



Tacoma Climate Adaptation Strategy

October 2021



Letter from City Council

Our fellow Tacomans,

Climate change is no longer a threat in the distant future – it's here now. And the impacts of climate change have been even more pronounced this past year in the Pacific Northwest. Our region has experienced unprecedented heat waves, wildfire smoke and heavy rain events. We will all need to adjust to our changing climate and prepare for more frequent and intense climate change impacts.

With over 30 miles of shoreline, soaring bluffs and a significant estuary at the mouth of a mighty glacier-fed river that joins Commencement Bay, Tacoma is the pearl of the Puget Sound. An uncomfortable truth is that many of our unique and treasured natural assets are threatened by climate change. Climate change threats extend to the built environment and people as well. The purpose of this Climate Adaptation Strategy is to help prepare the City of Tacoma to be more resilient in the face of these threats by enhancing our capacity to prevent, respond and adapt. The adaptation actions included in the plan focus on protecting its infrastructure, economy, and community in the face of increasing climate threats.

We also recognize that social equity is essential to effective and long-lasting resilience to climate change. Every step of the adaptation planning process ensures that city and community investments prioritize equity and frontline communities.

We can't succeed in doing this work alone; it will require community investment. This plan is a call to action for our government, businesses and residents. We invite you to join us in this important work.

In service,

[Signatures]

Land Acknowledgement

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We gratefully honor and acknowledge that we rest on the traditional lands of the Puyallup People. The Puyallup people have lived on this land since the beginning of time. They are still here today. They live, work, raise their children, take care of their community, practice their traditional ways and speak the Twulshootseed language – just as their ancestors did.

We recognize that this land acknowledgement is one small step toward true allyship and we commit to uplifting the voices, experiences, and histories of the Indigenous people of this land and beyond.

Source: Puyallup Tribe of Indians, [Land Acknowledgement](#).

See the Puyallup Tribe’s land acknowledgement spoken by Tribal members in their native Twulshootseed language: <https://youtu.be/KGnac8x-SIM>.

Acknowledgments

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Infrastructure, Planning, and Sustainability (IPS) Committee

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Executive Summary

Human-driven climate change continues to impact the Puget Sound region in multiple ways—the region has experienced unprecedented heat waves, warmer temperatures year-round, reduced snowpack, sea level rise, heavy rain events, wildfire smoke, and flooding. Even with ambitious climate mitigation actions that reduce the City’s greenhouse gas emissions, some climate impacts are already irreversible, and Tacoma will continue to experience them for years to come.

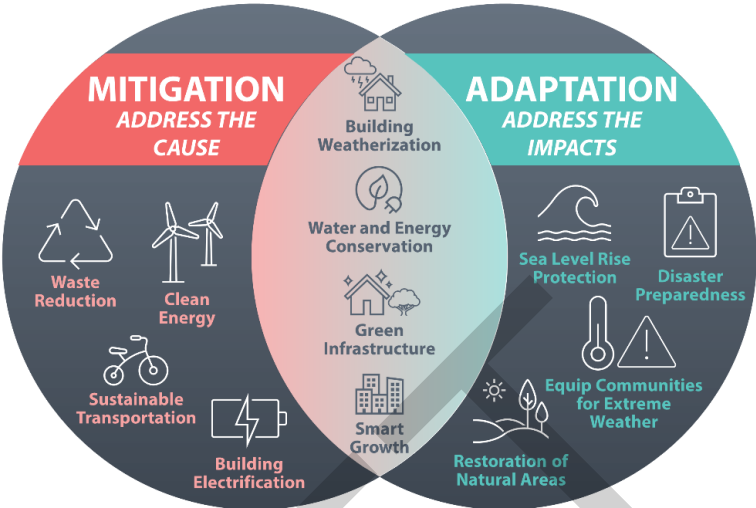
The City of Tacoma is continuing to invest in a climate-resilient and climate-smart future by building on our long history of climate action. These efforts include the first Tacoma Community Climate Action Plan in 2008, the 2016 Tacoma Environmental Action Plan, and the 2025 Tacoma Strategic Plan. To affirm this priority, the City simultaneously developed two updated plans: 1) this Tacoma Adaptation Strategy (“Strategy”), which aims to help the City cope and adapt to future climate impacts, and 2) the Tacoma Community Climate Action Plan, which aims to identify pathways to reduce the City’s greenhouse gas emissions.

Equity & Climate Resilience

Social equity is essential to effective and long-lasting resilience to climate change. The Tacoma Adaptation Strategy centered social equity along each step of the planning process.

- ▶ Equity was a key criterion to evaluate and prioritize actions.
- ▶ Adaptation strategies were cross-walked with other key city plans such as the Affordable Housing Action Strategy to ensure equitable impacts.
- ▶ Key strategies addressed community priorities of elevating youth leadership for environmental justice and creating central hubs to provide cooling and air quality relief.
- ▶ Each action has equity-specific considerations to ensure that investments prioritize equity and frontline communities.
- ▶ Implementation of key actions will be in conjunction with the [Tacoma Equity Index](#) to ensure that implementation and progress metrics are aligned with current City equity resources.

Climate Mitigation and Adaptation: What's the Difference?



The Tacoma Adaptation Strategy, summarized in the table below, provides a blueprint and foundation for the City of Tacoma to adapt to future climate risks and achieve its vision of a sustainable and resilient Tacoma. The Strategy's actions will reduce exposure to climate hazards, ensure that capital investments can withstand future climate change, protect our native habitats, build economic resilience and prosperity, support a diverse community with services and amenities, and enhance the health and well-being of current and future generations.

Sector	Strategies	Actions
Infrastructure	<ul style="list-style-type: none"> ▶ Improve building resilience ▶ Improve transportation resilience ▶ Improve water & energy infrastructure resilience ▶ Improve cross-sectoral infrastructure resilience 	<ul style="list-style-type: none"> ▶ Site-by-site flooding evaluation and planning ▶ Capital project standards and tools ▶ Development code improvements ▶ Capital project planning and prioritization, and implementation
Natural Systems	<ul style="list-style-type: none"> ▶ Improve ecosystem resilience ▶ Ensure a health and sufficient water supply 	<ul style="list-style-type: none"> ▶ Natural systems condition assessment and monitoring program ▶ Nearshore transitional zones ▶ Habitat restoration project guidance and resilience
Economy	<ul style="list-style-type: none"> ▶ Build resilient and adaptable industries. ▶ Build a resilient and effective workforce. 	<ul style="list-style-type: none"> ▶ Business engagement and continuity planning ▶ Just & green jobs transition plan
Public Health	<ul style="list-style-type: none"> ▶ Minimize climate-related health impacts ▶ Increase social cohesion ▶ Prepare for weather emergencies 	<ul style="list-style-type: none"> ▶ Cooling and air quality resilience hubs ▶ Co-create climate communications ▶ Filter fan distribution
Governance	<ul style="list-style-type: none"> ▶ Equip residents and businesses with resources to successfully adapt ▶ Increase City accountability ▶ Build regional, comprehensive resilience 	<ul style="list-style-type: none"> ▶ Climate equity initiatives ▶ Regional coordination ▶ Economic return-on-investment tools

To achieve the goals and vision of a more sustainable and resilient Tacoma for all residents, the City will need to collaborate with its implementation partners and strategically implement these adaptation actions. Key implementation considerations include:

- ▶ **Phasing:** The Strategy will be implemented in three phases spanning seven years (2021-2028).
- ▶ **Key Performance Indicators (KPIs):** The City will monitor, evaluate, and adjust action implementation and impact using quantitative KPIs.
- ▶ **Social Equity:** It will be important to optimize equitable outcomes and bridge historical health and economic disparities throughout action implementation, including inclusion of equity considerations and best practices.
- ▶ **Coordination:** Coordination with other City department and external partner activities and plans will leverage and streamline limited City resources.
- ▶ **Funding:** Options for funding action implementation include City resources and a variety of competitive federal, state, and private grants.

DRAFT

Introduction

The City of Tacoma is in the Puget Sound region of Washington State—approximately 30 miles southwest of Seattle and 31 miles northeast of the state capital, Olympia—is an economically and culturally important part of Washington State. Located at the edge of Commencement Bay, Tacoma boasts beautiful scenery and shorelines, but is increasingly vulnerable to climate impacts such as extreme heat, sea level rise, landslides, and flooding.

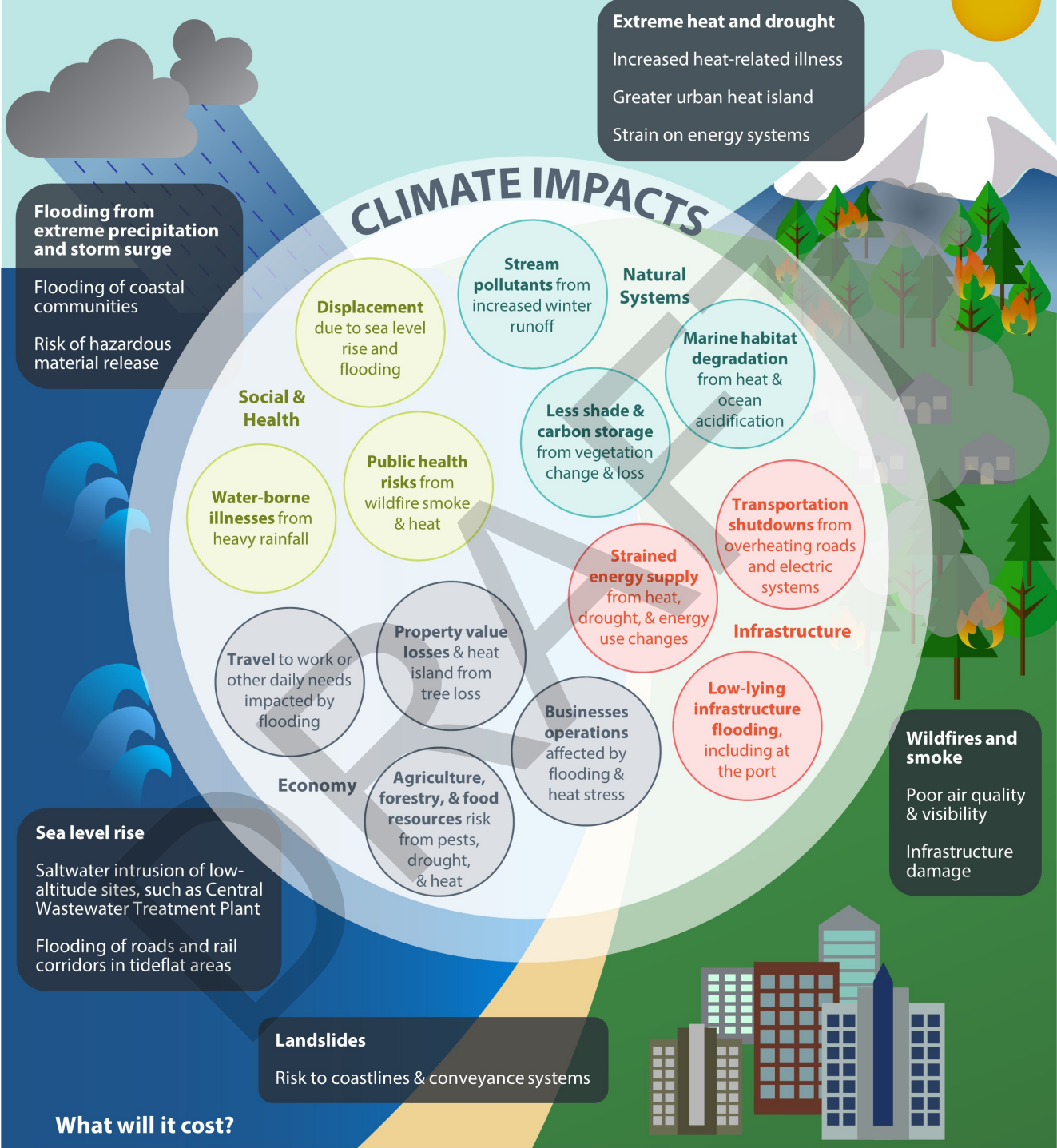
Tacoma has a variety of thriving industries—including maritime, technology, art, healthcare, and aerospace industries. The City of Tacoma currently has over 110,000 jobs and has adopted targets for 97,000 new jobs by 2040. While Tacoma supports many thriving industries that will be impacted by climate change, the low-lying areas in particular—such as the Tacoma Tideflats and Ruston Way—that support the region’s maritime and industrial activities will be heavily affected by sea level rise, warming temperatures, and storm events. Heat waves, such as the heat dome event of June 2021, closed many restaurants and outdoor businesses due to public health and safety concerns.

In addition to its many thriving economies, Tacoma offers a variety of amenities to its residents and visitors, including beautiful natural areas, a diverse and lively culture, and distinct and unique neighborhoods. Local parks and open spaces provide important recreational opportunities for Tacoma residents. Much of the Tideflats subarea is within the Puyallup Tribe survey boundaries and is an important location for cultural traditions and the practice of tribal treaty rights. The City is currently working to expand and enhance access to arts, culture, heritage, and science experiences by reducing barriers to access and expanding opportunities for underserved youth. These opportunities and assets—especially those in flood-and landslide-prone areas—will need to prepare for more frequent and damaging floods and landslides over the course of this century.

The heart of Tacoma is its people. The health and safety of Tacomans are increasingly threatened by severe extreme heat and wildfire smoke events—with record-breaking heat waves bringing 100°F+ temperatures to our region in 2021. These conditions are particularly dangerous for Tacomans with pre-existing health conditions, the very young and elderly, pregnant women, outdoor workers, and low-income and non-English speaking households with more limited access to resources and information.

The City of Tacoma has been working to prepare the community for the impacts of climate change. This **Tacoma Climate Adaptation Strategy** builds on a foundation of previous City efforts—such as the 2016 Climate Resiliency Study and the Environmental Action Plan—to prepare for climate change and provides a strategic roadmap for building communitywide resilience to climate change and other threats. The City is also working to lower climate-changing greenhouse gas (GHG) emissions, such as through the new Climate Action Plan and Resolution No. 40776, which restricts the use of fossil fuels in the City’s municipal operations.

TACOMA'S FUTURE CLIMATE



What will it cost?

Climate impacts are already affecting the lives of Tacoma's residents and will worsen if we do not act. The cost of climate impacts—or the loss of human life, reduction in quality of life, disruption of critical services, and loss of economic assets from natural hazards and extreme events under future climate change conditions—is \$3.05 billion by 2050. While we cannot completely avoid these costs, implementing the actions in the Climate Adaptation Strategy could lessen these costs by \$152 million.

Strategy for a Resilient Future

The City of Tacoma's climate adaptation and resiliency goals were iteratively developed by the Tacoma Adaptation Steering Committee. The vision for the Tacoma Adaptation Strategy is:

Tacoma is a resilient, safe, and healthy community that is a leader in preparing for current and future climate change by distributing resources and services equitably, protecting city infrastructure, using best available science to inform decision-making, and holding ourselves accountable.

The planning team followed the guiding principles below to develop ambitious and equitable adaptation solutions. Many of these guiding principles also guided development of the 2021 Tacoma Community Climate Action Plan.

