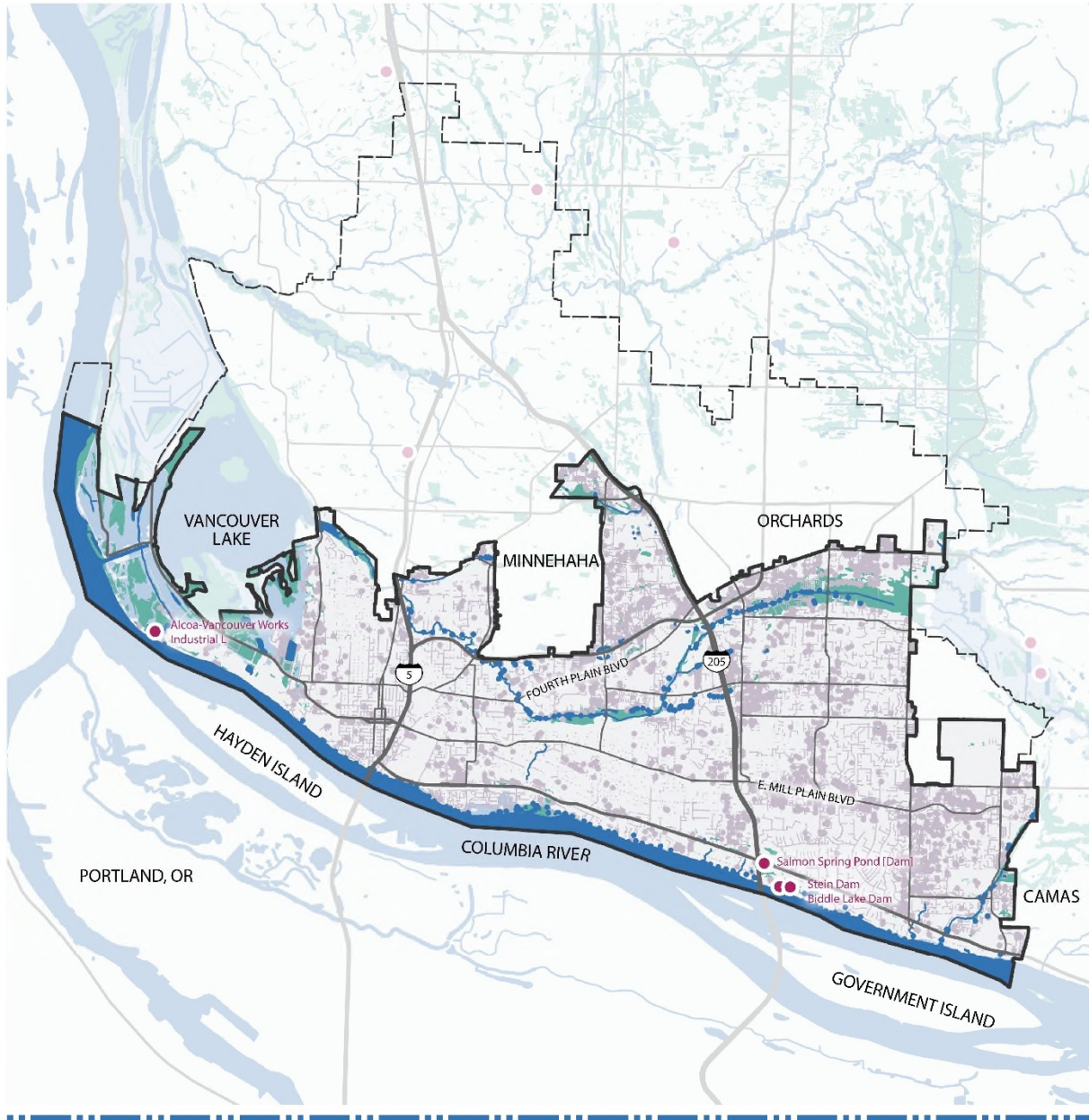
County of Clark, WA, Oregon Metro, Oregon state, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Source: (Design Workshop, 2024)

Stormwater System

The City has a Stormwater, Surface Water and Groundwater Utility. Vancouver has 400 miles of stormwater pipelines and 16,000 catch stormwater drains. See [Exhibit 80](#). The City manages both natural and built stormwater systems to manage water quantity and quality and avoid non-point pollution and unmanaged runoff. (City of Vancouver, 2024) The City applies stormwater rules to new development and prioritizes low impact development best management practices. The City has identified some priorities in a Stormwater Management Action Plan in 2023 for Middle Burnt Bridge Creek, with a goal of lower stream temperature, increase dissolved oxygen and reduce bacteria. (City of Vancouver, 2024) (City of Vancouver, 2023) The Climate Action Framework promotes stormwater infiltration and rainwater reuse. (City of Vancouver, 2022)

Exhibit 80: Stormwater System



- City Boundary
- UGA
- Waterbodies
- Stream
- Wetland
- 100 Year Floodplain
- Dam

- Stormwater
- Main Line
 - Outfall
 - Bio-retention, Swale, Pond, etc.



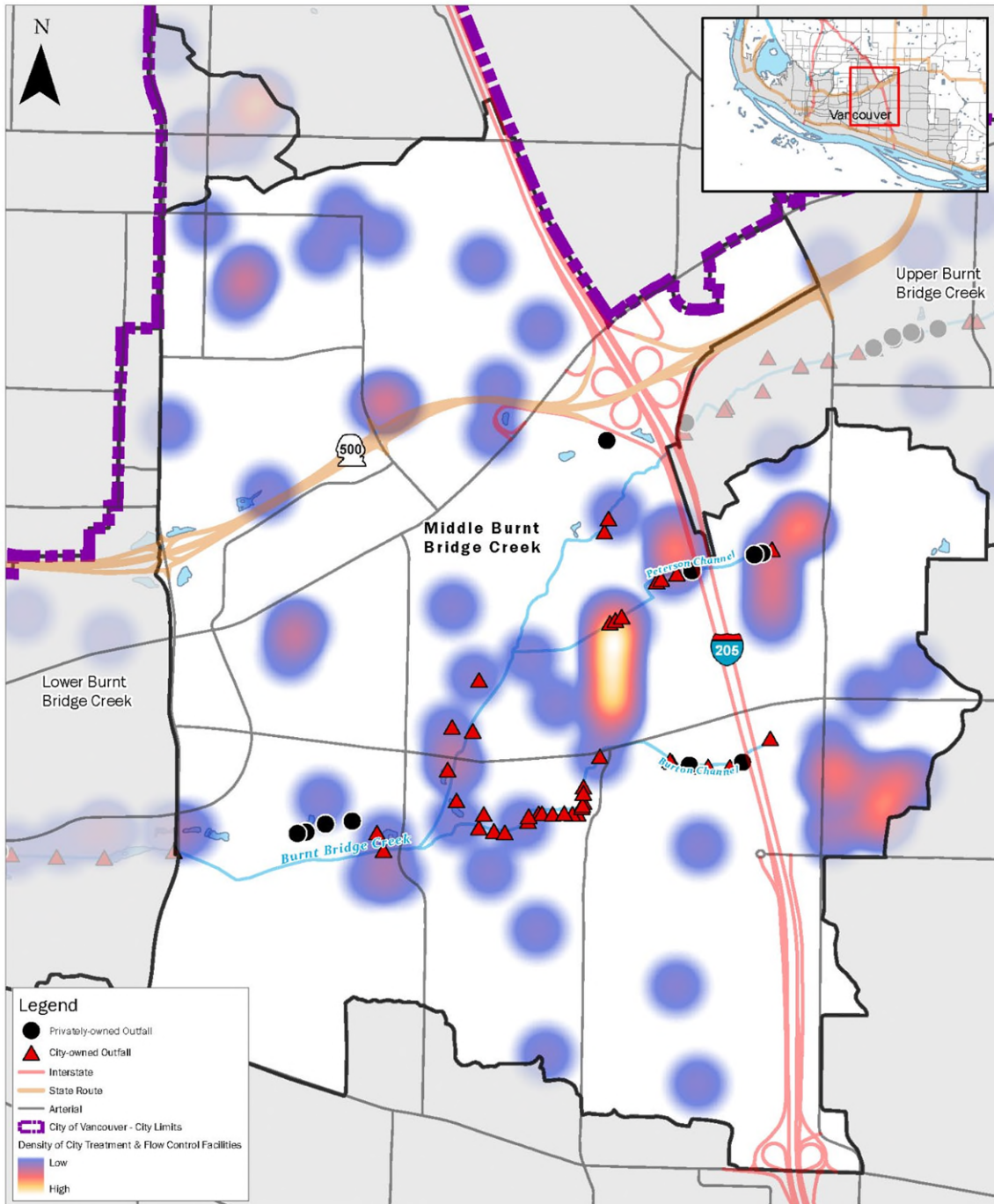
County of Clark, WA, Oregon Metro, Oregon state, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Source: (Design Workshop, 2024)

Exhibit 81: Priority Stormwater Management Action Plan Sub-basin



City Treatment Facility Heatmap and Outfall Location



Source: (City of Vancouver, 2023)

