Burien Climate Vulnerability

Assessment, Policies, and Strategies

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1 Executive Summary



Aerial view of Burien. Credit: City of Burien, Climate Action Plan 2021

Purpose and Use

In the Puget Sound region and in Burien, people, ecosystems, and infrastructure could be exposed to:

- Extreme heat
- Wildfire smoke
- Extreme precipitation
- Sea level rise and flooding
- Stream low flow due to decreased mountain snowpack
- Drought and low soil moisture

Some places are more vulnerable to climate hazards such as paved areas magnifying heat or homes in low-lying coastal flooding hazard areas. Very young and older people, people with health conditions, and overburdened communities with fewer resources can be at risk.

Planning for climate change includes considering greenhouse gas emissions (GHG), ways to mitigate climate change through government and community wide activities, and considering resilience activities and how to prepare for and adapt to climate change exposures.

DEFINITIONS – US Climate Toolkit

Climate Resilience: The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption.

Adaptation: The process of adjusting to new (climate) conditions in order to reduce risks to valued assets.

Mitigation: Processes that can reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing them from the atmosphere.

Burien focused first on strategies and actions for reducing GHG emissions through five focus areas: transportation and land use, buildings and energy, materials and consumption, water and natural systems, and community resilience and well-being. Burien engaged the community and adopted a Climate Action Plan in 2021.

In late 2022, the City of Burien received an early implementation climate grant with the Washington Department of Commerce to evaluate climate risks and vulnerabilities with the following key steps:

- A geographic information system spatial model that illustrates the key indicators for exposure, sensitivity, and capacity for adaptation and an index illustrating vulnerable communities.
- Analyze the impacts of climate change on critical systems in Burien and audit the Comprehensive Plan and Municipal Code for potential adjustments.
- Prepare Preliminary and Draft Assessment results and criteria that can be included with the Comprehensive Plan Periodic Update.

By planning for both climate change mitigation and adaptation, Burien can proactively reduce the drivers of climate change and protect its most vulnerable people and places.

Additionally, Burien will be well positioned to respond to new legislation that requires a climate change element (HB 1181) as part of a comprehensive plan. The element must include: a greenhouse gas emissions reduction sub element and a resiliency sub element. The Climate Action Plan will be the basis for the greenhouse gas emissions reduction sub element. The City's Natural Hazards Plan and this Climate Vulnerability Assessment will be a basis for the resiliency sub-element.

This document identifies preliminary draft resiliency strategies that can help the City plan for a livable and sustainable Burien.

Climate Trends

Climate is the average weather for a region expected at different times of the year. Climate is usually reported over a span of 30 years. Climate change means a difference in the average conditions in a region such as temperature and rainfall.

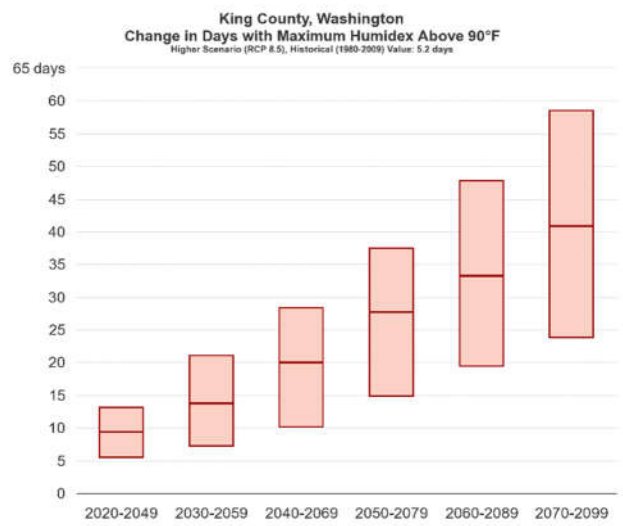
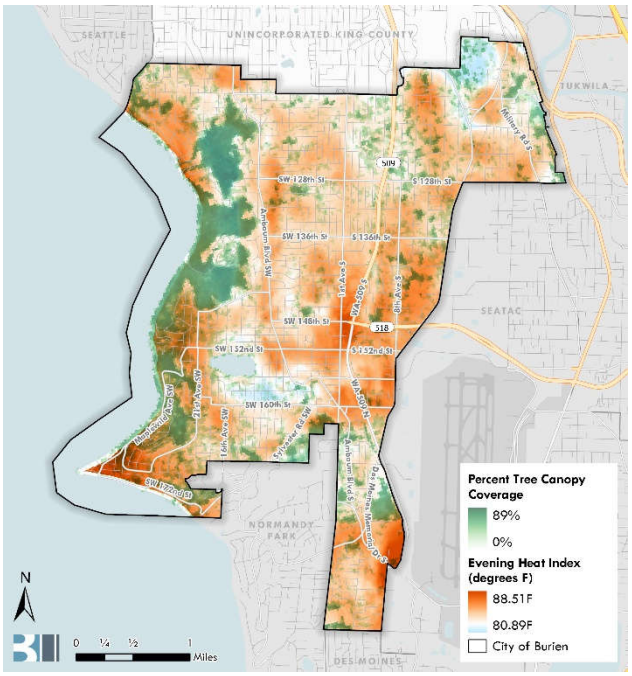
Based on scientific assessments including modeling developed by the University of Washington Climate Impacts Group, the following trends are noted for the Puget Sound region including Burien:

- Extreme high temperatures are increasing.
- Increasing exposure to wildfire smoke is likely.
- Increases in wet season precipitation and frequency of storms are expected.
- Less precipitation will fall as snow in winter affecting summer stream temperatures and low flows.
- Sea level rise along lower-lying coastal areas is predicted.

Information for the Burien Vulnerability Assessment has been gathered primarily for the year 2050 which is similar to the 2044 Comprehensive Plan periodic update horizon year. In some cases, to assist with long-term capital planning efforts given infrastructure has a long-life span, the year 2100 is used, e.g., for sea level rise.

Highlights of extreme heat and sea level rise data and mapping are included in Exhibit 1 and Exhibit 2. Full size maps are provided in Section 2.

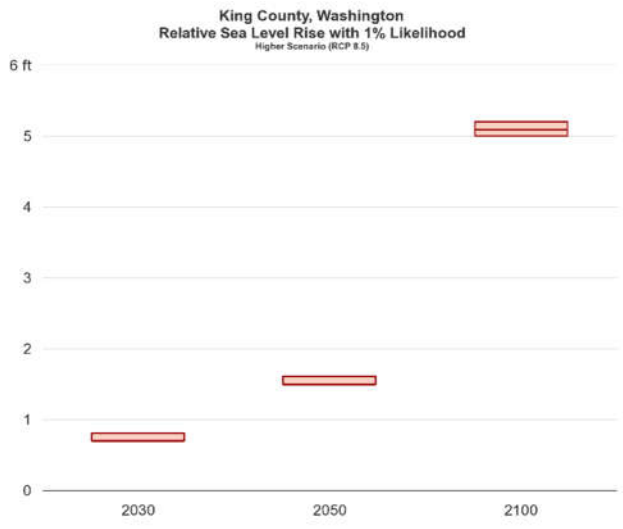
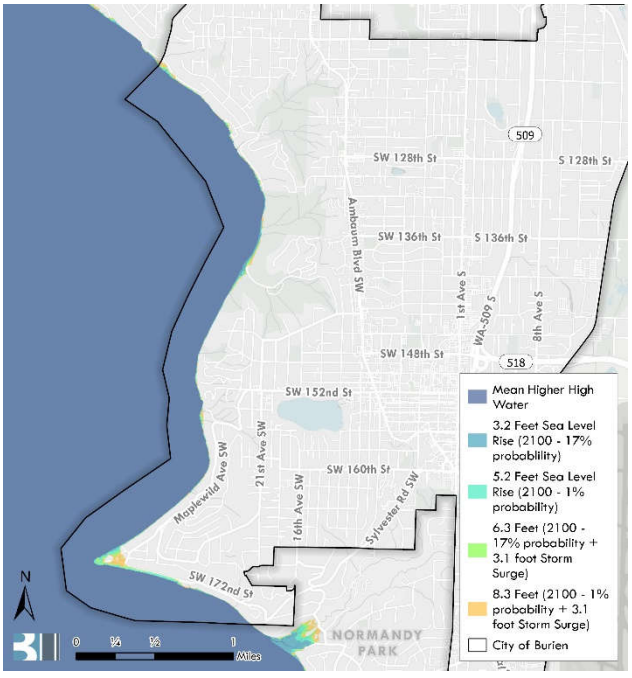
Exhibit 1. Extreme Heat Increase, Heat Islands, and Tree Canopy

Change in Days above 90°F Humidex: King County	Heat Islands and Tree Canopy in Burien
	

▶ By 2040-2069 (2050): + 20.1 days above 90°F humidex

Source: See Exhibit 14, BERK 2023.

Exhibit 2. Sea Level Rise Data and Coastal Flood Hazard Area in Burien

Sea Level Rise (Feet)	Sea Level Rise in Burien
	

▶ Likely Sea Level Rise by 2100: King County Model Mean 2100: +2.4 feet, similar for Burien.

▶ High Sea Level Rise by 2100: +5.1 King County, similar for Burien.

Source: See Exhibit 14, BERK 2023.

Communities Vulnerable to Climate Change



Burien Senior Wellness Program

Broadly, communities that tend to be more vulnerable to climate stressors are those that are already at social and economic risk, including older people, children, low-income families, and persons of color and immigrant communities. 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.

Compared to the County as a whole Burien has:

- A greater share of its population under 5 or over 64 years old and those with a disability.
- A greater share of residents living alone, or speaking English less than very well.
- More persons who have no high school diplomas or who live in poverty.
- More persons who work in construction are potentially susceptible to outdoor exposures.

Climate Vulnerability Index

Climate vulnerability is defined as the combination of exposure to a changing climate, the inherent sensitivity of people or environments to a changing climate, and the capacity of the community and place to cope with the impacts of a changing climate. Through the climate vulnerability assessment process, Burien developed a Climate Vulnerability Index (CVI). The CVI sums over 30 indicators of climate vulnerability and identifies which census block groups are more or less vulnerable to extreme heat or extreme precipitation, relative to other areas in Burien. The value in providing an aggregate and relative measure is that it allows for calling out relative 'hot spots' of vulnerability, which opens the door for a deeper dive to answer why some area may be more or less vulnerable. It also supports the planning-level view of vulnerability that is important for development an appropriate policy response.

Vulnerability = Exposure + Sensitivity + Low Adaptive Capacity

Exhibit 3. Climate Vulnerability Index Indicators

Exposure
Sea Level Rise
Extreme Heat
Extreme Precipitation
Extreme Precipitation
Sensitivity
Under 5 years old
Over 65 years old
Landslide Hazards
Seismic Hazards
Proximity to heavy traffic
Diabetes – rate in adults
Asthma – rate in adults
Respiratory Disease (COPD) – rate in adults
Coronary Heart Disease – rate in adults
Hypertension – rate in adults
Poor Physical Health – rate in adults
Poor Mental Health – rate in adults

Adaptive Capacity
People of Color
Population Experiencing Poverty
Low Educational Attainment – < high school degree
Linguistic Isolation – limited English households
Living Alone – householder living alone
Housing Cost Burden – renter households >30% of income
Access to Vehicle – households with no access to a vehicle
Access to Transit – % units outside 10-min walk of transit
Housing Condition – built before 1960
Low income housing - location
Urban Heat Island – Evening heat index
Impervious Surfaces
Unemployment
Outdoor Professions – jobs likely to be outside
Adult Population Without Health Insurance
Tree Canopy Coverage
Access to Parks/Open Space – % units outside 10-min walk

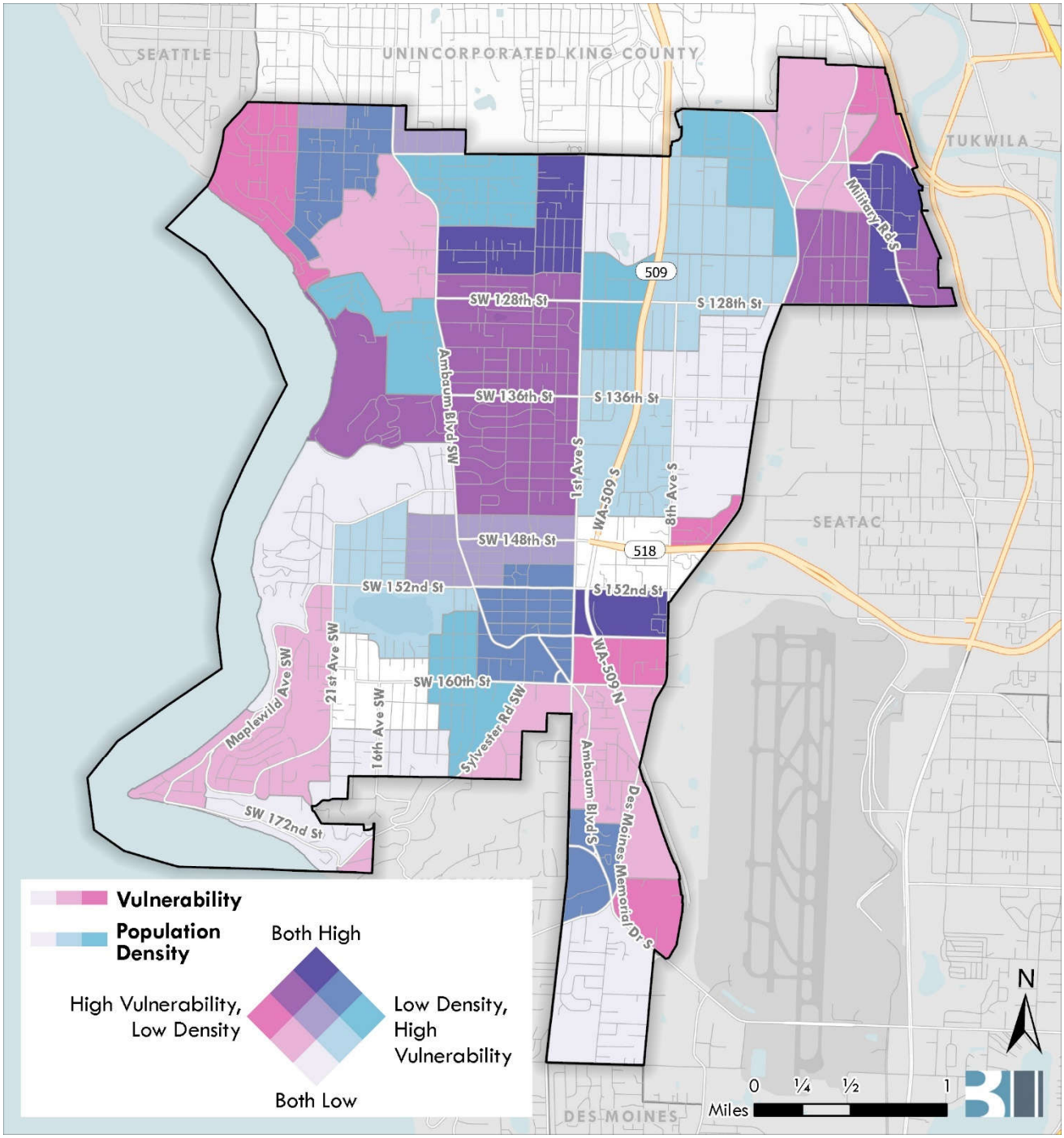
Exposure: An assessment of the magnitude and frequency of shocks or the degree of stress.

Sensitivity: The degree to which a system will be affected by, or respond to, a given shock or stress.

Adaptive Capacity: Adaptive capacities of individuals, communities, businesses, governments, institutions, or the natural environment to adjust to a disturbance, moderate damage, take advantage of opportunities and cope with consequences. (UKAID, 2011), (US Climate Resilience Toolkit, 2021)

Western Burien is less vulnerable and other areas between First Avenue S and Ambaum Boulevard SW north of SW 128th, Highline High School vicinity, and Boulevard Park are particular areas of vulnerability. See Exhibit 21.

Exhibit 4. Vulnerability and Population Density



Sources: See Exhibit 14, Exhibit 16, Exhibit 18; US Census 2020; BERK 2023.

Resilience Evaluation and Strategies

This Climate Vulnerability Assessment has followed the steps in the Commerce Model Element Guidebook to help develop resilience-focused goals and policies. Steps are shown in the sidebar and start with an understanding of climate impacts, an audit of plans and policies, a vulnerability/risk assessment, identification of sources of strategies, and developing goals and policies the Comprehensive Plan.

Burien's Comprehensive Plan was screened for the strengths or weaknesses across eleven sectors including:

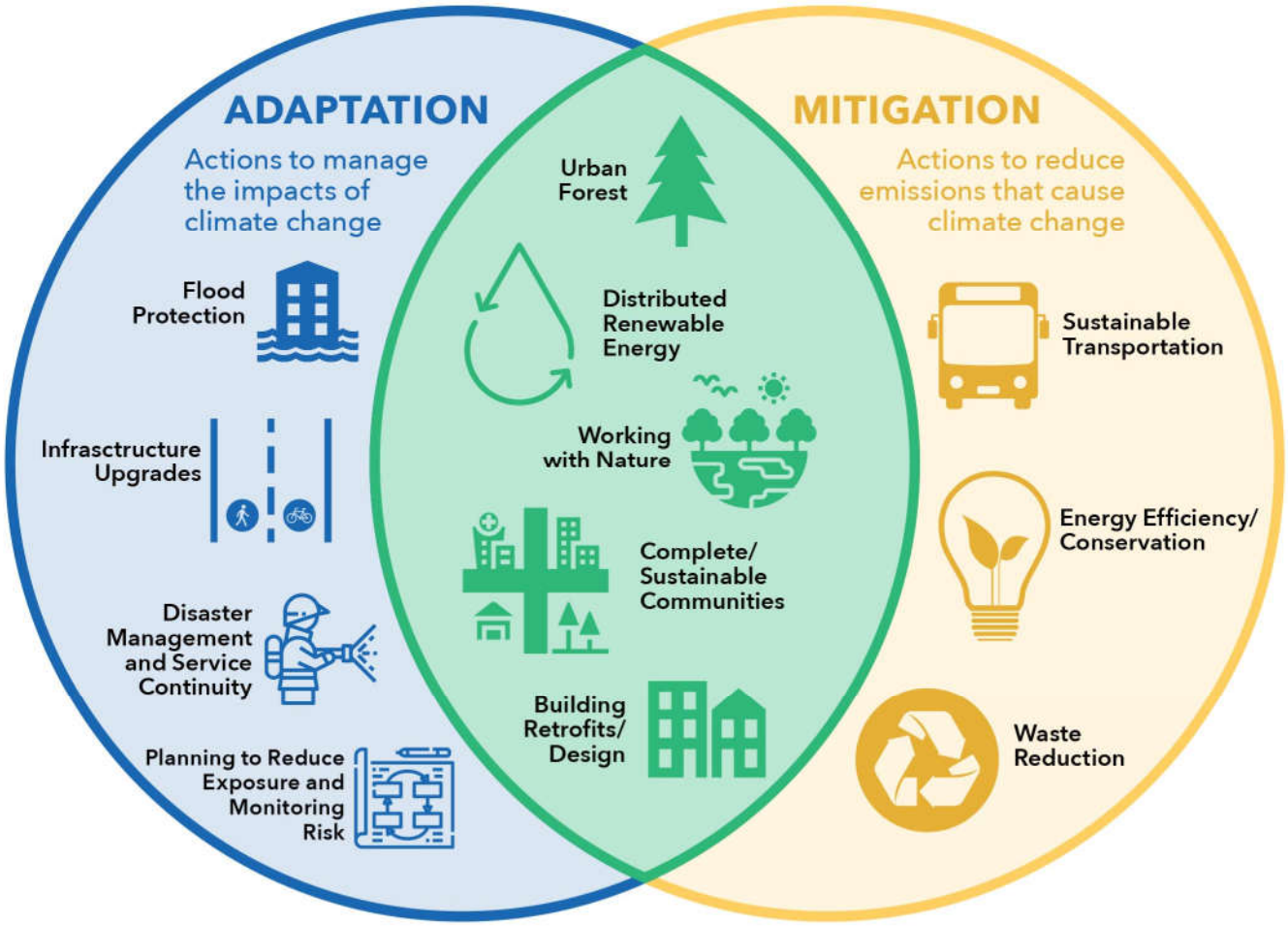
- Parks, Open Space & Food Systems (public parks and food systems);
- Buildings & Energy (includes energy generation, transmission, and consumption);
- Cultural Resources & Practices (includes historic sites and cultural resources and practices);
- Economic Development (includes business continuity, opportunities);
- Emergency Management (includes community preparedness, response, and recovery);
- Health & Well-being (includes community well-being, equity, and engagement);
- Ecosystems (includes land and water species and habitat);
- Transportation (includes multimodal travel and infrastructure);
- Waste Management (includes materials recycling and disposal);
- Water Resources (includes water quality and quantity); and
- Zoning & Development (includes site use, design, and other development facets).



Based on the policy review, the assessment identified resilience strategies to prevent, protect, or respond to potential climate stressors. Some strategies address both adaptation and mitigation. See Exhibit 5. Strategies were recommended for effectiveness, ease of implementation, and alignment considering the following resources:

- Burien Climate Action Plan, 2021
- Green Burien Urban Forest Stewardship Plan, 2018
- Washington Department of Commerce, Model Climate Element, Menu of Measures
- K4C Climate Action Toolkit, April 2021
- VISION 2050. Puget Sound Regional Council, October 2020

Exhibit 5. Adaptation and Mitigation Strategies



Sources: Grey County, Canada, 2020; New Zealand Association of Impact Assessment (NZAIA), 2020; (Zhao, 2018), BERK 2022

The top performing strategies are included in the chart below. For details, please see Section 3 Vulnerability Assessment.

Exhibit 6. Adaptation and Mitigation Strategies

Adaptation Category	High Performing Strategies	Sectors Addressed
Urban Forest	▶ Increase Amount and Resilience of Trees and Plants. ▶ Value and enhance tree canopy by hiring arborist.	▶ Parks, Open Space, Food Systems ▶ Economic Development ▶ Ecosystems ▶ Emergency Management ▶ Water Resources
Distributed Renewable Energy Energy Efficiency / Conservation Building Retrofits/ Design	▶ Advance the decarbonization of buildings: Adopt or exceed the Washington State Clean Buildings Act. ▶ Enhance climate resilience of Burien's businesses and districts (exterior – awnings, solar, cool roofs), promote weatherization.	▶ Economic Development ▶ Buildings & Energy

Adaptation Category	High Performing Strategies	Sectors Addressed
Working with Nature	▶ Ecosystem restoration to protect culturally important resources. ▶ Provide green stormwater infrastructure to mimic natural systems. ▶ Increase/heighten restoration requirements for wetlands/ habitats/ urban forests.	▶ Cultural Resources & Practices ▶ Ecosystems ▶ Water Resources
Complete/ Sustainable Communities Sustainable Transportation	▶ **Increase Access to Parks and Destinations.** ▶ Develop 10-minute communities. ▶ Promote climate-resilient designs of public parks and gathering spaces in support of recreation and cultural events. ▶ Public transit near shopping.	▶ Parks, Open Space, Food Systems ▶ Economic Development ▶ **Transportation** ▶ Zoning & Development
Flood Protection Infrastructure Upgrades	▶ Improve roadway stormwater system capacity . ▶ New and improved multimodal access, include grade-separated facilities. ▶ Coordinated road, stormwater, and sewer improvements.	▶ Transportation ▶ Waste Management ▶ Water Resources
Disaster Management & Service Continuity	▶ Resilience hubs (e.g., improved community center and adding additional sites).	▶ Emergency Management ▶ Human Health
Planning: Reduce Exposure & Monitoring Risk	▶ Accessible evacuation materials. ▶ Emergency planning of alternate routes for coastal neighborhoods. ▶ Update codes and design standards to be resilient by including capacity for anticipated new rainfall patterns. ▶ Develop a heat resilience strategy — also called extreme heat response plan.	▶ Emergency Management ▶ Transportation ▶ Water Resources
Waste Reduction / Diversion	▶ Develop and implement a strategy to expedite debris management during/after extreme climate event. ▶ Mandate recycling and composting at commercial and multi-family properties.	▶ Waste Management

Community Engagement and Next Steps

The Climate Action Plan included community meetings, a survey, and other events. Key community engagement themes included:

- Increased education and awareness around climate change impacts is one of the first steps we should take in Burien.
- Climate change impacts are already being felt in the community, especially by frontline communities.

- Burien should be a leader in this space and inspire other communities of a similar size to take action.
- Community members are passionate about taking climate action.

In April 2023 as part of a Youth Engagement discussion group, kids were asked about their current and ideal Burien and writing a policy to enact their changes. Food gardens, electric vehicles, clean air, solar panels, connected transportation systems and especially trees were important to making an ideal Burien. See Exhibit 7

Exhibit 7. Shape Your City Youth Discussion: Themes and Policies

Theme	Policy Example
Safety *Safety in public spaces and at home*	▶ Speed limit regulation ▶ Safe parks and more trees ▶ Citizens feel safe
Affordability *Housing and goods*	▶ More affordable housing ▶ Food is cheaper ▶ Food gardens
Climate Resilience *Infrastructure and tree policy*	▶ Clean Air ▶ Hybrid incentives and EV charging ▶ More trees (restoration) ▶ Pro animals ▶ Tree policy ▶ Solar panels ▶ Tree policy replacing 1:1
Transportation Investment *Multi-modal investments*	▶ More multi-modal transport options ▶ Better sidewalks





The Climate Vulnerability Assessment is in an early stage and will be shared with the Burien 2044 Comprehensive Plan Advisory Committee. The Draft Policies will be folded into the Draft Comprehensive Plan and part of engagement in fall 2023 and winter 2024, and the strategies and policy language will change over time.

Structure of Report

After an overview of climate change and vulnerability information, each sector is reviewed in the following order:

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

For each topic, the following information is provided:

- Methods and Assumptions
- Hazards, Vulnerability, and Risks
- Priorities and Implementation

How to Use this Report

This report is meant to provide a high-level summary of climate change, its potential effect in Burien, places that may be more or less vulnerable given planning level data, and strategies to consider in plans, programs, budgets, and partnerships in the medium and long-term to enhance Burien's resilience. Data and strategies would be updated and evolve over time.

2 Climate Trends

Regional Information

Climate is the average weather for a region expected at different times of the year. Climate is usually reported over a span of 30 years. Climate change means a difference in the average conditions in a region such as temperature and rainfall.[1]

Information for the Burien Vulnerability Assessment has been gathered for the year 2050 using the Representative Concentration Pathway (RCP) 8.5 greenhouse gas (GHG) concentration level, which is a very high GHG scenario.[2] The GHG scenarios do not differ significantly prior to 2050.[3] The year 2050 is similar to the 2044 Comprehensive Plan periodic update horizon year, and the City can use the Vulnerability Assessment to help shape the Comprehensive Plan and prepare the required Climate Element under HB 1181.

Information about climate change considers hazards based on climate and hydrologic models. The direction of climate trends in the county plus local information about conditions in Burien can be useful for "general planning and assessment, such as climate vulnerability assessments, climate resilience plans, climate action plans, or climate resilience elements in comprehensive plans." (University of Washington Climate Impacts Group 2022)

In the county and Burien, climate change could expose people, ecosystems, and infrastructure to:

- Extreme heat
- Wildfire smoke
- Extreme precipitation
- Sea level rise and Flooding
- Stream low flow due to decreased mountain snowpack
- Drought and low soil moisture

Exhibit 8 shares climate change trends expected in 2050 for King County.

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[1] See NASA Climate Kids: https://climatekids.nasa.gov/climate-change-meaning/#.

[2] 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.

[3] 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 greenhouse gas 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 greenhouse gas scenario is less important than for late century applications. See: https://cig-wa-climate.nkn.uidaho.edu/.