Guiding principle	The Tacoma Adaptation Strategy will...
<p>Lead with racial justice and equity.</p>	<ul style="list-style-type: none"> ▶ Prioritize strategies that benefit frontline communities—especially our Black, Indigenous, and communities of color and low-incomes communities—to ensure they have the access and resources to cope, adapt, and persist to future climate change. ▶ Empower frontline communities in decision-making and implementation to create an equitable future for all.
<p>Build transformational solutions for enduring community recovery.</p>	<ul style="list-style-type: none"> ▶ Be a leading example for other cities on how to adapt to future climate change in an ambitious and inclusive way. ▶ Pave the way for a prosperous and diverse community for all Tacomans for today and future generations.
<p>Be transparent and accountable.</p>	<ul style="list-style-type: none"> ▶ Build in accountability and transparency by integrating climate adaptation goals across congruent plans throughout all City departments. ▶ Utilize common language so that everyone understands what is being done and why. ▶ Track key metrics to ensure effective implementation and achievement of goals.
<p>Make decisions based on science and data, including community expertise and input.</p>	<ul style="list-style-type: none"> ▶ Ground decisions in best available science to inform policies and choices that will affect future generations. ▶ Respect and learn from the past. ▶ Listen to the community to stay connected, relevant, and responsive to their priorities.
<p>Prioritize health and other co-benefits.</p>	<ul style="list-style-type: none"> ▶ Ensure that all actions prioritize multiple co-benefits and support the health, well-being, economy, social fabric, housing equity, and cultural diversity of Tacoma.

Focus Areas & Goals

This Climate Adaptation Strategy focuses on six focus areas for achieving a resilient future:

Focus Area	Goal
Infrastructure	Promote resilient facilities and infrastructure that can withstand current and future climate impacts and provide multiple benefits.



Natural Systems	Protect and restore natural systems and landscapes to be resilient to climate impacts and provide ecosystem services.
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Economy	Promote a resilient economy that is both adaptable to future climate shocks and responsive to new economic opportunities.
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Public Health & Safety	Maintain and expand community-wide safety nets and services to ensure a healthy and safe community in the face of climate change.
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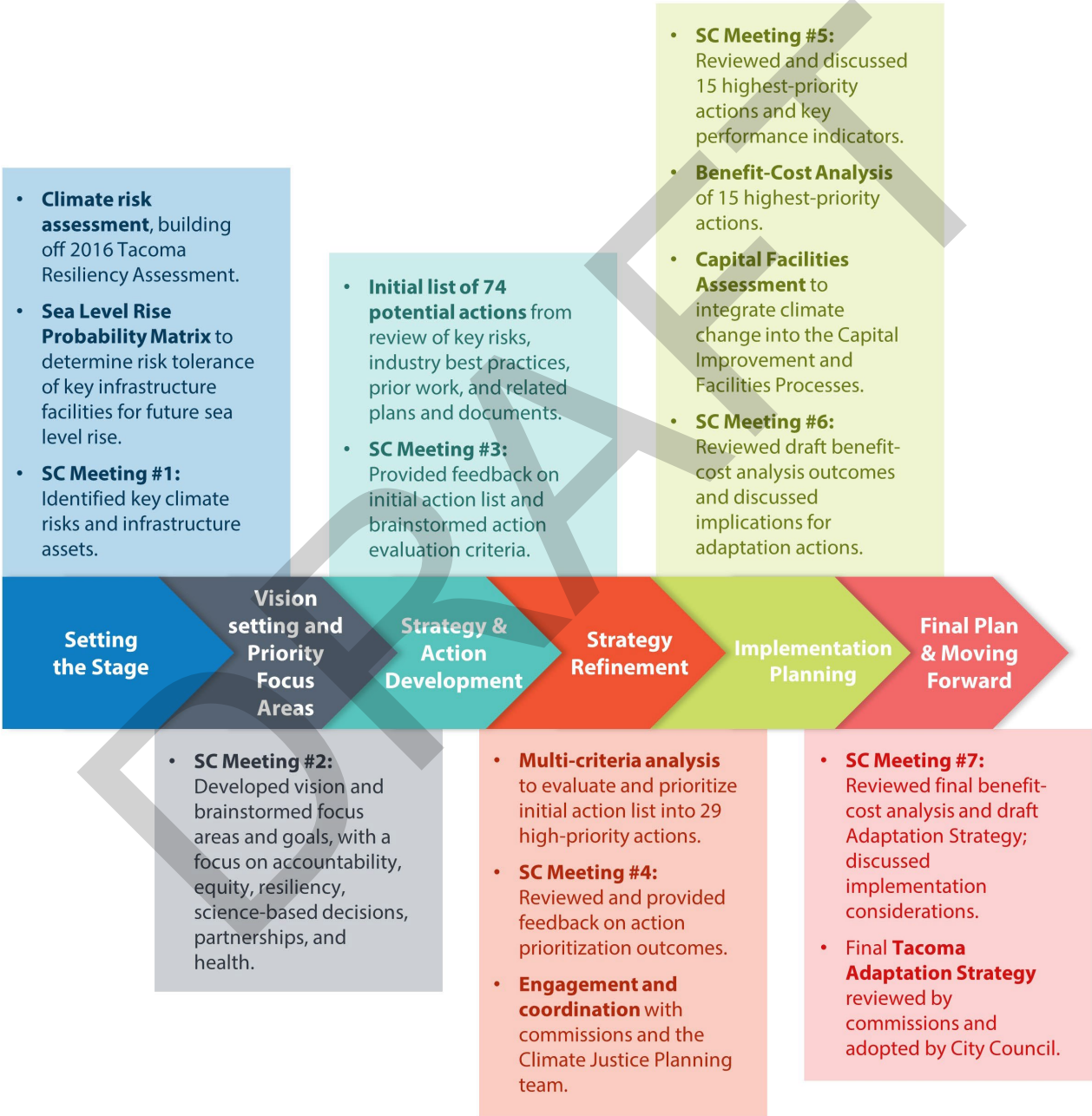


Governance	Institutionalize and prioritize climate change resilience across City processes and investments.
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Our Process

The City of Tacoma and Tacoma Adaptation Steering Committee iteratively developed the focus area goals, associated strategies, and specific actions in this Strategy. The committee met seven times over the course of the planning process (October 2020 through August 2021). Key planning milestones for the Tacoma Adaptation Strategy and key feedback from the Steering Committee (SC) are summarized below.



Centering Social Equity

Social equity is critical and central to the success of the Tacoma Adaptation Strategy. Climate change will disproportionately impact some groups—including communities of color, low-income communities, elderly people, non-English speaking households, and immigrant communities. Social equity has also been central to [Tacoma's community vision](#) for a sustainable, livable, economically vibrant, and socially responsible community for all its residents. This vision is supported by Resolution 40622 passed in 2020, which affirms the City of Tacoma's commitment to anti-racist systems transformation.



Building on a Foundation

The **Tacoma Adaptation Strategy**—which focuses on opportunities to increase resilience of Tacoma’s residents, communities, businesses, and infrastructure to cope and adapt to future climate change—was developed concurrently in 2020-2021 with the **Tacoma Community Climate Action Plan**—which focuses on the biggest opportunities for Tacoma to reduce its greenhouse gas emissions. The Tacoma Adaptation Strategy builds on previous studies, reports, and plans commissioned by the City to prepare for future climate change impacts.



Collaboration & Coordination









Climate adaptation and resiliency building will require collaboration and coordination across City departments, agencies, and partners. This collaboration can create synergies to maximize benefits and leverage funding and resources. For more details on how collaboration and coordination will inform the implementation of this plan, please see the [Coordination](#) section on page 48.



Taking Action

This section details the strategies and actions for achieving a resilient future.

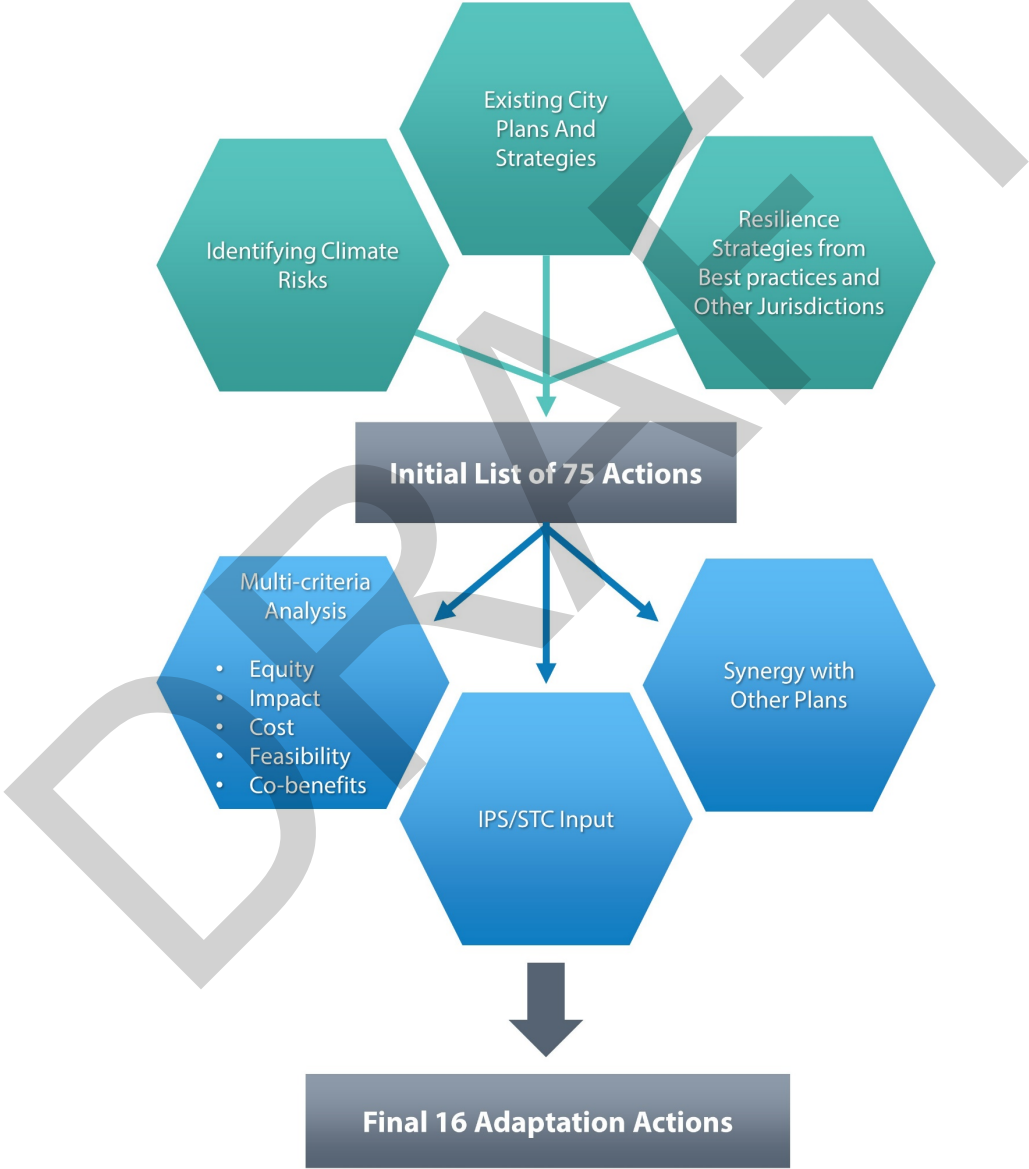
How to read actions in this section:

Action name			
Brief action description			
Why it's important	Why the action matters for the Tacoma community and climate resilience		
KPI	Key performance indicator to assess action progress		
Connection to other plans	Other City and organizational plans that include related actions or would require coordination	Hazards addressed	Climate hazards addressed:  Coastal Flooding  River Flooding  Snowpack & precipitation  Extreme heat  Wildfire smoke
		Co-benefits	Additional action benefits
		Project benefits*	Estimated avoided costs associated with action implementation*
Potential City Policies & Procedures Changes*	Potential climate adaptation changes for current city policies and procedures (Appendix E)		
Equity considerations	Considerations for ensuring equitable outcomes	Project costs*	Estimated City cost to implement action
		Cost of inaction*	Total estimated costs (damages) that community would have incurred from climate hazards and extreme events without action through 2080
		Lead implementor	Lead implementing entity
Other considerations	Other important implementation considerations	Partners	Needed partnerships to fully execute action
		Timeframe	Initiation timeframe:  = 2021-2024  = 2025-2027  = 2028 and beyond

*See Appendix C: Benefit-Cost Analysis for more details on the assumptions and parameters of the analysis and Appendix E: Potential Climate Adaptations for City Policies & Procedures for more details on applicable City programs & policies.

Action Development

Strategies and actions were iteratively developed by the City and consultant team in collaboration with the Tacoma Adaptation Steering Committee. An initial set of 75 actions were identified by reviewing existing City plans, best practices from comparable jurisdictions, and strategies that address key climate risks. Following this initial identification, a multi-criteria analysis, input from the City’s Infrastructure, Planning, and Sustainability (IPS) Commission and Sustainable Tacoma Commission (STC), and synergy across other City plans and priorities, the Steering Committee narrowed down the list of 75 actions to a set of 16 actions for inclusion in this Strategy.



Infrastructure

What is included?

Infrastructure encompasses the essential physical and organizational structures and facilities that is needed for the functional operation of the City government and its residents. City infrastructure includes roads, buildings, seawalls, piers, stormwater systems, wastewater facilities, and electric power facilities. Critical infrastructure will be impacted by a range of climate hazards, including sea level rise, flooding, extreme heat, and landslides. Investing in infrastructure resilience strategies can create local jobs, support economic resilience, protect valuable assets, and improve safety during emergencies.

***Goal:** Promote resilient facilities and infrastructure that can withstand current and future climate impacts and provide multiple benefits.*

How We'll Get There

Infrastructure resilience requires first identifying critical roads, infrastructure, and vulnerable populations that are at risk due to climate impacts. Once identified, updated standards and codes for current and future infrastructure can ensure assets are built to withstand and minimize climate impacts. This groundwork can inform the prioritization of specific capital improvement projects that build resilience in our built environment.


Sector Strategies:

- ▶ **Improve building resilience** by ensuring that private and publicly owned buildings are resilient to climate change.
- ▶ **Improve transportation resilience** by ensuring that transportation routes can withstand climate impacts.
- ▶ **Improve water & energy infrastructure resilience** by ensuring that water and energy supply and conveyance systems can withstand climate impacts.
- ▶ **Ensure that cross-sectoral infrastructure projects** can withstand climate impacts.

Connected Plans



- ▶ **Tacoma Community Climate Action Plan** includes actions for resilience retrofits, increasing staff capacity to meet new codes and retrofit opportunities, and keeping housing affordable and in good repair.
- ▶ **Affordable Housing Action Strategy** includes actions to access and renovate or resell derelict properties, using code compliance to support livability improvements, and using proactive rental inspection program to adhere to and support health standards.
- ▶ **Transportation Master Plan** includes actions to accommodate pedestrians and monitor sidewalk infrastructure, building incentives for developments that provide weather protection, and cross-jurisdictional collaboration to provide safe and accessible intersections to transit.
- ▶ **Planning & Development Services' 2025 Strategic Plan** includes actions to protect and preserve Tacoma's place-defining characteristics, including historic and cultural resources, scenic views, and natural settings.

Actions

Site-by-site flooding evaluation & planning		
Conduct a review of current science focusing on flooding impacts to critical roads, infrastructure, and steep slopes due to increasing intense rainfall events, sea level rise, flooding, and landslides. Integrate findings into City development codes, emergency management, and capital planning.		
Why it's important	An evaluation of subarea and basin flooding will help Tacoma better identify climate impacts on critical infrastructure. This action lays the groundwork for identifying vulnerable sites and preparing those sites for increasing sea levels, flooding, and landslides. Inaction would result in interrupted critical services and significant economic costs, especially during emergencies.	
KPI	Evaluation and assessment completion	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; One Tacoma Comprehensive Plan: Environment and Watershed Health Chapter	
Potential policy & procedure modifications	<ul style="list-style-type: none"> Prioritize the evaluation of contaminated areas to ensure they can withstand sea level rise. 	Co-benefits
Equity considerations	Ensure study assesses infrastructure that services key demographic groups.	Public health, natural system health
Other considerations	Will require regulatory action and City Council approval. Ensure diversity of multi-modal transportation options (e.g., rail, bicycles, and walking).	\$4.3 million
Timeframe		Project benefits
		Project costs
		\$1.1 million
		Cost of inaction
		\$14.9 million
		Lead implementor
		City of Tacoma (Public Works Department and Planning & Development Services)
		Partners
		Pierce County, Port of Tacoma & NW Seaport Alliance, Metro Parks Tacoma, City of Tacoma (Emergency Management, Environmental Services), Tacoma Public Utilities, WSDOT, Sound Transit, Washington Sea Grant, University of Washington



Capital project standards & tools

Develop tools and standards of practice to ensure that capital projects being planned now account for future climate conditions, such as a greenhouse gas emissions and climate impacts, for incorporation into budget, capital, and work plans at the departmental level.