Potential Impacts

Drought

There has been a persistent drought since 2019, easing in 2023, but in 2024 a statewide drought was declared. (Bumbaco, 2024) This drought applies in Clark County and nearly the entire state except for parts of King, Pierce, and Snohomish County. (Washington Department of Ecology, 2024)

The University of Washington Climate Impacts Group has summarized potential impacts due to changes in annual and late summer precipitation associated with extreme precipitation and drought:

- Changes in the timing and intensity of precipitation and increases in water demand and evaporation could offset increases in groundwater recharge due to more annual precipitation.
- Less summer precipitation is expected to contribute to summer water shortages for commercial and residential uses. Water quality may also decrease with less summer input and associated warmer water temperatures.
- More frequent and severe droughts due to low summer precipitation have the potential to increase voluntary or mandatory conservation requirements and water use restrictions.
- Less streamflow in the warm season is expected to increase dependence on stored water and reduce water available for residential and commercial uses.
- Warmer temperatures are expected to increase water demand and energy demand for cooling. (Raymond, 2022)

Wildfire

Wildfire risk is relatively limited in Vancouver per the *Hazard Mitigation Plan*. (Clark Regional Emergency Services Agency, 2023) Climate change mapping shows a relatively greater probability in western and central Vancouver and less in the east or north. A potential impact of increased wildfire likelihood could affect water resources such as:

- More frequent wildfires have the potential to damage water distribution infrastructure and reduce water quality in reservoirs due to more runoff, erosion, and turbidity. Changes in water quality could increase the need for water treatment and filtration. (Raymond, 2022)

Extreme Precipitation and Flooding

There would be increased demand on stormwater management systems. The *Natural Hazard Mitigation Plan* indicates that there are several areas in Vancouver already experiencing

shallow flooding. Areas already experiencing urban flooding could have more frequent or severe flooding with extreme precipitation events.

There are a number of areas in the community that experience seasonal, shallow urban flooding during prolonged periods of high precipitation. This can impact mobility as well as threaten life and property. Drainage and/or infiltration structures and pipes may become blocked by excess water, debris, sediment, landslides, or volcanic ash. Hazardous material spills may move off-site and contaminate downstream locations if not properly managed. (Clark Regional Emergency Services Agency, 2023)

Locations identified as having riverine and urban flooding concerns were identified in the 2025 Adaptive Capacity Assessment and 2025 Resilience Rising engagement.

Exhibit 82: Flooding and Drainage Concern Areas

Location	Description of Urban Flooding
Wastewater Treatment Plant	Potentially vulnerable to riverine flooding from the Columbia River (ACA p. 31).
Fruit Valley and Fourth Plain	Locations facing barriers to climate-adaptive transportation and cooling access (ACA p. 39). Fruit Valley residents described frequent flooding and clogged storm drains (Resilience Rising, p. 5)
Fourth Plain BRT Line	On the Fourth Plain BRT line, which runs through some older, low-lying neighborhoods, chronic street flooding has already been noted at certain intersections – these incidents are likely to worsen with climate change. (ACA, p. 8)
Burnt Bridge Creek Watershed and Locations along Fourth Plain and Hwy 99	Flood-prone areas in Vancouver include low-lying neighborhoods along creeks (like parts of the Burnt Bridge Creek watershed), areas with high groundwater, and pockets with poor drainage (such as some intersections along Fourth Plain or Hwy 99 that flood in big storms). (ACA, p. 22) Also cited as an area of water quality concern and potential risk for library branches located near it (pp. 12, 15, 30). City has developed a Stormwater Management Action Plan (SMAP) for Burnt Bridge Creek. (ACA, p. 22)
Areas with High Groundwater	A contributing factor to stormwater challenges, though not tied to a specific location (ACA, p. 31).

Sources: Adaptive Capacity Assessment (ACA), Resilience Rising, City of Vancouver 2025

Adaptive Capacity

The City has a 2016 water system plan amended in 2022, and the City anticipates updating it by 2026. The current water system plan does not address climate change projections and anticipates it would occur in the next update. HB 1181 requires water system plans to address climate resilience in updates after 2025.

No changes to demand projections were made for the 20-year planning period to account for potential climate change due to the uncertain magnitude and timing of local effects, and the difficulty in correlating historical climate and demand data. It is recognized that demands have the potential to increase in the future given anticipated climate changes. The City may want to develop a model to better track demands with temperature and rainfall for future demand planning. Additionally, it may be beneficial for the City to participate in regional climactic studies to qualify and quantify potential local climate impacts. (City of Vancouver, 2015)

Increased stormwater and precipitation events could adversely affect septic systems not yet connected to the sewer system and impact water quality. Extreme precipitation could also impact wastewater treatment facilities (overflow).

The City has stormwater plans and regulations in place and regularly updates them to meet federal requirements (NPDES). Standards for new stormwater facilities sized to address extreme precipitation have not been developed. The 2025 Adaptive Capacity Assessment has proposed a strategy to expand the capacity of stormwater systems including updated rainfall intensity forecasts and to design for projected storms rather than historic storms. (City of Vancouver, 2025)

Vulnerability Summary

A summary of vulnerability for water resources is provided in [Exhibit 82](#) and [Exhibit 83](#) below. It is largely driven by flooding exposure and stormwater quality affecting vulnerable communities.

Exhibit 83: Vulnerability by Census Tracts – Water Resources

Census Tracts	Area	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index	SMAP
53011042300	2	Medium-high	Medium-high	Medium-high	Higher	Higher	Medium-high	

Census Tracts	Area	Heat Exposure	Flooding/ Precipitation Exposure	Smoke/Air Quality Exposure	Overall Exposure	Health Conditions	Equity Index	SMAP
53011042400	2	Higher	Higher	Higher	Higher	Higher	Higher	
53011041111	3b	Medium	Medium-high	Medium-high	Medium-high	Higher	Higher	
53011041113	3b	Higher	Medium-high	Medium-low	Medium-high	Higher	Higher	X
53011041114	3b	Medium	Medium-high	Lower	Medium-high	Higher	Higher	X
53011041600	4	Medium-high	Higher	Medium	Higher	Higher	Higher	
53011041700	4	Medium	Medium-high	Medium-high	Medium	Higher	Medium-high	
53011042700	4	Medium-high	Higher	Medium-high	Higher	Higher	Higher	
53011041205	6	Medium-high	Higher	Medium-high	Higher	Medium-high	Higher	X
53011041312	7	Higher	Higher	Medium	Higher	Medium-high	Higher	
53011041313	7	Medium-high	Medium-high	Medium	Medium-high	Medium-high	Higher	X
53011041320	8	Medium-high	Medium-high	Medium-high	Higher	Medium-high	Medium-high	
53011041322	8	Higher	Higher	Higher	Higher	Medium-high	Higher	
53011041323	8	Higher	Higher	Higher	Higher	Medium-high	Higher	
53011041329	8	Medium-high	Higher	Higher	Higher	Lower	Medium-high	

Source: See [Chapter 2](#) for indicators and methods. BERK, 2025.

Higher Exposure + Higher Health & Equity Disparities | Stormwater Management Action Plan (SMAP) Priority Area

Exhibit 84: Risk Summary – Water Resources

Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Sources: BERK, 2025.

Gaps and Opportunities

Engagement and Strategies to Improve Adaptive Capacity

Through an interdepartmental engagement effort in an Adaptive Capacity Assessment and a community engagement process through Resilience Rising, a number of adaptive capacity strategies were developed:

- Fortify the wastewater treatment plant against flooding from both river rises and surface runoff. Enhance the wastewater treatment plant’s (WWTP’s) capacity and

flexibility to handle more variable flows and conditions. Guarantee an uninterrupted power supply for the WWTP. (City of Vancouver, 2025)

- Mitigate the risk of heavy rain overwhelming the WWTP by reducing how much stormwater gets into the sanitary sewers in the first place. This means continuing programs to detect and fix sewer leaks (lining or replacing old sewer pipes that crack and let groundwater in) and disconnect improper storm drain connections. (City of Vancouver, 2025)
- Have robust alert systems for neighborhoods around the WWTP and downstream along the river – if there’s an unplanned discharge or issue. (City of Vancouver, 2025)
- Expand Capacity of Stormwater Systems: Upgrade the stormwater mains, culverts, and channels to accommodate larger storm events. This involves identifying the key bottlenecks in the system – e.g., a culvert under a road that frequently overtops, or a stretch of pipe that causes backups – and upsizing them. Use updated rainfall intensity forecasts (taking into account climate change) to set new design standards. (City of Vancouver, 2025)
- Green Infrastructure and Infiltration: Reduce the burden on piped systems by capturing runoff naturally at the source. Expand use of green infrastructure such as bioswales, rain gardens, permeable pavements, and green roofs across the city. (City of Vancouver, 2025)
- Increase inspection and maintenance of the stormwater system to ensure it functions at peak capacity when storms hit. (City of Vancouver, 2025)
- Use land use planning to improve stormwater outcomes. Preserve and restore natural floodplains and wetlands that can act as safety valves for floodwaters. (City of Vancouver, 2025)
- Explore advanced solutions like smart stormwater management technologies. (City of Vancouver, 2025)

The pending water system plan update due in 2026 will be an opportunity to engage residents and business owners in the integration of climate resilience into the plan. Ongoing watershed planning unit participation will dovetail water supply needs with watershed protection.