Exhibit 8. King County Median Change by 2050

Climate Change	Description	King County: 2040-2069 compared to 1980-2009 (RCP 8.5)
 Extreme Heat	An increase in average summer temperatures is expected. This could affect people, landscaping, agriculture, and natural areas like wetlands, wildlife habitats, and other ecosystems. More days above 90°F humidex (humidity and heat) are expected which can affect public health. An increase in the number of cooling degree days is an indicator of greater potential for more cooling demand for buildings in the summer. Hotter days can increase ground-level ozone, a greenhouse gas (GHG).	+ 6.3 °F Change in Average Summer (June - Aug) Maximum Temperature + 20.1 days above 90°F humidex + 287 °F-days change in colling degree days (base 65°F)
 Wildfire & Smoke	There would be more fire-danger days that could affect homes and businesses where forests and wildland vegetation meet or intermingle. More wildfire smoke can result in particulates affecting those with health conditions (e.g. heart and lung disease, pregnancy, etc.).	+ 10 days Change in High Fire Danger Days
 Extreme Precipitation	More frequent and intense storms are expected. This could affect flooding, erosion, and runoff and impact stormwater systems, transportation, and emergency responses. Summer precipitation below 75% of normal is an indicator of drought because it is a consideration in the legal definition of drought in Washington State, which includes less than 75% of normal water supply.	+ 13% Change in the Magnitude of 25-Year Storm + 9% Change in the Magnitude of 2-Year Storm 25% Chance that a year in the 2040-2069 period will have summer precipitation at or below 75% of normal.
 Sea Level Rise & Flooding	Sea Level Rise: Moderate sea level rise is expected to inundate some coastal land and intensify coastal flooding of infrastructure. Sea level rise is expected to increase beach and bluff erosion in some areas. Increasing coastal hazards are expected to decrease the area of coastal land that is suitable for some types of development and increase the need for relocation.	Likely Sea Level Rise: King County Model Mean 2100: +2.4 feet, similar for Burien. High Sea Level Rise: +5.1 King County, similar for Burien.
	Flooding: The county would experience increases in peak stream flows, more areas flooded. This could impact more homes, businesses, farms, and infrastructure.	82% of stream lengths in King County would see Across the county streams could see 10-50% more streamflow on the day of the year with the highest streamflow. Values mapped in Burien: +12 %.
 Reduced Snowpack	In winter, there would be less stored water in snow, and less water available for streams, soil, and reservoirs. This could affect aquatic species, trees, vegetation, and water supply.	-76 % Change in April 1 Snowpack Most stream lengths would see -10 to -100% change from historic low streamflow in summer (June-September). Stream temperatures in August in Burien Streams (2040, Medium Scenario): 15.9 °C to 16.9 °C.

Source: (University of Washington Climate Impacts Group 2022); (US Environmental Protection Agency 2022)

Heat Islands

Climate change trends project increases in average heat and in days above 90°F humidex (heat and humidity combined) in the county and Burien. Areas with more impervious surfaces like parking lots and streets together with a lack trees or shade can magnify the change, and are where people are more likely to be at risk of health impacts due to increased heat.

Based on a local analysis of temperature measurements in July 2020 at different times of day, King County mapped "heat islands". See Exhibit 9. Evening Heat Index and Tree Canopy. Much of Burien, Downtown and other places throughout the city are considered to be a heat island. There could be a loss of tree canopy due to development, warmer climate, and drought.

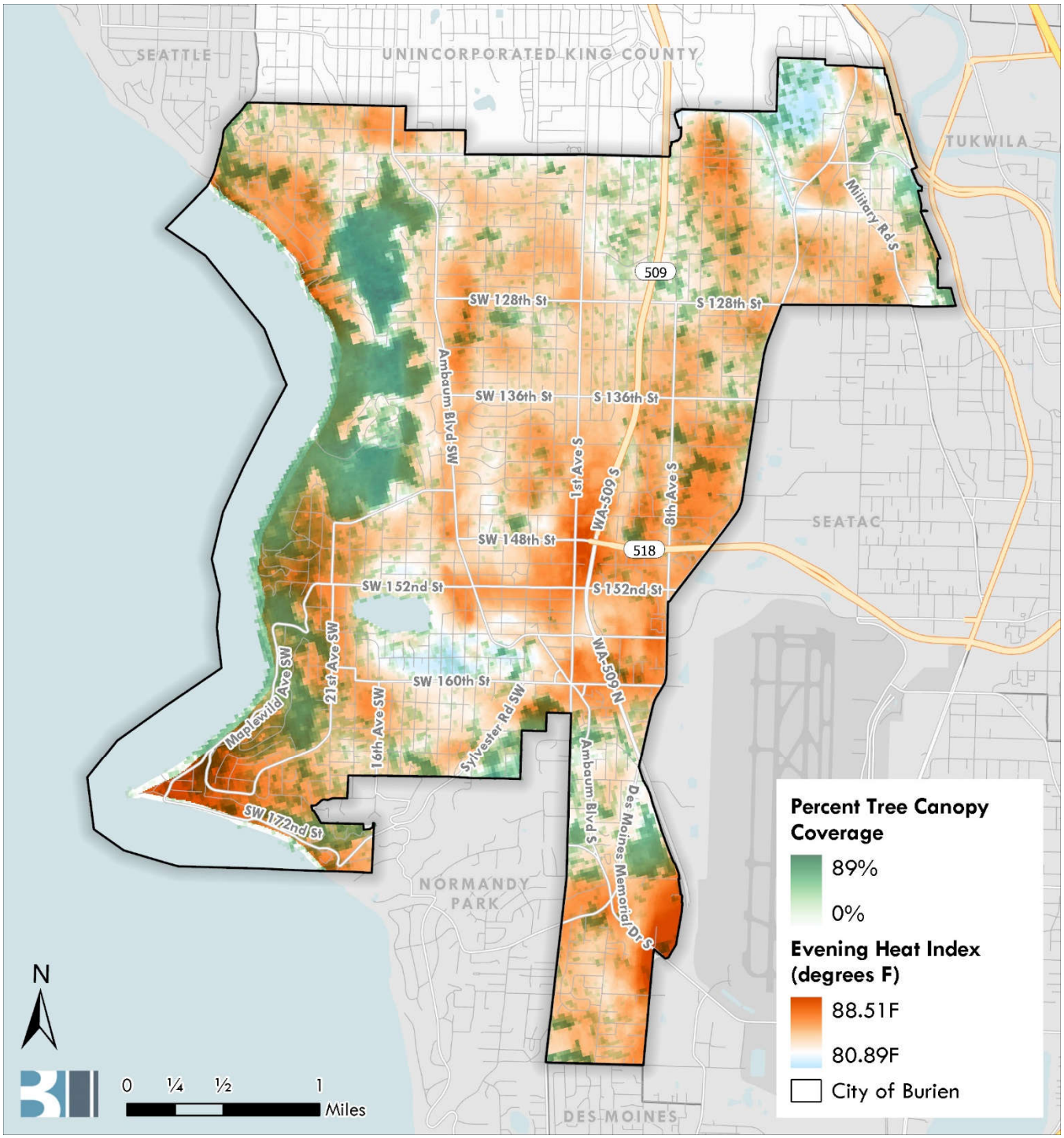
Sea Level Rise and Flooding

Sea level rise could result in coastal flooding, inundation, and erosion. Sea level rise projections are adapted from a 2018 study called *Sea Level Rise in Washington State – A 2018 Assessment,* and provided by the University of Washington Climate Impacts Group.[4] The index uses 6.3 feet of modeled sea level rise, which corresponds with the 17% likelihood scenario for Burien for the year 2100 (3.2 feet), plus 3.1 feet of storm surge. Areas of greater impact are along Three Tree Point and other areas fronted by parkland and residential uses along the marine shoreline. See Exhibit 10.

Most areas of flooding in Burien are associated with sea level rise, but there are smaller areas along inland streams that are susceptible to flooding. See Exhibit 11.

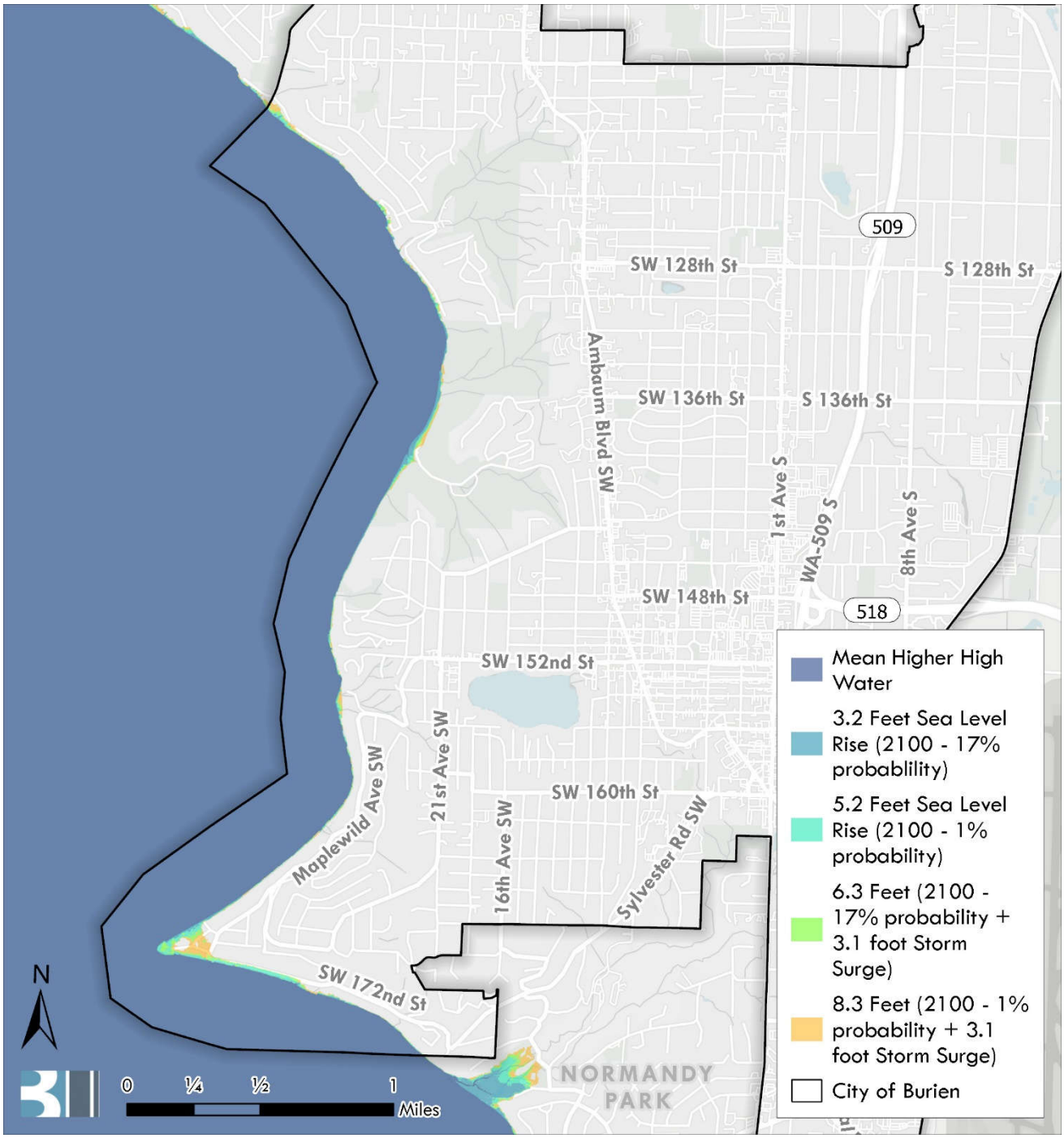
[4] See: https://cig.uw.edu/projects/projected-sea-level-rise-for-washington-state-a-2018-assessment/

Exhibit 9. Evening Heat Index and Tree Canopy



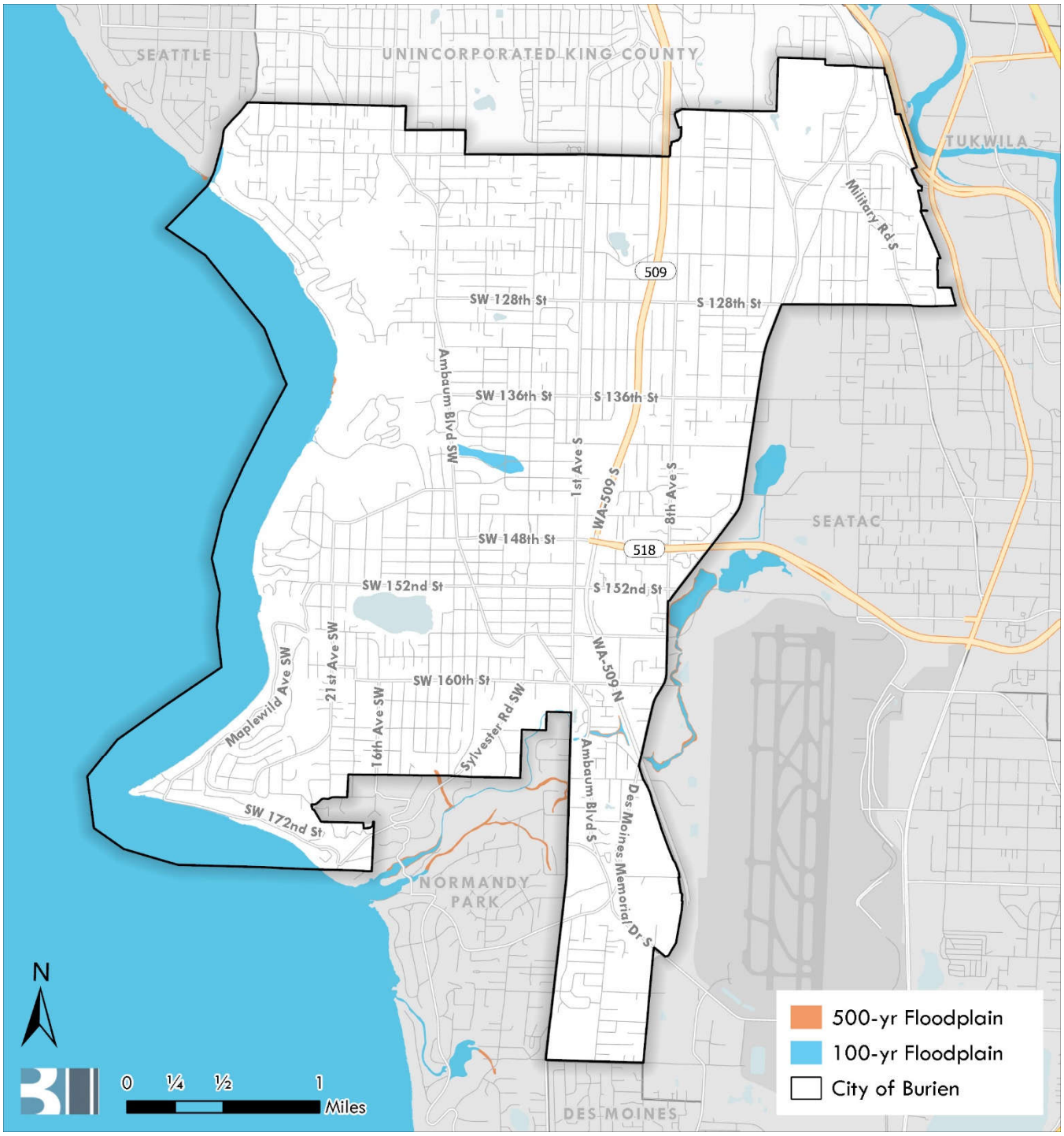
Source: See Exhibit 14, BERK 2023.

Exhibit 10. Sea Level Rise



Source: See Exhibit 10; BERK 2023

Exhibit 11. Flood Hazards



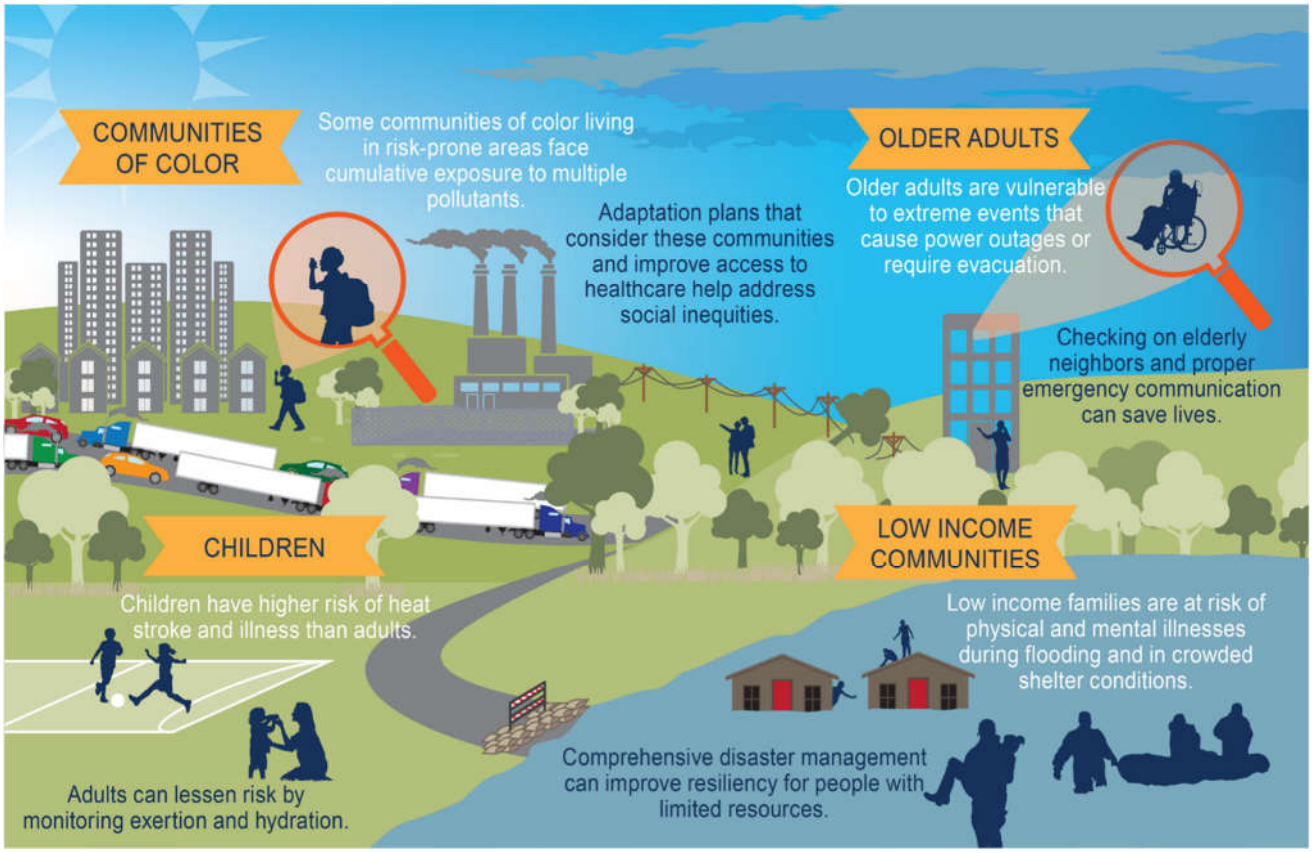
Source: See Exhibit 14, BERK 2023.

Community Demographics

Broadly, communities that tend to be more vulnerable to climate stressors are those that are already at social and economic risk, including older people, children, low-income families, and persons of color and immigrant communities. See Exhibit 12.

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, smoke and poor air quality, or heat, 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, or live in areas with less tree canopy. Persons that speak English less than very well may have more difficulties during evacuation and difficulties accessing post-disaster funding.

Exhibit 12. Vulnerable Populations



Source: EPA in The Fourth National Climate Assessment.

See Exhibit 13**.** ***Compared to the County as a whole Burien has*****:**

- A greater share of its population under 5 or over 64 years old and those with a disability.
- A greater share of residents living alone, or speaking English less than very well.
- More persons who have no high school diplomas or who live in poverty.
- More persons who work in construction potentially susceptible to outdoor exposures.

From 1990 to 2020, Burien has become a more racially and ethnically diverse community. From 2010 to 2020 Burien became a city where no single racial/ethnic group comprises more than 50% of the population. White alone residents comprise just under half of the population; about 25% identify as Hispanic or Latino, and 14% of the population as Asian.

About 25.1% of Burien's population is foreign born as of 2020. About 44.9% of the foreign born are naturalized citizens and 55.1% are not. Regions of birth include Latin America (41.7%), Asia (34.9%), Africa (16.1%), Europe (4.3%), North America (1.8%) and Oceania (1.2%). Over one third of Burien residents speak a language other than English and home, and nearly 20% speak English less than very well. Based on Highline School district information, in addition to English, other languages spoken at home, include Spanish, Vietnamese and Somali as well as Amharic, Cambodian, Arabic, Punjabi, Tigrinya, and Tagalog.

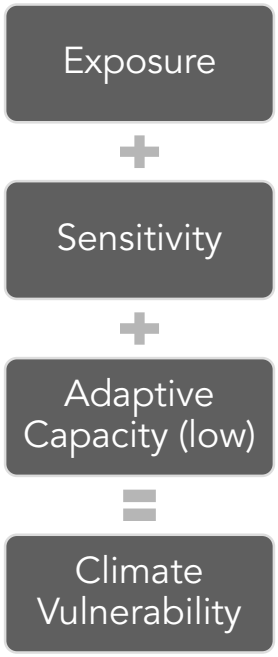
Exhibit 13. Burien Community Characteristics

Characteristic	Burien 2020
 Children	6.4% under 5 years in Burien 5.7% in King County
 Adults > 64 years	14.4% 65 years and over in Burien 13.2% in King County
 Communities of Color	Persons of color: 52.1% in Burien Persons of color 41.8% in King County
 Low-Income Communities	26.8% at under 200% of poverty level in Burien 18.3% in King County
 Living Alone	15.9% householder living alone in Burien 14.4% in King County
 Limited English	18.2% speak English less than very well in King County 10.8% in King County

Characteristic	Burien 2020
 Disabled	13.4% population with a disability 9.8% in King County
 Unemployment	3.8% unemployed in Burien 3.0% in King County
 Outdoor workers	9.20% in construction in Burien 5.10% in King County
 Pre-existing or chronic medical conditions	Diabetes: 7.6-9.5% in census blocks Asthma: 9-11.3% in census blocks Chronic Obstructive Pulmonary Disease (COPD): 4.7-6.4% in census blocks Coronary Heart Disease: 4.9-6.3% in census blocks
 Education	16.3% no high school diploma in Burien 6.6% in King County

Sources: 2020 ACS 5-Year Estimates, 2020 US Census, 2023 CDC Places

Climate Vulnerability Index



Through the climate vulnerability assessment process, Burien developed 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 work. The CVI sums over 30 indicators of climate vulnerability and identifies which census block groups are more or less vulnerable to extreme heat or extreme precipitation, relative to other areas in Burien.

The CVI groups the indicators into three categories according to their relationship to climate vulnerability: exposure, sensitivity, and adaptive capacity. The indicators address climate stressors, demographics, community health, critical areas, and others relevant to the spatial variability of climate vulnerability. (Yu, et al. 2021) Every measure in these indices has been normalized, regardless of the type of measure, and rescaled so each indicator can be added together and compared to other areas of Burien.

Climate vulnerability in this context is defined as the combination of exposure to a changing climate, the inherent sensitivity of people or environments to a changing climate, and the capacity of the community and place to cope with the impacts of a changing climate.

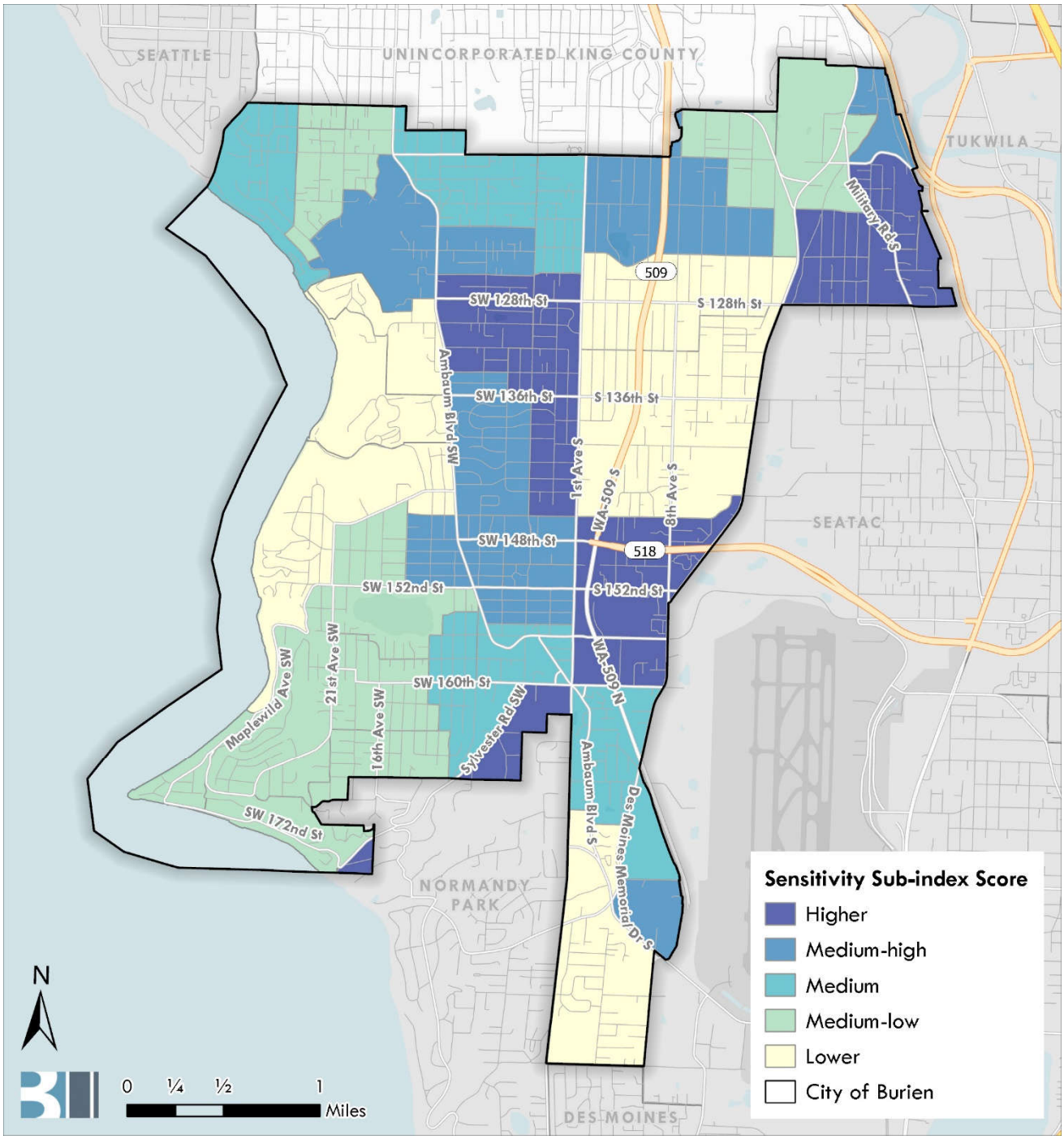
The value in providing an aggregate and relative measure is that it allows for calling out relative 'hot spots' of vulnerability, which opens the door for a deeper dive to answer why some area may be more or less vulnerable. It also supports the planning-level view of vulnerability that is important for development an appropriate policy response.

Exposure to climate change is a quantification of a given climate stressor and how that interacts with the environment. In Burien, exposure indicators include sea level rise, flooding, and extreme heat. See Exhibit 14.