Why it's important	This action will ensure that new development being planned now will accommodate future climate change. This will reduce the risk of hospitalizations and deaths from heat waves and wildfire events, support energy efficiency goals, and extend infrastructure lifespan. This action will also ensure that railways and roads can withstand heavier flooding and landslides—reducing potential disruption of transportation services.		
KPI	% of new capital projects that account for future conditions	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; City asset management program	Co-benefits	Public health, natural system health
		Project benefits	\$4.2 million
Equity considerations	Ensure that investments in capital projects are equitably distributed and provide benefits to the most vulnerable populations.	Project costs	\$1.3 million
		Cost of inaction	\$14.9 million
Potential policy & procedure modifications	<ul style="list-style-type: none"> Provide language to support adaptation recommendations in in the Right-of-Way Design Manual including: use of reclaimed water, permeable pavement for shared paths, alternative pavement options for roads. 		
Other considerations	Certain building types should be prioritized for investments if they provide services to particularly vulnerable populations (e.g., retirement homes, senior community centers).	Lead implementor	City of Tacoma (Public Works Department and Office of Budget & Management)
Timeframe		Partners	City of Tacoma (Environmental Services and Planning & Development Services), Tacoma Public Utilities, Pierce County


Code improvements

Identify opportunities to increase resilience and support health through development, energy, and land use code improvements. This could include: a) aligning with the Regional Code Council for both existing and new construction, b) including actions to ensure private buildings meet healthy building standards, c) informing updates or implementation of the development code to limit construction and development in hazard-prone areas, and d) providing informational resources for residents and businesses to understand options for retrofitting buildings to be more resilient to climate change.

Why it's important	Development code improvements—such as meeting healthy building standards to mitigated high heat and wildfire smoke impacts—can reduce deaths and hospitalizations as heat wave and wildfire smoke events become increasingly common during the summertime. Additionally, development and land use code improvements that limit development or require preparation for landslides and flooding will reduce property damage as well as protect resident safety in particularly vulnerable and hazardous areas.		
KPI	# of codes evaluated & improved	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; Green Economy action 5; Affordable Housing Action Strategy; Tacoma Title 13 (Land Use Regulatory Code); Tacoma Building Codes	Co-benefits	Community resilience, public health
			\$149.9 million
Potential policy & procedure modifications	<ul style="list-style-type: none"> • Require large new buildings to incorporate solar or living roofs. • Require development to implement measures to reduce heat island effects. • Develop Flood Damage Protection Ordinance. • Promote public benefits and climate adaptation thru bonus building capacity. • Consider adding the National Housing Standard to referenced technical codes. 	Project benefits	
Equity considerations	Development codes can increase the cost of buildings and make housing less affordable for low-income populations. Consider financially supporting historically underinvested areas.	Project costs	\$2.4 million
		Cost of inaction	\$1.3 billion
Other considerations	Some buildings will be affected by certain hazards more than others, so there will be a need to prioritize certain standards for some buildings and not others.	Lead implementor	City of Tacoma (Planning & Development Services Department)
		Partners	City of Tacoma (Office of Environmental Policy & Sustainability), Tacoma Public Utilities
Timeframe			

Capital project planning, prioritization, & implementation

Use the outcomes of the site-by-site flooding evaluation and planning and natural systems condition assessment and monitoring actions to define capital projects that are necessary to build resilience, prioritize those projects, and implement them and integrate into Capital Facilities Planning process. Include upgrading priority wastewater system areas for inflow and infiltration (I&I) reduction while considering areas with potential for saltwater intrusion and inflow into the system.

Why it's important	This action represents the implementation of upgrades following the site-by-site flooding evaluation and planning and natural systems condition assessment actions. This action will reduce property damage and disruption of critical services due to increased exposure to coastal and riverine flooding especially during storm events. Furthermore, the identification of priority areas to reduce I&I in the wastewater system will be important in protecting high water quality for recreational harvesters, fishers, and residents. Heavier precipitation due to climate change may damage wastewater collection systems and result in discharge of untreated wastewater into local water bodies.		
KPI	# of completed capital projects identified in assessment	Hazards addressed	
Connection to other plans	Capital plans for utilities; Tacoma Community Climate Action Plan; Tacoma Capital Facilities Program Plan; Wastewater Comprehensive Plan; One Tacoma Comprehensive Plan; 6-Year Capital Facilities Program	Co-benefits	Community resilience
		Project benefits	\$1.2 million
Potential policy & procedure modifications	<ul style="list-style-type: none"> • Prepare for changing base flood elevations. • Develop a plan for stormwater outfalls and culvert inundation. • Increase setback distances on coastal bluffs over time. • Consider bigger buffers around shorelines to combat accelerated coastal erosion. • Incorporate climate change into Critical Area Ordinance. 	Project costs	\$0.8 million
Equity considerations	Ensure investments prioritize vulnerable populations and key demographic groups.	Cost of inaction	\$8.5 million
		Lead implementor	City of Tacoma (Planning & Development Services, Public Works Department, Office of Management and Budget)
Other considerations	Will require regulatory action through planning commission and City Council if exceed Comprehensive Plan requirements. This action can build upon City asset management program.	Partners	Port of Tacoma, City of Tacoma (Environmental Services), Tacoma Public Utilities
Timeframe			

Natural Systems

What is included?

Natural systems such as open spaces, parks, shorelines, and natural habitat provide many resilience and adaptation benefits—including protecting residents and infrastructure from climate risks and hazards, filtering and maintaining clean air and water, and reducing the urban heat island effect. These natural systems and the benefits they provide are at risk from a changing climate, and their degradation would exacerbate citywide damages from sea level rise, flooding, landslides, and tsunamis. Investing in natural system improvements will create local jobs, protect valuable assets, improve public health, and improve safety during emergencies.

Goal: *Protect and restore natural systems and landscapes to be resilient to climate impacts and provide ecosystem services.*

How We'll Get There

Building natural system resilience will begin by assessing the condition of Tacoma's natural habitats and monitoring changes over time. In parallel, developing project guidance for habitat restoration can ensure that restored habitats are maintained and remain functional despite future climate impacts. With the assessment and guidance complete, establishing transitional zones nearshore will be critical to protect restored habitats and infrastructure from sea level rise, coastal storms, and tsunamis. Additional resources to support maintenance of existing open spaces and habitat restoration efforts will bolster natural barriers to flooding.

Sector Strategies:

- ▶ **Improve the resilience of inland, coastal, and marine ecosystems** to damaging climate impacts.
- ▶ **Ensure a healthy and sufficient water supply** for all needed uses, including for residents, businesses, and ecosystems.


Connected Plans

- ▶ **Open Space Management Plan** includes information around cost modelling and financial resources for open space maintenance and restoration. The plan also includes a monitoring and adaptive management program that leverages volunteers and prioritizes resources.
- ▶ **City of Tacoma Watershed Management Plan** (forthcoming in 2023/2024) includes effective stormwater actions and projects and an adaptable framework to account for development, climate change impacts, and new pollution hotspots. The Plan also sets standards for tracking and reporting progress towards goals.
- ▶ **Tideflats Subarea Plan** provides information to support local and regional Capital Facilities Programs and potential amendments to the City zoning districts, Shoreline Master Program, and City's Land Use Regulatory Code.
- ▶ **Tacoma Public Utilities' 2020 Integrated Resource Plan** includes proposed actions to meet energy needs such as through demand response, conservation portfolio, or Tacoma Power Hydro. There are also considerations of climate impacts on energy demand.

- ▶ **Transportation Master Plan** includes actions to ensure subarea plans for mixed-use zones to ensure transit and bicycle access.
- ▶ **Shoreline Restoration Plan** includes a prioritization plan, detailed timeline for shoreline restoration efforts, and an implementation plan which includes funding for conservation easements.



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Actions

Natural systems condition assessment & monitoring program			
<p>Assess conditions of seawalls, piers, revetments, shoreline infrastructure, open spaces, parks, and habitat to identify length of service, repair, and maintenance. Work with partners to develop a Sea Level Rise Master Plan and monitoring program to track sea level and shoreline changes at key locations (e.g., Tideflats, Ruston Way, Titlow, Foss) to determine needed adaptation actions.</p>			
Why it's important	<p>This action provides a critical first step in assessing and monitoring the conditions of seawalls, piers, revetments, shoreline infrastructure, open spaces, parks, and habitat. This step will be important in understanding the trajectory of sea level rise and allowing the City to adequately prepare for it—protecting property and critical services in the process.</p>		
KPI	% completion of assessment and plan	Hazards addressed	
Connection to other plans	<p>Strategic 20-Year Passive Open Space Plan; Envision Our Waterfront (Ruston Way Action Plan); Tacoma Community Climate Action Plan; SLR Master Plan (forthcoming); One Tacoma: Watershed Health; Shoreline Master Program; Shoreline Restoration Plan</p>	Co-benefits	Natural system health, community resilience
		Project benefits	\$7.5 million
Equity considerations	<p>Certain underinvested areas may be more vulnerable to sea level rise than others. Property that is worth more may be prioritized for funding, but this may not result in equitable outcomes.</p>	Project costs	\$2.5 million
		Cost of inaction	\$12.8 million
Other considerations	<p>Watershed Planning is creating a tool—similar to the Forest Landscape Assessment Tool—to evaluate conditions of current watershed habitats. There should be concerted efforts to engage shoreline landowners who can implement strategies (e.g., using soft armoring).</p>	Lead implementor	City of Tacoma (Environmental Services, Planning & Development Services)
Timeframe		Partners	Watershed Planning, Metro Parks Tacoma, Washington Sea Grant, University of Washington, Tacoma Public Utilities, City of Tacoma (Public Works Department)



Habitat restoration project guidance & resilience

Develop a Habitat Strategy that fosters a climate change-ready urban landscape by: a) updating critical areas, b) inventorying and mapping high priority habitats for protection and restoration, c) providing code recommendations, d) identifying goals for enhancements and new protections through purchase or easements, e) identifying funding for open space acquisition, and f) synthesizing and employing guidance—such as using native and climate-adapted vegetation and analyzing higher peak flows for restored wetlands and stream systems—for enhancing resilience of habitat restoration projects.

Why it's important	Habitat restoration can reduce the likelihood of landslide and flooding, as well as provide refuge during heat island events. Trees, plants, rain gardens, and low-impact development can also filter water and slow down stormwater that damages wastewater collection systems and pollute waterways. Healthy and restored habitats benefit the health and safety of wildlife and humans alike and can protect fish habitat and local economies that depend on them.		
KPI	Acres of habitat restored and maintained	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; Watershed Management Plan; Shoreline Master Program; Shoreline Restoration Plan; Tacoma Title 13 (Land Use Regulatory Code); Basin and site-specific plans	Co-benefits	Natural system health, community resilience
		Project benefits	\$10.4 million
Potential policy & procedure modifications	<ul style="list-style-type: none"> • Develop an addendum to address climate change in the open space planning process to include nature-based climate solutions. • Revise tree list and other planting requirements to create more resilient urban habitat and urban forest canopy. Consider expanding definition of climate adapted species in the City's Urban Forest Manual. 	Project costs	\$25.4 million
Equity considerations	Impact of restoration on salmonid and shellfish habitat that are critical to Tribal fisheries and cultural practices. Equitable access to green space can offer health benefits. Encourage long-term funding considerations, such as increasing to 2% of stormwater fees budgeted to Open Spaces program.	Cost of inaction	\$225.2 million
		Other considerations	Accessibility to recreational opportunities in habitat restoration areas.
Timeframe		Lead implementor	City of Tacoma (Environmental Services and Planning & Development Services)
		Partners	Pierce County Sustainability, City of Tacoma (Office of Environmental Policy & Sustainability, Office of Equity & Human Rights, Emergency Management)

Nearshore transitional zones

Establish transitional zones around the nearshore where armoring or other infrastructure currently restricts the ability of marine ecosystems to adjust to sea level rise. Identify places where infrastructure can be set back as part of capital improvement project implementation.

Why it's important	Establishing transitional zones will reduce damages to assets at risk from sea level rise, flooding, and landslides. Nearshore armoring can prevent flooding in the near-term, but it will result in erosion and severe slope stabilization issues that threaten nearshore properties.		
KPI	Acres of transitional zone established and maintained	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; Shoreline Master Program; Shoreline Restoration Plan	Co-benefits	Natural system health, community resilience
			\$7.7 million
Potential policy & procedure modifications	<ul style="list-style-type: none"> • Prepare for changing base flood elevations. • Increase setback distances on coastal bluffs over time. • Consider bigger buffers around shorelines to combat accelerated coastal erosion. 	Project benefits	
Equity considerations	Impact of infrastructure on salmonid and shellfish habitat that are critical to Tribal fisheries and cultural practices.	Project costs	\$41.5 million
		Cost of inaction	\$12.8 million
Other considerations	Creating new nearshore habitat is more difficult to permit than alternatives due to coastal hydrology and sediment transport processes. Will need to work with private landowners and businesses along shorelines to implement effectively.	Lead implementor	City of Tacoma (Environmental Services)
Timeframe		Partners	Washington Sea Grant, University of Washington, Metro Parks Tacoma

Economy

What is included?

Tacoma's economy includes the production, distribution, trade, and consumption of goods and services within the city. Economies are often characterized by economic security, types of jobs available, and the sectors of goods and services. From corporations to small business owners, creating flexibility and realizing opportunities for economic prosperity within Tacoma are crucial to building a resilient economy.

Goal: *Promote a resilient economy that is both adaptable to future climate shocks and responsive to new economic opportunities.*

How We'll Get There

By taking steps to improve strength of the local economy, Tacoma can have a smooth and equitable transition away from unsustainable business practices while building resilience and continuity in the face of climate change. Strategies to secure and employ local business resources, build continuity plans, and train workers will pay dividends for both local businesses and the broader Tacoma community for years to come.

Sector Strategies:

- ▶ **Advance economic security** by investing in adaptable and resilient industries, especially for local and small businesses.
- ▶ **Build a resilient and effective workforce** by expanding development and training pathways for workers in resilient industries with livable wages.



Connected Plans

- ▶ **Tacoma Community Climate Action Plan** includes actions to support sustainable business development, green job training, and sustainable industry collaboration.
- ▶ **Community & Economic Development Strategic Plan 2020-2025** includes actions to identify infrastructure issues that inhibit business growth, expanding the business, retention, and recruitment efforts to include smaller businesses, and supporting areas that might undergo gentrification.

Actions



Business engagement & continuity planning

Convene the business community in a conversation on business climate impacts and resilient industries. Provide technical assistance to local businesses for creating business continuity plans to better prepare employers and employees to act when a climate disruption occurs. Address both programming needs (e.g., business operations) and infrastructure needs (e.g., rail or roads that are disrupted).