Interdepartmental and public engagement to further identify areas currently experiencing or at risk of urban flooding could help stormwater adaptation efforts.

A relatively large number of septic systems continue to be [mapped](#) by Clark County GIS in Vancouver’s city limits. Integrating Clark County Public Health into engagement efforts could help support clean water and septic system decommissioning and link Vancouver’s wastewater system implementation efforts with public health.

Policies

Based on a policy evaluation, , some areas identified to improve policies include:

- Amending existing water quality policies or add a new one to address climate related impacts to water quality and adaptation.
- Amending stormwater system policies to add need to address climate change impacts, e.g., vegetation type, facility sizing, etc.
- Addressing how improvements to utilities to address climate change (e.g., enhanced energy efficiencies with wastewater treatment, use of renewable fuels) will be addressed in rates considering overburdened communities.

The [OUR VANCOUVER 2045](#) plan addresses water quality, stormwater systems, and renewable energy:

- **Stormwater Management:** Focus on improving water quality and prevent flooding through managing stormwater flows, encouraging natural filtration of precipitation to ground water, reducing runoff, mitigating flood risks by advancing systems that manage stormwater effectively, and enhancing local water quality in the watershed. (Draft Policy 10)
- **Support the Use of Renewable Energy:** Encourage new renewable energy infrastructure, promote development of storage systems, and work with Clark Public Utilities to promote demand-response strategies and programs to ensure a stable, resilient, and sustainable energy grid. (Draft Policy 19)



Zoning & Development

The Zoning & Development sector addresses Vancouver’s urban design including land use and design. This section reviews Vancouver’s:

- Land Use Plan & Zoning
- Shoreline Master Program
- Transportation system plan
- Urban forestry program
- Draft Green Building Strategy

Sector Overview and Assets

Site Use and Zoning

Downtown is the central hub of Vancouver with a walkable historic core, hospitality, offices, and civic and institutional uses. Commercial corridors include Fourth Plain Blvd and East Mill Plain Blvd. The remainder of the community is largely zoned for single family development. Vancouver has a public waterfront designed for commercial and recreational purposes. Other shorelines host industrial businesses. See [Exhibit 84](#) and [Exhibit 85](#).

Exhibit 85: Example Development Character and Neighborhoods



Downtown



Uptown Village



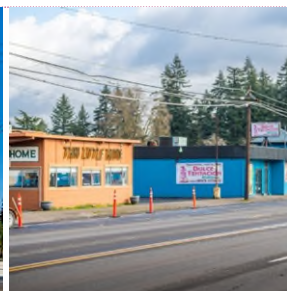
Waterfront



East Vancouver



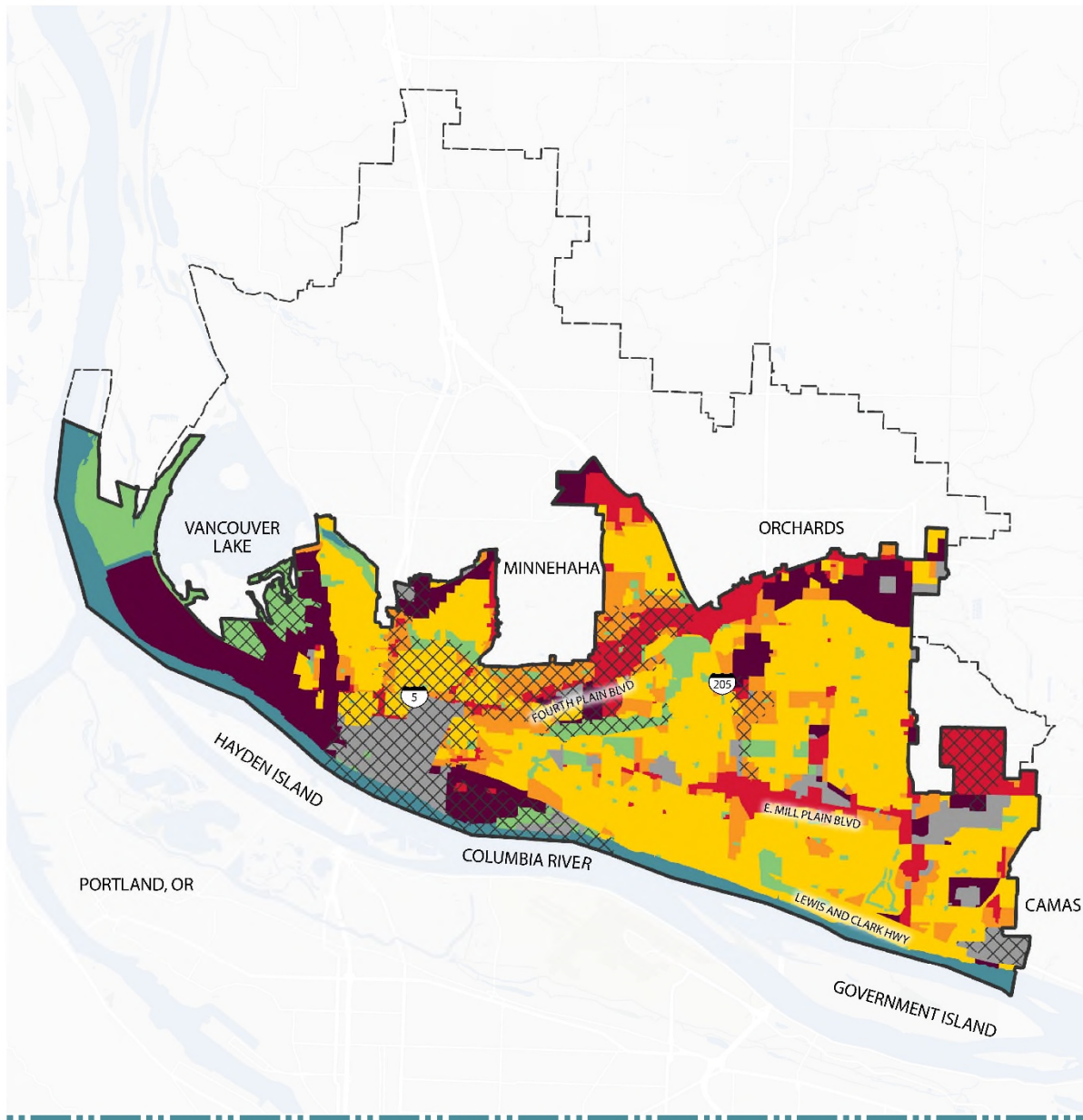
Fourth Plain



The Heights

Source; Visit Vancouver Washington, City of Vancouver, 2025.

Exhibit 86: Vancouver Zoning (2024)



- City Boundary
- UGA
- Waterbodies
- Zoning Overlay

- Parks and Open Space
- Single Family
- Multifamily
- Commercial
- Industrial
- Special District
- Water