Exhibit 14. Exposure Indicator List

Sub-Category		Indicator	Data Source
Sea Level Rise	(+)	17% Likelihood, 2100, plus 3.1 ft storm surge – 6.3 ft total	University of Washington Climate Impacts Group
Extreme Heat	(+)	FEMA National Risk Index – Heat Wave Exposure Score	FEMA
Extreme Precipitation	(+)	FEMA National Risk Index – Riverine Flooding Exposure Score	FEMA
Extreme Precipitation	(+)	100-yr and 500-yr Floodplains	FEMA

Exhibit 15. Exposure Sub-Index Map



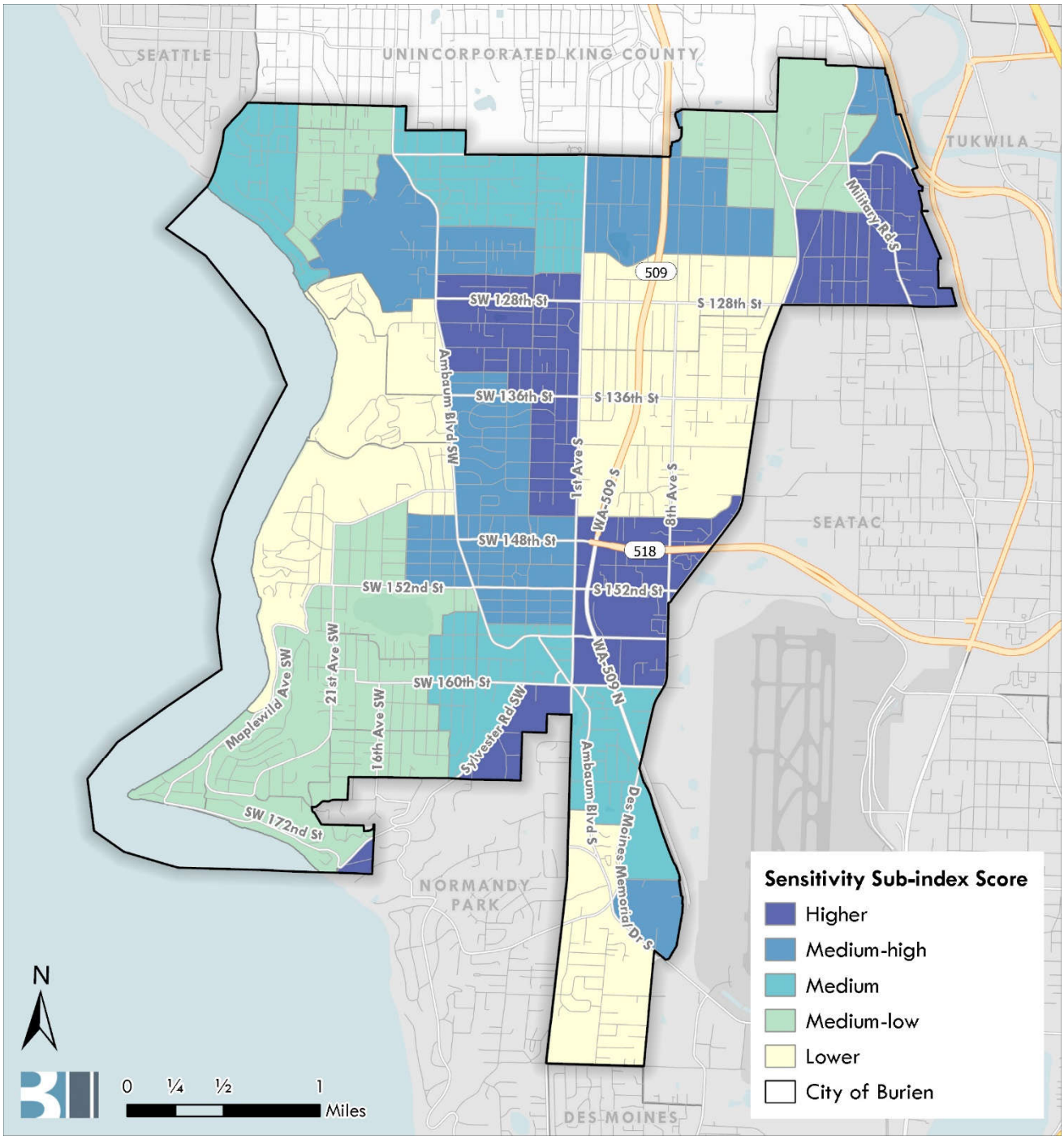
Sources: See Exhibit 14; BERK 2023.

Sensitivity is the component of the CVI addressing attributes inherent to the population or place that make them predisposed to increased sensitivity to climate exposure. The indicators for sensitivity are categorized into sub-categories of age, environment, and health conditions, and are presented in Exhibit 16.

Exhibit 16. Sensitivity Indicator List

Sub-Category		Indicator	Data Source
Age	(+)	Under 5 years old	US Census American Community Survey 5-year Estimates
	(+)	Over 65 years old	US Census American Community Survey 5-year Estimates
Environment	(+)	Landslide Hazards	City of Burien
	(+)	Seismic Hazards	City of Burien
	(+)	Proximity to heavy traffic	EJScreen
Health Conditions	(+)	Diabetes – crude rate in population >= age 18	CDC PLACES Project
	(+)	Asthma – crude rate in population >= age 18	CDC PLACES Project
	(+)	Respiratory Disease - COPD – crude rate in population >= age 18	CDC PLACES Project
	(+)	Coronary Heart Disease – crude rate in population >= age 18	CDC PLACES Project
	(+)	Hypertension – crude rate in population >= age 18	CDC PLACES Project
	(+)	Poor Physical Health – crude rate in population >= age 18	CDC PLACES Project
	(+)	Poor Mental Health – crude rate in population >= age 18	CDC PLACES Project

Exhibit 17. Sensitivity Sub-Index Map



Sources: See Exhibit 16; BERK 2023.

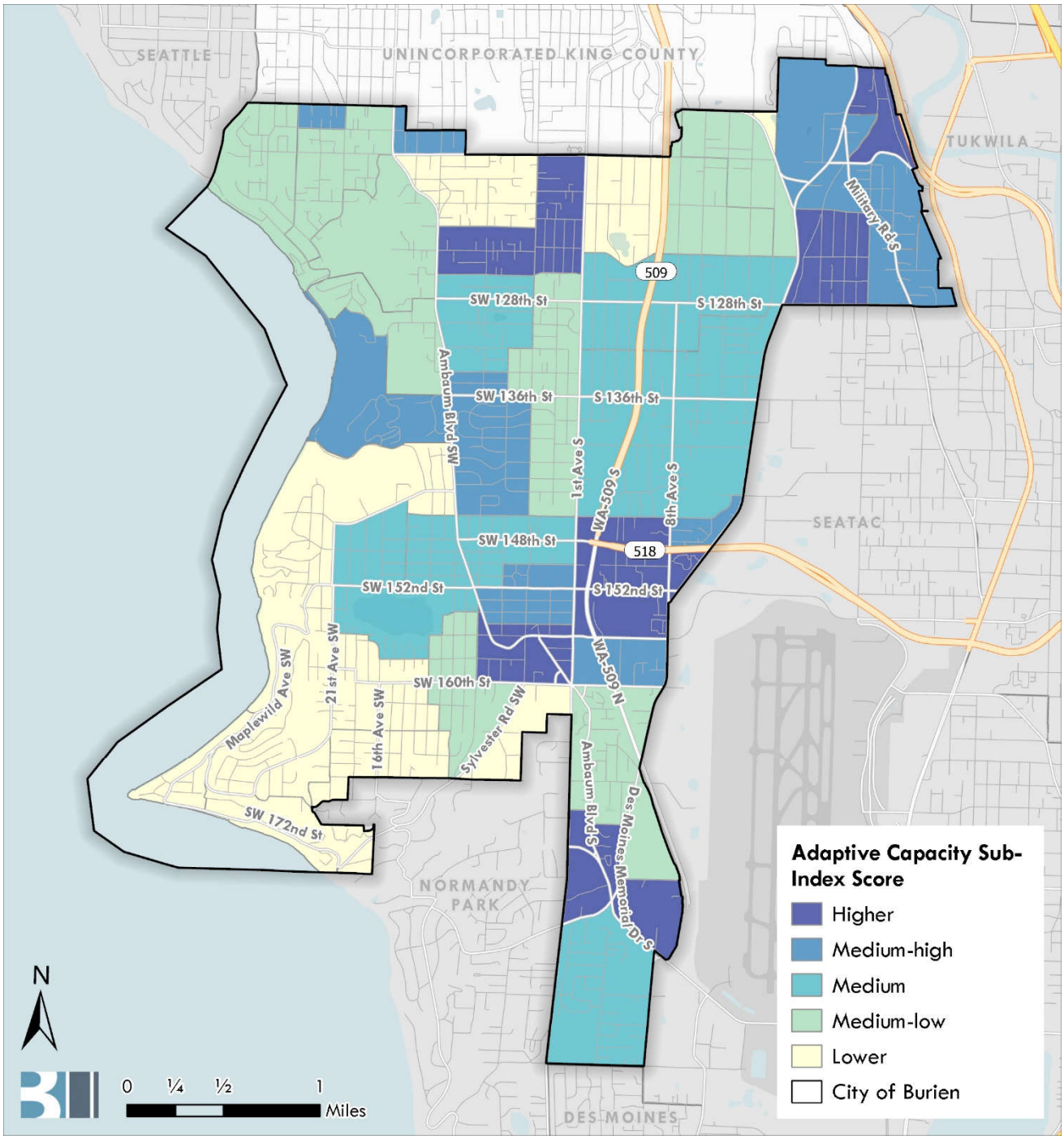
Adaptive capacity is the component of the CVI addressing attributes related to a population or environment's capacity to adapt to increased exposure to climate change. The indicators for adaptive capacity are categorized into sub-categories of socioeconomic, transportation, housing/built environment, employment, health, and environment/ecologic in Exhibit 18. The (+) or (-) in the table indicates how the given indicator is correlated to the index values. For adaptive capacity, there are three indicators with a (-): Access to Transit, Tree Canopy Coverage, and Access to Open Space. In

these three examples only, higher values correspond to lower vulnerability values. For example, if a given census block group has a high intersection with parks and open space access, it would have a correspondingly lower vulnerability value. The above also applies to adaptive capacity overall, as low adaptive capacity is associated with higher vulnerability.

Exhibit 18. Adaptive Capacity Indicator List

Sub-Category		Indicator	Data Source
Socioeconomic	(+)	People of Color	US Census American Community Survey 5-year Estimates
	(+)	Population Experiencing Poverty	US Census American Community Survey 5-year Estimates
	(+)	Low Educational Attainment – less than high school degree	US Census American Community Survey 5-year Estimates
	(+)	Linguistic Isolation – households with limited English speaking at home	US Census American Community Survey 5-year Estimates
	(+)	Living Alone – households comprised of householder living alone	US Census American Community Survey 5-year Estimates
	(+)	Housing Cost Burden – renter households spending >30% of income on housing	US Census American Community Survey 5-year Estimates
	(+)	Access to Vehicle – households without access to a vehicle	US Census American Community Survey 5-year Estimates
Transportation	(-)	Access to Transit – percent of housing units outside 10-min walk of transit	BERK; Sound Transit GTFS Regional Transit Stop Dataset
Housing/Built Environment	(+)	Housing Condition – houses built before 1960	US Census American Community Survey 5-year Estimates
	(+)	Low income housing - location	BERK, National Housing Preservation Database
	(+)	Urban Heat Island – Evening heat index	King County
	(+)	Impervious Surfaces	National Land Cover Database
Employment	(+)	Unemployment	US Census American Community Survey 5-year Estimates
	(+)	Outdoor Professions – jobs likely to be performed outside (NAICS code 11, 21, and 23)	US Census OnTheMap Tool, Longitudinal Employer Household Dynamics
Health	(+)	Adult Population Without Health Insurance	CDC PLACES Project
Environment/ Ecologic	(-)	Tree Canopy Coverage	National Land Cover Database
	(-)	Access to Parks/Open Space – percent of housing units outside 10-min walk of park/open space	BERK, City of Burien

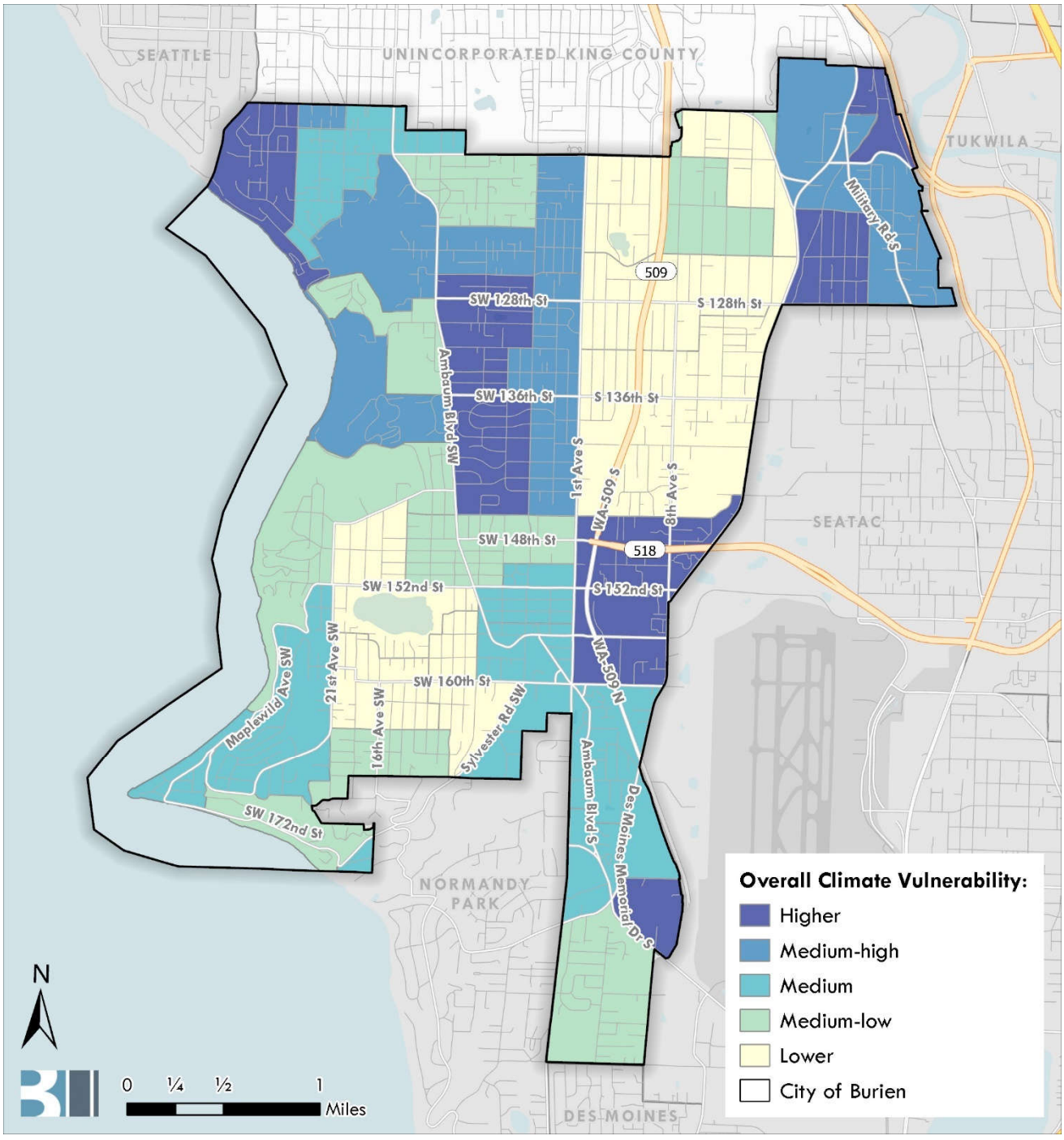
Exhibit 19. Adaptive Capacity Sub-Index



Sources: See Exhibit 18; BERK 2023.

Combining all exposure, sensitivity, and adaptive capacity indicators together, a composite index shows northwest, north central, SR 518/SR 509 intersection, and Boulevard Park as most vulnerable. See Exhibit 20.

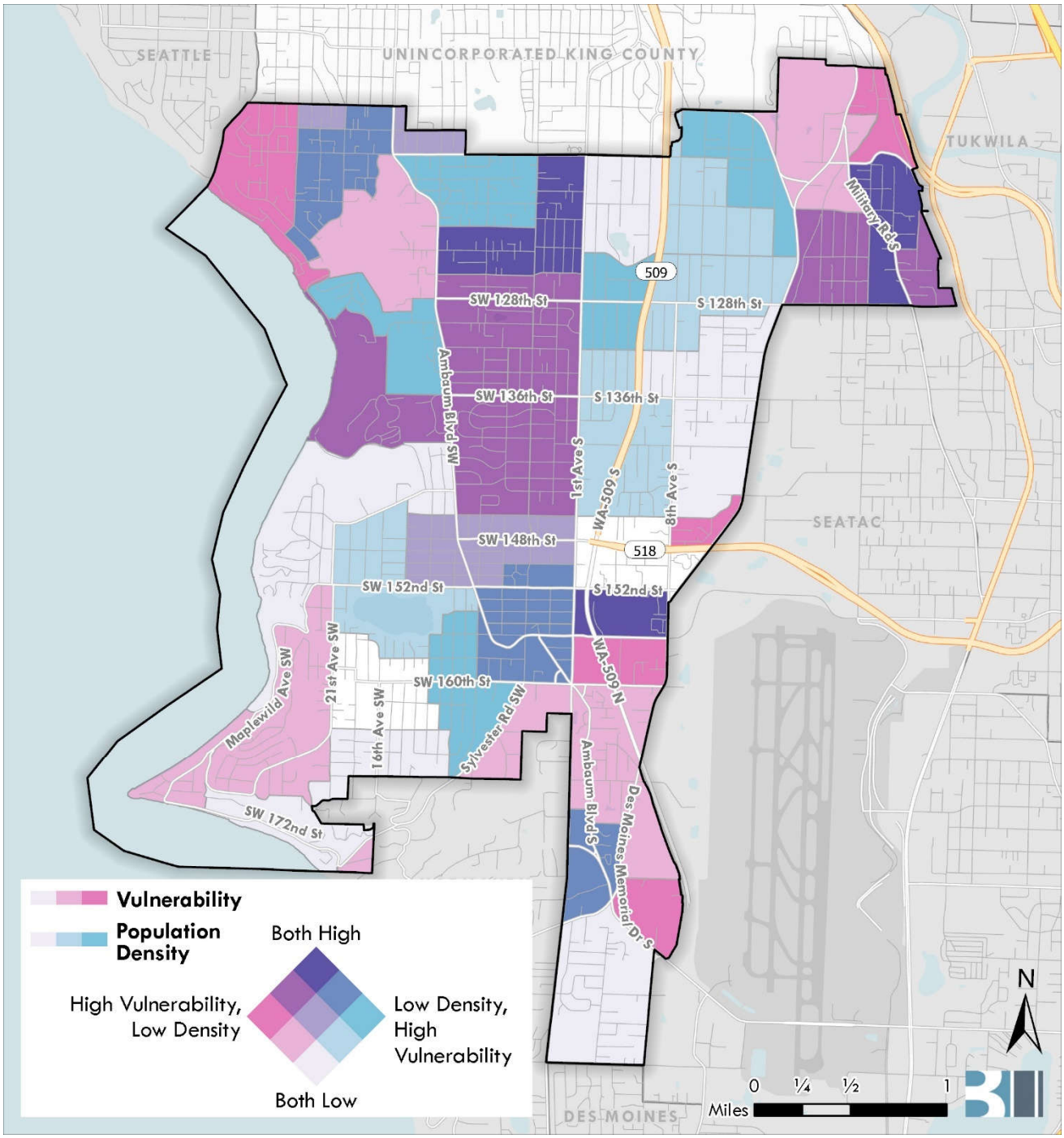
Exhibit 20. Burien Overall Vulnerability Index



Sources: See Exhibit 14, Exhibit 16, Exhibit 18; BERK 2023.

When accounting for population density, western Burien is less vulnerable and other areas in central-north, highway intersections, and Boulevard Park remain as a particular area of consideration. See Exhibit 21.

Exhibit 21. Vulnerability and Population Density



Sources: See Exhibit 14, Exhibit 16, Exhibit 18; US Census 2020; BERK 2023.

3 Vulnerability Assessment

Parks, Open Space, Food Systems

The Commerce Model Element guidebook recommends addressing agriculture and food systems in developing a Climate Element. As an urban community, Burien's connection to this sector is through farmers markets and community gardens. In addition, this section addresses Burien's parks and open spaces that would have similar management concerns as agriculture.



Methods and Assumptions

Resources for this section include:

- Burien 2018 Parks Recreation and Open Space (PROS) Plan, December 2017: https://www.burienwa.gov/residents/burien_s_vision/parks_recreation_and_open_space_plan .
- Burien Community Garden: https://www.burienwa.gov/residents/parks_recreation_cultural_services/community_garden.
- King County Local Food Initiative, 2020 Annual Report: https://your.kingcounty.gov/dnrp/local-food/documents/2020-LFI-Annual-Report.pdf and Local Food Finder application.

Hazards, Vulnerability, and Risks

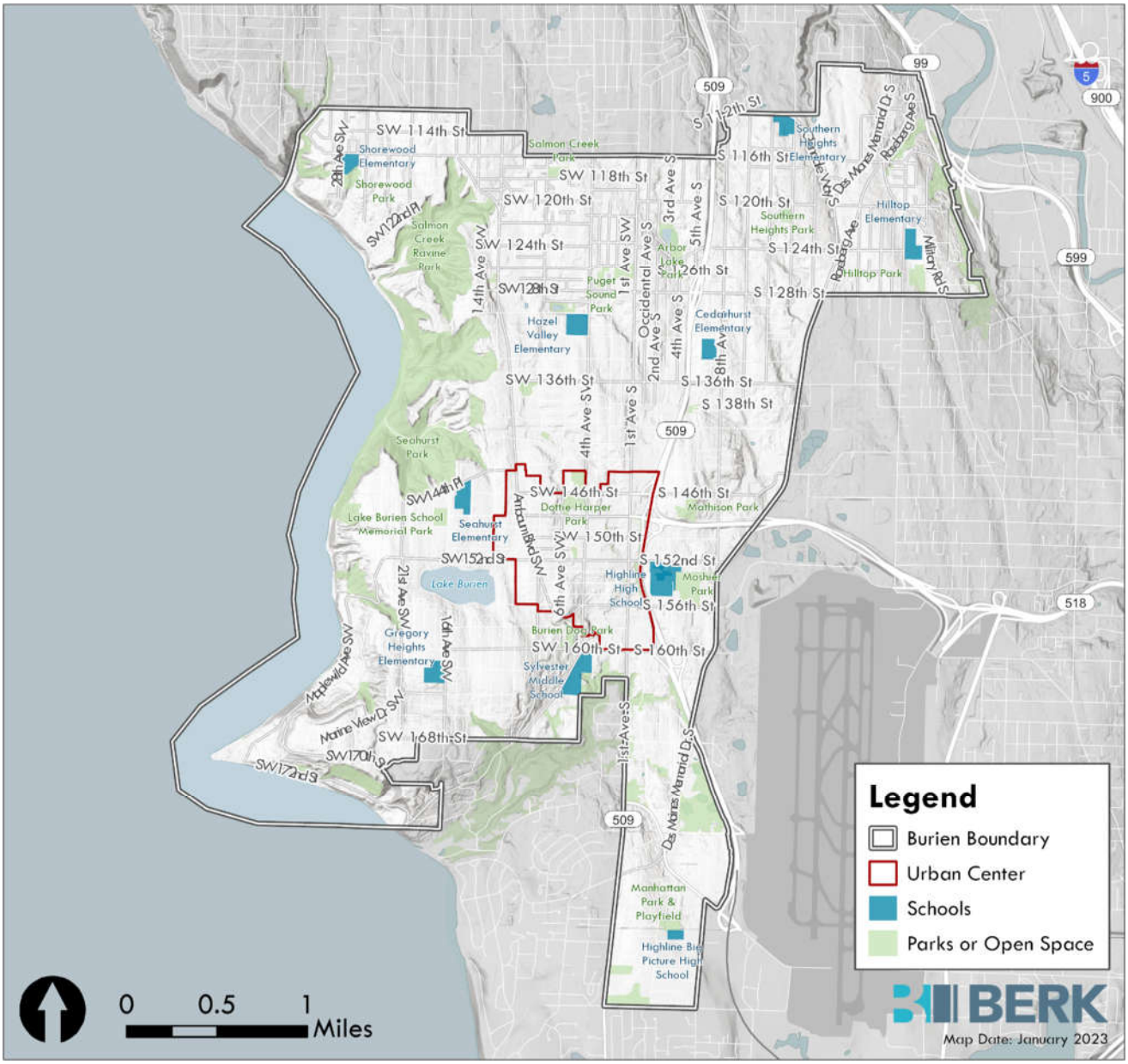
Physical and Social Assets

Burien has about 365 acres of parkland inventoried in the 2018 Parks Recreation and Open Space (PROS) Plan. Much of the parkland is located on the west side in an area with slopes and ravines fronting marine shorelines. In addition, schools provide open space resources with their playgrounds. See Exhibit 22.

Two facilities provide indoor space:

- Burien Community Center: 14700 6th Avenue SW
- Moshier Community Art Center: 430 S 156th Street

Exhibit 22. Current Burien Parkland



Source: City of Burien, BERK 2023.

Farmers Market, Community Garden, and Food Access

The Burien Farmers Market is open year round on Thursdays in the Burien Town Square Park. Burien also offers a community garden which is less than 1 acre in size; each plot is 75 square feet and costs $25 per year. There are 29 plots. A New Start High School Community Garden is oriented to students learning technology and other skills. (Scott Schaefer 2021)

- Grocery Stores: Several grocery stores serve Burien including but not limited to: Guadalupe Market, Grocery Outlet, PCC Community Markets, Safeway, Three Tree Point Store, Trader Joes, and more.

- Food Banks: The Highline Area Food Bank on 4th Avenue S serves Burien. Additionally, Alimentando al Pueblo, provides culturally relevant foods for south King County's Latino community and is located in Burien at 126 SW 148th St.

Hazards, Vulnerabilities, and Risks

Climate trends including extreme heat and extreme precipitation events and changes in the timing of precipitation could cause heat stress and reduced water availability in growing seasons for plants and trees as well as erosion and damage during storms. It could also result in more noxious weed growth.

To the extent that climate exacerbated events (e.g., extreme precipitation, heat, smoke) affect major transportation routes and distribution or outdoor events/activities, it is possible that groceries or regular events like farmers markets or community gardening could be temporarily unavailable.

Gaps and Opportunities

Investments in green infrastructure (urban forest canopy increases, new or enhanced parks, low impact stormwater improvements) especially where there are overburdened communities, such as in First Avenue and Downtown could reduce impervious surfaces and add tree canopy and greenery. This is considered a highly effective resilience and GHG emissions reduction activity. (Commerce Menu of Measures 2023; K4C Climate Action Toolkit 2021)

Policy Review

A policy review of the current Comprehensive Plan noted 20 policies regarding parks and open space that support or that could better support resiliency and GHG mitigation in the Comprehensive Plan. There are additional parks and open space policies or strategies in the Climate Action Plan, Shoreline Master Program, and Natural Hazards Plan. Suggestions for policy amendments include:

- Enhancement, addition of non-noxious plants that are climate resilient. Where appropriate, such as natural areas, native plant species should be used. In other areas plant diversity and function should be prioritized
- For marine parkland in sea-level rise areas address investments / improvements in structural protections (reinforce, managed retreat, or other adaptation measures).
- Improve walkable access to park and recreational space, increase tree canopy, and provide cooling shade.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Parks, Open Space, and Food Systems.

Exhibit 23. Potential Strategies: Parks, Open Space, and Food Systems

Key Approach	Strategy	Impact	Implementation	Alignment
Increase Access to Parks and Destinations	Establish connected parks, open spaces, and non-motorized trails to connect housing, schools, and businesses across a community.	High, Menu of Measures	High/Medium High return on investment Address in new PROS Plan, address funding gaps	High Climate Action Plan C-2.1.3
Ensure Tree and Landscape Standards are Adapted to be Resilient	Create a resilient urban forest that emphasizes tree diversity, right tree right place, and monitors and controls pests using an integrated pest management system. Ensure that tree species selection and planting guidance are updated to be resilient to climate change.*	High, Menu of Measures	High Focus in code, city specifications	High Green Burien Urban Forest Stewardship Plan
Control pest species that threaten the urban forest	Take early action to eliminate or control non-native invasive pests that take advantage of climate change, especially where invasives threaten native species or ecosystem function.	High, Menu of Measures	Medium/Low City has partial responsibility	Unknown
Increase Tree Canopy Cover on Public and Private Lands	Increase tree canopy cover to boost carbon sequestration, reduce heat islands, and improve air quality, prioritizing overburdened communities.	High Menu of Measures K4C	High	High Green Partnership Climate Action Plan W-1.12 K4C Climate Toolkit VISION 2050

*See for example, "Climate Change Vulnerability of Urban Trees Puget Sound Region, Washington," 2022, by forestadaptation.org

Legend/Key

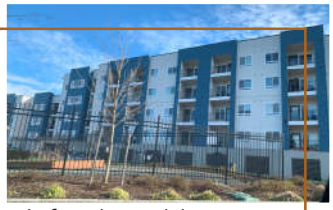
Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

Buildings & Energy


Single Family Home


Multifamily Building


Town Center Mixed Use

This section addresses Burien's buildings and energy generation, transmission, and consumption.