Why it's important	Investing in industries and businesses that are aligned with Tacoma's vision of being resilient and sustainable will foster a local economy is responsive and resilient to future economic innovations and opportunities. Engaging with local businesses will provide businesses with access to the resources they need to adapt to climate change in a timely manner, reduce long-term costs, and capitalize on future opportunities.		
KPI	# of Business Retention & Expansion (BRE) meetings that "climate change" is mentioned; # of climate-related referrals	Hazards addressed	
Connection to other plans	Tacoma Community Climate Action Plan; Community & Economic Development Strategic Plan		Co-benefits
Equity considerations	Ensure that small businesses and minority-owned businesses are not excluded from conversations.	Project benefits	Not estimated
		Project costs	Not estimated
		Cost of inaction	Not estimated
Other considerations	Certain businesses are more heavily impacted by certain hazards than others. If businesses request climate-related information from CED, they will need to work with other departments to provide tools and resources.	Lead implementor	City of Tacoma (Community and Economic Development Department)
Timeframe		Partners	Tacoma-Pierce County Chamber and Lakewood Chamber of Commerce

Just & green jobs transition plan

Identify industries at-risk from closure due to the low-carbon transition and make a transition plan for industry workers well in advance of industry closure. Transition plans should promote labor standards, shared benefits, reducing job commute times and trips, and long-term support, with a focus on green industries such as electric bus infrastructure. Within the plan, partner with frontline communities, labor organizations, educational institutions, and youth programs to develop a green jobs strategy that evaluates and establishes pathways to bring frontline communities—particularly Black, Indigenous, and Communities of Color (BIPOC communities)—into living-wage green jobs.

Why it's important	This action would involve funding a workforce development program that would help train local and BIPOC staff to meet the labor demands for the transition to a clean energy economy via training opportunities and a development program. Without a workforce development program, carbon-intensive industry workers will be left behind and the growing need for green labor may be left unmet.		
KPI	Completion of just & green jobs transition plan; # of businesses with transition plans	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; One Tacoma: Economic Development; Tideflats Subarea Plan	Co-benefits	Growth of local economy,
		Project benefits	Not estimated
		Project costs	\$4.3 million
Equity considerations	<ul style="list-style-type: none"> Consider demographic disparities that may exist between organizational leadership and workers in green industries. Consider career pathways that do not require a college degree and expand green career employment opportunities. 	Cost of inaction	Not estimated
		Other considerations	Provide continuing education opportunities and connect with south Tacoma green manufacturing efforts. Consider connection to the blue economy. Coordinate with the upcoming Green Economy Study, funded by the American Rescue Act.
Timeframe		Lead implementor	City of Tacoma (Community and Economic Development Department)
		Partners	City of Tacoma (Office of Environmental Policy & Sustainability, Planning & Development Services), WA State Centers of Excellence & Department of Commerce; Tacoma-based technical colleges and workforce central.

Public Health & Safety

What is included?

While climate change will affect the health and safety of all Tacomans, these impacts will disproportionately affect some groups more than others. Increased exposure to wildfire smoke and extreme heat in the summer will exacerbate pre-existing health conditions for frontline communities and increase hospitalizations and death. Higher temperatures will also increase the risk of vector-borne diseases, length of the pollen season, and incidence of harmful algal blooms. Flooding, landslides, and sea-level rise also threaten the safety and wellbeing of residents and businesses.

***Goal:** Maintain and expand communitywide safety nets and services to ensure a healthy and safe community in the face of climate change.*

How We'll Get There

The most significant and immediate public health and safety threat due to climate change are extreme heat and wildfire smoke events. Providing air filter fans and creating effective communications—especially for low-income residents—will ensure residents have access to resources to reduce exposure to extreme events, such as heat waves and wildfire smoke events. Building cooling and air quality centers to support residents—especially low-income residents and unhoused people—will ensure there are equitable benefits that reduce historical health disparities.

Sector Strategies:

- ▶ **Minimize climate impacts to community health**, including from decreased air quality and water- and vector-borne illnesses.
- ▶ **Increase social cohesion and connectivity** in Tacoma to ensure community support systems.
- ▶ **Ensure sufficient capacity to respond to weather-related emergencies** and maintain public safety.

Connected Plans



- ▶ **Tacoma Community Climate Action Plan** includes actions to leverage public land resources for resilience hubs and open space.
- ▶ **Affordable Housing Action Strategy** includes actions to access and renovate/resell derelict properties using code compliance to support livability improvements and using proactive rental inspection program to support health standards.
- ▶ **2020 Comprehensive Emergency Management Plan** includes procedures and mechanisms for responding and obtaining support and funding to address emergency events.

Actions

Cooling & air quality resilience hubs		
Coordinate with partner agencies to expand public access to cooling, warming, and clean air shelters and resilience hubs within every neighborhood.		
Why it's important	Cooling and air quality relief resilience hubs provide refuge to vulnerable residents who do not have access to air conditioning or filtered air during extreme heat and wildfire events, respectively. These hubs could reduce injury and mortality rates during extreme weather events, such as the heat wave of 2021 that brought regional hospitals to their capacity. These centers can also provide other critical amenities during extreme events, such as electrical power, food, and personnel support (e.g., welfare checks).	
KPI	% of <u>neighborhood council districts</u> with cooling & air quality resilience hubs	Hazards addressed 
Connection to other plans	Tacoma Community Climate Action Plan; Tacoma Equity Index; Neighborhood Council Program	Co-benefits Equity and inclusion, public health
		Project benefits \$22.5 million
Equity considerations	Ensure that frontline communities—especially in <u>communities of focus</u> such as Eastside and South Tacoma—can easily access cooling centers through alternative modes of transportation.	Project costs \$3.0 million
		Cost of inaction \$1.3 billion
Other considerations	Consider whether certain types of public & private buildings (e.g., libraries, business centers) can be considered cooling and air quality relief centers for the public.	Lead implementor City of Tacoma (Emergency Management Department and Neighborhood and Community Services),
Timeframe		Partners Tacoma-Pierce County Health Department, Metro Parks Tacoma

Co-create climate communications

Co-create communications with the City, County, and frontline communities that focus on climate impacts and health, access to emergency resources and warnings, and training and materials to prepare for emergency events and health impacts. Design and disseminate communications in a manner that reduces access and participation barriers.

Why it's important	Creating and disseminating climate-focused communications will be vital to ensuring that frontline communities have access to emergency resources during emergency events and are not left behind in the process. Climate change will amplify existing inequities and health disparities, and informative and accessible communications can equip frontline communities with resources to reduce those inequities.		
KPI	# of materials co-created and translated into non-English languages	Hazards addressed	
Connection to other plans	Tacoma Environmental Action Plan: Action C1; Tacoma Community Climate Action Plan	Co-benefits	Equity and inclusion, public health, community resilience
		Project benefits	\$2.4 million
		Project costs	\$1.9 million
Equity considerations	Ensure that translated materials are available for those who cannot read or speak English well. Ensure that vulnerable populations with less digital access can still be reached.	Cost of inaction	\$14.9 million
		Lead implementor	City of Tacoma (Emergency Management Department and Media and Communications Office)
Other considerations	In-person meetings during a pandemic will require additional precautions to reach populations with less digital access.	Partners	Tacoma-Pierce County Health Department, City of Tacoma (Office of Environmental Policy & Sustainability)
Timeframe			

Filter fan distribution

Work with the Tacoma-Pierce Health Department to provide filter fans for at-risk community members to assist in mitigating wildfire smoke in their homes and businesses.

Why it's important	Filter fans reduce indoor air pollution from wildfire smoke that can exacerbate respiratory and cardiovascular issues, particularly for people with asthma, cardiovascular disease, diabetes, Alzheimer's disease, dementia, and obesity. This action would reduce the risk of death or illness from air quality issues during wildfire events.		
KPIs	# of filter fans distributed to households; # of residents reached	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan	Co-benefits	Public health, equity, and inclusion
		Project benefits	\$25.5 million
		Project costs	\$2.3 million
Equity considerations	Ensure that frontline communities—especially in <u>communities of focus</u> such as Eastside and South Tacoma—are prioritized for distribution.	Cost of inaction	\$91.3 million
		Lead implementor	Tacoma-Pierce County Health Department
Other considerations	City already contracts with TPCHD to do this work. Digital or in-person trainings can support DIY home-filter fans. Tips on staying cool and information on cooling centers can be distributed in tandem with this action. Collecting KPIs at point-of-distribution can reflect true impact of action.	Partners	City of Tacoma (Office of Environmental Policy & Sustainability and Neighborhood and Community Services)
Timeframe			

Governance

What is included?

Governance includes City processes and investments that drive emergency response measures and infrastructure. Good governance is essential to responding in an equitable manner to all forms of climate hazards. Coordination and communication across City departments and with regional partners will encourage equitable investments, timely emergency response during extreme events, and effective implementation of adaptation actions.

Goal: Institutionalize and prioritize climate change resilience across City processes and investments.

How We'll Get There

Governance improvements require community and partner engagement and coordination to equip individuals, institutions, and agencies for climate emergencies. Support to decisionmakers such as through the development and use of financial tools can facilitate better understanding and prioritization of climate resilience actions across City government departments, levels, and activities.



Sector Strategies:



- ▶ **Engage and equip residents and businesses** with resources to successfully adapt to climate change.
- ▶ **Build in accountability mechanisms** for City departments to implement climate resilience actions, including funding and resource dedication.
- ▶ **Coordinate regionally and across sectors** to foster broad resilience to multiple climate impacts.

Connected Plans

- ▶ **Tacoma Community Climate Action Plan** includes actions, in coordination with the Tacoma Adaptation Strategy, that find critical roads and infrastructure and integrate into City emergency management and capital planning.
- ▶ **Environmental Services Strategic Plan 2018-2025** includes actions to identify priority locations for green projects that will prepare Tacoma to respond to climate impacts, identify how customers of different demographics obtain information on government services, and conduct outreach out to receive feedback on customer needs and barriers.
- ▶ **One Tacoma Plan** includes an action in the Environment and Watershed Health section that directs the City to utilize climate science and climate risks into our planning, codes, and investments.



Actions

Climate equity initiatives			
<p>Incorporate climate resilience and equity considerations in emergency planning and hazard mitigation updates to reduce climate vulnerability—especially for disproportionately impacted groups—with established checkpoints for justifying decisions with a climate and equity lens.</p>			
Why it's important	Centering equity in climate-related initiatives will ensure that everyone has access to critical emergency services—especially overburdened and frontline communities. Without climate resilience and equity considerations, emergency planning and hazard mitigation activities will be ill-equipped to address the growing disparities between populations.		
KPIs	Presence of climate change and social equity section(s) in hazard mitigation plan	Hazards addressed 	
Connection to other plans	Tacoma Environmental Action Plan; Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan; One Tacoma Plan: Environment and Watershed		Co-benefits Equity and inclusion, community resilience
Equity considerations	Consider an array of different feedback opportunities (e.g., surveys, workshops, pop-up events, public meetings) and consider varying accessibility considerations—such as childcare needs, time-of-day, and translation or interpretation requests.	Project benefits	Not estimated
		Project costs	\$1 million
		Cost of inaction	Not estimated
Other considerations	Equity considerations can be difficult to measure through quantitative metrics like KPIs.	Lead implementor	City of Tacoma (Emergency Management)
Timeframe		Partners	City of Tacoma (Office of Environmental Policy & Sustainability), Pierce County

Regional coordination			
Continue to support regional climate adaptation stakeholders by collaborating with agencies, institutions, property owners to tackle cross-jurisdictional information needs and adaptation opportunities. Continue to engage in and support regional efforts within the Puyallup River watershed basin to improve river management in the context of floods, sediment, agriculture, and infrastructure protection needs.			
Why it's important	Regional coordination with agencies and institutions will result in more efficient, holistic, and effective climate adaptation.		
KPIs	# of cross-agency collaboration meetings	Hazards Addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan	Co-benefits	Community resilience, natural systems health
		Project benefits	\$0.75 million
		Project costs	\$3.6 million
Equity considerations	Action accountability may become more difficult when multiple agencies are involved. Ensure that the public has opportunity to participate in the decision-making process.	Cost of inaction	\$2.0 million
		Lead implementor	City of Tacoma (co-led by Office of Environmental Policy & Sustainability and Planning & Development Services)
Other considerations	Structure coordination to acknowledge and accommodate varying risks and adaptation interests across organizations and property owners.	Partners	Port of Tacoma, Puyallup Tribe, Tacoma Public Utilities, Tacoma-Pierce County Health Department, Metro Parks Tacoma, Pierce County, Sound Transit, UW Climate Impacts Group, Puget Sound Climate Preparedness Collaborative, WA Sea Grant, WA Dept. of Ecology, WSDOT, FEMA, BNSF Railway
Timeframe			



Economic ROI tools

Create and utilize financial tools that capture the full lifecycle costs of City decisions, including the costs of climate maladaptation (adaptation strategies that increase climate risk or vulnerability) or inaction. Utilize this tool in complement with the [Tacoma Equity Index](#).

Why it's important	Economic return-on-investment tools can help justify and support climate adaptation investments. Without such a tool, the long-term benefits of climate adaptation efforts are not as transparent as the near-term costs. In complement with the Tacoma Equity Index, financial tools can clarify economic and equity co-benefits of the City's investments and , as a result, prevent health disparities from worsening.		
KPIs	# of projects that utilize ROI tool	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan	Co-benefits	Growth of local economy, equity, and inclusion
		Project benefits	Not estimated
		Project costs	\$0.05 million
Equity considerations	Areas that have been traditionally underinvested may have lower property values, which may result in prioritization of investments in wealthier areas.	Cost of inaction	Not estimated
		Lead implementor	City of Tacoma (Community & Economic Development, Office of Equity & Human Rights, Emergency Management)
Other considerations	Ensure transparency in assumptions and methods of the analysis.	Partners	City of Tacoma (Office of Environmental Policy & Sustainability, Management & Budget Office)
Timeframe			

Community check-ins

Provide ample and periodic opportunities—such as through surveys or public meetings—to engage the community around climate resilience issues and incorporate feedback into ongoing initiatives and programs.

Why it's important	Community check-ins provide a space for community members to express areas of support, concerns, and feedback to improve programs. Gathering community feedback can help secure community buy-in for climate action, inspire personal action, and improve resilience outcomes for all.		
KPIs	# of engagement activities; demographic of community members reached	Hazards addressed	
Connection to other plans	Tacoma Climate Change Resilience Study; Tacoma Community Climate Action Plan	Co-benefits	Community resilience, equity and inclusion, public health
		Project benefits	Not estimated*
		Project costs	\$0.8 million
Equity considerations	Ensure a diversity of engagement opportunities, including digital opportunities, in-person opportunities, and translated services.	Cost of inaction	Not estimated*
		Lead implementor	City of Tacoma (Office of Environmental Policy & Sustainability)
Other considerations	Consider pandemic precaution protocols in engagement. Ensure that engagement tools (survey, public meeting, tabling) are right-sized to the objective.	Partners	Community Based Organizations
Timeframe			

Implementation

Building resiliency to climate change impacts will require dedication, time, and resources from City government, the broader Tacoma community, and external partners. We must be thoughtful in how we sequence, fund, and implement actions to leverage windows of opportunity, minimize harms from climate impacts, and support those most in need. This implementation section presents a detailed plan for meeting desired outcomes of the Tacoma Adaptation Strategy, including information on implementation accountability and enforcement mechanisms, phasing, key performance indicators, social equity, coordination, and funding.

To effectively implement the Tacoma Climate Adaptation Strategy and the Tacoma Climate Action Plan, **the City will need to hire a Climate Action/Adaptation Manager** to coordinate the implementation and monitoring of the City’s climate efforts.

Phasing

Actions in this Strategy will be implemented in the following phases:

- ▶ **Phase I (2021-2024):** Near-term implementation focuses on establishing a foundation for meeting both mid- and long-term goals.
- ▶ **Phase II (2025-2027):** Mid-term solutions that address complex issues that require more time and coordination to get underway, such as incentive development and transitional plans.
- ▶ **Phase III (2028 & beyond):** Long-term strategies that are more comprehensive solutions that require long-term investment, careful planning, and broad coordination.