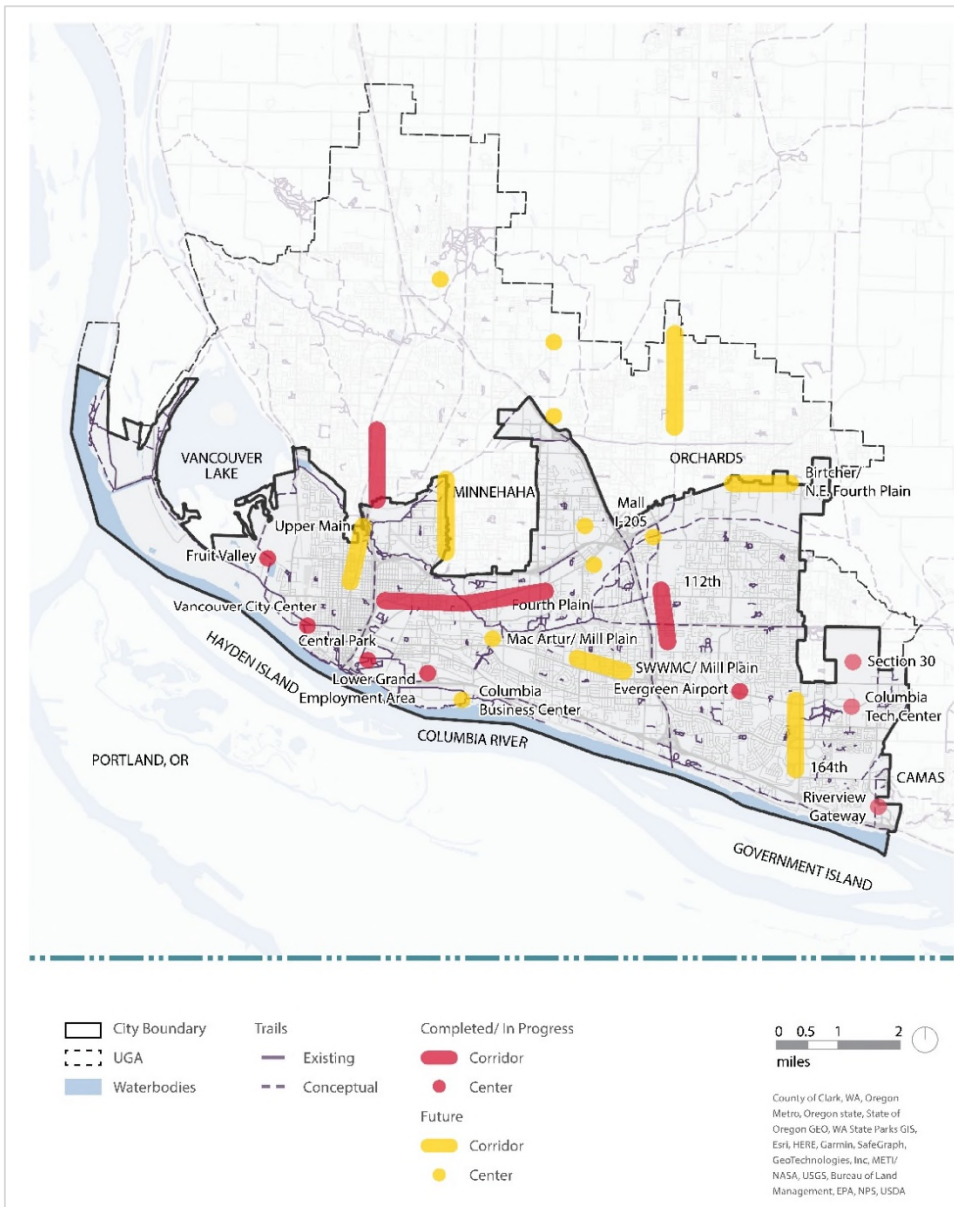
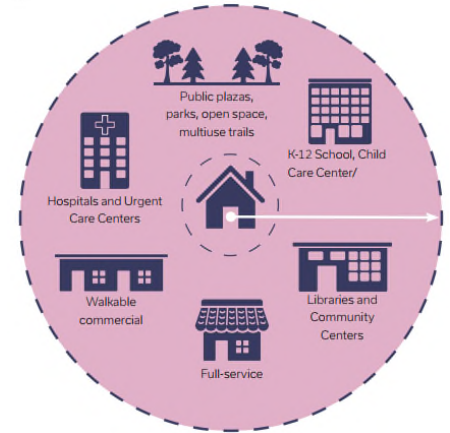


County of Clark, WA, Oregon Metro, Oregon state, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Source: Design Workshop, 2024.

Vancouver has identified important centers and corridors in its Comprehensive Plan to provide for connected neighborhoods and accessible services. See **Exhibit 86**. The City is planning for more connected neighborhoods in its Comprehensive Plan Periodic Update.

Exhibit 87: Centers & Corridors



(Design Workshop, 2024)

Public Realm

The public realm includes public streets, parks, and civic spaces where the public has access or can gather.

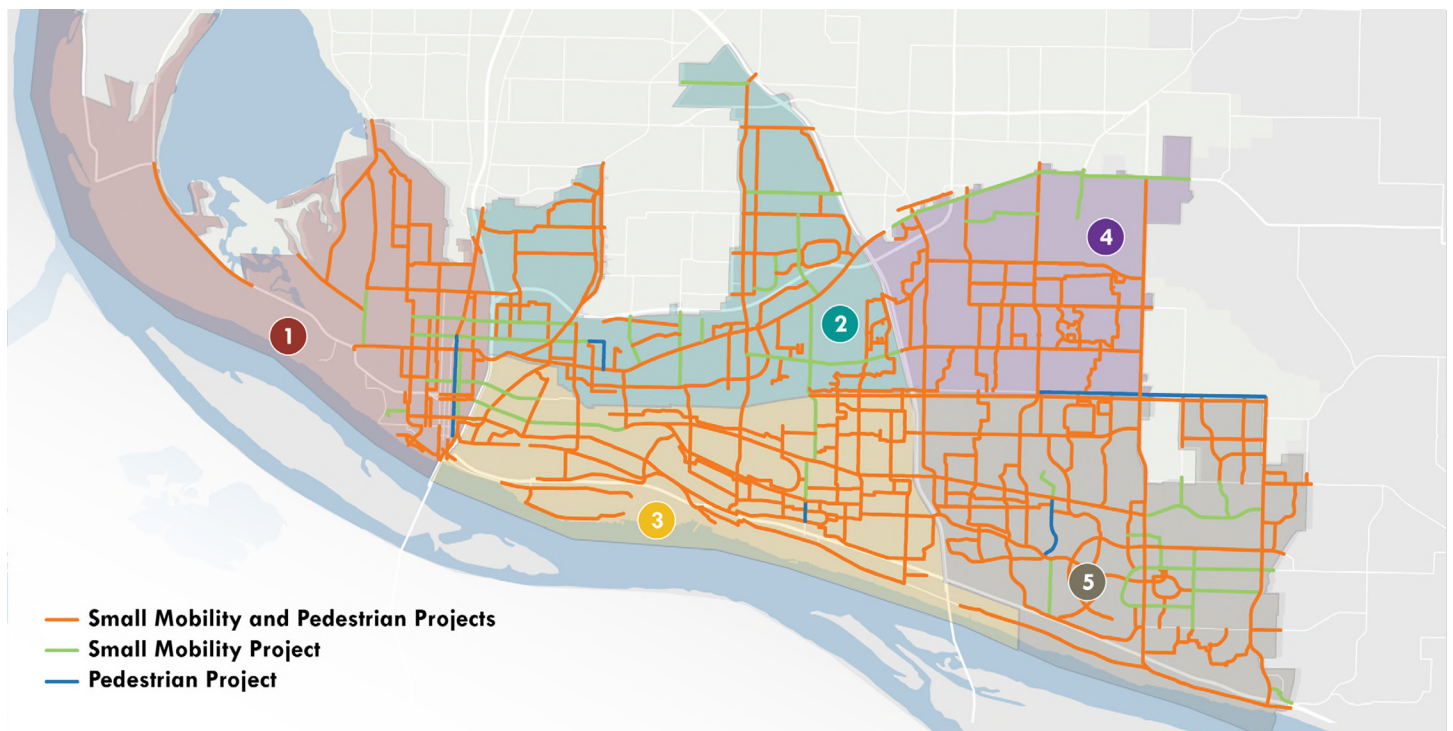
Parks

Vancouver contains parks and natural areas largely around waterbodies and shorelines. The City's Parks, Recreation, and Cultural Services plan (City of Vancouver, 2022) identifies a need for 1,200 acres of park land with over 800 acres developed to serve the population through the year 2031. Service standards also consider a ½-mile park service area of all neighborhood and community parks. Parts of Areas 1, 2, 3B, and 8 are identified as having a gap in community or neighborhood parks.

Transportation

The City developed a Transportation System Plan in 2023 that includes a number of mobility improvements including infill pedestrian projects, which would improve the public realm and make for a more walkable city. Each area is identified with priority projects.

Exhibit 88: Mobility and Pedestrian Improvements

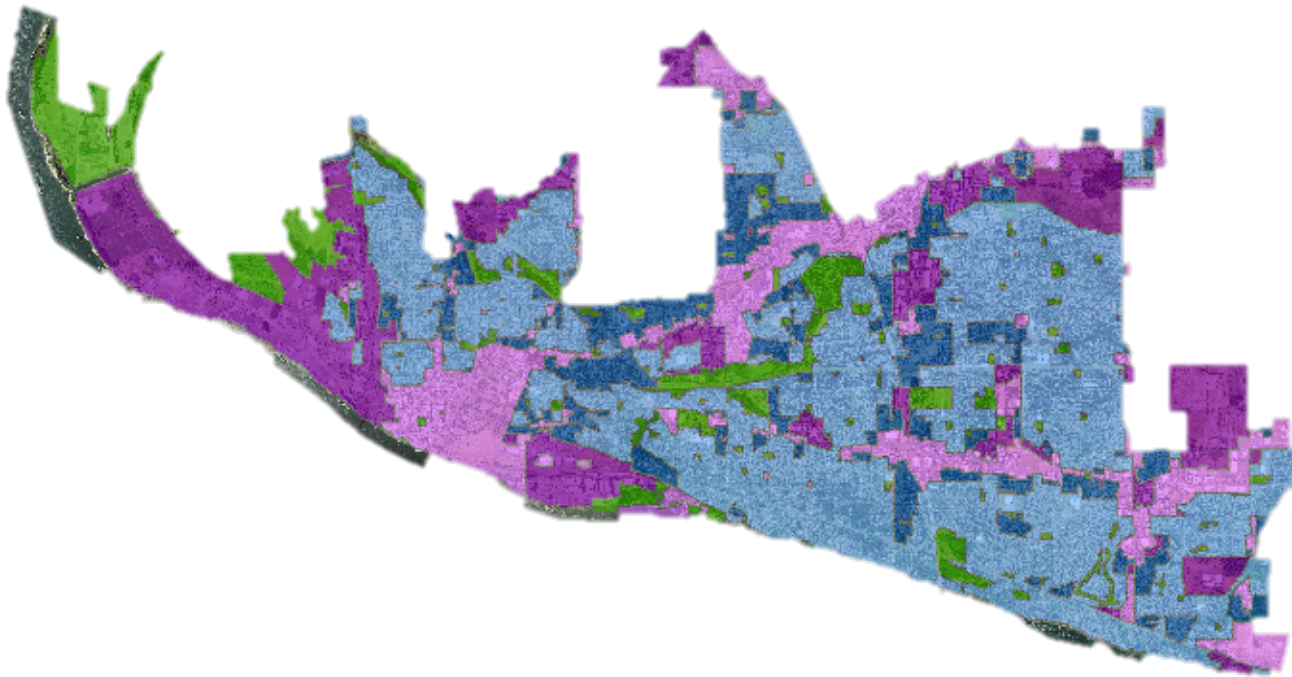


Source: (City of Vancouver, 2023)