Methods and Assumptions

This document considers information from the following:

- Association of Washington Cities, Climate Resilience Handbook: Preparing for a changing environment. Available: www.cfqc.org/wp-content/2021/06/ClimateHandbook.pdf
- Burien Climate Action Plan, 2021: https://www.burienwa.gov/city_hall/areas_of_focus/environment/climate_action_plan.
- Heartland, Zoning Propensity Analysis, presentation to Burien Economic Development Partnership, April 2023
- US Department of Housing and Urban Development, Evidence Matters: The Role of Housing in Climate Change Mitigation and Adaptation, Summer 2022. Available: https://www.huduser.gov/portal/periodicals/em/Summer22/highlight1.html.
- Washington 2021 State Energy Strategy: https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/
- Washington Department of Commerce, 2023 Biennial Energy Report: https://deptofcommerce.app.box.com/s/uohdamh5qd1fwal543x78elme2w0pr0h.

Hazards, Vulnerability, and Risks

Physical and Social Assets

The current building space in Burien is primarily residential as well as retail, service (office, hospital) and industrial. Half of the industrial space consists of ministorage. Residential space is found mostly in residential zones, but more is being added in commercial mixed use zones. See Exhibit 24. In Burien, residential, commercial, and industrial energy (electricity, natural gas, other) represents 47% of the city's total greenhouse gas emissions. (City of Burien 2021).

Exhibit 24. Building Space 2022

Category	Commercial Zones	Industrial Zones	Residential Zones	Total
Education	27,000	89,000	1,368,000	1,484,000
Entertainment	29,000	0	0	29,000
Hospital	301,000	0	0	301,000
Industrial	500,000	1,202,000	80,000	1,782,000
Office	769,000	20,000	165,000	954,000
Other	813,000	58,000	608,000	1,479,000
Parking	341,000	0	0	341,000
Residential	774,000	13,000	4,800,000	5,587,000
Retail	2,118,000	4,000	41,000	2,163,000
Total	**5,672,000**	**1,386,000**	**7,062,000**	**14,120,000**

Source: King County Assessor, 2022; Heartland, BERK 2023.

Energy utilities in Burien include Seattle City Light or Puget Sound Energy. The Climate Action Plan notes that while the two utility companies are pursuing strategies for greater use of renewable energy, there are also opportunities to disincentive the usage of natural gas, which is a key action in the 2021 State Energy Strategy. The State strategy promotes actions including improving weatherization, energy efficiency, and electrification, including adopting heat pump technology. The Climate Action Plan notes that by focusing on small-scale renewable energy initiatives, the need for fossil fuels could be reduced.

Hazards, Vulnerabilities, and Risks

About 60% of Burien's housing stock was developed 50 years or more ago. Typically:

- Older buildings tend to have lower insulation levels and overall efficiency compared to newer buildings construction under more stringent energy code.
- Upgrading windows or enhancing insulation contributes to improving the energy efficiency of buildings, yielding benefits throughout the year. PSE offers a weatherization assistance program and Seattle City light a HomeWise weatherization program.[5]
- Many commonly used landscaping trees, shrubs, and grasses lack tolerance to drought, flooding, heat, pests, or disease.

Much of the power distribution infrastructure is above ground and with climate exacerbated events (extreme precipitation, coastal flooding, extreme heat) could be at risk of damage. The City has a requirement to underground new and rebuilt facilities like electrical and communications services. (BMC Chapter 12.40 Utility Undergrounding Policy)

[5] See: https://www.burienwa.gov/residents/resident_resources/utilities/utility_bill_assistance.

Gaps and Opportunities

Burien regulates buildings and construction, enforcing energy codes. The Climate Action Plan, adopted in 2021, provides strategies to decarbonize buildings, increase energy efficiencies in buildings and homes, and increase the amount of renewable energy used in Burien.

Multifamily homes are inspected as part of a rental housing safety inspection program. While the focus is on safety the ability to heat a unit, have weather tight windows and doors, and have proper electrical systems is part of the checklist.[6]

Policy Review

Based on a review of Comprehensive Plan policies and the Climate Action Plan strategies, recommendations include:

- Integrate Climate Action Plan strategies into the Comprehensive Plan. These are highlighted in the priorities and implementation table below, and were developed by K4C.
- Address climate resilience and conservation for buildings and sites in a policy about City management of city capital facility management.

Priorities and Implementation

The K4C/Cascadia team reviewed Comprehensive Plan Sustainability policies and Climate Action Plan strategies and suggested additions to Burien's sustainability goals and policies primarily by integrating Climate Action Plan strategies. The Comprehensive Plan team reviewed other Comprehensive Plan policies. These ideas are reflected in Exhibit 25.

Exhibit 25. Potential Strategies: Buildings and Energy

Key Approach	Strategy	Impact	Implementation	Alignment
Advance the decarbonization of buildings*	Adopt or exceed the Washington State Clean Buildings Act	High K4C	High Leverage Building Code	High Climate Action Plan, K4C
Increase energy efficiencies in City-owned buildings and other City infrastructure*	Conduct energy audits in City buildings	Medium	Medium	High Climate Action Plan, K4C
	Renewable energy for City operations*	High	Medium	High Climate Action Plan, K4C

[6] See: https://www.burienwa.gov/city_hall/laws_regulations/renting_in_burien/rental_housing_inspection_program.

Key Approach	Strategy	Impact	Implementation	Alignment
Transition to the use of renewable energy to eliminate fossil fuel use whenever possible*	Evaluate barriers homeowners face in shifting to renewable energy	Medium	High	High Climate Action Plan, K4C
	Increase community knowledge about renewable energy and energy efficiencies*	Medium	High	High Climate Action Plan, K4C

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

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Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

***** K4C/Cascadia Review of Comprehensive Plan Sustainability Policies (existing) and review of Climate Action Plan Strategies for inclusion.

Cultural Resources & Practices

Methods and Assumptions

This section examines the projected impacts of climate change on Burien's cultural and historic resources and practices, such as archaeological sites, historical buildings and landmarks, heritage sites, and arts and culture festivals. Climate change projections of concern for this sector include sea level rise, increasing stream temperatures, increased extreme precipitation and associated flooding events, and increases in extreme heat events.

The City of Burien has experienced several rapid demographic shifts in response to economic growth over the last few decades, creating a more multicultural and diverse city.

Hazards, Vulnerability, and Risks

Physical and Social Assets

Prior to White settlement, Burien was part of "winter towns inhabited by Lushootseed-speaking peoples, including the Duwamish, Suquamish, Muckleshoot, and Puyallup." (DeCoster, Burien — Thumbnail History 2013) The Treaties of Point Elliot and Medicine Creek in 1854 established reservations of land for signatory tribes with the ability to continue fishing, hunting, and gathering off-reservations. (The Muckleshoot Indian Tribe 2023) Tribal members moved from their original homelands to the reservations, and White settlers took over non-reservation lands:

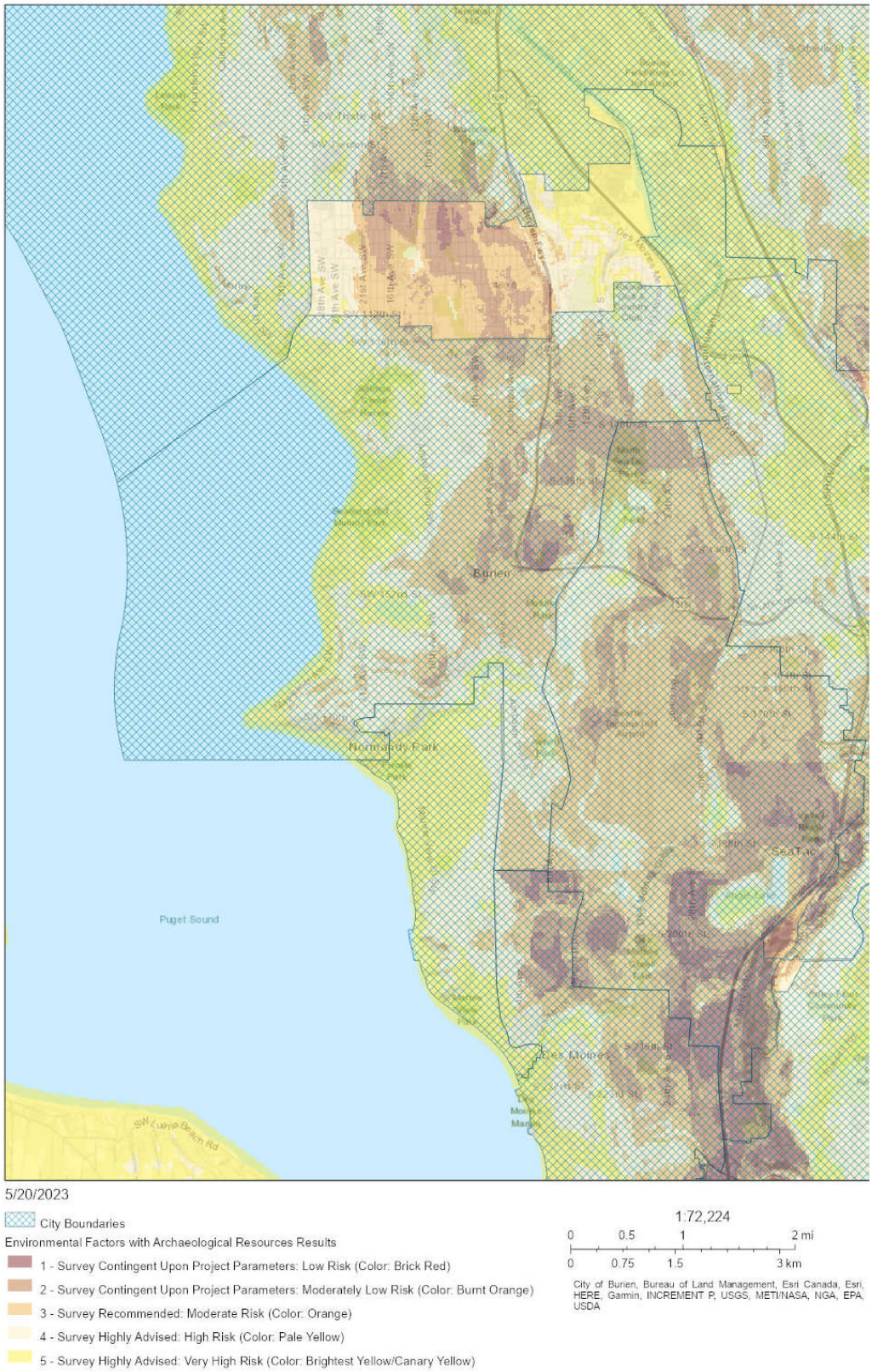
> *Following the establishment of the Muckleshoot Reservation in 1857, and as pressure from settlers increased, Indian people moved from their traditional villages throughout the Duwamish/Lake Washington and Upper Puyallup drainages to the Muckleshoot Reservation. (The Muckleshoot Indian Tribe 2023)*

The Muckleshoot Indian Tribe is a federally recognized tribe that are descendants of the Native people who inhabited the Duwamish and Upper Puyallup watersheds. The Tribe identifies its geographic area of interest to includes all Watershed Resource Inventory Areas 8, 9 and 10, which are the Lake Washington, Green-Duwamish & White-Puyallup River Basins. (The Muckleshoot Indian Tribe 2020) This includes the entirety of Burien which is in the WRIA 9 basin.

The Duwamish Tribe is seeking federal recognition and considers its aboriginal territory to include Seattle, Burien, Tukwila, Renton, and Redmond. (Mapes 2022)

The Tribes utilized Burien waterways for fishing, hunting, and trading, while the forests and bogs provided resources for hunting and gathering. The likelihood of archaeologic resources is higher around areas subject to sea level rise and landslide risks. See Exhibit 26.

Exhibit 26. Potential for Archaeological Resources



Source: Washington Department of Archaeology and Historic Preservation (DAHP), WISAARD, 2023.

All of the state's marine shorelines are considered a Maritime Washington National Heritage Area; a management plan was approved in 2022 by the Secretary of the Interior with goals, strategies, policies, and plans including funding, but there are no regulations. There are two unknown shipwrecks adjacent to Three Tree Point.

With White settlement, Burien's historic settlement patterns was characterized by agricultural production and beach communities along "Salt Water" (Puget Sound). The beach communities were served by the Puget Sound "Mosquito Fleet" of steamships, connecting Burien to larger cities like Seattle and Tacoma. The development of beach communities was driven by the desire of Seattle's wealthy families for summer retreats and camps. In 1895, Seattle merchants purchased land at Three Tree point, which was referred to as Point Pully on navigation charts. The initial road constructed in Burien was Military Road, which connected Fort Steilacoom to Seattle. Completed in 1860, it continues to exist today. Settlers established offshoots from Military Road to access their properties. (DeCoster, Burien — Thumbnail History 2013)

Properties eligible for inclusion on state and federal historic registers include the Burien Community Center and St. Elizabeth Episcopal Church (DAHP, WISAARD, May 2023); other structures in Burien are at least 50 years old and depending on significance and condition could be eligible over time.

Culturally important sites for residents could include faith-based centers. City spaces in the Burien Town Center also host community cultural events and celebrations. Burien has a designated Creative District supporting of innovation and creativity anchored by Downtown.[7]

Hazards, Vulnerabilities, and Risks

Cultural and Community Centers and Events

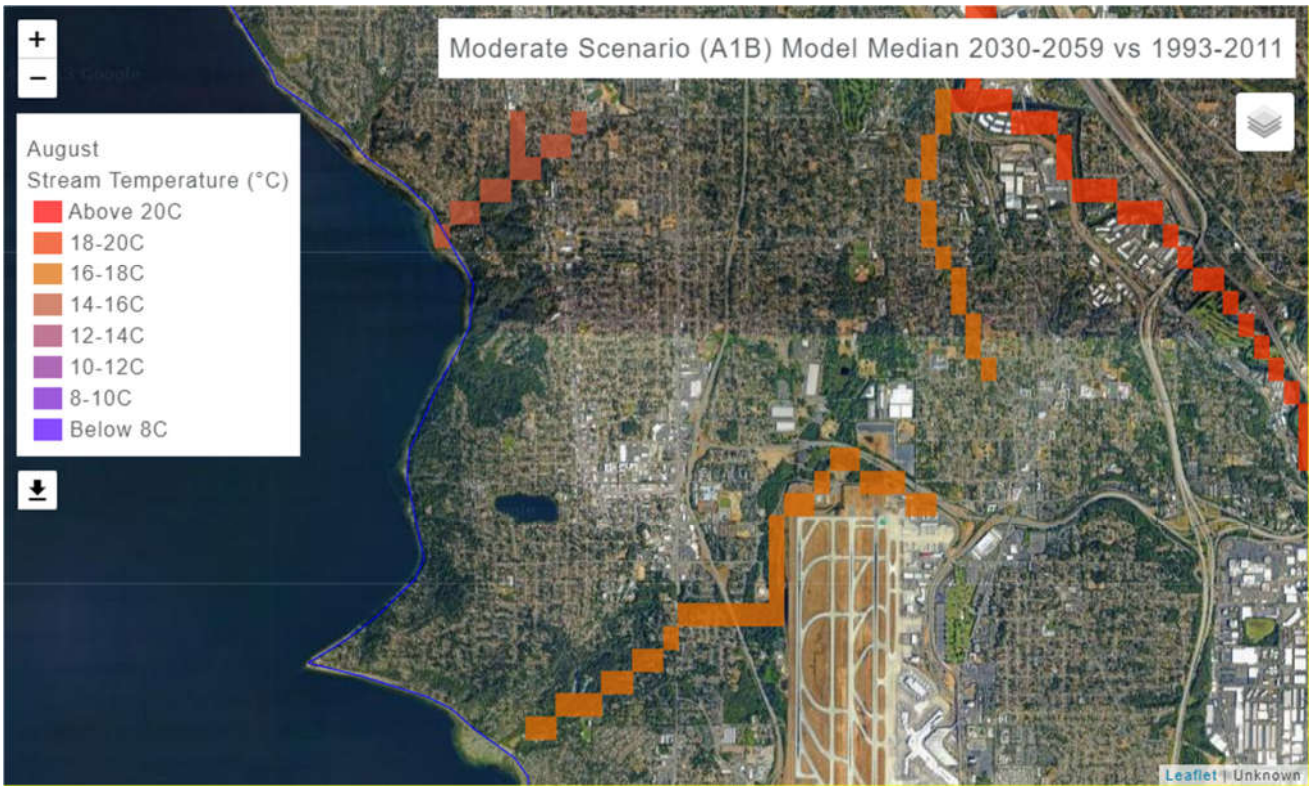
- Burien is host to many multicultural celebrations and events. Depending on circumstances, these events may be vulnerable to climate change impacts. Events held outside or in venues with exposure to climate change impacts may be affected by extreme heat or smoke.

Cultural Landscapes and Natural Resources

- Ecosystem health is intractably connected to human and cultural health in Native American worldviews (UW CIG 2018). Further damage or degradation of natural areas that exist within Burien threatens this already diminished aspect of cultural well-being for Indigenous individuals residing in and originating from the area. For example, lower stream flows and greater water temperatures in summer could harm fish and aquatic species. See Exhibit 27.

[7] See: https://www.burienarts.org/

Exhibit 27. August Stream Temperatures (2030-2059 Moderate Greenhouse Gas Scenario)



Source: (University of Washington Climate Impacts Group 2022)

Gaps and Opportunities

Archaeological sites may represent a greater vulnerability and need for protection and adaptation to sea level rise and erosion. Salmon and other species important for tribal culture may also be vulnerable. Salmon populations in the Salish Sea are already threatened by human disturbances to the environment. Compounding exposures from climate change impacts means adaptation for salmon populations is difficult, though many organizations and governments are aligned in their efforts to support and restore these populations.

Across Burien, including in coastal flooding areas, there are properties inventoried in the DAHP database with no eligibility determination. The City could commission local evaluations or incentivize property owner eligibility evaluations.

There may be a need to adapt cultural spaces and historic structures to provide cooling and clean air systems. Other undesignated but eligible sites along the shoreline may exist over time and have other adaptation needs.

Policy Review

Based on a review of existing Comprehensive Plan policies areas of focus could include:

- Adding reference to climate resilience / adaptation strategies to policies regarding tourism and cultural events in the Economic Development Element.

- Addressing ecosystem protection and enhancement to protect culturally important resources in policies.
- Integrating Climate Action Plan strategies around community education and investments to support overburdened communities.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Cultural Resources.

Exhibit 28. Potential Strategies: Cultural Resources

Key Approach	Strategy	Impact	Implementation	Alignment
Ecosystem restoration to protect culturally important resources	Protect, enhance, and restore ecosystems in order to meet tribal treaty rights and conserve culturally important consumptive and non-consumptive resources including foods, medicinal plants, and materials that could be adversely impacted by climate change.	High, Menu of Measures	Medium	High
Protect vulnerable archaeological sites	Establish and maintain government-to-government relations with Native American tribes for the preservation of archaeological sites and traditional cultural properties that are vulnerable to climate impacts.	Medium	Medium	Medium
Identify historic properties in coastal flood areas and protect as needed	Identify eligible historic properties in costal flood areas and protect significant historic sites prone to floods or other hazards worsened by climate change.	Medium	Medium	Medium
Incentivize cultural space adaptation	Incentivize climate adaptation / weatherization of important cultural and economic centers (e.g., faith-based buildings, arts centers, other).	High Energy efficiency in retrofits (Menu of Measures) Reuse of buildings reduces emissions.	Medium	High Washington State Energy Strategy Climate Action Plan

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support.

Economic Development



Burien Creative District



Five Corners: Auto Sales

This section addresses businesses in Burien and opportunities for advancing green technology as well as the potential for disruptions to the business economy due to climate exacerbated events, e.g., extreme precipitation and flooding, extreme heat, and smoke.

Methods and Assumptions

- Association of Washington Cities, 2021. Climate Resilience Handbook: Preparing for a changing environment. Available: www.cfqc.org/wp-content/2021/06/ClimateHandbook.pdf.
- BERK, Burien Housing Policy Evaluation, Racially Disparate Impacts, Displacement, and Exclusion in Housing, Draft, March 2023. https://burienwa.civicweb.net/filepro/documents/81475/?preview=81476.
- Burien Creative District: https://www.buriencreativedistrict.com/ and https://www.arts.wa.gov/burien/.
- Economic Development Research Partners, International Economic Development Council, January 2021. Economic Development in a Changing Climate: Minimizing Risks and Maximizing Opportunities. Available: https://app.hubspot.com/documents/19924342/view/477812481?accessId=605f5f.
- Heartland, Zoning Propensity Analysis, presentation to Burien Economic Development Partnership, April 2023.
- Office of the Insurance Commissioner, Washington State, 2022: 2022 Climate Summit Series: https://www.insurance.wa.gov/2022-climate-summit-series.
- US Environmental Protection Agency, 2021, Climate Change and Social Vulnerability In The United States: https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.

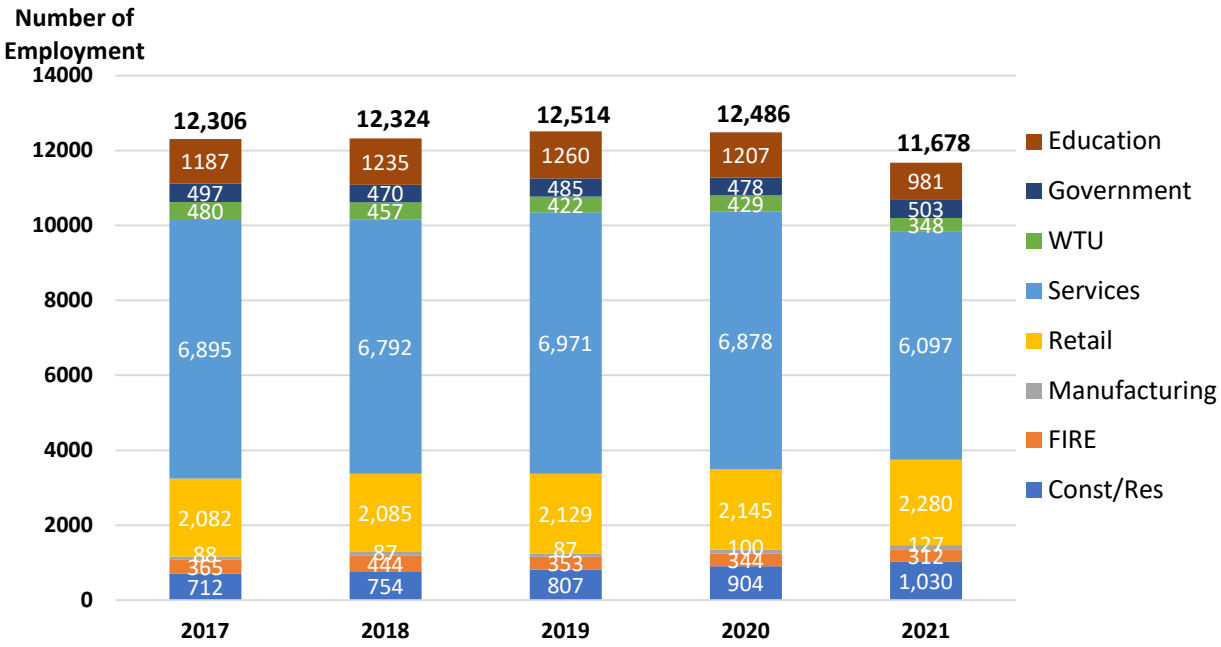
Hazards, Vulnerability, and Risks

Physical and Social Assets

Changes in climate due to extreme heat, extreme precipitation, wildfire smoke, and other events can affect Burien's economy by disrupting business continuity, increasing insurance costs, disrupting supply chains, altering the timing and rate of construction, increasing infrastructure costs, and other aspects of the economy. It can also present opportunities with increased demand for environmentally sensitive products and services, greater investment in green and low carbon technologies, improved local production and supply, and economic demand in areas with lower climate risks.

Burien's Job Sectors: As of 2021, Burien has nearly 11,700 jobs. See Exhibit 29.

Exhibit 29. Burien Total Covered Employment, 2017-2021



Source: Heartland, PSRC, ESD, 2023.

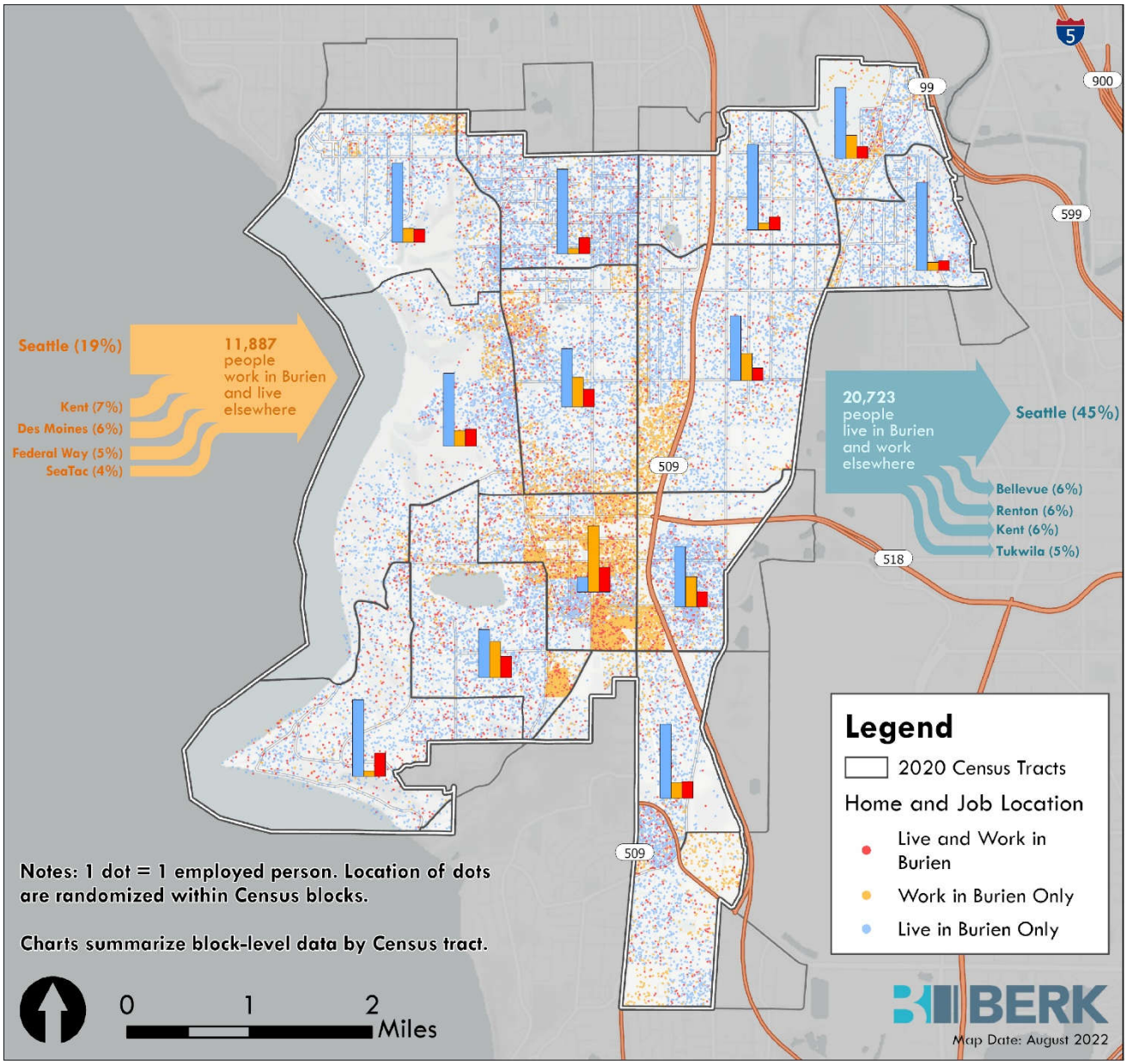
Burien's local jobs are primarily services and retail oriented. Retail and construction industries have seen a growth of 2% between 2017 and 2021, while employment in finance, insurance, real estate, manufacturing, and government has remained stable. Burien has an industrial district near the airport. Industrial jobs make up a relatively smaller share of its job mix.

Burien has also increased its emphasis on cultural arts and achieved designation as a creative arts district in Downtown and Boulevard Park. This includes both indoor and outdoor cultural events. These events could be impeded by increasing summer heat and wildfire smoke or other events, and may make indoor venues more important.