Action	Phase I	Phase II	Phase III
Site-by-site flooding evaluation & planning	→		
Capital project standards & tools	→		
Code improvements		→	
Capital project, planning, & implementation			→
Natural systems condition assessment & monitoring program	→		
Habitat restoration project guidance & resilience	→		
Nearshore transitional zones			→
Business engagement & continuity planning	→		
Just & green jobs transition plan	→		
Cooling & air quality resilience hubs	→		
Co-create climate communications	→		
Filter fan distribution	→		
Climate equity initiatives		→	
Regional coordination	→		
Economic ROI tools		→	
Community check-ins	→		

Accountability and Enforcement

<p>Progress Reporting Plan progress reports will be developed and reviewed annually and will include status updates on all actions and associated key performance indicators.</p>	<p>Implementation Team Plan implementation will be led by the City of Tacoma. A cross-departmental team of City staff will meet on a recurring basis to monitor and plan for implementation.</p>	<p>Partnerships The City will actively maintain partnerships with businesses, community leaders, and organizations throughout the implementation process through existing communication channels, key staff liaisons, and ongoing convening of the plan steering committee.</p>
		
<p>Public Participation The City will continue to engage the public through social media, news articles, monthly newsletters, and community meetings.</p>	<p>Lead by Example The Tacoma City Council will have the responsibility of oversight for the plan. The Council will receive annual updates on Strategy progress and make policy decisions, budgetary appropriations, and workplan approvals that will facilitate implementation.</p>	<p>Plan Updates The plan will be evaluated on an annual basis and updated as needed—at a minimum, within five years—to reflect lessons learned and changes in community priorities, technologies, and scientific understanding.</p>
		

Key Performance Indicators

Outputs: Action-Specific

Output-based KPIs, listed below, measure the progress of each specific adaptation action.

Action	KPI	Monitoring Lead	2030 Target	
Infrastructure	Site-by-site flooding evaluation & planning	Evaluation and assessment completion	City of Tacoma (Public Works and Planning & Development Services)	Completed initial evaluation; 2 additional evaluation iterations across Phases II and III
	Capital project standards & tools	% of new capital projects that account for future conditions	City of Tacoma (Public Works, Office of Management & Budget, Environmental Services, and Tacoma Public Utilities)	100% of new capital projects after 2024
	Code improvements	# of development and commercial energy codes evaluated & improved	City of Tacoma (Planning & Development Services)	5 plans/codes improved
	Adaptation capital project prioritization, & implementation	# of completed adaptation capital projects identified in assessment	City of Tacoma (Planning & Development Services and Public Works)	# (total determined from natural systems condition assessment and site-by-site evaluation actions)
Natural Systems	Natural systems condition assessment & monitoring program	Assessment completion	City of Tacoma (Environmental Services/Open Space and Planning & Development Services)	Completed initial assessment; 2 additional assessment iterations across Phases II and III
	Habitat restoration project guidance & resilience	Acres of habitat managed and protected	City of Tacoma (Environmental Services/Open Space and Planning & Development Services)	94.5 acres managed; 530 acres protected
	Nearshore transitional zones	Acres of transitional zone established and protected	City of Tacoma (Environmental Services/Open Space, Metro Parks Tacoma, Port of Tacoma)	300 acres protected
Economy	Business engagement & continuity planning	# of BRE meetings that "climate change" is mentioned; # of climate-related referrals	City of Tacoma (Community & Economic Development)	50 mentions of "climate change" in BRE meetings; 20 climate-related referrals
	Just & green jobs transition plan	Completion of just & green jobs transition plan or green economy strategy	City of Tacoma (Community & Economic Development)	Completed Green Economy Strategy and Implementation Plan by City
Public Health & Safety	Cooling & air quality resilience hubs	% of <u>neighborhood council districts</u> with cooling & air quality resilience hubs	City of Tacoma (Emergency Management and Neighborhood & Community Services)	100% neighborhoods with cooling & air quality resilience hub access during unhealthy events
	Co-create climate communications	# of materials co-created and translated to non-English languages	City of Tacoma (Emergency Management and Media & Communications Office)	5 different communication materials created with active frontline engagement
	Filter fan distribution	# of filter fans distributed to households; # of residents reached	Tacoma-Pierce County Health Department	2,500 distributed by 2024 while reaching 12,000 residents from frontline communities

Action	KPI	Monitoring Lead	2030 Target	
Governance	Climate equity initiatives	Presence of climate change and social equity section(s) in hazard mitigation plan	City of Tacoma (Emergency Management)	20 mentions of “climate change” and/or “social equity”
	Regional coordination	# of cross-agency collaboration meetings	City of Tacoma (Office of Environmental Policy & Sustainability and Planning & Development Services)	Convene County-wide adaptation group quarterly
	Economic ROI tools	# of projects that utilize ROI tool	City of Tacoma (Community & Economic Development, Office of Equity & Human Rights, and Emergency Management)	Every project after 2027
	Community check-ins	# of engagement activities; demographic of community members reached	City of Tacoma (Office of Environmental Policy & Sustainability)	2 engagement activities per year; demographics reflective of the City of Tacoma

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Outcomes: Cross-Cutting

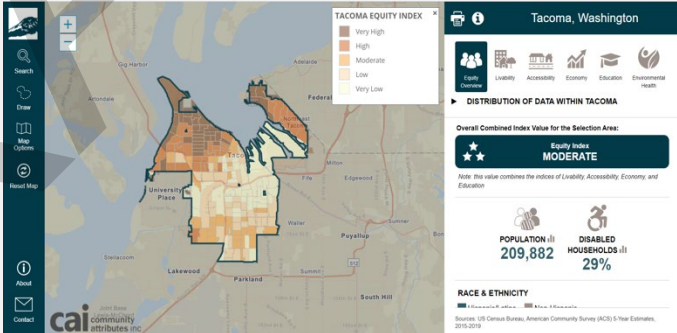
Outcomes-based KPIs, listed below, measure the long-term impact of the Tacoma Adaptation Strategy. These KPIs aren't associated with specific actions, such as the output KPIs, but are associated with the **overall resilience and adaptive capacity benefits we aim to achieve through the implementation of the adaptation actions**. Additionally, we include equity indicators for each outcome KPI to ensure that benefits are equitably distributed across Tacoma's communities. These KPIs may not require annual tracking. Some of these KPIs are not currently being tracked and will require additional levels of effort to monitor. For KPIs that are not currently tracked, a "—" is in the "Current Value" column.

Focus Area	KPI	Current Value	Target Trend	Equity Indicator	Monitoring Considerations
Infrastructure	# and % of buildings at risk of flooding	109 buildings; 0.17%	↓	Geographic distribution of disruptions of at-risk buildings	In Pierce County's 2017 FEMA Risk Report . Monitor next time associated report or Hazard Mitigation Plan is completed.
	# and % of buildings at risk of landslides	185 buildings; 0.29%	↓	Geographic distribution of disruptions of at-risk buildings	
Natural Systems	% tree canopy cover (<u>Equity Index</u> Indicator)	20%	↑	Geographic distribution of tree canopy cover	Dependent on LIDAR monitoring, which is infrequent due to costs.
	B-IBI index of the Puyallup River Watershed	1 site w/ good water quality; 11 sites w/ moderate water quality; 1 site w/ poor water quality	↑	—	Monitored by Pierce County's Public Works program here .
	% reduction in armoring in nearshore transitional zones	Narrows – 76% armoring; Point Defiance – 18% armoring; Ruston Way – 97% armoring; Waterways – 71% armoring; Marine View Drive – 12% armoring	↓	—	Based off 2007 Tacoma Shoreline Inventory and Characterization . Monitor next time there is a shoreline inventory.
	Access to Parks & Open Space	22% High Access ; 47% Moderate Access	↑	Geographic distribution of parks and open space	Tacoma Equity Index indicator. Monitored each time Equity Index tool is updated.
Economy	# of green jobs, as measured by tax credit	25 green jobs	↑ 250 green jobs	Demographic disparity of green job employees	Measured by green jobs tax credit.
	Student mobility of green job strategy programs (<u>Equity Index</u> Indicator)	10%	↑	Demographic disparity of student mobility	Tacoma Equity Index indicator. Monitored each time Equity Index tool is updated.
	# of business disruption events (e.g., restaurant closures from extreme heat)	—	↓	% minority-owned businesses impacted by business disruption events	Not currently tracked. Will be led by Community & Economic Development.

Focus Area	KPI	Current Value	Target Trend	Equity Indicator	Monitoring Considerations
	# of businesses that adopted climate-resilience measures in business planning	0	↑	% minority-owned businesses that adopt climate-resilience measures	Not currently tracked. Will be led by Community & Economic Development.
Public Health & Safety	# hospital visits from people with cardiovascular disease during wildfire events	—	↓	Demographic disparity of hospital visits	Not currently tracked. Will be led by Tacoma-Pierce County Health Department.
	ER visits or 911 phone calls related to physical injury or mental health during extreme events (heat waves, flooding)	—	ê	Demographic disparity of hospital visits	Not currently tracked. Will be led by Tacoma-Pierce County Health Department and City of Tacoma.
	<u>Tacoma Equity Index Score</u> (minimum)	District-dependent	↑	Increasing equity scores for Central, Southeast, and South Tacoma	<u>Tacoma Equity Index</u> indicator. Monitored each time Equity Index tool is updated.

Tacoma Equity Index

Multiple actions in this Strategy aim to decrease historical economic inequities and bridge health disparities. There are multiple outcome KPIs—such as tree canopy coverage and student mobility into green jobs—that are directly related to the [Equity Index](#). Tying this Strategy into existing equity work that the City is leading will ensure that benefits are equitably distributed and climate impacts are minimized for frontline communities.



Social Equity

Implementation will need to be carefully monitored and assessed to optimize equitable outcomes and ensure that frontline communities are prioritized through the city's resilience-building efforts. Among the actions in this strategy, key equity implementation considerations include the following:

- ▶ Ensure that studies and assessments examine impacts and implications **specific to key demographic groups**.
- ▶ Ensure that City investments—including capital and restoration projects—are **equitably distributed and provide benefits to the most vulnerable populations**. Consider that access to services varies by population and services must be accessible by alternative transportation modes. Recognize that areas with higher hazard damage costs are often in wealthier areas and should not be the sole basis for locating and prioritizing investment.
- ▶ Consider and proactively address unintended consequences of new or updated policies—such as development, building, and zoning codes—on **affordability** for lower-income households and **gentrification/displacement risks**.
- ▶ Ensure that **small businesses, minority-owned businesses, and BIPOC community members are included** in conversations, communications, and planning efforts. Consider language barriers and recognize that the demographic composition of organizational leadership is often different from that of its workers.
- ▶ Provide all communications and programmatic information in a **variety of formats**, including both digital and non-digital forms.
- ▶ Ensure that the **public has opportunity to participate** in decision-making processes and make an explicit effort to bring underrepresented voices to the table. This may mean compensating BIPOC experts. Recognize that communities have existing priorities and expertise, respect these “ways of knowing,” and share power with community members.
- ▶ Maintain **transparency and accountability** throughout plan implementation and decision-making processes by making information accessible, relevant, and culturally appropriate.

To monitor, evaluate, and ensure equitable outcomes, it will be important to conduct **disaggregated analysis** of key performance indicators. This means, for example, not just considering the number of people who receive a service—but the *demographic makeup* and *geographic distribution* of those people. To the extent possible, this information should be gathered during action implementation and a plan for doing so should be developed prior to action execution. For example, when distributing filter fans, the City should administer a demographic questionnaire for each household that receives a fan.

Coordination

The Tacoma Adaptation Steering Committee will continue to meet on a quarterly basis to coordinate implementation. Additionally, key City committees—such as the Sustainable Tacoma Commission and Infrastructure, Planning & Sustainability Committee—will be key leaders in directing the regional coordination and implementation of climate adaptation actions.

The table below documents key synergies between the Tacoma Adaptation Strategy and other City plans, as well as key coordination opportunities between the City and external partners.

City Department and Relevant Plans and Programs	Focus Area				
	Infrastructure	Natural Systems	Economy	Public Health & Safety	Governance
Environmental Services	X	X	X	X	X
<u>Environmental Services Strategic Plan 2018-2025</u>	X	X		X	X
<u>2016 Environmental Action Plan</u>	X	X	X	X	X
<u>2016 Climate Risk Assessment</u>	X	X	X	X	X
<u>Open Space Management Plans</u>		X			
<u>Tacoma's Healthy Neighborhoods Watershed Management Plan</u> (forthcoming in 2023/2024)		X		X	
Community & Economic Development	X		X	X	X
<u>Community & Economic Development Strategic Plan 2020-2025</u>	X		X	X	X
<u>Affordable Housing Action Strategy</u>			X	X	
Public Works	X			X	X
<u>Transportation Master Plan</u>	X			X	X
<u>Six-Year Comprehensive Transportation Improvement Program 2021-2026</u>	X			X	
Emergency Management				X	X
<u>2020 Comprehensive Emergency Management Plan</u>				X	X
Planning & Development Services	X	X	X	X	X
<u>Planning & Development Services' 2025 Strategic Plan</u>	X	X	X	X	X
Tacoma Public Utilities	X	X			X
<u>2020 Integrated Resource Plan</u>	X	X			

	Focus Area				
	Infrastructure	Natural Systems	Economy	Public Health & Safety	Governance
Key External Partners					
Puyallup Tribe		X			X
Port of Tacoma	X	X	X		X
Metro Parks Tacoma		X		X	X
Pierce County	X	X	X	X	X
Tacoma-Pierce County Health Department				X	X
Northwest Seaport Alliance	X		X		X
University of Washington, Tacoma	X	X		X	X
Washington Sea Grant	X	X			X
Pierce Conservation District		X			X

Funding

The City will utilize existing City resources and external grants and funding sources to the extent possible in implementing the Tacoma Adaptation Strategy. These investments will not only avoid future climate-related costs to the community, but will also bring other valuable environmental, social, and economic benefits such as job security, improved public health, and more beautiful and livable neighborhoods. Potential funding sources include:

- City general fund
- Bonds
- Taxes, fees, and utility revenues
- Federal and state grants
- Private grants/investment and public-private partnerships
- Revolving loan funds
- Local carbon funds

Funding Opportunities for Climate Adaptation

There are increasing federal, state, and private funding opportunities for local climate resilience programs and projects. Current resources to consider include:

- ▶ **FEMA Hazard Mitigation Assistance Grants:** Funding for eligible mitigation measures that reduce disaster losses.
- ▶ **FEMA Flood Mitigation Assistance (FMA) Program:** Funds for planning and projects to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program.
- ▶ **FEMA Building Resilient Infrastructure Communities (BRIC):** Support for states, local communities, and tribes undertaking hazard mitigation projects.
- ▶ **EPA Environmental Justice Small Grants Program:** Helps communities with localized strategies address climate change risks (CBOs and Tribal governments are eligible).
- ▶ **EPA Smart Growth Grants:** Occasionally offered to support activities that protect human health and the environment.
- ▶ **Kresge Environment Program:** Helps communities build resilience through place-based innovation and bringing to scale promising climate-resilience approaches.
- ▶ **WA Department of Ecology Shoreline Master Program (SMP) Competitive Grant Pilot Program:** Provides funding for local jurisdictions with a SMP to implement local shoreline planning priorities, permit monitoring and adaptive management, and sea level rise planning.
- ▶ **WA Department of Commerce Growth Management Grants:** Provides funding for cities and local jurisdictions to 1) adopt and implement new housing action plans, 2) facilitate transit-oriented development, and 3) develop utility improvements for affordable housing projects and low-income households.
- ▶ **U.S. Climate Resilience Toolkit:** Clearinghouse of current climate resilience funding opportunities.