Urban Forest

To maintain and enhance the urban environment, the City has an Urban Forest Management Plan that seeks to achieve a 28% citywide canopy goal. To achieve it the City would need to plant 3,000 acres of new canopy cover by 2047. That is an increase from today's canopy of about 18.9%.

Exhibit 89: Urban tree canopy in Vancouver by zoning (2021)



Zoning Category

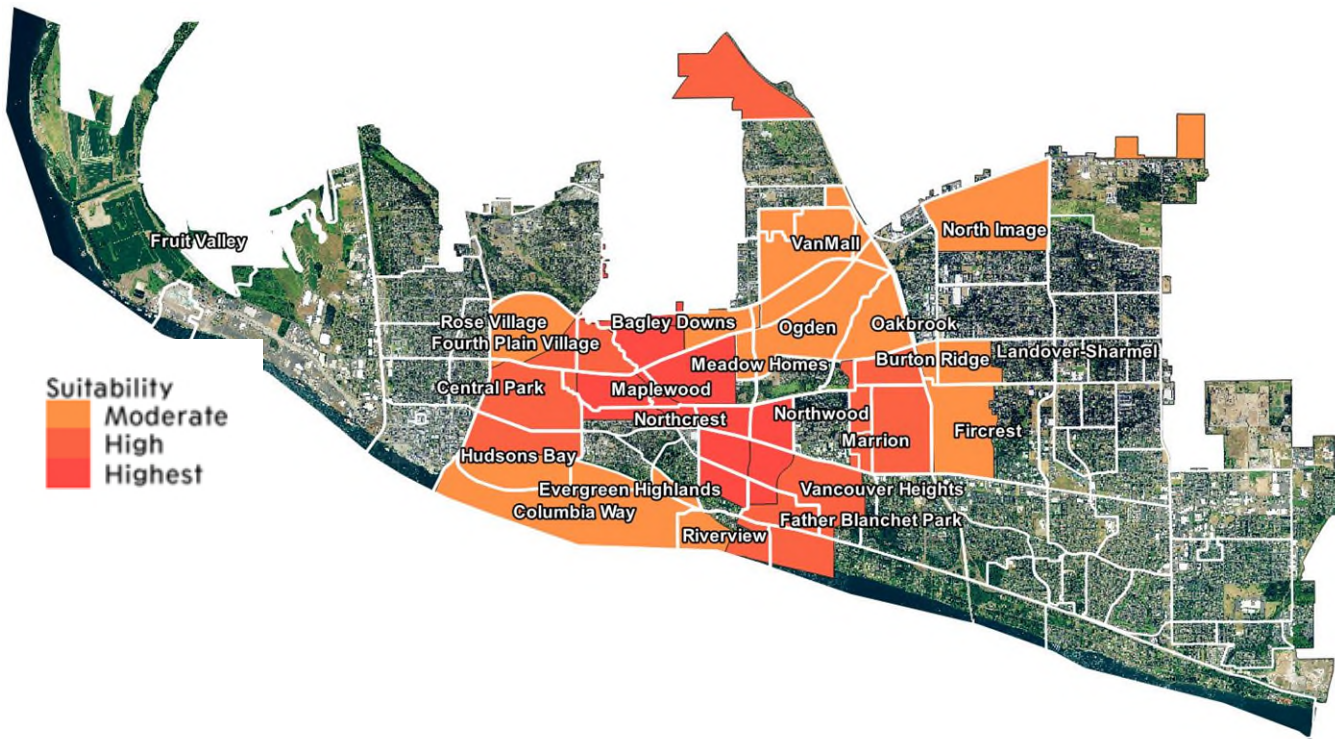
 Commercial - 12%	 Not Specified - 21%
 Industrial - 10%	 Single Family - 22%
 Multi Family - 18%	 Open Space Districts - 31%

Vancouver's canopy goals for zoning: Industrial properties= 9%, Commercial properties=15%; Residential properties = 33%.

Source: (PlanIT Geo, LLC, 2021)

Priority tree planting areas are proposed in areas 2, 3b, 4, 6, and 7. See [Exhibit 89](#).

Exhibit 90: Composite Map of Priority Planting Areas to Achieve Canopy Goals and Tree Equity



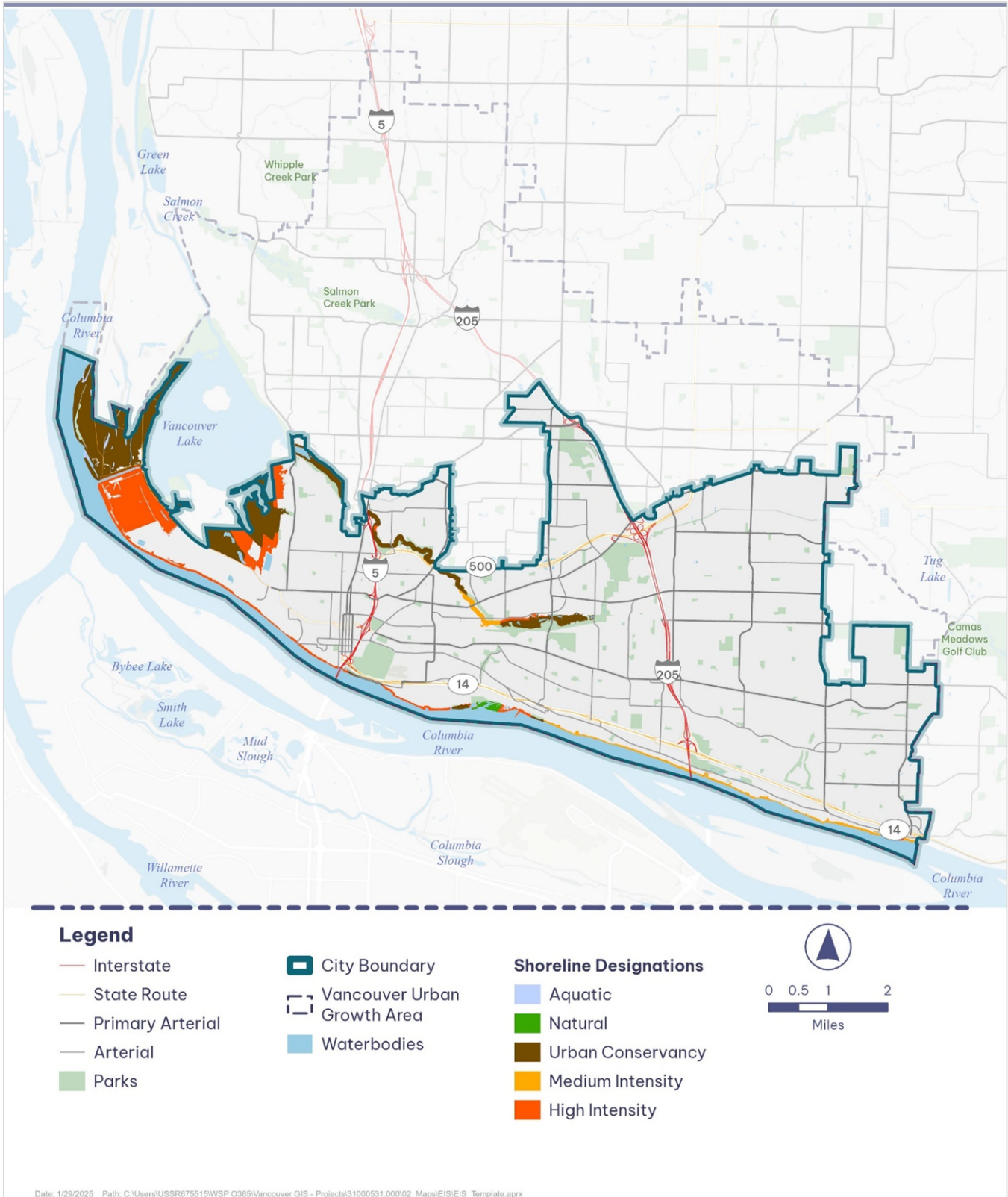
Source: (City of Vancouver, 2023)

Shoreline Master Program and Critical Areas

Vancouver has adopted a Shoreline Master Program (SMP) which promotes water oriented uses like ports, shoreline public access and enjoyment, and ecological protection and restoration. The SMP provides for shoreline uses, and buffers to protect sensitive environments and promotes soft shoreline alterations rather than hard structures. See [Exhibit 90](#).