As noted in Exhibit 13 Burien has a greater share of jobs in the construction industry compared to King County. These jobs along with others like parks and public works maintenance could be exposed to extreme heat or smoke, and limited from their work during such events.

Most of Burien's population commutes out of Burien to jobs in Seattle and South King county. There is a concentration of jobs with people who live and work in Burien in Downtown, First Avenue, and Ambaum Boulevard. See Exhibit 30. Access to SR 518, SR 509, and SeaTac Airport is essential for the community.

Exhibit 30. Job Inflow/Outflow Locations in Burien, 2019 (All Primary Jobs).



Sources: Longitudinal Employer-Household Dynamics, Origin-Destination Employment Statistics, 2019; BERK 2022.

Hazards, Vulnerabilities, and Risks

Burien and the region are expected to experience more days of extreme heat, increases in extreme precipitation, and increases in frequency or extent of flooding. Broad effects across the city could include:

- **Increased disruptions of business continuity from hazards.** Business disruptions could include closures because of climate events affecting customers or employees. For example, with extreme heat, the region saw retail and restaurant business closures, restrictions on recreation and outdoor work, as well as greater demand for spaces with air conditioning.
- **Increased insurance premiums due to more extreme weather.** Insurance coverage rates or mortgage interest rates could increase for properties at greater risk of exposure, and conversely lower rates in areas with lower risks. Washington State's Office of the Insurance Commissioner has coordinated with other national efforts to address future risks.
- **Impacts on business infrastructure.** The intensity and frequency of storms could affect roads, stormwater systems, and result in greater costs to the city or businesses or commuters in/out of Burien.
- **Shifts in business opportunities.** There could be growth in businesses that promote renewable energy and low carbon technologies consistent with the city's sustainability goals.
- Increasing cost of building energy, e.g., cooling space.
- Disruption of supply chains.
- Potential losses of businesses or employment and recovery after an event.

In addition to business disruption during and after extreme climate events, some workers could be more affected by climate events than others. The US EPA has identified that Low income households and Hispanic and Latino individuals are more likely to live in areas with the highest projected labor hour losses in weather-exposed industries due to climate-driven increases in high-temperature days. Burien has a relatively high share of lower income households, higher shares of population that self-identify as Hispanic or Latino, and higher shares of construction jobs than the county.

Gaps and Opportunities

Burien has over 1,800 businesses, mostly located in commercial zones as well as home-based businesses in residential areas. Most are in retail, food, and services. Burien's businesses have grown and changed over time in existing buildings built prior to modern energy codes such as in Downtown, First Avenue S, Ambaum Boulevard S and Boulevard Park. Newer mixed use buildings in Downtown reflect design standards that increase pedestrian comfort with awnings. There is a need for commercial building weatherization of existing properties that may not redevelop for some time, and there could be exterior improvements to increase comfort of pedestrians and visitors.

While climate change has the potential to negatively affect Burien businesses, there are also opportunities to increase "green economic development."

- Strategies to reduce greenhouse gas (GHG) emissions, transition to clean energy, and adapt to climate change will drive new green economic development. Energy, water, transportation, agriculture, building materials, health care, technology, and other economic sectors are likely to experience new green economic activity in response to climate change. Markets for new green economic development technologies, goods, and services are global. (Association of Washington Cities 2021)

- Local or smaller business options could include eco-friendly retail or services (beauty salon, landscaping, sustainable construction materials, organic catering, bike repair, handmade natural products, organic farmers market vendor, green housekeeping, upcycled furniture, secondhand stores, etc.). (Max Freedman 2023)

Other noted opportunities include:

- Leverage small business programs to address employee commuting options, emergency preparedness communication, business disaster planning, and other activities.
- Recognize shifts in tourism dollars from jurisdictions losing recreational opportunities to jurisdictions gaining opportunities. (Economic Development Research Partners 2021) Tourism and recreation are part of the City's desired economic sectors; the Creative Arts District reflects that. Outdoor recreation could be limited in extreme climate events such as heat and precipitation, but could be increased indoors where temperature is regulated such as at museums, theaters, libraries, or other indoor venues.

Policy Review

A review of policies by the Comprehensive Plan team and K4C resulted in recommendations to strengthen existing goals and policies, including:

- Adding specificity about climate risks and business protection and recovery.
- Providing resources for cooling and clean air adaptation.
- Coordinating with businesses regarding emergency preparedness.
- Investing in increasing green jobs and attracting environmentally friendly businesses.
- Incorporating Climate Action Plan strategies for GHG reduction.
- Addressing adaptation in capital facilities projects to support Burien's local economy and commuters.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Economic Development.

Exhibit 31. Potential Strategies: Economic Development

Key Approach	Strategy	Impact	Implementation	Alignment
Enhance climate resilience of Burien's businesses and districts	Encourage design features in commercial and employment districts to integrate exterior building features (e.g., awnings, cool roofs, solar panels) that reduce the impacts of climate change.	High Menu of Measures	High	High Urban Center Plan
	Incentivize weatherization, energy efficiency, and passive survivability in commercial and mixed use construction.	High Menu of Measures	High Leverage City business programs. Offer grants or incentives.	High Burien Business Resources
	Support local businesses' efforts to generate and store renewable electricity on-site, which can provide back-up power during emergencies and help ensure continuity of operations.	Medium	Medium Update building codes and offering tax incentives or grants.	High
	Promote climate-resilient designs of public parks and gathering spaces in support of recreation and cultural events.	See Parks, Open Space, Food Systems		
Support Burien's economic growth	Encourage the development of climate-resilient and green technology businesses and industries.	Medium	High Leverage City business programs.	High State Energy Strategy and Clean Energy Fund Port of Seattle Clean Energy Future

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

Emergency Management

This section examines the City of Burien's capacity to respond to the impacts of climate emergencies.

Methods and Assumptions

Burien's adopted comprehensive emergency management plan has a three-tiered approach: Preparedness/Mitigation, Response, and Recovery. (City of Burien 2022)

- Preparedness/Mitigation identifies education, training, and plan development as paramount in ensuring clear and organized instructions in the event of an emergency.
- The Response section establishes a chain of command after the incidents lead agency has been identified based on the nature of the emergency. The Director of Emergency management (City Manager) and the Emergency Manager (Public Works Director) are the primary staff for the City's emergency management program. The Director is also responsible for engaging partner agencies when the emergency response needs to extend beyond Burien's capacity.
- The Recovery section of this plan assigns a chain of command including all partners to ensure recovery tasks are completed and essential services are restored.

Examples of emergency resources include emergency medical services, police services, severe weather shelters, mutual aid services, and utility services. Climate change hazards that are predicted to continue and worsen in the City of Burien include extreme heat, sea level rise, extreme precipitation resulting in flooding, landslides, and road hazards, and low air quality index days resulting from regional wildfires. See Section 2. These climate hazards and their associated effects put vulnerable communities at increased risk of health emergencies and displacement and require increased access to emergency service providers.

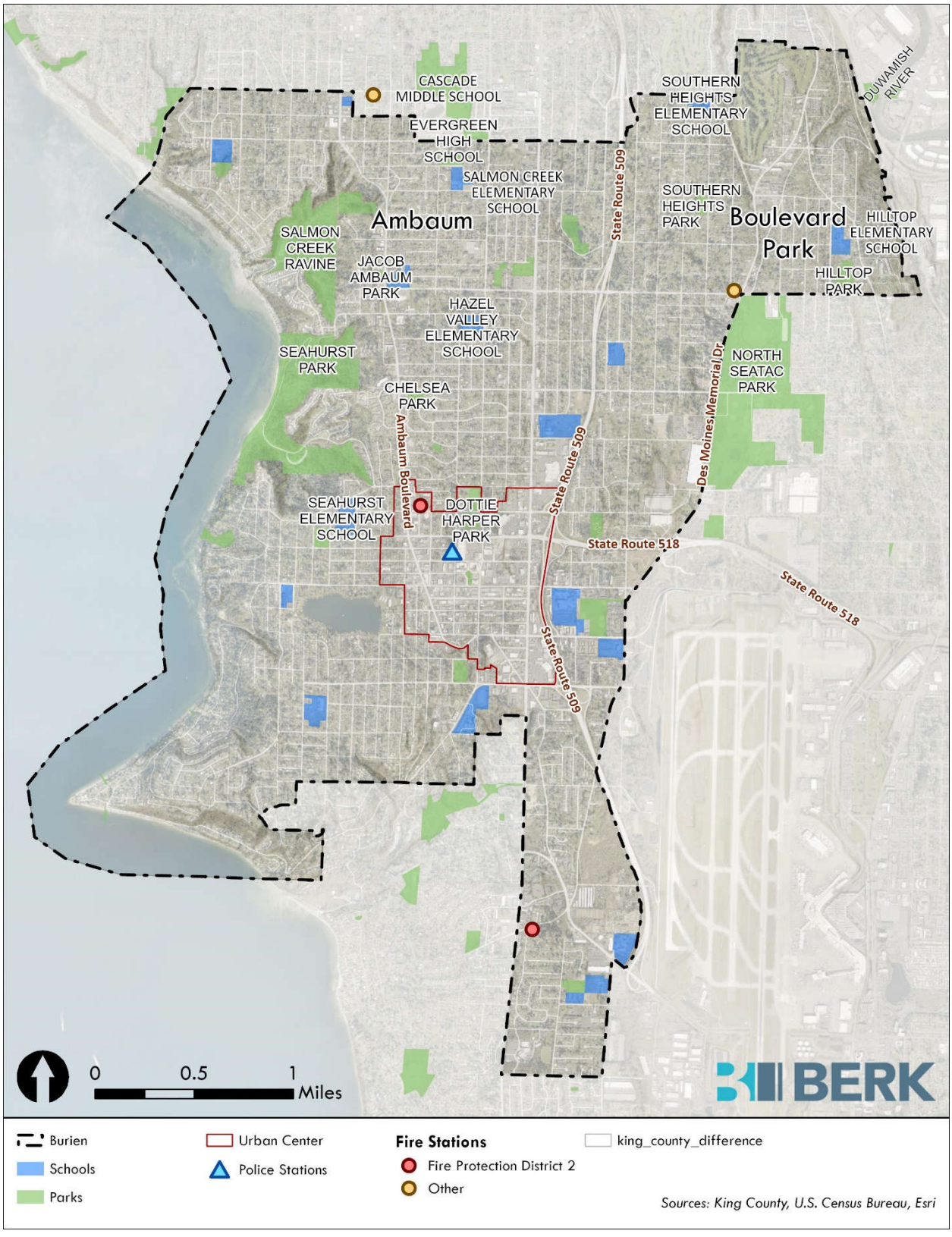
Hazards, Vulnerability, and Risks

Physical and Social Assets

Emergency Service Providers

Per the City of Burien Comprehensive Emergency Management Plan (CEMP) "Burien's professional services such as Police, Fire and EMS are provided by King County Sheriff's Office and King County Fire Protection District #2, respectively. Advanced Life Support Services are provided by King County Medic One." A map of fire and police facilities is shared in Exhibit 32 below.

Exhibit 32. Burien Area Fire Station and Police Facilities



Source: King County, BERK 2023.

Emergency Facilities

Healthcare Facilities

The only hospital located in Burien with an emergency department is St. Anne's Hospital. Major medical emergencies are required to be transferred to larger medical facilities in neighboring jurisdictions.

Police Stations

The City of Burien contracts with the King County Sheriff's Department for police services and these officers operate out of King County Sheriff's Office precinct #4 Burien Station. See Exhibit 32. Officers within the sheriff's department may also operate outside of their home precincts in the event of emergencies that require more officers.

Roadways

The City of Burien has access to State Route 509 as well as several arterial roads and residential streets. Roadways and stormwater facilities are managed by Burien Public Works.

Extreme Weather Shelters

Burien Community Center serves as the main extreme weather and emergency medical center for the city. Beaches operated by the Burien Department of Parks and Recreation such as Seahurst Park may be used by many residents and visitors to address extreme heat and may pose additional health risks.

Hazards, Vulnerabilities, and Risks

Extreme Heat

Burien is expected to experience more common and more severe extreme heat days because of climate change. This hazard presents a threat to vulnerable populations through the city and will strain existing resources and require additional investment in emergency mitigation strategies. The impacts to emergency management are as follows:

- Increased energy use for in house climate controls and air conditioning may result in more power outages. These power outages may leave many without air conditioning, refrigeration, and access to necessary medical equipment. These interconnected issues may exacerbate health outcomes as they relate to extreme heat and increase demand for basic life support services, advanced life support services, and cooling centers. See also Buildings & Energy.
- Increase in the number of acute medical emergencies that require EMS response such as heat exhaustion, heat stroke and acute severe dehydration especially in vulnerable populations such as the elderly, young children, and those with pre-existing medical conditions. (DeVine, et al. 2017) (CAPA Strategies 2021)

- The increased occurrence of heat waves will place a greater burden on Washington state's healthcare system as heat-related hospitalizations are expected to rise in response to a 67% increase in heat-related illnesses and deaths projected to occur. (Rachel Ross 2022)

Extreme Precipitation or other Short Term Weather Events

Extreme precipitation and its associated hazards as possible strains on infrastructure and existing emergency management facilities could include:

- Road hazards that can decrease response times for emergency calls and lead to worse health outcomes during acute extreme weather events (U.S. Department of Transportation). Related to climate change trends, road hazards can result from extreme precipitation in the following ways:
- Increased flood risk
- Increased landslide risk onto roadways
- Heightened landslide risk in areas near the coast in the bluffs such as Inglesea and Seahurst neighborhoods puts residents at risk of landslide related emergencies such as fires, medical emergencies, and power outages that require multi-departmental response.
- Fallen trees and other debris can injure, lead to power outages, and cause roadway hazards that may increase response times for EMS and other emergency personnel such as police, fire, and utilities workers.

Many of the risks associated with the extreme precipitation climate hazards are associated with a lack of mobility due to possible impacts to the cities roadways and transportation systems. These risks can stop individuals from reaching emergency services, shelters, or medical care in personal vehicles or with public transportation and can also increase response time from emergency personnel in the event of a concurrent emergency.

Air Quality and Wildfire

While the City of Burien is not at high risk for wildfires within city limits, emergency services are still necessary to mitigate the downstream effects of wildfires on at risk communities (US Environmental Protection Agency 2022).

- Wildfire smoke pose an extreme health hazard that may require acute medical response for individuals with asthma or other respiratory illnesses.
- Demand for clean air shelters and associated emergency services may exceed capacity, staffing, and resources.
- Long term health conditions from exposure to low air quality may put unprecedented chronic strain on emergency services even during non-emergencies.

Gaps and Opportunities

Burien Emergency Management – Facility and Operational Improvements

The City of Burien has identified certain gaps in their CEMP mostly relating to capital facilities, staffing, and equipment that may hinder the City's ability to respond to climate related emergencies. Opportunities to address and alleviate these deficiencies have been identified and should be incorporated into future emergency management planning especially in response to climate related hazards.

One identified gap is the size of Burien's Public Works Facility that does not have the storage space for additional emergency equipment that alleviates the impacts of climate hazards identified in the previous section. The Burien Department of Public Works may be identified as the lead agency per the emergency chain of command and without adequate facilities to house equipment, resources and personnel, response times and emergency response times may suffer.

Another opportunity in Burien's capital facilities used for emergency management is the Burien Community Center. This facility serves as an inclement weather center, a mass care center, and a response and recovery center in the event of emergencies. The City has noted that although this facility currently meets capacity needs for these services there are concerns about the increased dependence on the Burien Community Center for inclement weather protection in the case of an earthquake (City of Burien 2022). The building has not been deemed seismically unsafe but rather does not have documentation on the structural soundness in the event of a catastrophic earthquake.

The Burien Community Center serves as an effective resilience hub for the community. The City has identified it in the Burien Annex to the Regional Hazard Mitigation Plan for a post-disaster essential facility. It may also be useful as a cooling or clean air center, or place that provides central information, power, and supplies before, during, and after events. There are also a need and an opportunity to add additional cooling centers, clean air shelters, or other post disaster centers to the city,

- Strategy #BU-2-15 – Structural Evaluation of the Burien Community Center: Evaluate the Burien Community Center and make a recommendation on necessary retrofits or replacement for use as an essential facility following a disaster.

Burien has also noted that a major power outage would severely impact the Burien Community Center as there is not currently a power generator for this facility. Any event caused or worsened by climate change that results in a power outage would severely impact emergency management and emergency response. The City of Burien is seeking to equip the community center with power generators to combat this deficiency in their emergency response. Relatedly, the City has commissioned a study to assess needed seismic retrofits so the Community Center can be used as an emergency shelter. (City of Burien 2022)

The final two gaps in Burien's climate change emergency response are the staffing deficits experienced by city departments required for the chain of command. While EMS, Fire, and Police services are not documented as experiencing staff shortages, shelter staff and a dedicated emergency manager are positions that are required and unfilled or understaffed as of 2022. The policy that the City has in place requires an emergency manager to dictate a lead agency and coordinate interdepartmental and interjurisdictional emergency response in the event of a disaster or emergency.

Shelter staff are required to operate the extreme weather and mass care shelters but lack the training opportunities and capacity to hire and retain staff for these positions.

Overall, Burien has gaps in their emergency response but each one presents opportunities to fill this gap and ensure their preparedness, response, and recovery goals in the CEMP.

Extreme Heat Mitigation

Recommended actions to address the consequences of extreme heat include ways to cool urban environments, providing early warnings, and ensuring broad community's awareness of health impacts and risks with easy to access accessible indoor cooling spaces: (Rachel Ross 2022)

- Adding green spaces within the built environment through urban planning: Vegetation and tree canopy in cities emits an urban green space cooling effect, with reduction in daytime temperatures averaging about 33°F within these spaces. Adding more green spaces to urban areas can reduce human exposure to extreme temperatures and UV radiation, reduce ozone levels, and provide a cooling effect through the processes of evaporation and transpiration. These processes alone can reduce summer heat temperatures by 2–9°F, especially when the vegetation is included in urban planning efforts and is planted strategically to provide optimal shade to frequently trafficked areas.
- Improving regional surveillance strategies to enhance early heat warning systems: Early warning systems can lower rates of heat-related mortality and morbidity. Defining heat waves by using local meteorological data and using local epidemiologic data could better enable communities to appropriately deploy public health resources and facilitate a proactive emergency preparedness response.
- Tailoring education interventions to increase awareness of the health impacts of heat waves as well as public resources to decrease those impacts. Populations with vulnerability to extreme heat may not be aware of their own risks. Researches have also found that those who are vulnerable may be unaware of cooling centers locations, or limited by spaces that are not easily accessible (e.g., access by public transport or walking), whether pets were allowed, and whether food was provided. Providing information that is accessible and simple to understand regardless of education level or language spoken.

Policy Review

Below are policy recommendations that could help the City reach preparedness, response, and recovery goals and address likely climate change hazards and subsequent emergencies.

- Integrate CEMP recommendations into the Comprehensive Plan, such as facility improvements in the Burien capital facility plan.
- Integrate Climate Action Plan strategies to plan for climate change and to build community awareness of risks and strategies.
- Use heat island and locations of vulnerable populations to prioritize tree canopy installation and to plan for expanded park spaces.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and emergency management. See also the strategies to increase tree canopy and parks in Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Parks, Open Space, and Food Systems.

Exhibit 23, and improvements to the community center and other locations as resilience hubs in Exhibit 34.

Exhibit 33. Potential Strategies: Emergency Management

Key Approach	Strategy	Impact	Implementation	Alignment
Accessible evacuation materials	Create template evacuation plans and outreach materials to help residents plan and practice actions that make evacuation quicker and safer. Ensure materials are accessible in different formats and languages.	High Menu of Measures	High	High Climate Action Plan CEMP
Improved data collection	Support enhanced data collection for hazard events of all magnitudes to provide a fuller understanding of the community's hazard characteristics — including those affected by climate change.	Medium	High Leverage	Medium

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

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Human Health

This section addresses community health and well-being and climate resilience engagement.



Burien 2044 Youth Engagement – April 2023

Methods and Assumptions

This section addresses climate change effects on human health based on local demographic information shared in Section 2, and literature and professional sources:

- DeVine AC, Vu PT, Yost MG, Seto EYW, Busch Isaksen TM. A Geographical Analysis of Emergency Medical Service Calls and Extreme Heat in King County, WA, USA (2007–2012). *International Journal of Environmental Research and Public Health*. 2017; 14(8):937. https://doi.org/10.3390/ijerph14080937
- Ebi, K.L., J.M. Balbus, G. Luber, A. Bole, A. Crimmins, G. Glass, S. Saha, M.M. Shimamoto, J. Trtanj, and J.L. White-Newsome, 2018: Human Health. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R.

Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 572–603. Doi: 10.7930/NCA4.2018.CH14. Available: https://nca2018.globalchange.gov/chapter/14/.

- US Environmental Protection Agency, 2021, Climate Change and Social Vulnerability In The United States: https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.
- US Environmental Protection Agency. 2022. "Climate Change Impacts on Air Quality." December 13. https://www.epa.gov/climateimpacts/climate-change-impacts-air-quality.
- Yu et al. University of British Columbia. Geospatial indicators of exposure, sensitivity, and adaptive capacity to assess neighborhood variation in vulnerability to climate change-related health hazards Environmental Health (2021) 20:31. doi.org/10.1186/s12940-021-00708-z.

In addition, spatial information and sources associated with the University of Washington Climate Impacts Group *Climate Mapping for a Resilient Washington* and the Burien Climate Vulnerability Index (Section 2) were considered.

Hazards, Vulnerability, and Risks

Physical and Social Assets

Human health is influenced by many social, environmental, and economic factors. Climate change hazards such as extreme heat, exposure to hazards, disruption of health services, and poor air quality are detrimental to the health and well-being of Burien's population.

The Burien Climate Vulnerability Index identifies at risk groups such as children under 5, the elderly, and those with chronic illnesses such as COPD, asthma, or heart disease. Other social indicators including poverty, race, linguistic isolation, living alone, and other factors may limit engagement, preparation, or response to climate hazards. By addressing these health and social factors that make someone sensitive to climate hazards Burien can adopt and improve policies to increase community well-being for the most vulnerable in the City. (Ebi 2018) (EPA 2021) (Yu, et al. 2021)

Areas with populations vulnerable to climate stressors – age, health, socioeconomics – are more likely to be living in areas between 1st Avenue South and Ambaum Boulevard north of SW 126th Street, Boulevard Park to the northeast, and the Sunnydale area around Highline High School. See Exhibit 17, Exhibit 19, and Exhibit 21.

Hazards, Vulnerabilities, and Risks

Extreme Heat

Extreme heat and increased average summer temperatures are expected to increase concentrations of air pollutants such as Ozone. It can also increase risks for certain vector borne illnesses such as West Nile Virus due to the increased prevalence and longevity of insect vectors or water-based viruses (Ebi 2018).

The increased likelihood of 90°F max humidex (heat and humidity combined) days also poses a risk to vulnerable populations such as the elderly, children under five years old, and those with pre-existing health conditions, and increase demand for fire and emergency medical services. (DeVine, et al. 2017) These individuals are at a higher risk of heat exhaustion, severe dehydration, and heat stroke because of increased temperatures. In response to high temperatures, there is a possible positive feedback loop of increased power grid demand that can eventually lead to power outages and even worse human health outcomes as a result. Extreme heat is worsened by the Urban Heat Island effect and is a risk factor in the City of Burien (CAPA Strategies 2021).

Extreme Precipitation

Periods of extreme rainfall can increase the likelihood of flooding and the associated health impacts of standing water in homes, businesses, and public rights-of-way. Coastal flooding is a key risk; there are homes in the northwest and Three Tree Point areas, though most of the shoreline is in parks and open space use. Some populations in the west side of the community are less at risk due to incomes and employment status but the area includes older populations with some health risks.

Inland flooding hazards are not a major risk identified in Burien, but increased precipitation combined with inundation of flood management and stormwater management resources may increase the risk of this specific hazard. Certain water borne illnesses may also impact those living or working within Burien's small flood plains depending on the length and severity of the precipitation event (NCA, 2018).

Extreme precipitation can also create dangerous travel conditions. This can not only create medical emergencies from vehicle accidents or slip-and-falls but can also limit individuals' ability to access their health services during these acute climate events. This can lead to injury and even death in certain situation depending on the type and severity of severe weather. These travel hazards can range from severe rain leading to flooding and landslides, to ice storms, and heavy snowfall that all pose a risk to road users. People who cannot work from home, especially those in service industries, would be most exposed to risks of falls and vehicle collisions (U.S. Department of Transportation).

Drought Conditions & Wildfire Smoke

Drought conditions throughout the Northwest United State and British Columbia have become more prevalent and severe in recent years. These conditions lead to extended wildfire seasons and associated air pollution and smoke which can worsen health outcomes. The region and Burien experience a number of smoke days each year where air quality, particulate matter and carcinogenic smoke impact residents and employees throughout the city (City of Burien 2021). These conditions pose a more severe public health threat to those with asthma, senior citizens, and children. There are other risk factors that can worsen the impacts of wildfires such as proximity to highway corridors and the associated air quality. The resulting health impacts could be new diagnoses of respiratory illness or worsening of existing respiratory illness such as asthma, COPD, and lung cancer (University of Washington Climate Impacts Group 2022).

While mental health is a far less studied impact climate of wildfire hazards, the climate vulnerability index does highlight this as a sensitivity indicator for climate vulnerability. Those with mental illnesses may feel the impacts of hazards more severely and the symptoms of certain mental illnesses can be exacerbated during wildfire smoke events (Eisenman and Galway 2022).

Gaps and Opportunities

Burien has the potential to increase resilience and support vulnerable populations through:

- Incorporating public health considerations into governance and planning efforts. Recently this has been demonstrated by:
  - Climate Action Plan adoption in 2021,
  - Recent Tree Code update to protect and replace trees on private lands in 2022, and
  - Ongoing Human Services Commission distribution of CDBG and other funds to non-governmental entities to support communities vulnerable to climate stressors.
- Continuing investments in healthy active living through parks and recreation programs and capital investments.
  - Access to healthy food, and support of the local food system, including community gardens.
  - Use of the community center and other facilities resilience hubs. See Emergency Management.
- To reduce the potential for emergency services providing information or incentives to property owners to ensure buildings are retrofitted or built to filter air and provide for cooling. (Urban Sustainability Directors Network (USDN), 2023)

Policy Review

There are several policies to combat human health hazards associated with climate change in both the Burien Comprehensive Plan and Climate Action Plan. One such policy in the Climate Action Plan highlights the need for dedicated outreach to increase awareness of the risks of wildfire smoke on human health. Other strategies would establish clean air shelters and emergency healthcare facilities to space for Burien residents to go in the event of an emergency. Policy CF 8.1 meets this need by stating that the City will site and design public facilities to protect and promote public health, particularly in areas with housing vulnerable populations. This policy addresses the need for public intervention and addresses housing vulnerability as an indicator of poor health outcomes and directly targets them in this intervention. It could be broadened to include climate resilience more directly.

There are also several policies that would address stormwater and flood risks that could worsen health outcomes in Burien. Overall, these policies fail to address specific hazards and mitigation strategies for their associated health risks.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Human Health.

Exhibit 34. Potential Strategies: Human Health

Key Approach	Strategy	Impact	Implementation	Alignment
Heat Reduction Strategy	Develop a heat resilience strategy — also called extreme heat response plan — could include heat mitigation and management actions that prepare for and respond to chronic and acute heat risk.	High Menu of Measures	High	High
Enhance climate resilience of parks and trails	Monitor and assess the risk of trails and parks for climate related safety hazards in recreational sites throughout Burien.	Medium	High	Medium
Resilience hubs (e.g., improved community center and adding additional sites)	Provide necessary improvements and staffing for the Burien Community Center and additional locations as they serve as the resilience hubs for cooling and clean air. Ensure community accessibility (e.g., transit) and awareness.	High Menu of Measures	High	High CEMP Hazard Mitigation Plan

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

Ecosystems

This section addresses terrestrial and aquatic species, habitats, and services in Burien and potential effects of climate change on them.

Methods and Assumptions

Vulnerability assessments typically rely on a synthesis of current best available scientific information to describe the degree to which the key resources, ecosystems, or other features of interest are affected (adversely or beneficially) by the variability of current climate or the potential changes in climate. The effect may be direct (e.g., reduced regeneration in response to increased temperatures) or indirect (e.g., damages caused by an increase in the frequency of wildfire or drought). Information and data assembled by the University of Washington Climate Impacts Group was compared to existing Burien policies and assets for this assessment.