Appendix A: Climate Risk Assessment

This memorandum documents the suite of **identified top priority climate-related risks** that the City is expected to face in the future. These risks are organized into the following categories and will be used **for identifying adaptation goals and actions** in the Tacoma Adaptation Strategy:

- ▶ Flooding
- ▶ Sea level rise & storm surge
- ▶ Extreme precipitation
- ▶ Wildfire smoke
- ▶ Landslides
- ▶ Warmer temperatures, extreme heat, & drought

What's at Risk	Evidence/ Rationale
Flooding	
Critical infrastructure	<ul style="list-style-type: none"> ▶ Puyallup River is at high risk of flooding that could affect many types of infrastructure, including the Central Wastewater Treatment Plant and Interstate 5, as water flows towards Commencement Bay. These road obstructions could limit emergency vehicle access. ▶ Puyallup River has low capacity for adaptation due to levee placement and past river management (increased sedimentation due to ending dredging). ▶ White River at Buckley & Puyallup watershed. ▶ Flooding could risk release of hazardous materials located in vulnerable areas.
Coastline communities	<ul style="list-style-type: none"> ▶ Communities along city coastline (West End/Salmon Beach, North End, South Tacoma, Tacoma Tideflats) will experience higher flood risk due to precipitation changes and sea level rise. ▶ Communities that travel to flooded areas for work or other daily needs will also be impacted by localized and coastal flooding.

What's at Risk	Evidence/ Rationale
Sea level rise & storm surge	
Critical infrastructure	<ul style="list-style-type: none"> ▶ Central Wastewater Treatment Plant at high risk due to saltwater intrusion and inflow causing corrosion or system upsets. ▶ Large portions of the wastewater system in the tide flats area are below the existing Base Flood Elevation and several feet below projected future extreme high tide. ▶ Tidally-influenced stormwater conveyance and outfalls are at high risk from backwatering of outfalls. ▶ Roads (tide flat areas, Puyallup River historic channel migration zone, Ruston Way, Marine View Drive) are at high risk, are not currently well protected by dikes or levees, and will be further degraded in their capacity over time due to sedimentation in the Puyallup River. ▶ At least two public health facilities are at risk of flooding from sea level rise. Hospital systems and the NW Detention Center in the tide flats may also be at risk. ▶ Bridge abutments could be at increased risk of scour. ▶ Freight mobility in the tidelands will be at higher risk with more frequent storm and flood events.
Marine ecosystems	<ul style="list-style-type: none"> ▶ Marine ecosystems (including aquatic life such as salmon, fish, and shellfish) are at high risk due to increased frequency and duration of inundation in currently supratidal and upland areas, reduction in light penetration in subtidal areas, and changes to sediment dynamics. ▶ Ocean acidity is expected to increase in Puget Sound, leading to impacts such as increased corrosion and inhibited shellfish development.
Public access to coastal areas	<ul style="list-style-type: none"> ▶ Public access to coastal areas—including public amenities and businesses—are at risk from sea level rise and storm-related inundation and damages. This lack of access could have implications for the ability of vulnerable populations to find cool outdoor spaces during heat waves.
Port functions	<ul style="list-style-type: none"> ▶ Port jobs and infrastructure could be at risk from flooding and other changes.

What's at Risk	Evidence/ Rationale
Extreme precipitation	
Stormwater and wastewater systems	<ul style="list-style-type: none"> ▶ Areas of the stormwater system with known capacity issues and culverts and small bridges are at risk from more intense rain events. Stormwater systems are at most risk in tide flats, Foss Waterway, Leach Creek, and Flett Creek watersheds. Future conveyance systems will also need to be designed to account for changing precipitation patterns. ▶ Tidally-influenced conveyance and outfalls may experience increased flow rates which put densely developed places at higher risk, especially where backflow prevention devices are not present.
Freshwater ecosystem health	<ul style="list-style-type: none"> ▶ Freshwater tributary systems will experience increased peak flows due to more precipitation falling as rain, particularly streams with erodible glacial sediment and no bypass pipe. ▶ Winter runoff will transport pollutants from urbanized areas into streams.
Public health	<ul style="list-style-type: none"> ▶ Heavy precipitation events could contribute to transmission of water-borne illnesses—especially among unhoused populations.
Wildfire smoke	
Public health	<ul style="list-style-type: none"> ▶ Wildfire smoke can be especially dangerous for sensitive groups—including infants, children, people over 65, and those that are pregnant, have heart or lung diseases, and other preexisting conditions.
Landslides	
Roads/ infrastructure	<ul style="list-style-type: none"> ▶ Conveyance system has high exposure to landslides; a system failure would cause significant environmental, property, and health/safety impacts. ▶ North End Treatment Plant is exposed to increased potential for high flows in Mason Gulch. ▶ Ruston Way and Marine View Drive have increased risks.
Coastline communities	<ul style="list-style-type: none"> ▶ Communities along coastlines (West End/Salmon Beach, North End, port area of New Tacoma) face higher landslide risk.
Warmer temperatures, extreme heat, & drought	
Existing urban vegetation	<ul style="list-style-type: none"> ▶ Existing vegetation, including tree health may be affected by pest, water, and heat stress resulting in loss of habitat, shade, water retention/interception, and filtering (water and air) of pollutants.

What's at Risk	Evidence/ Rationale
	<ul style="list-style-type: none"> ▶ Tree loss may negatively impact property values and increase the impact of heat island effects.
Public health	<ul style="list-style-type: none"> ▶ Extreme heat will disproportionately threaten populations in urban heat islands with low canopy cover (e.g., New Tacoma and central part of the city). ▶ Heat and air quality related illnesses may impact those over age 65, children, poor and socially isolated individuals, people without shelter, people with mental illnesses, outdoor laborers, and those with cardiac, respiratory, or other underlying health problems. ▶ Warmer climates could also increase the risk of mosquito-borne diseases such as West Nile virus.
Agriculture/forestry	<ul style="list-style-type: none"> ▶ The agricultural and forestry industry may be affected by pest, water, and heat stress concerns due to rising temperatures. This in turn could threaten local food resources.
Industries	<ul style="list-style-type: none"> ▶ Industries relying on cooling water may be impacted by additional water and heat stress.
Freshwater ecosystem health	<ul style="list-style-type: none"> ▶ Freshwater tributary systems will experience higher stream temperatures. ▶ Freshwater wetland systems (especially those dependent on surface water) may experience changes in water availability. ▶ Wapato Lake water quality is at high risk from increased temperatures. ▶ Tacoma lakes could experience higher incidences of toxic algae from warming temperatures.
Municipal water supply	<ul style="list-style-type: none"> ▶ Freshwater supply may decrease as winter snowpack decreases.
Energy supply	<ul style="list-style-type: none"> ▶ Changes in temperature, hydrological conditions, customer energy use, and the number of customers served could strain hydropower energy supply sources and systems.

Appendix B: Sea Level Rise Matrix

DRAFT



memorandum

date May 5, 2021 – revised June 2, 2021

to Beth Jarot, City of Tacoma

cc Andrea Martin, Cascadia Consulting Group

from Lindsey Sheehan, P.E., ESA

subject City of Tacoma Sea-Level Rise Matrix

As part of the City of Tacoma’s Comprehensive Climate Adaptation Strategy, ESA has developed a sea-level rise matrix to prioritize assets for implementing adaptation strategies. This memorandum documents the development of the sea-level rise matrix, which is based on the most recent downscaled sea-level rise projections from the Washington Coastal Resilience Project (WRCP). ESA worked with the project Steering Committee to identify which assets to consider in the matrix and to gather data on the assets’ life cycles. The following sections provide additional detail on this process.

1. Sea-Level Rise Projections

1.1 State Projections

In 2018 as part of the WRCP ¹, an updated assessment of projected sea-level rise for Washington State was prepared, which included projections for sea-level rise at various locations along the open coast and the Puget Sound shoreline. The University of Washington’s Climate Impact Group developed a [website](#) that includes interactive sea-level rise data visualizations to illustrate the data from the updated assessment. The report presents different sea-level rise values based on two global greenhouse gas emissions scenarios:

High Emissions Scenario (Representative Concentration Pathway (RCP) 8.5) – This scenario assumes a future where there are no significant local or global efforts to limit or reduce emissions. This scenario assumes “high

¹ Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E., 2018. Projected Sea Level Rise for Washington State – A 2018 Assessment. A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, University of Oregon, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project. updated 07/2019 <https://cig.uw.edu/resources/special-reports/sea-level-rise-in-washington-state-a-2018-assessment/> [last accessed December 28, 2020]

population and relatively slow income growth with modest rates of technological change and energy intensity improvements, leading in the long-term to high energy demand and greenhouse gas emissions”.²

Low Emissions Scenario (RCP 4.5) – This scenario assumes more aggressive emissions reduction actions corresponding to the aspirational goals of the 2015 Paris Agreement, which calls for limiting mean global warming to less than 2 degrees Celsius and achieving net-zero greenhouse gas emissions in the second half of the century. This scenario is considered challenging to achieve and would include updated climate policies, concerted action by all countries, and a shift to a lower emissions service and information economy.

The 2018 assessment provides a range of probabilistic projections of sea-level rise, which was an update specifically designed to help inform decision-makers. A second WRCP report³ discusses how coastal managers can properly apply the projections. The report provides guidance on the different probabilistic projections as follows:

High Probability Projections (>83%) – These projections are for risk-tolerant situations where infrastructure can accommodate sea-level rise impacts or where projects have significant flexibility or adaptability. This range of probabilities would be appropriate for a beach path, where the consequences of flooding would be minimal.

Mid-Range Probability Projections (83% - 17%) – This is the most likely to occur range, with the 50% probability projection representing the most likely future amount of sea-level rise based on all model projections. This scenario should be used for assets or projects that are not particularly risk-averse or risk-tolerant.

Low-Range Probability Projections (<17%) – These projections are for assets or projects that are more risk-averse and where sea-level rise will have substantial consequences. This scenario is a more conservative approach and should be used for critical infrastructure, such as sewage treatment plants or emergency response infrastructure, or others that would be seriously compromised by flooding.

Extreme Low Probability Projections (0.1%) – This projection is designed as the physical upper limit for sea-level rise. The scenario should be used only as the worst-case scenario for extremely conservative decisions. This amount of sea-level rise is unlikely to be revised upward with future scientific updates.

Table 1 shows the 2018 assessment projections for the State of Washington with the probabilities identified in the columns. While the assessment provides projections through 2150, it is important to note that sea-level rise is expected to continue for centuries, because the earth’s climate, cryosphere⁴, and ocean systems will require time to respond to the emissions that have already been released to the atmosphere. Although sea-level rise is typically presented as a range in the amount of sea-level rise that will occur by a certain date (e.g., 1-2 feet of sea-level rise by 2050), it can also be presented as a range of time during which a certain amount of sea-level rise is projected to occur (e.g., 1.5 feet of sea-level rise between 2040 and 2070). Even if emissions are reduced to levels consistent with the low-emissions-based projections, sea levels will continue to rise to higher levels, just at a later date.

² Riahi, K., Rao, S., Krey, V. et al., 2011. RCP 8.5—A scenario of comparatively high greenhouse gas emissions. *Climatic Change* 109, 33. <https://doi.org/10.1007/s10584-011-0149-y> <https://link.springer.com/article/10.1007/s10584-011-0149-y#citeas> [last accessed February 19, 2021]

³ Raymond et al, 2020. How to Choose: A Primer for Selecting Sea Level Rise Projections for Washington State,

⁴ The cryosphere is the portions of the Earth’s surface where water is in solid form, like glaciers and ice caps.

TABLE 1
ABSOLUTE SEA-LEVEL RISE PROJECTIONS FOR WASHINGTON STATE (MILLER ET AL. 2018)

PROJECTED ABSOLUTE SEA LEVEL CHANGE (feet, averaged over each 19-year time period)						
Time Period	Greenhouse Gas Scenario	Central Estimate (50%)	Likely ⁵ Range (83-17%)	Higher magnitude, but lower likelihood possibilities		
				10% probability of exceedance	1% probability of exceedance	0.1% probability of exceedance
2050 (2040-2059)	Low	0.6	0.4 - 0.8	0.9	1.2	1.8
	High	0.7	0.5 - 0.9	1.0	1.3	2.0
2100 (2090-2109)	Low	1.6	1.0 - 2.2	2.5	4.1	7.2
	High	2.0	1.4 - 2.8	3.1	4.8	8.3
2150 (2140-2159)	Low	2.5	1.5 - 3.8	4.4	8.5	16.2
	High	3.4	2.3 - 4.9	5.6	10.0	18.3

The 2018 assessment also provided local estimates of relative sea-level rise (RSLR), which combine estimates of absolute sea-level rise and vertical land movement. Where the land is uplifting, the RSLR is less than in areas where the land is subsiding. The assessment provides estimates of RSLR for 171 locations along Washington’s coastline.

1.2 Tacoma Projections

The 2018 assessment provides future flood hazards from RSLR for the Puget Sound shoreline areas of Tacoma, divided into 2 segments (Figure 1). Table 2 presents a summary of the RSLR projections for the two segments of Tacoma under both emissions scenarios and four probabilities. At most, the RSLR projections for the two segments of the Tacoma shoreline vary by 0.3 feet for the extreme probability projection for 2100. The extreme probability projection under the RCP 8.5 scenario predict an upper limit of 8.6 – 8.8 feet of RSLR. This is higher than absolute sea-level rise shown in Table 1 due to the addition of vertical land movement.

For the purposes of this project, the higher projections for the eastern segment of the city were used as a conservatively high estimate of RSLR for the full Puget Sound shoreline within Tacoma.



Figure 1. The two Tacoma shoreline segments defined in the WCRP modeling.

TABLE 2
RELATIVE SEA-LEVEL RISE PROJECTIONS FOR THE CITY OF TACOMA

Year	Area	Amount of SLR (ft)							
		RCP 4.5				RCP 8.5			
		Low (83%)	Medium (50%)	High (17%)	Extreme (0.1%)	Low (83%)	Medium (50%)	High (17%)	Extreme (0.1%)
2030	East	0.3	0.5	0.6	0.9	0.3	0.5	0.6	0.9
	West	0.2	0.4	0.5	0.8	0.3	0.4	0.5	0.8
2060	East	0.8	1.1	1.4	3	0.9	1.2	1.5	3.2
	West	0.6	0.9	1.2	2.8	0.7	1	1.3	3
2100	East	1.5	2.1	2.7	7.9	1.9	2.5	3.3	8.8
	West	1.2	1.8	2.5	7.6	1.6	2.3	3	8.6

2. Future Water Levels

2.1 Tidal Datums

The National Oceanic and Atmospheric Administration (NOAA) maintains a tide gage in the Tacoma Tideflats area (Station ID: 9446484). Table 3 provides the tidal datums based on the Tacoma gage. Assuming a RSLR increase of 8.8 feet, based on the extreme probability projection under the RCP 8.5 scenario, future mean higher high water (i.e., the average daily highest high tide; MHHW) would be 18.2 feet NAVD88⁵ in 2100 (Table 3).

TABLE 3
CURRENT AND FUTURE TIDAL DATUMS

Datum		Current Elevation (ft NAVD88)	2100 Elevation (ft NAVD88)
Mean higher high water	MHHW	9.39	18.19
Mean high water	MHW	8.51	17.31
Mean tide level	MTL	4.48	13.28
Mean sea level	MSL	4.45	13.25
Mean low water	MLW	0.45	9.25
Mean lower low water	MLLW	-2.39	6.41

⁵ North American Vertical Datum of 1988

2.2 Extreme Water Levels

The Federal Emergency Management Agency (FEMA) provides projections of extreme coastal water levels as part of their National Flood Insurance Program (NFIP). However, FEMA does not presently address climate change related flood hazards as part of the NFIP. Table 4 provides an estimate of future extreme total water elevations⁶, assuming the same RSLR increase of 8.8 feet as discussed in the previous section. While adding RSLR to the FEMA projections does not consider complex hydrodynamics including changes to waves and currents based on higher water levels inundating different land covers, it offers a good first order approximation of the elevations that may be inundated with sea-level rise.