Vancouver also protects critical areas across the city such as wetlands, fish and wildlife habitat conservation areas, critical aquifer protection areas, flood hazard areas, and geologic hazard areas.

Exhibit 91: Shoreline Master Program, Shoreline Environments



Source: (City of Vancouver, 2021), WSP 2024.

Potential Impacts

Urban places can exacerbate climate impacts because they tend to have greater impervious areas with taller buildings and pavement, less trees, and altered natural systems. Greater buildings and pavement can exacerbate flooding, magnify urban temperatures, compromise indoor air quality, increase exposure to allergens, and increase energy demand. (See sidebar and **Exhibit 91.**)

Vacant and redevelopable lands (5,583 acres) will add capacity for housing and jobs in the next 20+ years. Larger areas of development include the port, Section 30, and a number of commercial mixed-use areas. This could add impervious areas, but there are also opportunities to add green and blue infrastructure. (Design Workshop, 2024)

Black and Hispanic/Latino residents are less likely to be homeowners in Vancouver. (ECONorthwest, 2024) Single-family zones have a greater percentage of tree canopy than in multifamily or commercial zones. (PlanIT Geo, LLC, 2021) Those with lower incomes tend to live in areas with less tree canopy and more pavement, near high traffic volume roadways, and in housing that may be older and with less modern HVAC and filtration systems.

Air pollution already generated by transportation and industry could be exacerbated by extreme heat such as ozone and by drought and wildfire smoke (PM 2.5).

(US EPA, 2024) (West, Ch. 14. Air quality. In: Fifth National Climate Assessment. Crimmins, A.R., 2023)

Climate Change: Built Environment, Urban Systems and Cities

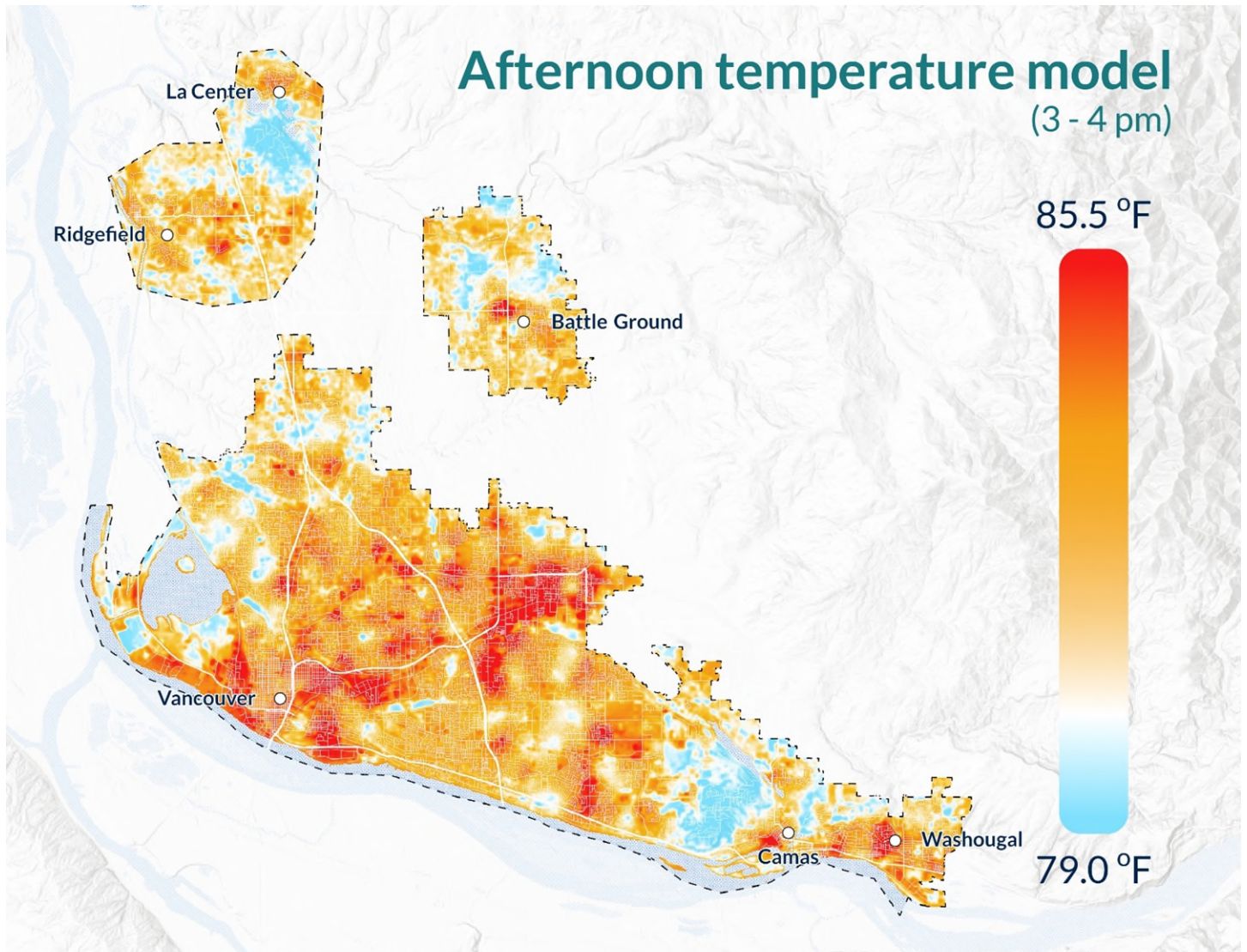
Urban development patterns significantly influence local and regional environments, and these patterns can exacerbate the local effects of climate change. Depending on the type of built environment, both urban growth and land-use change have impacted and will continue to impact surface and ambient air temperature, local and regional humidity, wind patterns, precipitation, flooding, and dispersion of air pollutants...

Changes in design, form, and mass of buildings and configurations of streets, open green spaces, and water features—as well as their interactions—have direct effects on urban temperature and energy demand... Nighttime air temperatures, in particular, are expected to be higher across many urban areas due to radiant heat and heat conductance from buildings...

Exclusionary housing practices—which persist today—leave overburdened communities with lower access to heat-reduction strategies such as urban trees and green space, as well as to broader economic and social resources...

Another example of the uneven impact of climate change on the built environment is the deteriorating indoor air quality experienced by people living in neighborhoods with substandard housing. This includes exposure to allergens such as mold and dust and pollutants such as carbon dioxide and nitrogen dioxide. In wildfire-prone regions, indoor air quality is additionally compromised by smoke. There are also potential negative mental health outcomes from decreases in social interaction and physical activity when people are confined indoors to avoid temperature extremes. ... (Chu, 2023)

Exhibit 92: Urban Heat Islands – Clark County Public Health Heat Watch



Heat Watch data was collected on July 12, 2024, during a one-day event organized by Clark County Public Health with the support of more than 50 volunteers, local government partners and technical assistance from CAPA Strategies.

Source: (Clark County Public Health, 2024)

Vancouver’s public parks, trails, and open spaces provide trees and green spaces that help cool the city, but extreme heat can make parks uncomfortable or even unsafe during heatwaves, especially those parks with large open turf or concrete and minimal shade. Wildfire smoke can interfere with outdoor activities. Many parks are intentionally located in low-lying areas to recognize floodplain and wetland functions and values, but then the parks would flood more frequently and severely as precipitation extremes intensify. (City of Vancouver, 2025)