> Ecosystem services are the benefits that humans receive from nature. These benefits underpin almost every aspect of human well-being, including our food and water, security, health, and economy. *US EPA in Model Climate Element Planning Guidance prepared by Commerce in March 2023*

Because existing information resources may not be able to fully describe the vulnerability for a specific location or geographic area, assessments include a more extensive analysis to explore a variety of future climates and their effects. Approaches to identify societal vulnerabilities to future changes in resources and ecosystems dynamics have used quantitative and qualitative methods. Consideration of the societal implications of climate change can provide a broader view of management challenges posed by climate change and may begin a discussion of the role of communities in the context of changing resources and ecosystems.

Vulnerability assessments do not set priorities or make decisions for management action. Instead, they inform the development of management activities, such as where to focus management efforts or what items should be monitored. The assessment may identify where monitoring might be valuable to gain more information on the status of species or habitats and their responses to changes in climate. Additionally, the assessment may include information on adaptation options that may be available to managers.

Global warming has brought many negative impacts on marine, aquatic, and terrestrial ecosystems, which makes the vulnerability of ecosystems one of the key issues in current ecological research. To consider ecosystem vulnerability, comprehensive plan policies were evaluated with the effects of increased temperature and precipitation. Vegetation stability, defined as the proportion of intact natural vegetation that remains unchanged under changing climate, was considered together with vegetation functions to contemplate the presumable climate change risks for the City in the adaptability of ecosystems.

Hazards, Vulnerability, and Risks

Vulnerability assessments, like other climate change assessments, specifically work to recognize, evaluate, and communicate the uncertainties associated with climate change within a system or area of interest. While much is known about the effects of climate change on a global scale, the ability to analyze effects and vulnerabilities at the regional and local scales important to managers is more challenging and has a higher level of scientific uncertainty.[8]

Water: Climate change will alter patterns of snowfall, rain, and snowmelt, shifting how our region receives and stores water. These changes will have an impact on every aspect of life in the Northwest, from forests to farms, ski areas to coastal cities such as Burien. Most climate models suggest that we should expect less rain in summer. The results are more mixed for other seasons, but generally suggest slightly more rain in fall, winter, and spring. Higher river flows as well as heavier rainfall could increase flood risks and erosion, particularly in the fall and winter.

Flooding: The impacts of climate change on water availability and flooding are daunting, but there is a lot a community can do to prepare. For example, when roads or culverts are updated due to damage or for regular maintenance, projections of future precipitation into their design can better accommodate future heavy rains.

Coasts: Due to the burning of fossil fuels, sea levels are rising as oceans are absorbing carbon dioxide and warming and acidifying. These changes threaten Pacific Northwest coastal property and infrastructure, fishing and recreation, communities, and wildlife. Around the world, land-based glaciers and ice sheets are melting, causing sea levels to rise. The ocean has also absorbed more than 90% of the excess heat humans have added to the climate system, causing the oceans to warm and expand. On average, coastal areas in Washington state may increase 4 to 6 inches in the next three decades. By the end of the century, the state could see nearly 3 feet in average sea level rise (NOAA 2022 Sea Level Rise Technical Report). Coastal storms and extreme high tides will pose more severe threats than they have in the past. Areas higher and further from the coast that were previously untouched by these coastal hazards will be at increased risk of flooding and erosion. Flooding and erosion will be more common. Some low-lying coastal areas may be permanently inundated. Sea level rise may degrade or destroy coastal habitats such as wetlands, estuaries, and intertidal zones: placing additional stress on oysters, mussels, salmon, and other species. It is virtually certain the ocean will continue to warm, rise, and acidify throughout the 21st century.

The planning level sea level rise mapping included in Section 2 uses 2018 information developed by the University of Washington[9] and considers a storm surge as well. See Exhibit 10.

[8] See Section 2 of this report. Per University of Washington Climate Impacts Group, *Climate Mapping for a Resilient Washington, Users Guide, Selecting a Greenhouse Gas Scenario*, considering different scenarios is appropriate, but prior to 2050 the greenhouse gas scenarios do not markedly differ. See: https://cig-wa-climate.nkn.uidaho.edu/.

[9] See: https://cig.uw.edu/projects/projected-sea-level-rise-for-washington-state-a-2018-assessment/.



Ed Munro Seahurst Park

Wildlife: Climate change is causing warmer average temperatures and declining snow in the mountains. As a result, Pacific Northwest landscapes and habitats are changing and affecting the plants, animals and humans who rely on them. Wetlands, ponds, rivers and streams in Burien and the region will likely have less water in summer, some even drying up, due in part to increasing drought. Warming and shrinking rivers and streams threaten salmon, which require cold water as they make their migratory journey up freshwater rivers and streams where they spawn. Rising seas are projected to displace coastal habitats, while ocean acidification threatens marine species and ecosystems. Areas suitable for iconic Washington tree species, including Douglas fir and ponderosa pine, are projected to decline. Wildfire, floods, and other disturbances will alter regional ecosystems. As ecosystems undergo these and other changes, many animal and plant species will shift their ranges to track changes in the location of their suitable habitats. Whether their habitats are well-connected (rather than fragmented by roads, development, or other disturbances) will in part determine whether species can successfully find new, hospitable habitats as the climate changes. The timing of critical biological events will shift, causing ripple effects in animal and plant communities. For example, mild temperatures will generally lead to insects emerging earlier in the season. This may result in migratory birds arriving from tropical wintering grounds too late to take advantage of peak resources. Climate change stands to irrevocably alter Northwest ecosystems, with cascading impacts on regional fish and wildlife. Working to ensure Northwest habitats are well-connected can help species respond to disturbances and migrate to more suitable areas as the climate warms.

Fire: Increasingly hot, dry summers will also contribute to more frequent and intense wildfires and native vegetation instability.

Insects: Insect outbreaks and tree diseases, like wildfire, are disturbances that can kill trees. Like wildfires, they are also a critical component of a healthy forest. As the climate changes, however, some insect outbreaks and diseases are projected to become increasingly common. When diseases and

insect outbreaks become more widespread and severe than what is normal for the natural system, forests and other vegetated areas may be less able to provide ecosystem functions, such as carbon storage, clean water, soil binding for slope stability, and habitat for the wildlife that depend on vegetative cover.

Trees and Forests: Climate change is expected to reduce the establishment, growth and distribution of some trees and other plants – transforming forests in the Northwest during the next century or more. Trees with particular ecological and economic importance for the state – Douglas-fir, western redcedar, and coastal shore pines are susceptible to the changing climate. Disturbances such as insect outbreaks, disease, drought, and fire may lead to rapid changes in vegetative cover.

Physical and Social Assets

Physical assets in the context of the natural ecological environment include surface water and groundwater; greenspaces including urban forests; critical areas such as wetlands, streams, and steep slopes; and fish and wildlife. Climate change stands to have profound effects on individuals and their communities. Warmer temperatures and changes in patterns of precipitation and snowmelt, among other climate impacts, will affect human health, the natural and built environment, recreation, and other facets of society.

Burien ecological assets include:

- **Puget Sound:** Burien is situated along the Puget Sound, a large and ecologically diverse estuary. The Sound supports a wide range of marine life, including salmon, orcas, seals, and various seabird species.
- **Shoreline Habitats:** Burien has several miles of shoreline along the Puget Sound, providing habitats for various species of shorebirds, marine invertebrates, and coastal plants. These habitats include sandy beaches, rocky shores, and intertidal zones.
- **Forests and Parks:** Burien is home to more than 365 acres of parks and open space, including Ed Munro Seahurst Park with a diverse ecology. Green spaces contain forested areas that support a diversity of plant and animal species, including migratory birds, small mammals, and native plants.
- **Urban Green Spaces:** Burien incorporates urban green spaces throughout the city, including neighborhood parks, community gardens, street trees, and trees on private property. These areas contribute to the overall ecological health of the city, improve air quality, and provide habitat for urban wildlife.
- **Water Bodies and Riparian Corridors:** Lake Burien and several creeks and streams, such as Miller Creek and Salmon Creek provide ecological functions.
- **Wetlands:** Wetlands are important ecological assets that help purify water, mitigate flooding, and provide habitat for numerous plant and animal species. Burien has wetland areas, such as Seahurst Park Wetlands, which support diverse wetland-dependent species.
- **Wildlife Corridors:** The region surrounding Burien features natural and semi-natural areas that serve as wildlife corridors, allowing for the movement of species between larger habitat patches.

These corridors contribute to biodiversity conservation and facilitate gene flow between populations.

Gaps and Opportunities

Mainstream climate resilience strategies can be integrated into existing decision making at all levels of government and management.

Burien participates in a formal governance structure to facilitate strategic and coordinated large landscape resilience measures for Burien integrated with regional approaches. The King County-Cities Climate Collaboration (K4C) is one such organization where local governments can partner on regional climate action strategies.

Several opportunities exist that would provide greater adaptive capacity to local ecosystems. They are summarized as:

- Increasing tree plantings and selected drought and disease tolerant and pest resistant plants.
- Enhance vegetated critical areas and buffers to slow surface water flows, facilitate filtration, and encourage infiltration of clean water.

Policy Review

Climate change resilience strategies are recommended for integration by the Comprehensive Plan team. A policy review suggested addressing more of the following concepts:

- Cooling, green infrastructure, and proper selection of trees and plantings for drought tolerance.
- Enhancement, addition of native plants that are resilient to heat, precipitation, managed retreat, or adaptation, etc.
- Integrate resilience into Shoreline Master Program goals and policies at the time of the next periodic update.
- Maintain an arborist on staff to help value and enhance tree canopy per Climate Action Plan strategy to support water and natural systems.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Ecosystems.

Exhibit 35. Potential Strategies: Ecosystems

Key Approach	Strategy	Impact	Implementation	Alignment
Urban Forest	Nature-based Solutions: Increase Amount and Resilience of Trees and Plants	High K4C	Medium	Medium

Key Approach	Strategy	Impact	Implementation	Alignment
Surface and Groundwater	Provide green stormwater infrastructure to mimic natural systems	High	High	Medium
Critical Areas	Nature-based Solutions: Buffer Enhancement	High	Medium	Medium
Fish and Wildlife	Nature-based Solutions: Buffer Plant Density and Diversity. Provide incentives or requirements for habitat enhancement and restoration to increase plant density and diversity and habitat connectivity.	Medium	High	Medium
Water and Natural Systems*	Maintain a staff arborist: Value and enhance tree canopy in Burien to address climate impacts by hiring an arborist. The arborist will support the preservation of native trees, educate city staff on best practices, assist in the development and implementation of tree codes, and track and report tree removal to enable the City to effectively manage tree cover.	High K4C	High	High K4C Climate Toolkit Green Partnership Tree Canopy Code

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

* K4C/Cascadia Review of Comprehensive Plan Sustainability Policies (existing) and review of Climate Action Plan Strategies for inclusion.

Transportation

This section considers transportation impacts of climate change on the City's transportation systems. Those systems include vehicle travel, transit, and non-motorized travel (pedestrians and bicyclists) of both people and goods ("freight") and the infrastructure with which this travel takes place.

Methods and Assumptions

This section considers:

- City of Burien, Comprehensive Plan: https://www.burienwa.gov/residents/burien_s_vision/comprehensive_plan.
- University of Washington Climate Impacts Group *Climate Mapping for a Resilience Washington*: (https://cig.uw.edu/resources/analysis-tools/climate-mapping-for-a-resilient-washington/),
- Federal Emergency Management Agency, National Risk Index: https://hazards.fema.gov/nri/map,
- City of Burien's Climate Vulnerability Index Tool (BERK): See Section 2 Climate Trends.

The horizon year is assumed to be the year 2100. [10]

Hazards, Vulnerability, and Risks

Physical and Social Assets

The City of Burien's physical transportation assets consist of a network of roadways, transit routes with stops and a transit center, sidewalks, and bicycle facilities. The City owns a network of these public facilities.

The primary travel mode in the City is vehicular travel. The highest functional class roadways which experience the most traffic include routes that run north-south through the entire City – Ambaum Boulevard SW and 1st Avenue S. Des Moines Memorial Drive also provides a primary arterial that runs northwest-southeast through the bottom leg of the City. East-west primary arterials include two roadways that connect from Ambaum Boulevard Southwest to SR-509 – SW 128th Street and SW 148th Street. The City's system also consists of minor arterials and collector arterials. Additionally, SR-509 and SR-518 are two state highways that serve the City of Burien, though they are owned and maintained by Washington State Department of Transportation.

Transit infrastructure in the City mainly centers around the Transit Center located near the City's downtown core. Routes that serve the transit center consist of both local and regional routes that

[10] See Chapter 2 Climate Trends. Year 2100 is considered for the sea level rise; otherwise, most trends are assumed for the 2040-2069 (2050) period.

connect commuters to workplaces, such as downtown Seattle. King County's new RapidRide H line connects to the transit center.

Non-motorized facilities are present only in certain areas of the City, primarily in areas that have experienced recent development since City incorporation. The downtown core contains a robust network of sidewalks. In 2012, 59 miles of sidewalks existed in the City (Transportation Master Plan, 2012). The bicycle network contains mainly on-street bicycle lanes in select areas as the City continues to build out its network.

Hazards, Vulnerabilities, and Risks

The City's transportation system is vulnerable to increased heat exposure from future temperature rises. The largest effect for transportation will be experienced by vulnerable populations, such as those over the age of 65 and families with children under the age of 5, who utilize non-motorized transportation or transit. Throughout the City, heat wave risk is expected to remain relatively low (FEMA National Risk Index – Heat Exposure). As shown in Chapter 2 Climate Trends the County is expected to have an increase of 6.3 °F average in the summer, and a heat island map shows places in Burien where the effects can be magnified. (University of Washington Climate Impacts Group 2022) Effects of this temperature rise will be experienced by vulnerable populations such as older or younger people who do not have vehicle access as a method of transportation. Additionally, rising temperatures can pose more of a risk of urban wildfire risk. This is particularly prevalent near and on SR-509 and SR-518 where dry brush exists. In these locations the traffic is more prone to starting fires due to spills from freight and collisions.

Increased flooding poses a significant risk to roadway infrastructure. Extreme precipitation will contribute to these flooding hazards, particularly on roadways without drainage infrastructure designed to current standards. Precipitation and flooding will also significantly impact the pedestrian and bicyclist environments, particularly in areas lacking sidewalks and bicycle facilities that are grade-separated from roadways. Models show that the 25-year storm that roadway drainage systems are typically designed to accommodate is anticipated increase in frequency, becoming the new 8-year storm event. Days with heavy precipitation will see an increased volume of rain by 13-15%. Overall, an annual increase of 1-1.5 annual days with at least 1-inch of precipitation is anticipated. Roadways over or adjacent to streams and rivers are where the effects of these rain events will be experienced the most. Annual maximum streamflow for rivers and streams such as the Miller-Walker Creek system is anticipated to increase by 20% by 2070-2099. (University of Washington Climate Impacts Group 2022) Roadways susceptible to riverine flooding are identified where stream buffers intersect with classified roadways, grouped by geographical area:

- Sylvester Road SW, S 160th Street, 4th Avenue SW
- Des Moines Memorial Drive, SR-509, and S 160th Street
- Des Moines Memorial Drive at S 171st Street
- Ambaum Boulevard at SW 120th Street
- SW 130th St and Shorewood Drive
- SW 144th Street/Place, Maplewilde Ave SW, SW 156th Street

- SW 172nd Street
- 8th Avenue S, S 144th Way
- S 128th Street at SR-509
- 24th Ave S, Military Road S, S 116th Street

Sea level rise will impact roadways and within low-lying coastal areas, mainly within designated floodplains along the shoreline. Effects of sea-level rise will also be compounded with increased extreme precipitation and flooding of rivers and streams to exacerbate affects in areas prone to erosion and landslides along Burien's coastline. Additional inland floodplains will also experience the need for increased storage volume and increased flood area due to more extreme precipitation. Likely sea level rise is anticipated to be 3.2-8.3 feet by 2100 based on a 17% probability (UW Climate Impacts Group 2018; BERK 2023). Due to the existing geography of the coastal areas, many of those neighborhoods have minimal roadways access into and out of the neighborhood (such as a single lane one-way loop). This means even if one roadway is blocked in these areas due to flooding or erosion, entire neighborhoods can be cut-off from any access out of the neighborhood. Areas that are the most suspectable to the most severe effects of sea level rise and increased flooding at floodplains consist of areas already identified as critical areas – landslide areas along the coast, shoreline zones, and floodplains. Important access roadways for neighborhood access within these critical areas are:

- SW 172nd St and Maplewilde Avenue in the Three Tree Point neighborhood
- SW 156th Street
- SW 150th Street
- Shorewood Drive SW (which provides access to the Salmon Creek sewer treatment plant)
- Shorewood Lane SW
- 30th Ave SW

Impacts to roadway infrastructure and traffic due to flooding events may include temporary or full closures, detours, and delays. Additional ponding is expected to deteriorate pavement more quickly as well as introduce more splashing hazards for pedestrians and bicyclists, overall leading to a more uncomfortable experience. Temporary closures should be anticipated to perform more frequent maintenance and repairs. In extreme cases where climate change impacts are compounded with landslide or seismic hazards near the coast, roadways may even require permanent closures where underlying or downhill soil conditions are no longer sufficient to support roadways. This will most greatly affect populations who do not have access to nearby essential services, such as transit, groceries, and health facilities. Additionally, populations who lack the physical health necessary to navigate in emergency situations that may arise where roadways become impassable will be most significantly vulnerable.

Gaps and Opportunities

Areas within deteriorating or outdated drainage infrastructure can be updated to meet current standards. The City of Burien regularly updates the City's Stormwater Drainage Master Plan and

identifies areas experiencing flooding issues and should continue to do so, considering prioritizing updating areas prone to future flooding hazards. The City could develop a policy about roadway access to primary homes, such as at 172nd Street where there are area of inundation and accessory structures in the right of way. Design standards should be updated to accommodate larger storm events, in accordance with the current 25-year storm event becoming the future 8-year storm event. Design standards should be updated to require redundancy in stormwater systems along classified transportation roadways that lie within areas that are anticipated to experience more flooding. Roadway maintenance should ensure that the transportation network is maintained with serviceable roadways that can serve as alternate routes in areas where limited routes currently provide access to neighborhoods along the coast.

Planning to reduce impacts on those without vehicles during climate events by providing transit-friendly, walkable, and bicycle-friendly neighborhoods with access to amenities in close proximity is an effect that the City can continue through the Comprehensive Planning process, and recent subarea planning processes (Burien Ambaum-Boulevard Park). Burien can also continue utilizing updates to the Transportation Master Plan as a process to identify locations and types of critical infrastructure improvements for roadways and non-motorized facilities.

Additionally, strengthening incentives for reducing impervious land cover and increasing tree canopy coverage will both allow areas to adapt more easily to both flooding and heat exposure. The largest opportunities for impervious land coverage reduction to curb effects of flooding and heat exposure exist in the Evansville and Chelsea Park neighborhoods. The largest opportunities for additional tree coverage to curb effects of flooding and heat exposure exist in the Downtown, Evansville, and Chelsea Park areas.

Policy Review

The City's Transportation Element and related chapters was audited and reviewed for alignment with resilience to climate change by the Comprehensive Plan Team.

The following policy audit themes were developed into recommended strategies to further promote resilience:

- Add consideration of alternate routes suitable for detours and critical routes in the event of a climate hazard emergency.
- Add consideration of priority routes in the event of a climate disaster (flood) when developing LOS standards.
- Add consideration of pedestrian need for a separated facility in areas prone to flooding.
- Add specificity to focus on features that provide enhancements for climate resilience, such as designing drainage for extreme flooding, and providing trees and greenery.
- Add consideration of on-site infiltration, including pervious pavement, in areas prone to flooding and/or with aging drainage infrastructure
- Add specificity to define "safety" through a climate lens. Consider adding drainage as a safety consideration.

- Add specificity for increased pavement maintenance; establish metrics.
- Consider adding transit shelters, priority roadways for snow plowing, and include drainage as a safety consideration. Define priority transit stop amenities to include canopied and walled shelters.

K4C/Cascadia reviewed selected transportation policies and the optimal integration of Climate Action Plan strategies particularly those in alignment with K4C model policies and ability to address greenhouse gas reduction.

- Develop an electric vehicle (EV) infrastructure plan.
- Remote work for City employees.
- Transition City fleet to all EV.
- Encourage Commute Trip Reduction (CTR) programs.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Transportation.

Exhibit 36. Potential Strategies: Transportation

Key Approach	Strategy	Impact	Implementation	Alignment
Infrastructure Upgrades	Improve roadway stormwater system capacity and condition to accommodate future storm events	High	Medium	High
Infrastructure Upgrades	New and improved multimodal access, include grade-separated facilities	High	Medium	High
Working with Nature	Incorporate hydrologic climate impacts into design of water-crossing structures (culverts)	Medium	Medium	High
Complete/ Sustainable Communities	Reduce stormwater impacts from projects through LID/GSI	High	High	Medium
Urban Forest	Increase Street Tree Canopy	High	Medium	Medium
Complete/Sustainable Communities	Increase shelter of transit stops and centers	Medium	High	Medium

Key Approach	Strategy	Impact	Implementation	Alignment
Planning	Redefining "safety" language to incorporate climate resilience	Medium	High	Medium
Planning	Emergency planning of alternate routes for coastal neighborhoods	High	High	Medium
Transition to the use of energy efficient vehicles*	Develop an EV infrastructure plan	High K4C	Medium	High State Electric Transportation Incentives Climate Action Plan
Reduce transportation emissions associated with government operations*	Remote work for City employees	Medium	High	High Climate Action Plan
	Transition City fleet to all EV*	Medium	Medium	High Climate Action Plan
Enable and provide multiple modes of green transportation*	Encourage Commute Trip Reduction (CTR) programs	Medium	High Leverage current programs	High State CTR Law

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

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***** K4C/Cascadia Review of Comprehensive Plan Sustainability Policies (existing) and review of Climate Action Plan Strategies for inclusion.

Waste Management

This section primarily addresses materials recycling and disposal. Secondarily it addresses stormwater and wastewater.

Methods and Assumptions

This section considers information:

- Burien, Draft Stormwater Management Action Plan: https://connect.burienwa.gov/projects/stormwater-management-action-plan/.
- Burien, Utilities: https://www.burienwa.gov/residents/resident_resources/utilities.
- Burien, Waste Reduction: https://www.burienwa.gov/business/sustainability/waste_reduction.
- King County, 2019, Comprehensive Solid Waste Management Plan: https://kingcounty.gov/en/dept/dnrp/waste-services/garbage-recycling-compost/solid-waste-planning-monitoring/comprehensive-solid-waste-management-plan.

Hazards, Vulnerability, and Risks

Physical and Social Assets

The City of Burien relies on a complex waste management system to provide residents and businesses with materials recycling and disposal as well as wastewater and stormwater management.

Sewer Services

Sewer services are provided by multiple different utility providers including Southwest Suburban, Midway, and Valley View sewer districts. These special districts provide wastewater collection services. Wastewater treatment ultimately is accomplished by King County. The system serves residents and businesses in Burien and ensures efficient disposal of wastewater in Burien.

About 600 properties use septic systems in the Boulevard Park Area. (City of Burien 2023)

Stormwater Management

Stormwater management is also a main tenant of essential waste management. The City of Burien is currently drafting a Stormwater Management Action Plan to improve the stormwater infrastructure and reduce the overall harmful effects of stormwater runoff. Stormwater conveyance infrastructure includes bioswales, catch basins, culverts, pipes, and ditches. Burien currently has an estimated 600 different stormwater conveyances to serve the five basins within City limits including the Lower Puget Sound Burien South and Burien North Basins, the Downtown Tributary Subbasin, the Lake Burien Creek Subbasin, and the West Fork Miller Creek Subbasin.

Stormwater infrastructure is vital to ensuring healthy and productive watersheds in the event of climate change caused extreme weather events. Events such as extreme precipitation can overwhelm current stormwater infrastructure and limit the effectiveness of different conveyances throughout the city.

Solid Waste and Recycling

The final subcomponent of waste management is solid waste. Burien provides businesses and residents with multiple streams of waste such as garbage, compost, and recycling. These solid waste streams are managed through multiple agencies including Recology, Waste Management and Cedar Grove. Through education and outreach, Burien is attempting to reduce the amount of solid waste sent to landfill through dedicated, no-cost recycling programs and low-cost composting services.

Recycling lowers overall carbon emissions by reducing the number of raw materials needed for manufacturing while composting reduces the amount of organic material that ends up in landfills. Organic material in landfills decomposes anaerobically and produces greenhouse gases such as methane that worsen climate change. Composting is the process in which these organic materials are separated from other solid waste to decompose in a controlled environment eventually converting to highly valuable compost that can be used in home gardens and urban agriculture. While these are not strategies to mitigate the impacts of climate change, overall waste reduction, efficient solid waste collection, , and proper disposal and recycling are all paramount in reducing Burien's greenhouse gas emissions.

Solid waste management can also be used to mitigate the impacts of climate change. Solid waste threatens ecosystems and human health in the event of climate emergencies. Flooding can impact solid waste receptacles and introduce hazardous materials to Burien's watersheds and eventually impact human health. Extreme heat and other extreme weather can limit the ability for solid waste collectors to collect refuse safely and effectively and which can lead to overflows, additional litter and debris, and the emergence of pests.

Waste management is also a tool that is necessary to respond to emergencies. Clearing debris from roadways, power lines, and other infrastructure are all necessary responses. Climate hazards that are increasing in likelihood and severity require a dedicated response to restore transportation infrastructure in the event of debris flows and landslides.

Physical Assets

Physical assets and real estate required for effective waste management predominantly fall outside of the city boundary. The largest physical asset related to waste management is the Bow Lake Transfer and Recycling station used by waste hauling contractors and the general public whose waste generation exceeds their residential or commercial bin capacity. This facility is in the City of Tukwila but serves several jurisdictions in South King County.

Other physical assets include stormwater management infrastructure like sewer pipes, bioswales, culverts, and catch basins.

Social Assets

Contracts with waste hauling organizations, sewer authorities, and other jurisdictional, non-profit, or private partners that can serve as the lead agency or a co-lead in the event that during a climate emergency that generates an associated solid waste management emergency.

Hazards, Vulnerabilities, and Risks

Extreme Temperatures

- Increasing summertime temperatures may stress wastewater equipment and components.
- Solid Waste providers are extremely susceptible to extreme temperatures given the physical nature of solid waste collections. Extreme heat can pose a severe risk of heat stroke, heat exhaustion, and dehydration.
- Solid Waste collections can also be impacted by cold weather and winter storms that prevent collection vehicles from safely completing their routes.

Extreme Precipitation

- Extreme precipitation increases the risk of flooding that can impact roadways and associated wastewater and stormwater infrastructure.
- The wastewater collection system in roadways and attached to bridges may be damaged by erosion during heavy rain events.
- Septic and sewer systems can overflow due to extreme precipitation events.
- Stormwater infrastructure may become overwhelmed with rainwater and result in untreated stormwater entering sub basins throughout Burien.
- Ecosystem damage may impact tree canopy and other natural barriers and water retention systems that are necessary components of the stormwater infrastructure and can increase the risk of flooding and landslides that require removal by city staff or contractors.
- Extreme precipitation and flooding can affect solid waste collection, such as:
- Debris must be cleared by a solid waste agency, a city department, or a contractor to restore transportation.
- Floods caused by extreme precipitation can damage solid waste receptacles and result in leaching of materials in waterways that are detrimental to human health, ecosystem health, and the local environment.

Gaps and Opportunities

Wastewater and Stormwater

City policies address the need for coordination with wastewater and other special districts and adequate facilities for development. The system providers should prepare plans to address:

- Flooding and any potential for risks to sanitary sewer system overflows considering storm intensities and frequencies associated with climate change trends. The service providers should identify improvements necessary to the collection system to address potential risks.
- Extreme precipitation could affect septic systems causing overflows and affecting water quality. Districts should plan for climate change trends and continue sewer service extension. Burien should ensure stormwater system improvements and retrofits address climate change trends and consider known and potential areas of urban flooding to avoid water quality concerns.

Stormwater management hazards, risks, and opportunities and the review of existing stormwater policies can be found in the Water Resources section of this document.

Solid Waste

There are multiple strategies in place to address overconsumption and diversion of solid waste from landfills to recycling and composting facilities. Overall, these strategies are effective in achieving this outcome and reducing overall greenhouse gas emissions but do not address hazard mitigation for solid waste facilities and resources. There are opportunities to incorporate debris clearance and hazardous waste mitigation following climate hazards into this section.