TABLE 4
CURRENT AND FUTURE TOTAL WATER LEVELS FOR TACOMA

Return Period	Current Elevation (ft NAVD)	2100 Elevation (ft NAVD)
10-year event (10% annual chance)	14.7	23.5
50-year event (2% annual chance)	15.2	24.0
100-year event (1% annual chance)	15.3	24.1
500-year event (0.2% annual chance)	15.5	24.3

2.3 Sea-Level Rise Mapping

NOAA developed a [Sea-Level Rise Viewer](#) to view sea-level rise and potential coastal flooding impact areas and relative depth. The Viewer provides a good first-order approximation of flooding extent with different amounts of sea-level rise. The Viewer does not account for erosion and should only be used as a screening-level tool for management decisions. More refined coastal hazard modeling could be done to better evaluate the City's vulnerabilities.

3. Sea-Level Rise Matrix

In coordination with the project Steering Committee and the City's Infrastructure Committee, ESA identified key City assets that would be tidally inundated with 8.8 feet of RSLR as a conservative estimate of the assets that could experience flooding by 2100. Assets were categorized based on the categories used in the City of Tacoma's Capital Facilities Plan 2021-2026. Based on the condition/age, cost/value/importance, and function of the asset, recommendations from the WRCP, and City staff input, a probability projection or risk tolerance was assigned to the asset. Risks were generally assigned as follows:

- Parks and open space, trails and bike paths, and natural areas were assigned a 50% or mid-range probability of sea-level rise exceeding the planned amount.

⁶ The total water level represents the still water level (the result of astronomical and meteorological effects) plus the effect of waves.

- Buildings, key roads and railroad tracks, pump stations, and power substations were assigned a 17% or low-range probability of sea-level rise exceeding the planned amount.
- Public safety or public health facilities and the Central Wastewater Treatment Plant were assigned a 1% or very-low-range probability of sea-level rise exceeding the planned amount.

Next, using the corresponding sea-level rise scenario for each risk projection and elevations for each individual asset, hazard exposure was determined for each asset. The elevations are approximate based on LiDAR data in the vicinity of the asset and do not include seawalls or other structures that may protect against flooding unless otherwise noted. Therefore, the hazard exposure analysis may have resulted in conservatively high estimates of flooding in certain cases. Table 5 provides the asset matrix with the resulting exposures to flood hazards.

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Asset	Current Elevation (ft NAVD)	Condition/Age	Cost/Value/Importance	Function	Risk	Exposure	Adaptation Note
Community Development							
Sea Scouts/Tacoma Steam Plant Building	14.5 - 15.5	Built prior to 1950			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	May need to be reconstructed with longer guide piles and support piles to allow infrastructure to float higher with higher water levels.
Berg Scaffolding Building	11.5 - 12.5				17%	10-yr coastal storm flooding today, tidal inundation by 2100	
16th Street Pier	n/a				n/a	Already exposed based on purpose of structure	
Kayak Float at Waterway Park	n/a				n/a	Already exposed based on purpose of structure	
North Moorage	n/a				n/a	Already exposed based on purpose of structure	
Pier A	n/a				n/a	Already exposed based on purpose of structure	
Dock St. Marina	n/a				n/a	Already exposed based on purpose of structure	
Delin Docks	n/a				n/a	Already exposed based on purpose of structure	
Cultural Facilities - none within SLR hazard zone during study timeline							
General Governmental Municipal Facilities							
Museum of Glass Garage	19				17%	Not expected to flood during 100-yr coastal storm through 2100	
Center for Urban Waters	13 - 14				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Libraries - none within SLR hazard zone during study timeline							
Parks and Open Spaces							
Days Island	5 - 30				50%	Some areas likely flood during high tides now, and exposure will increase with sea-level rise	
Julia's Gulch	7 - 9				50%	Some areas likely flood during high tides now, and exposure will increase with sea-level rise	
Marine View Drive	~15				50%	Low points expected to flood during 100-yr coastal storm today, with frequency increasing to flooding during 10-yr coastal storm by 2030	
Marine View Drive East	~15				50%	Low points expected to flood during 100-yr coastal storm today, with frequency increasing to flooding during 10-yr coastal storm by 2030	
Swan Creek	13.5 - 15				50%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Titlow Park	6 - 20				50%	Some areas likely flood during high tides now, and exposure will increase with sea-level rise	

Asset	Current Elevation (ft NAVD)	Condition/Age	Cost/Value/Importance	Function	Risk	Exposure	Adaptation Note
Parks and Open Spaces Continued							
Bayside Park	14 - 15				50%	Low points expected to flood during 10-yr coastal storm today, with flooding becoming more frequent through 2100	
Chinese Reconciliation Park	14 - 20				50%	Low points expected to flood during 10-yr coastal storm today, with flooding becoming more frequent through 2100	
Hamilton Park	~14				50%	Low points expected to flood during 10-yr coastal storm today, with flooding becoming more frequent through 2100	
Jack Hyde Park	>8				50%	Some areas likely flood during high tides now, and exposure will increase with sea-level rise	
Marine Park & Les Davis Pier	13 - 17				50%	Low points expected to flood during 10-yr coastal storm today, with flooding becoming more frequent through 2100	
Ruston Way Tidelands	>9				50%	Some areas likely flood during high tides now, and exposure will increase with sea-level rise	
Public Safety							
Marine Security Joint Operations Center	14.5 - 15				1%	10-yr coastal storm flooding today, tidal inundation by 2100	
Fire Station No. 6	15.5 - 16.5				1%	10-yr coastal storm flooding by 2030-2040, with flooding becoming more frequent through 2100	
Fire Station No. 5/renamed No. 6	14.5 - 15.5		\$7.005 million in funding in 2021-2026 CFP		1%	10-yr coastal storm flooding today, tidal inundation by 2100	
Fire Training Center	15.5 - 16.5				1%	10-yr coastal storm flooding by 2030-2040, with flooding becoming more frequent through 2100	
Transportation							
Environmental Services (Tagro) - Cavanaugh	12.5 - 13.5				17%	10-yr coastal storm flooding today, tidal inundation by 2100	
Ruston Way Trail and Bike Lane	14 - 16				50%	10-yr coastal storm flooding by 2100	
Owen Beach Trail	12 - 13				50%	10-yr coastal storm flooding today, tidal inundation around 2100	
Ruston Way	14 - 16	Built in early 1900s and renovated in mid-1980s. Poor condition			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Marine View Drive	15 - 20				17%	100-yr coastal storm today, with frequency increasing to flooding during 10-yr coastal storm by 2030	Not city-owned
Tideflats Roads	13 - 20				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	

Asset	Current Elevation (ft NAVD)	Condition/Age	Cost/Value/Importance	Function	Risk	Exposure	Adaptation Note
Transportation Continued							
Dock Street	13 - 16				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
N Schuster Pkwy (Ruston-0 Block)	13.5 - 15				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
E Dock St (E D St-SEN)	13 - 13.5				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
E D St (Dock-15th)	11.5 - 14				17%	10-yr coastal storm flooding today, tidal inundation around 2100	
Urban Waters (E D St, E F St, etc)	13 - 14				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
E 11th St (Dock-Portland)	13 - 14				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
St Paul Ave (11-Portland)	11 - 14				17%	10-yr coastal storm flooding today, tidal inundation around 2100	
E 15th St (D-St Paul) and Adjacent Streets	12 - 14				17%	10-yr coastal storm flooding today, tidal inundation around 2100	
Puyallup Ave (Milwaukee-F) and Adjacent Streets	14 - 16				17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Portland Ave (27-SEN)	12.5 - 14				17%	10-yr coastal storm flooding today, tidal inundation around 2100	
Port Streets - A (Puyallup River-Blair Waterway, SR 509-Commencement Bay)	11 - 15				17%	10-yr coastal storm flooding today, tidal inundation around 2100	
Port Streets - B (Blair Waterway-Hylebos Waterway, SR 509-Commencement Bay)	11.5 - 14				17%	10-yr coastal storm flooding today, tidal inundation around 2100	
Site 10 Seawall & Esplanade Repair and Replacement	17.6		\$1.715 million in funding in 2021-2026 CFP		17%	100-yr coastal storm flooding by 2080 and 10-yr coastal storm flooding by 2100	
Site 12 Seawall	17.6		\$1.7 million in funding in 2021-2026 CFP		17%	100-yr coastal storm flooding by 2080 and 10-yr coastal storm flooding by 2100	
Solid Waste - none within SLR hazard zone during study timeline							

Asset	Current Elevation (ft NAVD)	Condition/Age	Cost/Value/Importance	Function	Risk	Exposure	Adaptation Note
Storm Water							
Cleveland Way Pump Station	14 - 16	Installed 2016. Age of individual assets within facility varies.			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Central WWTP Floodwall Bypass Pump Station	Flood wall protects for 500-year storm plus 1 foot.				1%	500-yr riverine storm flooding by 2040	
Wastewater							
Central Wastewater Treatment Plant	Flood wall protects for 500-year storm plus 1 foot.	Constructed in 1952			1%	500-yr riverine storm flooding by 2040	
North End Wastewater Treatment Plant						Beyond study timeline	https://www.cityoftacoma.org/go/vernment/city_departments/environmentalservices/wastewater/wastewater_system/netp
Western Slopes Wastewater Treatment Plant						Beyond study timeline	
Eductor Facility	15 - 18	Constructed in 2013. Good condition.		Area to decant water from solids collected during conveyance system cleaning.	17%	100-year coastal storm flooding today, 10-year coastal storm flooding by 2030	
Septage Facility	14.5 - 17	Constructed in 2013. Good condition.		Septage dumping station for customers	17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Wastewater Pump Stations							
2201 - Titlow	14	Constructed in 1973			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
1304 - Salmon Beach Lower	7.5 - 9.5	Constructed in 1991			17%	Already exposed to tidal inundation	
3104 - 15th & Dock	17.5 - 18.5				17%	100-yr coastal storm flooding by 2080 and 10-yr coastal storm flooding by 2100	
3101 - Dock Street	20 - 21				17%	Not expected to flood during 100-yr coastal storm through 2100	
3105 - Picks Cove	12.5 - 13	Constructed in 1980			17%	10-yr coastal storm flooding today, tidal inundation around 2100	
3103 - 11th St. Bridge	14.5 - 15	Constructed in 1981			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4101 - Lincoln Ave.	14.5 - 15.5	Constructed in 1986			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	

Asset	Current Elevation (ft NAVD)	Condition/Age	Cost/Value/Importance	Function	Risk	Exposure	Adaptation Note
Wastewater Continued							
4109 - Milwaukee Way	13.5 - 14	Constructed in 1983			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4116 - Marshall & Port of Tacoma	15 - 16	Constructed in 1989			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4104 - Lincoln & Port of Tacoma	13.5 - 14	Constructed in 2008			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4105 - Ross & Port of Tacoma	14.5 - 15.5	Constructed in 2008			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4102 - Lincoln & Alexander	14 - 15	Constructed in 1990/2012			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4106 - Lincoln & Taylor Way	15 - 15.5	Constructed in 2007			17%	100-year coastal storm flooding today, 10-year coastal storm flooding by 2030	
4107 - Taylor Way	13 - 13.5	Constructed in 1979/2013			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4103 - Marine View Drive	14.5 - 15	Constructed in 1990/2012			17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
4108 - Marine View Drive	16.5 - 17	Constructed in 1989			17%	100-yr coastal storm flooding by 2050 and 10-yr coastal storm flooding by 2070	
Tacoma Power							
Alexander Distribution Substation	14.5 - 15.5	Constructed in 1977 with some rebuild in 1998	Critical to local customers; \$6-10M to replace	Distribution Substation, which transforms power from high voltage to medium voltage.	17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Blair Distribution Substation	16 - 18	Constructed in 2004	Critical to local customers; \$6-10M to replace	Distribution Substation, which transforms power from high voltage to medium voltage.	17%	100-yr coastal storm flooding by 2040, with frequency increasing to flooding during 10-yr coastal storm by 2060	
East F Distribution Substation	15.5 - 16.5	Constructed in 1970 with full rebuild in 2016	Critical to local customers; \$6-10M to replace	Distribution Substation, which transforms power from high voltage to medium voltage.	17%	100-yr coastal storm flooding today, with frequency increasing to flooding during 10-yr coastal storm by 2040	
Lincoln Distribution Substation	14 - 15.5	Constructed in 1999	Critical to local customers; \$6-10M to replace	Distribution Substation, which transforms power from high voltage to medium voltage.	17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	

Asset	Current Elevation (ft NAVD)	Condition/Age	Cost/Value/Importance	Function	Risk	Exposure	Adaptation Note
Tacoma Power Continued							
Northeast Distribution Substation	12.9 - 15	Constructed in 1972	Critical to power system; \$20-30M to replace	Transmission and Switching Substation.	1%	10-yr coastal storm flooding today, high tide inundation by 2080	
Milwaukee Distribution Substation	12.8 - 13.5	Constructed in 2010	Critical to local customers; \$6-10M to replace	Distribution Substation, which transforms power from high voltage to medium voltage.	17%	10-yr coastal storm flooding today, high tide inundation by 2100	
Taylor Distribution Substation	14.4 - 17	Constructed in 2018	Critical to large customer; \$6-10M to replace	Distribution Substation, which transforms power from high voltage to medium voltage.	17%	10-yr coastal storm flooding today, with flooding becoming more frequent through 2100	
Municipal Railway							
Tacoma Rail, Tidelands Headquarters	16.5 - 18.5				17%	100-yr coastal storm flooding by 2050, with frequency increasing to flooding during 10-yr coastal storm by 2070	
Tidelands Track	>13				17%	10-yr coastal storm flooding today, spring high tide inundation by 2100	
Water							
Highland Pump Station	16 - 18				17%	100-yr coastal storm flooding by 2040, with frequency increasing to flooding during 10-yr coastal storm by 2060	
Natural Areas							
Gog-le-hi-te Wetlands	High ground is 18 - 20 ft				50%	Already exposed based on type of habitat	Some habitat transgression area
Puget Gulch	Some areas down to 15 ft				50%	Already exposed based on type of habitat	Room for habitat to transgress upstream
Swan Creek	Some existing low areas				50%	Already exposed based on type of habitat	Room for habitat to transgress upstream
Public Health							
Franciscan Occupational Health - Port Clinic	14 - 14.5				1%	10-yr coastal storm flooding today, tidal inundation by 2100	

4. Results

The exposure column of Table 5 is color coded to represent the more exposed assets in darker blues and the lesser exposed assets in lighter blues. The hazard analysis identified two types of assets for the City to prioritize:

- High consequence assets – assets where failure could result in considerable public health, public safety, or environmental impacts.
- High exposure assets – assets that are most at risk for impacts with RSLR.

4.1 High Consequence Assets

The high consequence assets are assets the City will want to prioritize for adapting to sea-level rise to avoid failure of the asset. These assets include (in order of exposure):

- Within the 10-year coastal storm flood elevation today, with risk of tidal flooding by 2100:
 - Marine Joint Operations Center
 - Fire Station Number 5
 - Franciscan Occupational Health (Port Clinic)
- Within the 10-year coastal storm flood elevation by 2030-2040, with flooding becoming more frequent through 2100:
 - Fire Station Number 6
 - Fire Training Center
- Central Wastewater Treatment Plant and Floodwall Bypass Pump Station: The Plant and Pump Station are protected from the 500-year riverine storm event with a floodwall with 1 foot of freeboard. Sea-level rise will eliminate this freeboard by 2040.

4.2 High Exposure Assets

The high exposure assets should also be prioritized for adapting to sea-level rise as they will be the first assets impacted. These assets include (in order of exposure):

- Salmon Beach Lower Pump Station
- St. Paul Avenue (11th St. to Portland St.)
- Port Streets – A (Puyallup River to Blair Waterway to SR 509 to Commencement Bay)
- Berg Scaffolding Building
- E. D Street (Dock St. to 15th St.)
- Port Streets – B (Blair Waterway to Hylebos Waterway to SR 509 to Commencement Bay)

- E. 15th Street (D St. to St. Paul Ave.) and adjacent streets
- Picks Cove Pump Station
- Environmental Services (Tagro) – Cavanaugh
- Portland Avenue

4.3 Conclusions

When planning for adaptation to sea-level rise, the City could consider a two-phased approach. Initially, the City will be able to develop asset-specific adaptation strategies to address the most at-risk assets. However, at a certain point (when water levels regularly reach around 11 – 12 feet NAVD likely around 2050 – 2080), much of the key infrastructure in the Tideflats, including the roads, will be at risk for flooding. At this stage, the City will need to collaborate with the City of Fife, the Puyallup Tribe of Indians, Port of Tacoma, BNSF Railway, and Pierce County to develop a broader adaptation strategy to address flooding across the Tideflats area.