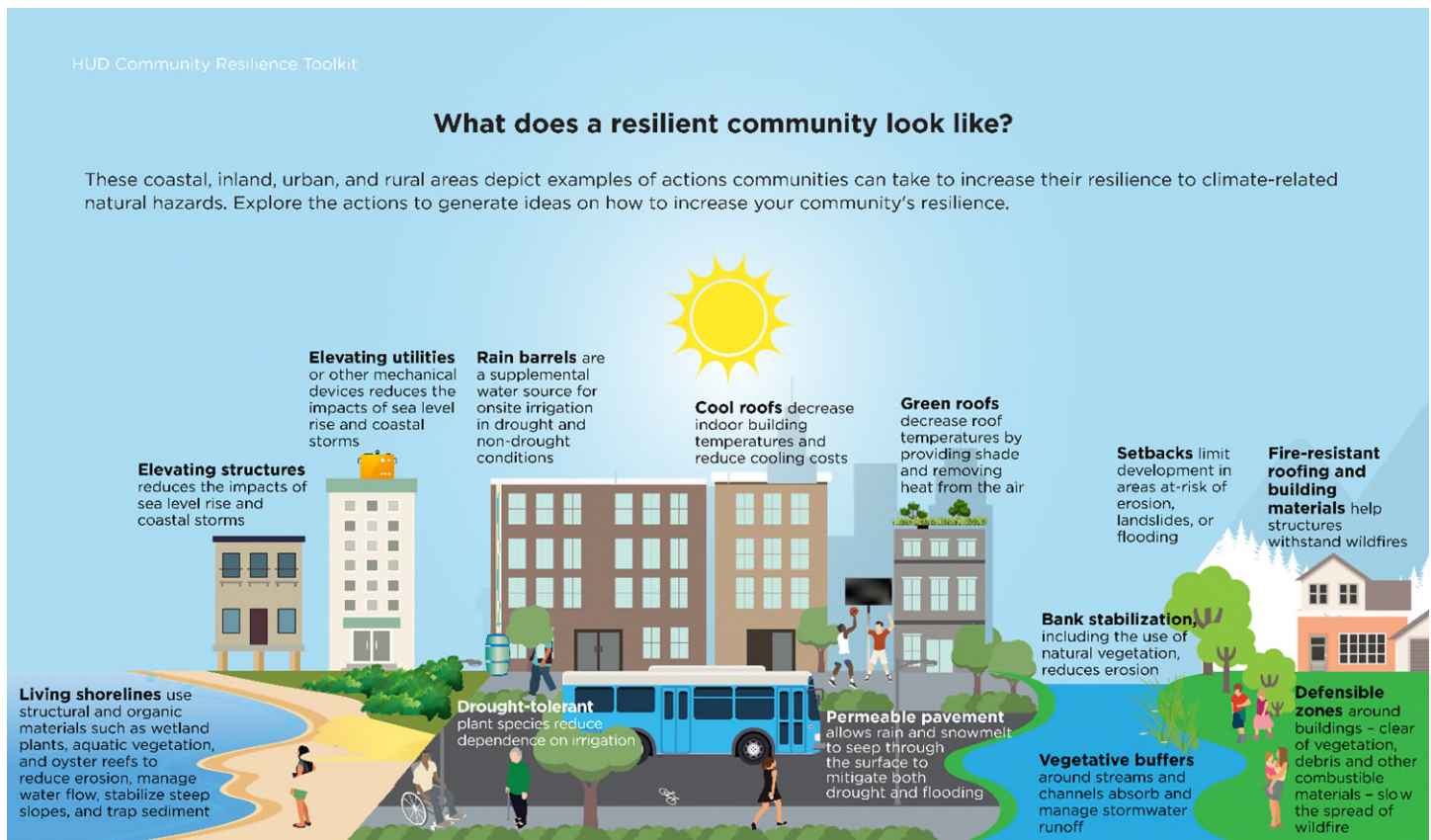
Adaptive Capacity

The creation of a resilient community is holistic. Important urban design elements include:

- Environmental conservation and protection like living shorelines and vegetative buffers.
- Protecting existing infrastructure in floodplains such as elevating structures and utilities.
- Green and blue infrastructure like rain barrels, cool roofs, green roofs, and permeable pavement.
- Greenspace with drought-tolerant species and tree canopy.
- Defensible zones and fire-resistant construction.
- Encouraging mobility that reduces greenhouse gas emissions but also provides redundant access to homes, services, and employment.
- Increasing the supply of affordable energy-efficient housing.

See [Exhibit 92](#) for a diagram of many of these resilient community elements.

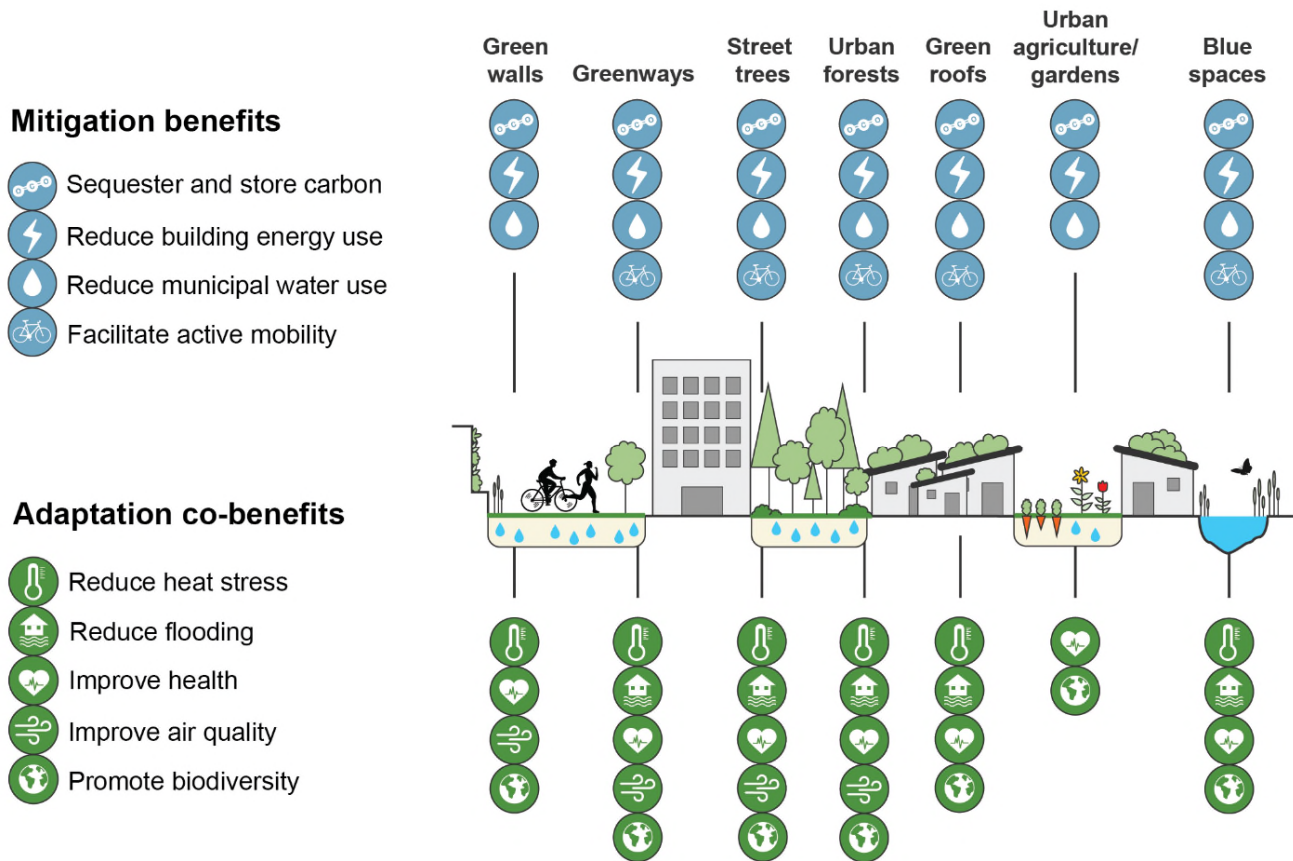
Exhibit 93: What does a resilient community look like?



Source: (U.S. Department of Housing and Urban Development, 2017)

Natural infrastructure – including green and blue elements applied to buildings and landscapes – has both mitigation and adaptation benefits. See [Exhibit 93](#).

Exhibit 94: Natural infrastructure in cities provides climate mitigation and adaptation benefits



CAPTION: The figure illustrates the potential benefits (in no particular order) of integrating natural infrastructure strategies—also termed green, blue, or nature-based solutions—within the built environment. Nature-based, green, and blue infrastructure options are strategically planned interconnected sets of natural and constructed ecosystems, spaces with vegetation or waterscapes, and other landscape features that provide important GHG mitigation and climate adaptation functions, as well as improve human well-being, biodiversity, and ecosystem health. This figure shows examples of how urban forests and street trees can sequester and store carbon while simultaneously reducing building energy demand. Reducing municipal water use can provide a mitigation benefit by decreasing energy use in wastewater treatment plants. Lwasa et al. 2022) (Chu, 2023)

The City has programs underway that support many of these community resiliency measures:

- The City adopted a **Stormwater Management Action Plan** (City of Vancouver, 2023) to prioritize water quality treatments in the Middle Burnt Bridge Creek basin with impaired ecological conditions and with underserved and overburdened communities. There may be lessons learned with these basin improvement efforts that could apply to other locations in the city.
- Vancouver has an **Urban Forest Management Plan** to increase canopy to 28% by 2047. (City of Vancouver, 2023) Priority blocks are noted in **Exhibit 89** to address tree equity.
- The City is implementing **Middle Housing** zoning to provide more homeownership opportunities for all incomes. This could increase opportunities for physical activity,

reduce greenhouse gases, and improve community connections through mixed use neighborhoods.