Policy Review

Wastewater and Stormwater

The city could continue coordinating with special districts and requiring adequate service for urban development. Where there are overlapping responsibilities, e.g., road and stormwater system management by Burien, the City and Districts could identify potential for joint improvement efforts to facilitate urban sewer system use and reduce impacts on stormwater systems.

Districts should prioritize resources to extend sewer mains into areas with septic systems or provide support for the evaluation and retrofitting of septic systems to reduce the amount of infiltration during flooding and reduce the potential for contamination.

See the section on Water Resources regarding stormwater.

Solid Waste Management

The policies for waste management adopted by the City of Burien address issues predominantly related to multi-stream waste disposal and the associated reduced carbon emissions. The policies which address composting and recycling to reduce carbon emissions are found in goal M-1 and the related strategies in the Burien Climate Action Plan. Overall, these policies are effective in achieving

this goal but fail to address issues related to waste management as hazard mitigation in the likely event of additional climate change related hazards. This component is addressed in the Priorities and Implementation section below.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Waste Management.

Exhibit 37. Potential Strategies: Waste Management

Key Approach	Strategy	Impact	Implementation	Alignment
Promote a circular economy	Mandate recycling and composting at commercial and multi-family properties	High K4C	High	High Climate Action Plan
Debris Clearance	Develop and implement a strategy to expedite debris management work (e.g., downed tree limbs and buildings blocking roads and streams) during and after a disaster incident to reduce the risks of subsequent fire, flood, injury, and disease vectors.	Medium	Low	High Can be incorporated more explicitly in the CEMP
Coordinated road, stormwater, and sewer improvements	Identify opportunities for joint planning of road, stormwater, and sewer infrastructure extension in areas subject to extreme precipitation and local flooding to protect water quality and infrastructure.	High K4C*	Medium	High Stormwater and Miller Creek Basin Plan Comprehensive Plan Land Use Element and achievement of growth strategies

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

Implementation: High: Easy/Flexible/Feasible in Near Term; Medium: Time or Resource Consuming/Feasible in Long Term Low: Very Costly and Lower Feasibility

Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support.

* As one element of green building practices along with other green infrastructure and water conservation efforts identified in the K4C Climate Action Toolkit: "Ban installation of septic tanks where not connected to public sewer systems."

Water Resources

This section considers impacts of climate change on the City's stormwater infrastructure and receiving water bodies. The City of Burien owns and maintains a separated stormwater system that is governed by Washington State Department of Ecology (Ecology). Because Burien has a portion of Miller Creek that is fish bearing and a stormwater system that outlets to the Puget Sound, there is heightened awareness and interest in water quality and quantity to protect and improve habitat and stream and Puget Sound health.

See also Transportation and Ecosystems sections for more about water systems.

Methods and Assumptions

This section considers stormwater investments under the City of Burien's current Comprehensive Plan and stormwater plans, and analyzes how well they address resilience to climate change:

- Burien Comprehensive Plan: https://www.burienwa.gov/residents/burien_s_vision/comprehensive_plan
- Burien Stormwater Management Action Plan: https://connect.burienwa.gov/projects/stormwater-management-action-plan/
- Burien Storm Drainage Master: https://www.burienwa.gov/residents/public_works/master_and_facility_plans
- University of Washington Climate Impacts Group *Climate Mapping for a Resilience Washington*: (https://cig.uw.edu/resources/analysis-tools/climate-mapping-for-a-resilient-washington/),
- Federal Emergency Management Agency, National Risk Index: https://hazards.fema.gov/nri/map,
- City of Burien's Climate Vulnerability Index Tool (Berk): See Section 2 Climate Trends.

The horizon year is assumed to be the year 2100. [11]

Hazards, Vulnerability, and Risks

Physical and Social Assets

The stormwater system includes collection and conveyance systems, stormwater treatment facilities for both water quality and quantity and the receiving water bodies such as the City's creeks, groundwater, and the Puget Sound.

[11] See Chapter 2 Climate Trends. Year 2100 is considered for the sea level rise; otherwise, most trends are assumed for the 2040-2069 (2050) period.

Burien owns stormwater infrastructure that includes conveyance systems (pipes, inlets, catch basins, maintenance holes, etc.), water quality facilities and flow control facilities. Burien also has many natural assets including Lake Burien, Miller, Salmon and Seola Creeks, Puget Sound Shoreline and wetlands.

Hazards, Vulnerabilities, and Risks

Climate change is impacting historic rainfall patterns and temperatures. Historic patterns are used to establish codes and standards that guide designing facilities with adequate capacity to protect life and property and to create safe conditions in the City environment. The following are identified hazards, vulnerabilities and risks associated with climate change:

- More frequent and higher duration rain events increase the likelihood of flooding and/or poor function of water quality facilities.
- More frequent and higher duration rain events increase the likelihood of conveyance system flooding, stream flooding, erosion, and landslide.
- Changes in rainfall pattern and resulting snowpack increases the likelihood of drought with subsequent impacts including lower groundwater levels, habitat loss, wetland loss/poor quality wetlands and lower creek baseflow levels.
- Lower socioeconomic populations typically live in areas that are underserved by stormwater infrastructure and are more likely to experience negative impacts of climate change.

Gaps and Opportunities

The City may choose to provide incentives or require heightened stormwater treatment levels, such as infiltration best management practices (BMPs) are required or 100% of stormwater should be treated. Incentives if these levels are met might include allowing another story on a new building or other development standard flexibility.

The City could review its critical areas regulations and consider increased/heightened requirements or incentives for restoration of wetlands, habitat, and tree canopy.

Policy Review

The Comprehensive Plan review team identified areas for policy improvement including integrating the gaps and opportunities above as well as:

- Identifying increased climate risks and resilience in policies regarding groundwater.
- Integrating Climate Action Plan strategies such as protecting stormwater infrastructure and expanding green infrastructure including increasing City resources for system replacement frequency and designing the system replacement, sizing, and addition based on climate change predictions.

Priorities and Implementation

Based on the gaps and opportunities and the policy review, below are strategies addressing climate resilience and Water Resources.

Exhibit 38. Potential Strategies: Water Resources

Key Approach	Strategy	Impact	Implementation	Alignment
Infrastructure Upgrades	Increase conveyance and treatment facility capacities to accommodate anticipated peak rainfall events.	High	Medium	High
Restoration	Increase/heighten restoration requirements for wetlands/ habitats/ urban forests.	High	Medium	High
Code and Design Standard Updates	Update codes and design standards to be resilient by including capacity for anticipated new rainfall patterns.	High	Medium	High
Partnering with other Agencies	Partner with adjacent agencies to facilitate actions on shared assets, such as Miller Creek.	Medium	Low	Medium

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

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Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

***** K4C/Cascadia Review of Comprehensive Plan Sustainability Policies (existing) and review of Climate Action Plan Strategies for inclusion.

Zoning & Development

This section addresses how climate change effects Burien's land uses today, and planned growth.

Methods and Assumptions

The following documents were reviewed as part of Zoning and Development:

- K4C Climate Action Toolkit: https://kingcounty.gov/services/environment/climate/actions-strategies/initiatives-programs/climate-action-toolkit.aspx.
- Puget Sound Regional Council, 2023. Vision 2050. Available: https://www.psrc.org/planning-2050/vision-2050.
- BERK, Burien Housing Policy Evaluation, Racially Disparate Impacts, Displacement, and Exclusion in Housing, Draft, March 2023. https://burienwa.civicweb.net/filepro/documents/81475/?preview=81476.
- US EPA, May 2022. Smart Growth and Climate Change. Available: www.epa.gov/smartgrowth/smart-growth-and-climate-change.
- US Department of Housing and Urban Development, January 2023, U.S. Department of Housing and Urban Development Community Resilience Toolkit: https://www.hudexchange.info/resource/5981/community-resilience-toolkit/

Hazards, Vulnerability, and Risks

Physical and Social Assets

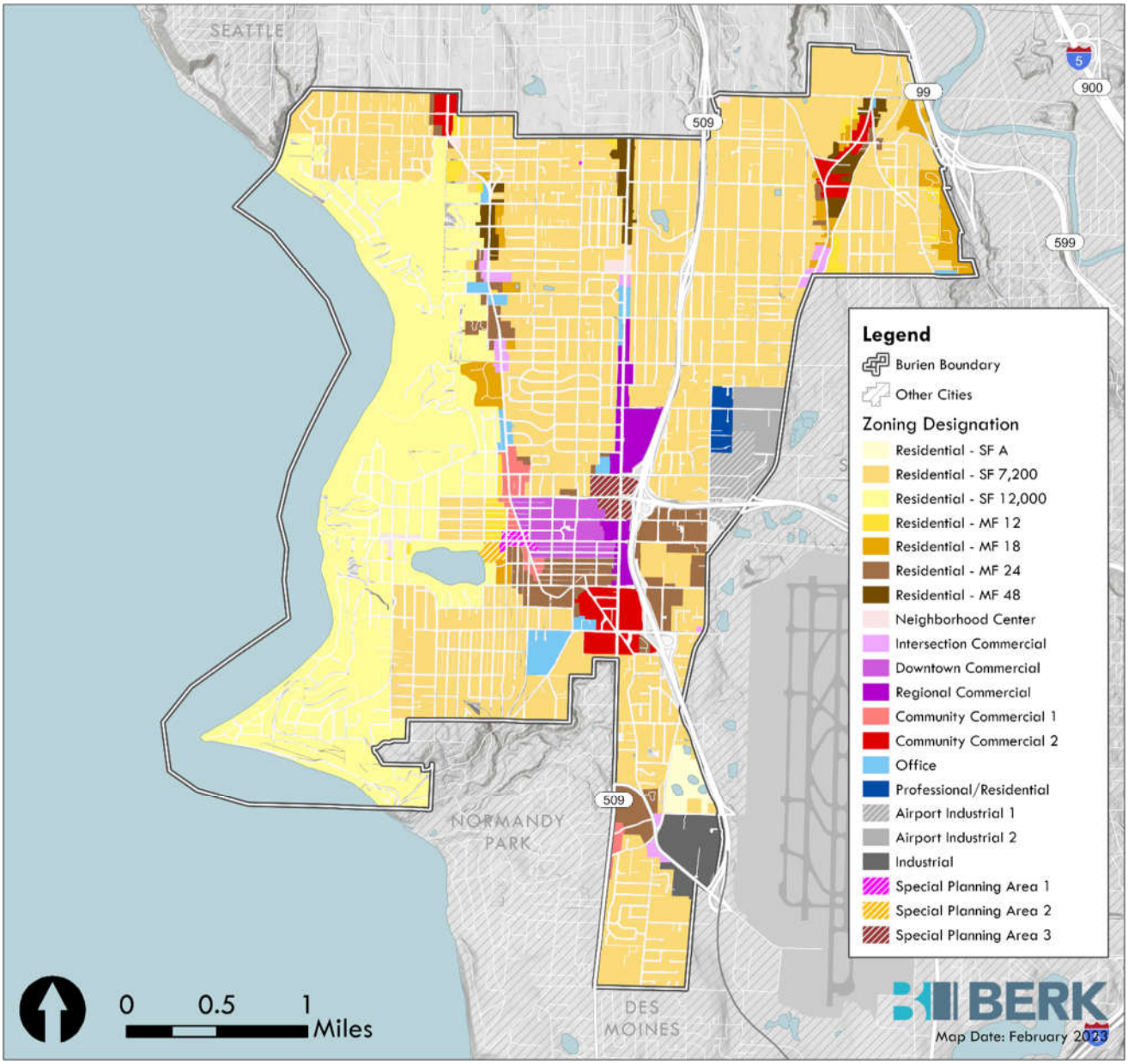
Burien inherited plans and zoning from King County at the time of its incorporation in 1993 and has generally continued a pattern of single family zoning in a majority of the city limits with concentrated nodes of multifamily and commercial housing downtown and along major arterials. Burien has over 5,000 acres of zoned land, primarily for single-family residential purposes. About 78% of the city's land is zoned as Residential Single Family (RSF). See Exhibit 39 and Exhibit 40.

Exhibit 39. Burien Zoning Table

Zone Category	Zone	Acres
Community Commercial	CC-1	33.7
	CC-2	97.9
Intersection Commercial	CI	30.8
Neighborhood Center	CN	15.9
Regional Commercial	CR	73.2
Downtown Commercial	DC	74.7
Industrial	I	74.3
Airport Industrial	AI-1	60.9
	AI-2	55.6
Office	O	61.8
Professional Residential	PR	25.4
Residential, Multi-Family	RM-12	50.4
	RM-18	112.1
	RM-24	210.9
	RM-48	61.6
Residential, Single-Family	RS-12000	1,341.7
	RS-7200	2,723.0
	RS-A	41.9
	SF 9600	0.9
Special Planning Area	SPA-1	7.8
	SPA-2	9.9
	SPA-3	26.2
Unknown		0.7
Grand Total		5,191.2

Source: City of Burien, King County, 2019; BERK 2023

Exhibit 40. Zoning Map



Source: City of Burien, BERK 2023.

Hazards, Vulnerabilities, and Risks

Current and future neighborhoods could be impacted by:

- Need for new or upgraded sea level rise, flood-control and, erosion-control structures in hazard areas. In addition, extreme precipitation could affect geologic hazard areas such as erosion and landslides. Western Burien is most at risk of landslides particularly lands along shorelines. Some smaller mapped landslides are found in Boulevard Park to the east.

- Risk to infrastructure damage due to extreme weather events. Bridges and roads, stormwater facilities, and water and wastewater systems among other infrastructure could be affected by extreme weather. This in turn could affect growth and development in the city.

- Increased climate-induced displacement and migration and changes in housing stock availability due to hazard events. Displacement of households with housing security challenges could be exacerbated by climate stressors (see additional information below).

Vulnerable populations are at risk for displacement due to high housing costs and redevelopment potential, and climate stressors could damage housing and make it more challenging for lower-income households to respond, and exacerbate conditions for persons already at risk of displacement. Primarily areas between First Avenue S on the east and Ambaum Boulevard SW on the west, Inglesea, Boulevard Park, as well as the Sunnydale area along Highline High School have the highest concentration of vulnerable populations. See Exhibit 19 and Exhibit 21.

Gaps and Opportunities

The City is developing a Comprehensive Plan Update that will address growth through the 2024-2044 period. The growth targets ask the City to plan for significant new growth:

- Burien Targets: 2019-2044
  - 7,500 housing units
  - 4,770 jobs
- Capacity
  - Housing: 6,712
  - Jobs: 752

The City will be making choices about land use designations and zoning to meet these targets. The climate vulnerability index could help development of the land use plan and zoning.

> Missing Middle Housing refers to homes that are in between single-family homes and large apartment buildings. This includes:
>
> - townhouses,
> - duplexes, triplexes, fourplexes,
> - courtyard buildings,
> - accessory dwelling units, and
> - live/work lofts.

A climate-exacerbated risk is the potential for housing stock damage and loss, and resulting displacement of households, especially those with preexisting health conditions and limited resources. In Burien areas with the potential for housing loss include areas subject to sea level rise or increased risk of landslides due to extreme precipitation. Areas with more vulnerable populations include Inglesea and Boulevard Park. A key area opportunity to address risk of housing damage is the Comprehensive Plan Housing Element, which must be amended to meet recent State requirements to provide housing for all income levels, and to remove racially disparate impacts that impede access to housing including ownership housing. The City is also evaluating middle housing opportunities to promote more housing types in single family zones. This could help increase housing supply and improve housing quality; locating more housing choices and improving multimodal and park access can "prioritize communities that are transit-dependent and disproportionately impacted by climate change and other stressors" per the Climate Action Plan.

The Comprehensive Plan Update and associated Zoning Code changes give the city opportunities to reinforce the success of its Urban Center as well as create additional small centers focused around new high-capacity transit (e.g., Ambaum Boulevard), which could create greater walkability and less need to move by automobile. It could also help implement the Climate Action Plan strategy to encourage density and mixed land use in strategic areas.

Policy Review

Based on a policy review, the following are areas of potential strengthening of policies.

- Add or amend policies addressing building, landscape and site design that promote resilience.
- Add policy language to adapt existing infrastructure in sea level rise and flooding areas.
- Amend design standards for utilities.
- Amend existing tree policies to consider Tree City USA and Department of Natural Resources related assistance.
- Link Comprehensive Plan Elements to the Climate Action Plan metrics and monitoring.
- Through Housing Element update address new housing types and densities.
- Update shoreline goals and policies to reference resilience measures; consider including in shoreline restoration plan.

Priorities and Implementation

The K4C team reviewed Comprehensive Plan policies and Climate Action Plan strategies to promote coordinated transportation and land use planning and reduce greenhouse gas emissions. These are reflected in Exhibit 41 below along with the Comprehensive Plan Update team evaluation.

Exhibit 41. Zoning and Development Strategies

Key Approach	Strategy	Impact	Implementation	Alignment
Encourage density and mixed land use in strategic areas.*	Update land use policies to develop ten-minute communities.	Medium	High	High Climate Action Plan
Focus growth in urban areas with services.	Increase density limits within urban growth areas.	High K4C	High	High CPPs, VISION 2050, K4C
	Allow middle housing types, such as duplexes, triplexes, and ADUs, on all residential lots.	Medium	High	High GMA, CPPs, VISION 2050

Key Approach	Strategy	Impact	Implementation	Alignment
	Ensure public transit stops and stations are located at or near (e.g., within 600 ft.) shopping centers and malls.	High K4C	Medium	High CPPs, VISION 2050, K4C
Improve resilience of shorelines and critical areas.	Update shoreline management policies and restoration plan to reflect climate stressors and adaptation measures.	High Menu of Measures	High	High Shoreline Management Act VISION 2050

Legend/Key

Impact: High: Identified as an effective strategy (Commerce, K4C)/Addresses multiple co-benefits; Medium: Addresses a single climate vulnerability/valuable even if the climate does not change as currently projected; Low: May not be effective at reducing vulnerability

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Alignment: High: Consistent with Regional, State, and Local Priorities; Medium: Similar to Regional & State Priorities/May require additional Local Support; Low: Not consistent with other entity priorities, requires new program resources and additional time to establish local support

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5 Appendices

A. Targeted Policy Review: K4C

Climate policy list review (from CAP, Sustainability draft, new draft comp plan policies)

FOR CITY TO POPULATE				K4C Model Policy Tier Alignment		Impact Assessment			Comp Plan Alignment (Next step for City)				
Sector	Strategy	Action		Primary Climate Issue	Tier	Quality	Recommendationed edits	Notes	Extent covered	Comp Plan Element			Recommendations
CAP sector name	*Strategy description*	*Action short name*	*Action description*			*How well does this policy address City's priorties? Low Quality = nothing with "teeth"; Medium Quality = some teeth/climate considerations; High Quality - addresses priorities & climate risk well*	*Recommended policy edits*	*Gaps and opportunities*	*Addressed in current Comp plan? (Y/N) (Cascadia crosswalked with what's in Camp Plan tab)*	*Existing Comprehensive Plan policy*	*Existing Comprehensive Planning goal*	*Element name*	*Modifications needed?*	*Revised Policy*
Transportation and Land Use	Transition to the use of energy efficient vehicles	Develop an EV infrastructure plan	Develop an Electric Vehicle (EV) infrastructure plan that: - Reviews current EV infrastructure in the city to identify gaps in charging locations. - Identifies locations for chargers in commercial, multifamily residence areas, and city facilities. - Reviews feasibility of fast charging stations. - Addresses barriers to charging for homeowners and renters. - Identifies key stakeholders to EV infrastructure use and development. - Identifies partners in the region who can assist with charging station infrastructure to lower. program and construction costs.	Transportation electrification - passenger vehicles	I	High	N/A - this is a very strong policy	N/A - this is a very strong policy	N			Transportation	Include as new policy in Transportation	Develop an Electric Vehicle (EV) infrastructure plan that: - Reviews current EV infrastructure in the city to identify gaps in charging locations. - Identifies locations for chargers in commercial, multifamily residence areas, and city facilities. - Reviews feasibility of fast charging stations. - Addresses barriers to charging for homeowners and renters. - Identifies key stakeholders to EV infrastructure use and development. - Identifies partners in the region who can assist with charging station infrastructure to lower. program and construction costs.
Transportation and Land Use	Reduce transportation emissions associated with government operations	Remote work for City employees	Continue to support remote work for employees by: - Updating the City's telecommuting policy to increase the number of days staff work from home. - When feasible, allowing multiple virtual options to employees and city stakeholders.	Other car trip reduction strategies (e.g., telecommuting, biking, micromobility, walkability, and vehicle usage pricing)	II	Medium	N/A	N/A	Y	Pol. TR 1.4.5 Encourage employers to establish and maintain a commute trip reduction program that supports and promotes reducing the number of single- occupant vehicle commute trips by encouraging alternative modes of transportation such as riding the bus, vanpool and carpool, biking to work, working from home, or a compressed workweek. (Amended, Ord. 497, 2008)	Objective TR 1.4 Assure that transportation improvements are concurrent with development to maintain the City's LOS standards (i.e. concurrency).	Transportation	"When feasible, allowing multiple virtual options to employees and city stakeholders."	Pol. TR 1.4.5 Encourage employers to establish and maintain a commute trip reduction program that supports and promotes reducing the number of single- occupant vehicle commute trips by encouraging alternative modes of transportation such as riding the bus, vanpool and carpool, biking to work, working from home, a compressed workweek, and/or allowing multiple virtual options to employees and city stakeholders. (Amended, Ord. 497, 2008)
Transportation and Land Use	Reduce transportation emissions associated with government operations	Transition City fleet to all EV	Invest in transitioning the City's fleet to all electric vehicles where feasible. Where infeasible, pursue short-term approaches (e.g., short-term leases) to acquire fuel-efficient vehicles.	Transportation electrification - freight/service vehicles	III	Medium	Add in a defined target here - replace 50% of fleet vehicles with EVs by 2040. Or say all new fleet vehicles purchases/replacements must be EV where available.	Opportunity to use stronger language.	Y	Pol. SU 6.1 Burien should take actions to both mitigate and adapt to climate change. Actions may include maximizing energy efficiency by increasing use of renewable energy resources, supporting green building initiatives, reduce greenhouse gas emissions of city vehicles, reduce motor vehicle miles traveled by improving convenience and safety of nonpolluting transportation modes such as bicycling and walking, protect and enhance the natural landscape and vegetation, and support recycling and waste reduction. (Ord. 630, 2015)	Goal SU.3 Conserve energy and reduce the amount of carbon dioxide released into the atmosphere.	Sustainability	"transition City fleet to all electric vehicles, where feasible"	Pol. SU 6.1 Burien should take actions to both mitigate and adapt to climate change. Actions may include maximizing energy efficiency by increasing use of renewable energy resources, supporting green building initiatives, reduce greenhouse gas emissions of city vehicles by transitioning to all electric vehicles where feasible, reduce motor vehicle miles traveled by improving convenience and safety of nonpolluting transportation modes such as bicycling and walking, protect and enhance the natural landscape and vegetation, and support recycling and waste reduction. (Ord. 630, 2015)
Transportation and Land Use	Enable and provide multiple modes of green transportation	Encourage Commute Trip Reduction (CTR) programs	Encourage business owners to offer Commute Trip Reduction (CTR) programs or similar incentives to their employees for using transit or rideshare options.	Other car trip reduction strategies (e.g., telecommuting, biking, micromobility, walkability, and vehicle usage pricing)	II	Medium	Add more detail on how Burien could encourage this - vamping up rideshare programs, providing discounted public transit passes to largest employers, etc.	Think of how businesses could be incentivized rather than encouraged.	Y	Pol. TR 1.4.5 Encourage employers to establish and maintain a commute trip reduction program that supports and promotes reducing the number of single- occupant vehicle commute trips by encouraging alternative modes of transportation such as riding the bus, vanpool and carpool, biking to work, working from home, or a compressed workweek. (Amended, Ord. 497, 2008)	Objective TR 1.4 Assure that transportation improvements are concurrent with development to maintain the City's LOS standards (i.e. concurrency).	Transportation	"and incentivize"	Pol. TR 1.4.5 Encourage and incentivize employers to establish and maintain a commute trip reduction program that supports and promotes reducing the number of single-occupant vehicle commute trips by encouraging alternative modes of transportation such as riding the bus, vanpool and carpool, biking to work, working from home, or a compressed workweek. (Amended, Ord. 497, 2008)
Transportation and Land Use	Encourage density and mixed land use in strategic areas	Update land use policies to develop ten-minute communities	Review and update land use, zoning, and planning policy to prioritize the development of affordable ten-minute communities (where work, shopping, schools, and play are within ten minutes of where people live). This can include: - Altering zoning and planning policies to integrate Transportation Demand Management (TDM) standards into Comprehensive Plan code changes for institutional and commercial development. - Using code requirements, incentives, or impact fees as tools to integrate public amenities and services such as parks, open space, public art, street front retail and community services in neighborhoods. - Incentivizing infill and mixed-use development (e.g., through density bonuses, zoning amendments to increase density, tax benefits, and reduction in parking or other code requirements). - Requiring pedestrian-friendly street frontages with landscaping, ample sidewalks, and parking that minimizes conflicts between pedestrians and automobiles (may require amendments to zoning code and road standards). - Utilizing equitable transit-oriented development (ETOD) planning and investments to increase neighborhood density and use of public transit.	Land use & focused development	II	High	N/A - this is a very strong policy	N/A - this is a very strong policy	Y	Pol. TR 4.1.5 Require new development and redevelopment to incorporate pedestrian supportive measures such as ; Pol. TR 4.1.6 Prioritize the development and maintenance of a pedestrian oriented commercial area corresponding to Old Burien and the downtown area. The goals and policies of the land use and community character elements establish the character of development in these areas. (Amended, Ord. 272, 1999, Ord. 445, 2005) ;	**Goal 4 Pedestrian and Bicycle Facilities Create a safe and convenient environment for walking and bicycling integrated with roads and other transportation facilities.**	Transportation	add action as new policy"prioritize the development of affordable 10-minute communities; TDM and ETOD; infill and mixed-use"	Review and update land use, zoning, and planning policy to prioritize the development of affordable ten-minute communities (where work, shopping, schools, and play are within ten minutes of where people live). This can include: - Altering zoning and planning policies to integrate Transportation Demand Management (TDM) standards into Comprehensive Plan code changes for institutional and commercial development. - Using code requirements, incentives, or impact fees as tools to integrate public amenities and services such as parks, open space, public art, street front retail and community services in neighborhoods. - Incentivizing infill and mixed-use development (e.g., through density bonuses, zoning amendments to increase density, tax benefits, and reduction in parking or other code requirements). - Requiring pedestrian-friendly street frontages with landscaping, ample sidewalks, and parking that minimizes conflicts between pedestrians and automobiles (may require amendments to zoning code and road standards). - Utilizing equitable transit-oriented development (ETOD) planning and investments to increase neighborhood density and use of public transit.