- The City’s **Transportation System Plan** implementation would increase mobility and transit-oriented development connecting residents with amenities and employment.
- The City is developing a Draft **Green Building Strategy** which would ensure buildings have good indoor air quality and use better heating and cooling systems. The strategy would promote building designs that are safer for birds, using plants that need less water, and saving trees. The strategies would promote buildings that handle extreme weather by adding better insulation, keeping buildings cooler with shading or reflective materials, controlling energy use during busy times, and providing backup power for outages. (City of Vancouver, 2024)

In the future the City could consider adopting **wildland urban interface codes** to ensure human and property safety. The State Building Code Council developed rules, but they are not in effect while the mapping and rules are under review for applicability and effectiveness. (Demkovich, 2024)

The City is completing a **health impact assessment** along with the Comprehensive Plan Update that could help address wildfire smoke exposure, as well as ongoing exposure from transportation sources. Addressing right of way treatments and abutting site and building design to **reduce exposure to air pollution** and noise due to high volume roadways could improve adaptive capacity both for day-to-day pollution exposures and increasing risks of climate change.

Example Studies and Approaches to Mitigating Air Pollution

[Air Quality and Land Use Planning](#), 2023, Review of Literature by Bellevue, with Mitigation Strategies – land use (limiting sensitive uses), urban design, barriers/walls/vegetation, highway lids, building design and ventilation

[USDA Air Quality and Conservation Buffers](#) Manual to enhance visual quality, control noise levels, control air pollutants and odor



A 65 to 600 ft wide buffer may reduce particulate pollution by 40 to 75 percent although many factors will affect pollutant removal

Vulnerability Summary

Vancouver is likely to be exposed to extreme heat in the planning period and has wide swaths of lands that have relatively lower tree canopy or implementation of adaptive building features (e.g., cool roofs, etc.) that can mitigate these risks. The City has a relatively small area subject to flooding often flanked by greenways (Burnt Bridge Creek) or with extensive flood control structures and with population densities relatively lower (Columbia River) but is subject to urban flooding that could experience extreme precipitation during the planning

period. The City has plans and priorities regarding where to address lacking tree canopy, as well as improving stormwater management, largely in central Vancouver.

Areas most vulnerable due to higher exposures and higher shares of communities with health sensitivities or equity disparities are identified in the **Executive Summary** in **Exhibit 4 and Exhibit 5** and include Areas 1, 2, 4 and 7.

The widespread location of areas most vulnerable and the responsibility of the city to promote resilient urban design make zoning and development a higher risk and priority to address. See **Exhibit 94**.

Exhibit 95: Risk Summary – Zoning & Development

Likely Climate Impacts in next 10+ years				Magnitude of Loss			City Responsibility			Vulnerable Communities			Areas Most Affected								
Heat	Fire	Precip	Drought	Less	More	Most	Less	More	Most	Less	More	Most									
													1	2	3A	3B	4	5	6	7	8

Source: BERK, 2025.

Gaps and Opportunities

Equitable Engagement and Strategies to Improve Adaptive Capacity

The City has engaged its interdepartmental team and community members to identify solutions addressing improved connectivity and parks in the public realm.

Example strategies include:

- Residents have identified community spaces they currently rely on or trust during extreme events (e.g., churches, schools, parks). (City of Vancouver, 2025)
- Promote other forms of green infrastructure, especially in places suffering from extreme heat. Prioritize investment in areas that have lower property values. Green infrastructure investments should be coordinated with affordable housing and other policies to avoid impacts of green gentrification and related displacement. (City of Vancouver, 2025)
- Implement land use planning policies for flood mitigation. (City of Vancouver, 2025)
- Increase Shade and Tree Canopy at park by planting more trees and preserving mature ones to create extensive shade. (City of Vancouver, 2025)
- Add Water Features and Cooling Elements. Incorporate cooling water features in park design to help people cool off. Splash pads, interactive fountains, or misting stations. (City of Vancouver, 2025)

- Heat-Resilient Landscaping: Adapt park landscaping and maintenance practices to withstand hotter, drier summers with less water. (City of Vancouver, 2025)
- Leverage parks as part of overall community stormwater management. (City of Vancouver, 2025)
- For parks at the wildland-urban interface or with significant natural wooded areas, implement fire management strategies. (City of Vancouver, 2025)
- Involve the community in making parks climate resilient and prioritize improvements in the parks that serve the most vulnerable populations. (City of Vancouver, 2025)
- Make physical upgrades to trails to better withstand heavy rain, flooding, and erosion. (City of Vancouver, 2025)
- Increase shade cover along popular walking and cycling routes to protect users during heat and also to extend the life of trail materials. (City of Vancouver, 2025)
- Implement practices to reduce wildfire risk in trail corridors and prepare for smoke events. (City of Vancouver, 2025)

Policies

A policy evaluation found strength in Comprehensive Plan land use policies promoting resilience but opportunities to address a number of topics to address climate resilience and health. **Exhibit 95** below shares example climate mitigation and adaptation options noted in the *Fifth National Climate Assessment Ch. 12. Built environment, urban systems, and cities.* (Chu, 2023) It also provides examples from the *Commerce Climate Planning Guidance* (Commerce, 2023), and the *Vancouver Climate Action Framework.* (City of Vancouver, 2022) The City could update its Comprehensive Plan policies to catch the plan up to the City’s ambitious Climate Action Framework, as well as efforts under the **OUR VANCOUVER 2045** plan such as the Health Impact Assessment.

Exhibit 96: Examples of Land- Mitigation and Adaptation Options in Cities and Built Environments

Options	NCA Examples of Mitigation and Adaptation Options	Commerce Climate Policy Explorer Examples	Vancouver Climate Action Framework
Natural, green, and blue infra structure	Urban ecosystems and biodiversity, street trees, greenery, coastal wetlands and dune systems	High Priority Increase tree canopy cover to boost carbon sequestration, reduce heat islands, and improve air quality, prioritizing overburdened communities.	Strategy NS-1. Increase carbon storage in trees, vegetation, and soil Strategy NS-2. Improve ecosystem resilience Action #10: Community gardens and local markets

Options	NCA Examples of Mitigation and Adaptation Options	Commerce Climate Policy Explorer Examples	Vancouver Climate Action Framework
Gray infrastructure	High albedo/reflective pavements, coastal protection (such as seawalls), dams, flood controls, drainage	High Priority Consider climate change, including sea-level rise, extreme precipitation, increased winter streamflow, and other impacts, in floodplain management planning.	Indirectly; see above (NS-2)
Land management	Zoning to reduce impact exposure and support GHG emissions mitigation, co-location of development with low-GHG transportation and technologies, reduced encroachment on natural lands, fire management, land restoration	High Priority Prioritize and promote public transit expansion and use through coordination of land use and transportation planning. Establish development regulations that incorporate best practices for reducing the risk of wildfire, extreme heat, flooding, and other climate-exacerbated hazards.	Strategy TLU-1. Create neighborhoods that support clean modes of transportation
Resource use	Improved water supply, reduced emissions from waste and wastewater	High Priority Manage water resources sustainably in the face of climate change through smart irrigation, stormwater management, preventative maintenance, water conservation and wastewater reuse, plant selection, and landscape management.	Strategy NS-3. Conserve water resources
Migration and relocation	Managed retreat	In areas with significant vulnerability to climate hazards, facilitate and support long-term community visioning including consideration of managed retreat.	Not addressed

Source: (Chu, 2023), (City of Vancouver, 2022), BERK 2024.

The City's **OUR VANCOUVER 2045** plan incorporates many policies addressing a resilient built environment such as:

- Incorporate Green Infrastructure into Development: Prioritize integrating green infrastructure into new development, redevelopment, replacement of existing infrastructure, and development of public spaces within the City to improve stormwater quality and reduce urban heat island effect. (Draft Policy 5)
- Stormwater Management: Focus on improving water quality and prevent flooding through managing stormwater flows, encouraging natural filtration of precipitation to ground water, reducing runoff, mitigating flood risks by advancing systems that

manage stormwater effectively, and enhancing local water quality in the watershed. (Draft Policy 10)

- Adapt Infrastructure to Climate Change: Retrofit existing infrastructure, parks and natural spaces, and construct new facilities to adapt to the localized impacts that will occur in the community due to climate change. (Draft Policy 11)
- Protect Critical Areas and Shorelines: Protect existing Critical Areas within the City, and Shorelines of Statewide Significance, and ensure no net loss of ecological functions through avoidance of impacts, conservation design principles, and compensatory mitigation when loss of ecological function cannot be avoided. (Draft Policy 12)
- Equitable Distribution of Tree Canopy: Meet tree canopy coverage goal of 28%, using the City's Equity Index to target investment in underserved neighborhoods lacking coverage. (Draft Policy 14)
- Support Transit with Resilient Infrastructure Improvements: Invest in transit-supportive infrastructure that responds to localized impacts of a changing climate to ensure reliable, frequent, and accessible future transit service, prioritizing underserved areas and those with high climate vulnerability. (Draft Policy 27)
- Improve Connectivity Between Parks and Open Spaces: Create an expansive network of linear parks that encourage active transportation, improve community health and wellbeing, enhance tree canopy and stormwater management, and link parks and open space with housing. (Draft Policy 79)

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