Climate policy list review (from CAP, Sustainability draft, new draft comp plan policies)

FOR CITY TO POPULATE				K4C Model Policy Tier Alignment		Impact Assessment			Comp Plan Alignment (Next step for City)			
Sector	Strategy	Action		Primary Climate Issue	Tier	Quality	Recommendationed edits	Notes	Extent covered	Comp Plan Element		Recommendations
Buildings and Energy	Advance the decarbonization of buildings	Adopt or exceed the Washington State Clean Buildings Act	Adopt or exceed the Washington State Clean Buildings Act to advance energy performance standards and low carbon design for new, renovated, and existing buildings. Specifically: - Require building energy performance disclosure* and benchmarking from all privately-owned commercial buildings by 2030 (at a minimum, any multi-family or non-residential building over 20,000 sq. ft) and set a maximum target for energy per sq. ft. by 2030. (*Existing State policy requires benchmarking and energy requirements of new and existing commercial buildings over 50,000 sq. ft by 2028. Incentives available for buildings that adopt early; incentives cover commercial and multi-family residential buildings). - Require EV infrastructure (the greater of 1 space of 10% of spaces) for all new commercial and multi-family property development to increase available EV charging stations in the city. - Require electric heating/cooling pumps in all new builds or renovations (no new natural gas) - Provide incentives for or require the development of new builds to be high-performance certified commercial and multi-family buildings through programs such as LEED (or built to LEED standards), EDGE, or Built Green, with the goal to achieve net zero EUI in new buildings							Energy Related Policies in addition to Sustainability Element	Include as new policy in Energy Related Policies in addition to Sustainability	Adopt or exceed the Washington State Clean Buildings Act to advance energy performance standards and low carbon design for new, renovated, and existing buildings. Specifically: - Require building energy performance disclosure* and benchmarking from all privately-owned commercial buildings by 2030 (at a minimum, any multi-family or non-residential building over 20,000 sq. ft) and set a maximum target for energy per sq. ft. by 2030. (*Existing State policy requires benchmarking and energy requirements of new and existing commercial buildings over 50,000 sq. ft by 2028. Incentives available for buildings that adopt early; incentives cover commercial and multi-family residential buildings). - Require EV infrastructure (the greater of 1 space of 10% of spaces) for all new commercial and multi-family property development to increase available EV charging stations in the city. - Require electric heating/cooling pumps in all new builds or renovations (no new natural gas) - Provide incentives for or require the development of new builds to be high-performance certified commercial and multi-family buildings through programs such as LEED (or built to LEED standards), EDGE, or Built Green, with the goal to achieve net zero EUI in new buildings
Buildings and Energy	Increase energy efficiencies in City-owned buildings and other City infrastructure	Conduct energy audits in City buildings	Conduct energy audits in all city operated buildings and partner with the local utility and private contractors to make improvements.	Building decarbonization (fossil fuel reduction and electrification)	I	High	N/A - this is a very strong policy	N/A - this is a very strong policy	N	Energy Related Policies in addition to Sustainability Element	Include as new policy in Energy Related Policies in addition to Sustainability	Conduct energy audits in all city operated buildings and partner with the local utility and private contractors to make improvements.
Buildings and Energy	Increase energy efficiencies in City-owned buildings and other City infrastructure	Renewable energy for City operations	Join either the Seattle City Light Green Up program or Puget Sound Energy's (PSE) Green Direct program to reduce emissions from government operations. Through Green Direct, Burien can purchase 100 percent of their energy from local, renewable energy resources. The Green Up program allows customers to match up to 100% of their monthly electricity use through Renewable Energy Credits.	Building efficiency (e.g., energy codes, retrofits, disclosure)	II	Medium	Specifiy how often energy audits should occur		N	Energy Related Policies in addition to Sustainability Element	Include as new policy in Energy Related Policies in addition to Sustainability	Join either the Seattle City Light Green Up program or Puget Sound Energy's (PSE) Green Direct program to reduce emissions from government operations. Through Green Direct, Burien can purchase 100 percent of their energy from local, renewable energy resources. The Green Up program allows customers to match up to 100% of their monthly electricity use through Renewable Energy Credits.
Buildings and Energy	Transition to the use of renewable energy to eliminate fossil fuel use whenever possible	Evaluate barriers homeowners face in shifting to renewable energy	Evaluate and assess the barriers and challenges homeowners face in shifting to renewable energy sources. Based on the results of the assessment, begin to support projects that bring renewable energy to Burien, such as the development of community solar projects that benefit all residents, particularly communities of color, low-income populations, and members of limited-English-speaking communities (e.g. Spark Northwest).	Building decarbonization (fossil fuel reduction and electrification)	I	Medium	When will one of these programs be joined?		N	Energy Related Policies in addition to Sustainability Element	Include as new policy in Energy Related Policies in addition to Sustainability	
Buildings and Energy	Transition to the use of renewable energy to eliminate fossil fuel use whenever possible	Increase community knowledge about renewable energy and energy efficiencies	Increase community knowledge about renewable energy options and energy efficiencies. This can include: - Implementing incentives for renewable energy projects through the City's permitting process, such as reducing fees and expediting the permitting process. - Partnering with utilities and contractors to provide information to businesses and school districts on renewable energy options along with how to upgrade equipment that improves affordability, comfort, indoor air quality and energy efficiency in all commercial/multi-family buildings and schools. - Promoting incentives for energy conservation and renewable energy for homeowners, with a priority for those who are energy- and housing- burdened. - Supporting Homeowner Energy Efficiency Workshop Events designed to inform the community about green building and efficiency certification programs, project permitting, financing, innovative products, as well as architect and contractor certification resources.	Renewable energy sources (e.g., solar)	II	High	N/A - this is a very strong policy	N/A - this is a very strong policy	Y	Pol. HS 1.18 The City should advocate for additional funding at County, Federal, State, and other levels to expand programs that facilitate home ownership by low and moderate income families, and provide assistance for repair, rehabilitation, energy efficiency, and weatherization. (Amended, Ordinance No. 614, December 2014)	*(no goal found in comp plan tab)*	Energy Related Policies in addition to Sustainability Element	Elaborate more on homeowners transitioning to renewable energy and how Buien can support this transition	Increase community knowledge about renewable energy options and energy efficiencies. This can include: - Implementing incentives for renewable energy projects through the City's permitting process, such as reducing fees and expediting the permitting process. - Partnering with utilities and contractors to provide information to businesses and school districts on renewable energy options along with how to upgrade equipment that improves affordability, comfort, indoor air quality and energy efficiency in all commercial/multi-family buildings and schools. - Promoting incentives for energy conservation and renewable energy for homeowners, with a priority for those who are energy- and housing- burdened. - Supporting Homeowner Energy Efficiency Workshop Events designed to inform the community about green building and efficiency certification programs, project permitting, financing, innovative products, as well as architect and contractor certification resources.
Materials and Consumption	Promote a circular economy	Mandate recycling and composting at commercial and multi-family properties	Mandate recycling and composting at commercial and multi-family properties by 2026. Use education and incentives to guide building owners, operators, and residents to achieve this goal. Use culturally competent multilingual education and outreach alongside incentives to guide building owners, operators, and residents to achieve this goal while reducing contamination within waste streams.	Renewable energy sources (e.g., solar)	II	High	N/A - this is a very strong policy	N/A - this is a very strong policy	N	Sustainability	Include as new policy in Sustainability	Mandate recycling and composting at commercial and multi-family properties by 2026. Use education and incentives to guide building owners, operators, and residents to achieve this goal. Use culturally competent multilingual education and outreach alongside incentives to guide building owners, operators, and residents to achieve this goal while reducing contamination within waste streams.
Water and Natural Systems	Protect and support native habitats, open spaces, and the quality and flow of water resources	Hire an arborist	Value and enhance tree canopy in Burien to address climate impacts by hiring an arborist. The arborist will support the preservation of native trees, educate city staff on best practices, assist in the development and implementation of tree codes, and track and report tree removal to enable the City to effectively manage tree cover.	Waste prevention and reduction	II	High	N/A - this is a very strong policy	N/A - this is a very strong policy	N	Sustainability	Include as new policy in Sustainability	Value and enhance tree canopy in Burien to address climate impacts by hiring an arborist. The arborist will support the preservation of native trees, educate city staff on best practices, assist in the development and implementation of tree codes, and track and report tree removal to enable the City to effectively manage tree cover.
				Tree/forest/open space/canopy protection and restoration	I	High	Consider adding a timeframe for when Burien should have an arborist hired by.		N			

B. Resilience Policy Revisions by Sector

Policy Review

The Policy Review illustrates that the Burien Comprehensive Plan has a large number of policies that have relationship to resilience or could be amended to have a relationship to resilience. Most of the policies that are relevant are associated with zoning and development (e.g., land use, critical areas, and capital facilities), transportation, or water resources (e.g., stormwater)

Exhibit 42. Current Comprehensive Plan Policy Review

Sector	Equity	GHG Mitigation	Resilience	Not Directly or Indirectly Related	Grand Total
Buildings & Energy		1	2	1	4
Cultural Resources & Practices			5		5
Economic Development			18	2	20
Ecosystems			28	5	33
Human Health	3		8	2	13
Parks, Open Space, Food Systems		1	18	1	20
Transportation	1	8	69	57	135
Waste Management			1		1
Water Resources			47	1	48
Zoning & Development	2	19	107	20	148
Grand Total	**6**	**29**	**303**	**89**	**427**

Proposed Comprehensive Plan Element Structure

The current comprehensive plan consolidates goals and policies into a single chapter. The proposed comprehensive plan is anticipated to be divided into the following elements.

Exhibit 43. Burien 2044 Comprehensive Plan: Proposed Structure

Elements	Sub-Headings
Chapters	In each element:
0 Vision & Plan Introduction	▶ Our [Element] Vision
1 Equity	▶ Introduction
2 Land Use	▶ Conditions & Trends
3 Transportation	▶ Our [Element] Plan
4 Housing	▶ Goals & Policies
5 Human Services	▶ Implementation
6 Economic Development	
7 Community Health and Wellbeing	
8 Sustainability & Natural Environment [includes natural environment/critical areas]	
9 Climate Change [added]	
10 Parks, Recreation, & Culture	
11 Capital Facilities/Utilities	

Parks, Open Space & Food Systems: Resilience

Policy Evaluation

A policy review of the current Comprehensive Plan noted 20 policies regarding parks and open space that support or that could better support resiliency and GHG mitigation in the Comprehensive Plan. There are additional parks and open space policies or strategies in the Climate Action Plan, Shoreline Master Program, and Natural Hazards Plan. Suggestions for policy amendments include:

- Enhancement, addition of native plants that are resilient to heat, precipitation, managed retreat, or adaptation, etc.
- For marine parkland in sea-level rise areas address investments / improvements in structural protections (reinforce, managed retreat, or other adaptation measures).
- Improve walkable access to park and recreational space, increase tree canopy, and provide cooling shade.

Example Goal and Policy Edits

Add these concepts to the updated / new Climate Element and coordinate with Parks, Recreation, and Open Space Plan Update:

> Goal: Prepare for climate changes in parks and recreation sites due to heat, extreme precipitation, landslides, and sea level rise.

Add to the new Climate Element and coordinate with Parks, Recreation, and Open Space Plan Update:

> Policy: Promote the design of city parks and trails to be climate resilient to heat exposure. Develop standards for climate resilient trees and landscaping. Eliminate or control non-native invasive pests through integrated pest management. Provide low-impact green infrastructure to support improved stormwater management. Utilize water conservation methods and technologies in development of irrigation infrastructure.
>
> Policy: Evaluate risks of future park or trail improvements in coastal flooding areas. Adapt parks and recreation facilities to reflect the risks of climate change including sea level rise, extreme precipitation, erosion, and landslides. Implement an adaptation hierarchy with strategies and interventions to protect, accommodate, or retreat from coastal flood hazard areas that would be exacerbated with climate change. Where interventions are necessary for protection prefer nature-based designs.
>
> Policy: Increase tree canopy in parks and rights of way. Prioritize overburdened communities.
>
> Policy: Create a resilient urban forest that emphasizes tree diversity, right tree right place, and monitors and controls pests using an integrated pest management system.

Policy: Increase connectivity of on and off street pedestrian facilities and trails to connect parks, housing, schools, and businesses across Burien. Prioritize communities most affected by traffic fatalities and serious injuries.

Buildings & Energy: Resilience

A policy evaluation suggested that the City could:

- Integrate Climate Action Plan strategies into the Comprehensive Plan.
- Address climate resilience and conservation for buildings and sites in a policy about City management of city capital facility management.

See Appendix A for Climate Action Plan strategies proposed for inclusion in the greenhouse gas portion of the Climate Element, and Appendix C for language that can be added to address criteria for city capital facility management.

Cultural Resources & Practices: Resilience

Policy Evaluation

Based on a review of existing Comprehensive Plan policies areas of focus could include:

- Adding reference to climate resilience / adaptation strategies to policies regarding tourism and cultural events in the Economic Development Element. [See Economic Development below.]
- Addressing ecosystem protection and enhancement to protect culturally important resources in policies.
- Integrating Climate Action Plan strategies around community education and investments to support overburdened communities.
    - See Emergency Management.

Example Goal and Policy Edits

Add a goal and policy in the Climate Element about cultural resources protection, similar to the Shoreline Master Program

Goal: Protect culturally significant resources, land, and artifacts.

Policy: Establish and maintain government-to-government relations with Native American tribes for the preservation of archaeological sites and traditional cultural properties that are vulnerable to climate impacts.

Policy: Protect, enhance, and restore ecosystems in order to meet tribal treaty rights and conserve culturally important consumptive and non-consumptive resources including foods, medicinal plants, and materials that could be adversely impacted by climate change.

Policy: Support the identification of eligible historic properties in costal flood areas and protect significant historic sites prone to floods or other hazards worsened by climate change.

Economic Development: Resilience

Policy Evaluation

A review of policies by the Comprehensive Plan team and K4C resulted in recommendations to strengthen existing goals and policies, including:

- Adding specificity about climate risks and business protection and recovery.
- Providing resources for cooling and clean air adaptation.
- Coordinating with businesses regarding emergency preparedness.
- Investing in increasing green jobs and attracting environmentally friendly businesses.
- Incorporating Climate Action Plan strategies for GHG reduction.
- Addressing adaptation in capital facilities projects to support Burien's local economy and commuters.

Example Goal and Policy Edits

In the Climate Element, either create a new goal or cross reference to Economic Development Goal ED.7 and add policies.

> Goal ED. 7 Promote art, aesthetic design and cultural events as central to businesses and job retention, job creation, and quality of life (Amended, Ordinance 701, December 2018).
>
> Policy: Provide incentives to encourage energy, weatherization, and cooling system retrofits of important cultural and economic centers (e.g., faith-based buildings, arts centers, other) particularly in Burien's Creative District.
>
> Policy: Promote climate-resilient designs of public parks and gathering spaces in support of recreation and cultural events.

In the Climate Element, either create a new goal or cross reference to Economic Development Goal ED.3 and add policies:

> Goal ED. 3 Diversify the economy and promote economic vitality and employment throughout the city.
>
> Policy: Encourage design features in commercial and employment districts to integrate exterior building features (e.g., awnings, cool roofs, solar panels) that reduce the impacts of climate change.

Policy: Support local businesses' efforts to generate and store renewable electricity on-site, which can provide back-up power during emergencies and help ensure continuity of operations.

Policy: Encourage the development of climate-resilient and green technology businesses and industries.

Incorporating Climate Action Plan strategies for GHG reduction, can be accomplished in land use, transportation, and capital facilities sections of the Climate Element.

See Appendix C addressing adaptation in capital facilities projects to support Burien's local economy and commuters.

Emergency Management: Resilience

Policy Evaluation

Below are policy recommendations that could help the City reach preparedness, response, and recovery goals and address likely climate change hazards and subsequent emergencies.

- Integrate CEMP recommendations into the Comprehensive Plan, such as facility improvements in the Burien capital facility plan.
  - See Appendix C addressing adaptation in capital facilities projects regarding the CEMP.
- Use heat island and locations of vulnerable populations to prioritize tree canopy installation and to plan for expanded park spaces.
  - See Parks, Open Space, Food Systems
- Integrate Climate Action Plan strategies to plan for climate change and to build community awareness of risks and strategies.

Example Goal and Policy Edits

Add Climate Action Plan goals and high level strategies into the Climate Element addressing culturally competent engagement to build awareness. Keep detailed strategies in Climate Action Plan as an implementation activity.

Goal C-1: Strengthen the capacity to support climate action. [Add to Climate Element]
Strategy C-1.1: Build awareness in the community around climate-related impacts and resilience preparedness and action. [Add to Climate Element with edit]
C-1.1.1 Partner with community organizations and key stakeholders to host culturally competent and multi-lingual educational workshops around aspects of sustainability, including waste reduction, zero waste, upcycling, natural yard care, water conservation, benefits of trees, air quality, energy efficiencies in homes, and energy conservation.

Goal C-2: Enhance the resilience of populations that will be disproportionately impacted by climate change. [Add to Climate Element]

Strategy C-2.1: Focus investments on communities that experience disproportionate climate impacts.

C-2.1.1 Identify current and future vulnerable populations (frontline communities) most affected by climate change in Burien. Once identified:
- Conduct targeted outreach with these populations to understand their needs, and how the City can best assist them in preparing to meet those needs.
- Implement resilience-building actions to support these populations. Resilience- building actions can include jobs training, volunteer opportunities, community organizing, and school and recreation-based activities.

C-2.1.2 Partner with community organizations to conduct wildfire smoke outreach and education campaigns to increase awareness of how homeowners and renters can prepare for the negative impacts of wildfire smoke. Prioritize communities without air conditioning or air filtration, health co-morbidities, and those who work outside. [Put with Human Health next to heat strategy?]

C-2.1.3 Ensure equitable access to parks, green space, and recreational services by creating more usable green space in Burien's activity centers and incorporating a higher volume of smaller parks and urban public spaces. [Address in PROS Update]

C-X.X. Create template evacuation plans and outreach materials to help residents plan and practice actions that make evacuation quicker and safer. Ensure materials are accessible in different formats and languages.

C-X.X. Support enhanced data collection for hazard events of all magnitudes to provide a fuller understanding of the community's hazard characteristics — including those affected by climate change.

Health & Well-being: Resilience

Policy Evaluation

The Comprehensive Plan and Climate Action Plan include relevant policies around capital facility design to address public health and most burdened populations, as well as to increase outreach. Current Comprehensive Plan policies also address stormwater and flood risks.

A recommendation is to address specific hazards and mitigation strategies for their associated health risks.

Example Goal and Policy Edits

The following goal and policies could be included in the Climate Element

Goal: Enhance emergency plans, resources, and response to minimize the impacts of climate exacerbated emergencies and disasters on people, property, environment, and economy.

Policy: Regularly update and implement the Comprehensive Emergency Management Plan. Factor climate impacts into the planning of operations and coordination of preparedness, response, and recovery activities among first responders and partners, including public health, law enforcement, fire, school, and emergency medical services (EMS) personnel. Plan for emergency evacuations and post damage evaluation of City buildings and infrastructure.

Policy: Provide necessary improvements, staffing, and investments for the Burien Community Center and other locations to serve as community hubs for cooling and clean air. Ensure community accessibility (e.g., transit) and awareness.

Policy: Develop a heat resilience strategy — also called extreme heat response plan — could include heat mitigation and management actions that prepare for and respond to chronic and acute heat risk. *[Could put this with Emergency Management]*

Policy: Monitor and assess the risk of trails and parks for climate related safety hazards in recreational sites throughout Burien. *[Could move this to Parks, Open Space, and Food Systems]*

Ecosystems: Resilience

Policy Evaluation

Climate change resilience strategies are recommended for integration by the Comprehensive Plan team. A policy review suggested addressing more of the following concepts:

- Cooling, green infrastructure, and proper selection of trees and plantings for drought tolerance.
- Enhancement, addition of native plants that are resilient to heat, precipitation, managed retreat, or adaptation, etc.
- Integrate resilience into Shoreline Master Program goals and policies at the time of the next periodic update.
- Hire an arborist to help value and enhance tree canopy per Climate Action Plan strategy to support water and natural systems.

Example Goal and Policy Edits

Add an Ecosystem goal and policies, including an arborist recommendation from the Climate Action Plan.

Goal: Increase green infrastructure and ecosystem services.

Policy: Provide green stormwater infrastructure to mimic natural systems.

Policy: Increase the amount and resilience of trees and plants. Promote proper selection of trees for drought tolerance.

Policy: Provide incentives or requirements for habitat enhancement and restoration to increase plant density and diversity and habitat connectivity.

Policy: Value and enhance tree canopy in Burien to address climate impacts by hiring an arborist. The arborist will support the preservation of native trees, educate city staff on best practices, assist in the development and implementation of tree codes, and track and report tree removal to enable the City to effectively manage tree cover. *[Consider putting the first sentence as the policy and the rest as a description/discussion under the policy.]*

Transportation: Resilience

Policy Evaluation

The following policy audit themes were developed into recommended strategies to further promote resilience:

- Add consideration of alternate routes suitable for detours and critical routes in the event of a climate hazard emergency.
- Add consideration of priority routes in the event of a climate disaster (flood) when developing LOS standards.
- Add consideration of pedestrian need for a separated facility in areas prone to flooding.
- Add specificity to focus on features that provide enhancements for climate resilience, such as designing drainage for extreme flooding, and providing trees and greenery.
- Add consideration of on-site infiltration, including pervious pavement, in areas prone to flooding and/or with aging drainage infrastructure
- Add specificity to define "safety" through a climate lens. Consider adding drainage as a safety consideration.
- Add specificity for increased pavement maintenance; establish metrics.
- Consider adding transit shelters, priority roadways for snow plowing, and include drainage as a safety consideration. Define priority transit stop amenities to include canopied and walled shelters.

K4C/Cascadia reviewed selected transportation policies and the optimal integration of Climate Action Plan strategies particularly those in alignment with K4C model policies and ability to address greenhouse gas reduction. *These would be included in the GHG reduction portion of the Climate Element.*

- Develop an electric vehicle (EV) infrastructure plan.
- Remote work for City employees.
- Transition City fleet to all EV.
- Encourage Commute Trip Reduction (CTR) programs.

Example Goal and Policy Edits

Add under a Transportation section of the Climate Element the following (and coordinate with Public Works on Transportation Master Plan):

> Goal: Develop and maintain a connected, safe, and resilient transportation system.
>
> Policy: Improve roadway stormwater system capacity and condition to accommodate future storm events. Prioritize areas where storm impacts are the highest.
>
> Policy: Provide new and improved multimodal access, including grade-separated facilities.
>
> Policy: Incorporate hydrologic climate impacts into design of water-crossing structures (culverts).
>
> Policy: Reduce stormwater impacts from projects through low impact development/green stormwater infrastructure (LID/GSI)
>
> Policy: Increase street tree canopy, and prioritize areas with overburdened communities.
>
> Policy: Increase shelter of transit stops and centers. Define priority transit stop amenities to include canopied and walled shelters.
>
> Policy: Ensure transportation system design and construction standards account for climate resilience due to extreme climate events and promote climate safety considerations.
>
> Policy: Prepare emergency plans providing alternate transportation routes for coastal neighborhoods.

Waste Management: Resilience

Policy Evaluation

Where there is overlapping responsibilities, e.g., road and stormwater system management by Burien, the City and Districts could identify potential for joint improvement efforts to facilitate urban sewer system use and reduce impacts on stormwater systems.

A primary solid waste policy consideration is to address issues related to waste management as hazard mitigation in the likely event of additional climate change related hazards. A policy review of the Climate Action Plan suggests adding Goal M-1 and the related strategies in the GHG reduction portion of the Climate Element.

Example Goal and Policy Edits

The following goal and policy could be part of a Climate Element resilience section:

> Goal: Increase municipal cleanup and refuse capacity to prepare for increased need following extreme precipitation events.

Policy: Develop and implement a strategy to expedite debris management work (e.g., downed tree limbs and buildings blocking roads and streams) during and after a disaster incident to reduce the risks of subsequent fire, flood, injury, and disease vectors.

The following policy could be located with Transportation or Water Resources goals and policies:

Policy: Identify opportunities for joint planning of road, stormwater, and sewer infrastructure extension in areas subject to extreme precipitation and local flooding to protect water quality and infrastructure.

Water Resources: Resilience

Policy Evaluation

The Comprehensive Plan review team identified areas for policy improvement including integrating the gaps and opportunities above as well as:

- Identifying increased climate risks and resilience in policies regarding groundwater.
- Integrating Climate Action Plan strategies such as protecting stormwater infrastructure and expanding green infrastructure including increasing City resources for system replacement frequency and designing the system replacement, sizing, and addition based on climate change predictions.

Example Goal and Policy Edits

The following policies would be part of the Water Resources section of the Climate Element:

Goal: Preserve and enhance water resources sustainably in the face of climate change.

Policy: Increase conveyance and treatment facility capacities to accommodate anticipated peak rainfall events.

Policy: Increase restoration requirements or incentives for wetlands, habitats, and urban forests.

Policy: Update codes and design standards to be resilient by including capacity for anticipated new rainfall patterns.

Policy: Partner with adjacent agencies to facilitate actions on shared assets, such as Miller Creek.

Zoning & Development: Resilience

Policy Evaluation

Based on a policy review, the following are areas of potential strengthening of policies.

- Add or amend policies addressing building, landscape and site design that promote resilience.

- Add policy language to adapt existing infrastructure in sea level rise and flooding areas.
- Amend design standards for utilities.
- Amend existing tree policies to consider Tree City USA and Department of Natural Resources related assistance.
- Link Comprehensive Plan Elements to the Climate Action Plan metrics and monitoring.
- Through Housing Element update address new housing types and densities.
- Update shoreline goals and policies to reference resilience measures; consider including in shoreline restoration plan.

Example Goal and Policy Edits

Policy changes will be developed with land use alternatives for the Comprehensive Plan. The alternatives and associated goals/objectives would help test the following ideas:

- Update land use policies to develop ten-minute communities.
  - Land Use Alternatives are exploring neighborhood centers.
- Increase density limits within urban growth areas. Study displacement impacts on the increase in density limits.
  - Increases in heights are anticipated in the Urban Center.
- Allow middle housing types, such as duplexes, triplexes, and accessory dwelling units (ADUs), on all residential lots.
  - Under review with alternatives.
- Ensure public transit stops and stations are located at or near (e.g., within 600 ft.) shopping centers and malls.
  - Address through Transportation Master Plan.
- Update shoreline management policies and restoration plan to reflect climate stressors and adaptation measures.
  - Address in next Shoreline periodic review.

C. Prioritization Criteria for Capital Improvements

Adjusting Capital Facility Plan Criteria for Resilience

The City can integrate climate resilience and equity into its capital facility plan element. Example community approaches include the following for Pierce County and the Cities of Bainbridge Island and Everett parks and stormwater planning. Pierce County and Bainbridge island have checklists to review each proposed legislation/code item (Pierce County) or capital facility (Bainbridge Island). They use equity and environmental information. Everett used an equity analysis to help identify overburdened / underserved areas and the capital programs are designed to fill those gaps. The City of Burien could use the climate index and equity metrics or principles under development for the Comprehensive Plan to screen capital projects.

Exhibit 44. Example Capital Facility Plan Screening Tools and Criteria

Agency	Climate/Equity Tool	Links
Pierce County	Four departments including Planning and Public Works fill in a checklist with any proposed change to legislation.	https://www.piercecountywa.gov/7938/Equity-In-Decision-Making
City of Bainbridge Island	Directly relevant checklist – links climate impacts and facility type/location.	https://ecoadapt.org/data/documents/EcoAdaptCCAC_BSB2022_Fillable.pdf
City of Everett	Two system plans address socioeconomic factors in identifying gaps and proposals to fill gaps.	▶ https://storymaps.arcgis.com/collections/1a3a34df6ec04486844587defff66259?item=1 ▶ Final version of the 2022 PROS plan. ▶ https://www.everettwa.gov/2837/Stormwater-Management-Action-Plan-Plan

Policies to Review for Amendment

- Potential policies for amendment – add reference to climate adaptation and resilience:

  "Pol UC.12: Plan for, prioritize, and implement infrastructure improvements in the Urban Center.

  "Pol. UT 1.3 Development shall be allowed only when and where all essential utility services are adequate in accord with their level of service guidelines, and only when and where such development can be adequately served by essential utilities without reducing levels of service below the level of service guidelines elsewhere. Alternative means of providing essential utility services shall be allowed only when consistent with the policies of this element."

  "Pol. CF 1.2 The City shall integrate its land use and public works planning activities with an ongoing program of long range financial planning to ensure that the City's future land use plan and level of service standards can be supported by quality public facilities. Such planning should address the following in order of priority:

- Improvements needed to provide adequate public safety or to remove hazards
- Investments needed to maintain existing facilities from further deterioration
- New Investments to increase capacity for growth focused into specific areas that implement the comprehensive plan.
- Improvements to meet comprehensive planning objectives to serve existing residential neighborhoods."

"Pol. EPF 2.6 Siting of public facilities outside of an appropriately zoned site shall be based upon criteria including, but not limited to:

a) Specific facility requirements (acreage, transportation access, etc.);

b) Land use compatibility;

c) Potential social impacts on the community;

d) Potential fiscal impacts;

e) Potential environmental impacts;

f) Potential traffic impacts;

g) A complete consideration of alternatives, both in terms of sites and demand management measurements if appropriate; and

h) Fair distribution of such public facilities throughout the County and region.

The application of these criteria shall be documented by independent professional analysis in an appropriate form such as an Environmental Impact Statement and be subject to meaningful public review prior to approval."

Pol. ST 1.8 As part of its review process, the City shall consider the impacts of stormwater runoff from new development on the City's natural drainage systems, and require any appropriate mitigating measures. When redevelopment occurs, and the amount of impervious surface increases, the City shall require existing development to be retrofitted with stormwater management facilities. Criteria for implementing this policy should also be developed using a threshold approach patterned after SEPA requirements.