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Appendix C: Benefit-Cost Analysis

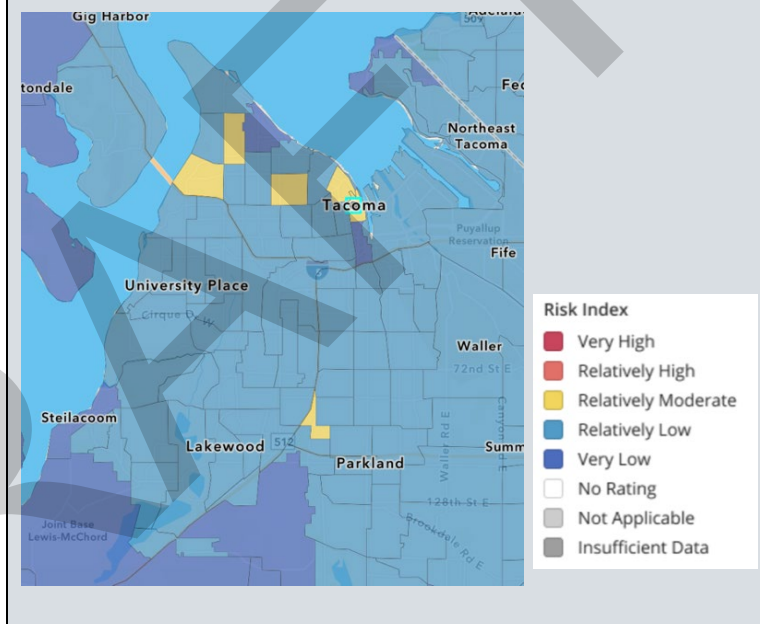
The benefit cost-assessment (BCA) provides an overview of the economic implications of climate hazards and impacts in Tacoma and how the Tacoma Adaptation Strategy can reduce Tacoma's exposure and costs associated with climate impacts. Knowing the benefits and costs of each action will help guide which actions to prioritize. Benefits include impacts to human life, infrastructure, and property. Costs include staffing, materials, capital infrastructure, plan development, and technology.

Methodology

The benefits of the actions were estimated by using the FEMA National Risk Index which characterizes 18 natural hazard risks¹, plus social vulnerability, and community resilience. The main climate change hazards that Tacoma faces include extreme heat, coastal flooding, river flooding, landslide, and wildfire smoke.

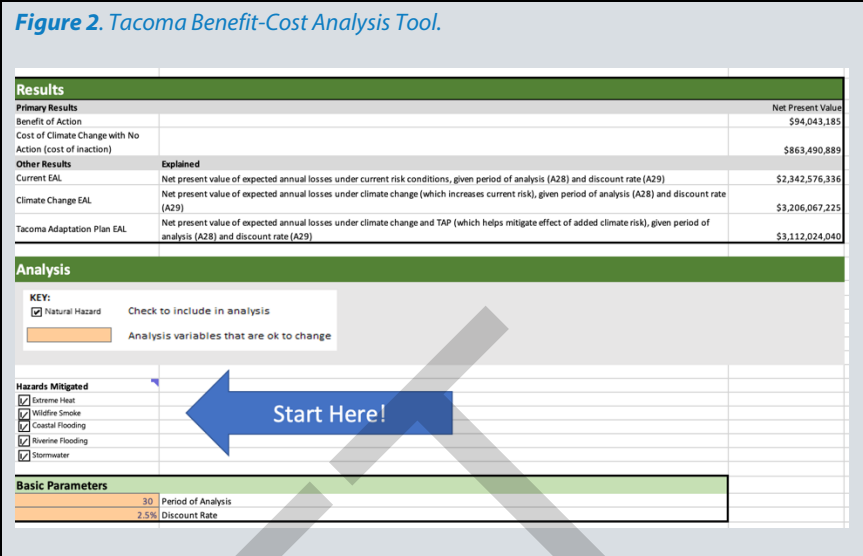
- ▶ Extreme heat increases mortalities associated with extreme heat events (above 82 degrees F).
- ▶ Coastal flooding includes tidal flooding which is compounded by sea level rise, coastal storms, and damages buildings and other structures.
- ▶ River flooding is the predicted within the floodplain. This impacts structures, population, and agriculture.
- ▶ Landslides impact homes and buildings in certain areas and infrastructure like roads, rail, and stormwater.
- ▶ Wildfire smoke increases mortalities due to respiratory and cardiovascular issues.

Figure 1. FEMA National Risk Index for the City of Tacoma, based on census tracts.



¹ Risk is identified as the likelihood of exposure multiplied by the economic consequence of that exposure.

The BCA estimates the net present value (NPV) of expected losses on an annualized basis and extended out for a hundred years, discounted at a rate of 2.5%. In the table below, the “Status quo” column shows expected annual losses that the City can experience from current hazards. The “Status quo over 100 years” shows the long-term costs that the City can experience from current hazards absent future climate change. The “Future climate change” column shows how hazards will worsen under future climate change and its economic impact on the City for the next 100 years. Finally, the “Tacoma Adaptation Strategy” column shows the NPV of avoided damages from this Strategy. Individual cost of CAS inaction—or the embedded costs of not successfully implementing the actions in the CAS—calculations are directly associated with each action and can be referenced in the action-specific tables.



Hazard	Status quo: NPV of annual expected losses from hazards	Status quo over 100 years: NPV of expected losses from hazards over 100 years	Future climate change: NPV of expected losses from hazards, considering how climate change will exacerbate current hazards	Tacoma Adaptation Strategy: NPV of damage avoided from hazard exposure reduction over 100 years
Coastal Flood	\$59,200,000	\$2.2 billion	\$3.1 billion	\$116 million
Extreme Heat	\$9,247,920	\$347 million	\$729 million	\$34 million
Landslide	\$684,780	\$26 million	\$39 million	\$3.9 million
River Flood	\$60,247	\$2.3 million	\$4.3 million	\$430,000
Wildfire Smoke	\$40,000,000	\$1.5 billion	\$1.7 billion	\$10 million

Action Assumptions

The table below provides high-level details in the benefit and cost assumptions of each of the actions in the Tacoma Climate Adaptation Strategy.

Action	Hazards addressed	Benefit assumptions	Cost assumptions
Site-by-site flooding evaluation & planning		The evaluation will identify at-risk buildings and people and allow Tacoma to prepare accordingly.	Cost of the vulnerability assessment.
Capital project standards & tools		New development will be able to accommodate high heat and wildfire smoke – reduction in human health impacts.	Cost of tools and standards development. Ongoing program administration costs.
Development code improvements		Future buildings will incorporate climate-conscious planning, population will be less susceptible to these impacts.	Cost to conduct study and develop HVAC and building material code improvements.
Capital project planning, prioritization, & implementation		Reduced impact of at-risk buildings and population. *Does not include stormwater flooding*	Cost of upgrading stormwater system and program administration. Ongoing O&M costs.
Natural systems condition assessment & monitoring program		Reduction in damages to assets at risk from SLR, flooding, and landslide.	Cost to conduct initial assessment; ongoing program administration.
Nearshore transitional zones		Reduction in damages to assets at risk from SLR, flooding, and landslide.	Cost to conduct initial assessment, cost of nearshore restoration, cost of ongoing monitoring program.
Habitat restoration project guidance & resilience		Reduction in likelihood of slide and flooding (frequency), as well as provide refuge during heat island events (exposure).	Annual per acre cost for restoration, program administration.
Business engagement & continuity planning		Not estimated.	Not estimated.

Action	Hazards addressed	Benefit assumptions	Cost assumptions
Just & green jobs transition plan		Benefits not quantified due to wide variability in action parameters and associated impacts.	Cost of staff time to develop workforce grant application. \$100k annually for workforce development grant program funded by the city.
Cooling & air quality resilience hubs		At-risk population will have places to seek refuge during extreme heat events.	Establishing 3 resilience hubs in the most critical locations. Ongoing O&M costs.
Co-create climate communications		TAP will prepare the city to deal with climate change driven hazards, reducing the risk to Tacoma's population.	\$50k in startup costs and ongoing cost of staff time.
Develop a coordinated strategy for addressing extreme heat and smoke risks		Avoided costs associated with people who suffer from health impacts (mortality) associated with wildfire smoke and heat hazards.	\$60 per filter box fans for 12,450 box fans. Cost to administer program.
Climate equity initiatives		Benefits not quantified due to wide variability in action parameters and associated impacts.	Cost of climate equity fellow, cost of racial equity trainings and materials.
Regional coordination		Reduction in the frequency and extent of flooding.	\$1.5 million in initial restoration planning, modeling, capital investments for 2 major watershed basins; \$60,000 in ongoing restoration maintenance costs.
Economic ROI tools		Benefits not quantified due to wide variability in action parameters and associated impacts.	Cost to create economic tools, based on similar tools developed in Redmond, WA.
Community check-ins		Benefits not quantified due to wide variability in action parameters and associated impacts.	Ongoing 0.15 FTE cost with \$25,000 in initial cost and \$5,000 in ongoing costs for materials with translation services.

Considerations

The estimated benefits of actions are conservative because of the limitations of the FEMA National Risk Index model and limited information regarding the impacts of supportive actions. The model does not consider the economic losses such as reduced tourism or work productivity. It also does not consider increased morbidity and the costs associated with increased hospitalizations. During the recent 2021 summer heat wave, regional hospitals were at capacity, and they activated their emergency response. Furthermore, the FEMA National Risk Index model does not measure the indirect benefits of “soft” or supportive actions like co-creating climate communications or a just and green jobs transition plan. These benefits are more difficult to measure and are not estimated in this cost-benefit analysis.

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Appendix D: Capital Facilities Assessment

Date: August 23, 2021

To: City of Tacoma Climate Adaptation Strategy Steering Committee
Beth Jarot, City of Tacoma

Copy to: Andrea Martin, Cascadia Consulting Group
Mike Chang, Cascadia Consulting Group

From: Matt Fontaine, Herrera Environmental Consultants
Julianne Chechanover, Herrera Environmental Consultants

Subject: Task 2.6 – Capital Facilities Adaptation Assessment

Introduction

The City of Tacoma (City) is in the process of understanding how City departments and Metro Parks Tacoma are integrating climate change and social equity into their capital planning processes. Currently, these departments both independently and collaboratively incorporate various levels of climate adaptation measures and social equity considerations into their planning processes. To gain a better understanding of these processes, this technical memorandum serves to:

- ▶ Document how climate change and social equity is being incorporated into City capital planning processes
- ▶ Provide recommendations to further incorporate climate change and social equity into City capital planning processes

It should be noted that the recommendations provided in this memorandum are not a comprehensive or exhaustive list but create an opportunity for the departments to learn from each other and create a foundation to continue incorporating climate change and social equity into their capital planning processes.

Methods of Analysis

Five city departments and Metro Parks Tacoma were interviewed about their current capital planning processes and how climate change and social equity are currently being incorporated into those processes. These departments were selected for the following reasons:

- ▶ They are the primary departments within and affiliated with the City of Tacoma that are managing infrastructure projects.
- ▶ They are able to incorporate climate change and social equity into their infrastructure projects.
- ▶ They are active members of the City's Climate Adaptation Strategy Steering Committee.

The City’s Office of Management and Budget was also interviewed about how climate change and social equity is being incorporated in the Capital Facilities Plan (CFP). These departments and their points of contact are summarized in Figure 1 and Table 1, respectively.

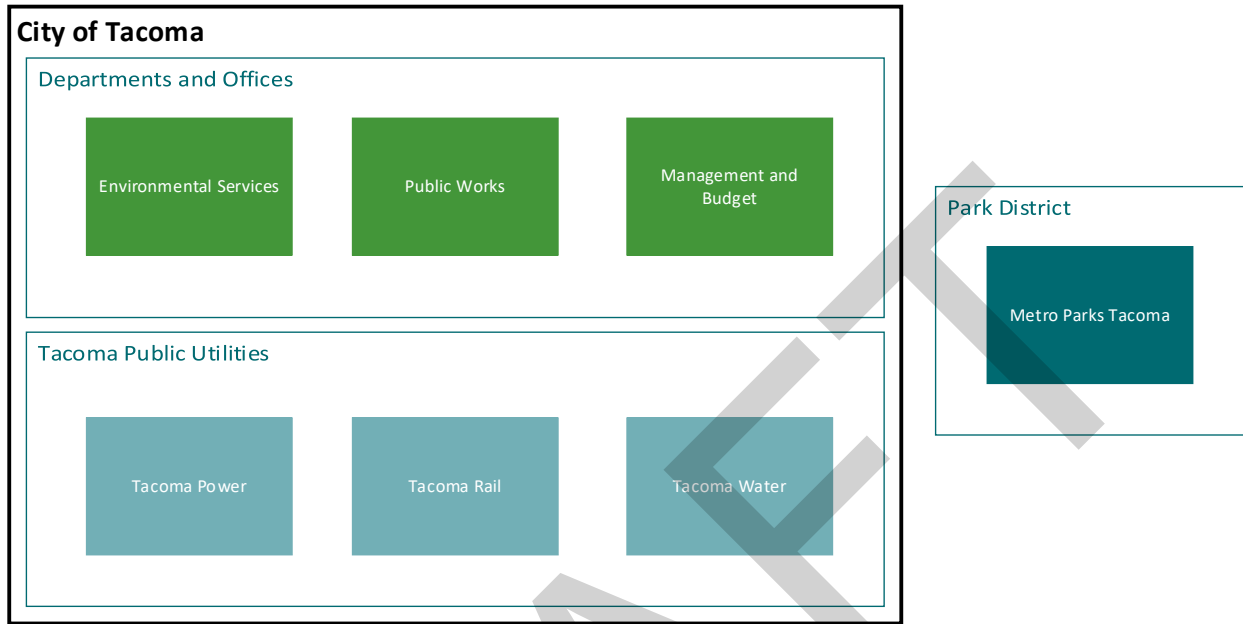


Figure 1. Departments interviewed during this study.

Table 1. Points of Contact.				
Name	Title	Department	Email	Phone
Karen Bartlett	Principal Engineer	Environmental Services	kbartlet@cityoftacoma.org	(253) 502-2257
Chris Larson	Engineering Division Manager	Public Works	clarson@cityoftacoma.org	(253) 591-5538
Nick Anderson	Management Analyst	Management and Budget	nanderson@cityoftacoma.org	(253) 591-5847
Bonnie Meyer	Facilities Conservation and Planning Administrator	Tacoma Power	bmeyer@cityoftacoma.org	(253) 753-3027
Terry Coggins	Facility Manager		tcoggins@cityoftacoma.org	(253) 502-8310
Alan Matheson	Assistant Superintendent	Tacoma Rail	amatheson@cityoftacoma.org	(253) 502-8934
Tosha Siebert	Assistant Division Manager for System and Asset Planning	Tacoma Water	tsiebert@cityoftacoma.org	(253) 878-2323
Jessica Knickerbocker	Project Delivery Manager		jknicker@cityoftacoma.org	(253) 502-2119
Marty Stump	Deputy Director	Metro Parks Tacoma	marty@tacomaparks.com	(253) 305-1078

Results

Generalized Capital Planning Process

For consistency across all departments (excluding Management and Budget), a generalized version of capital planning process was illustrated based on questionnaire responses and displayed in Figure 2.

Most departments have identified ways that they already incorporate climate change and social equity in their capital planning processes. These adaptation measures and recommended adaptation measures are described in more detail in the following section.

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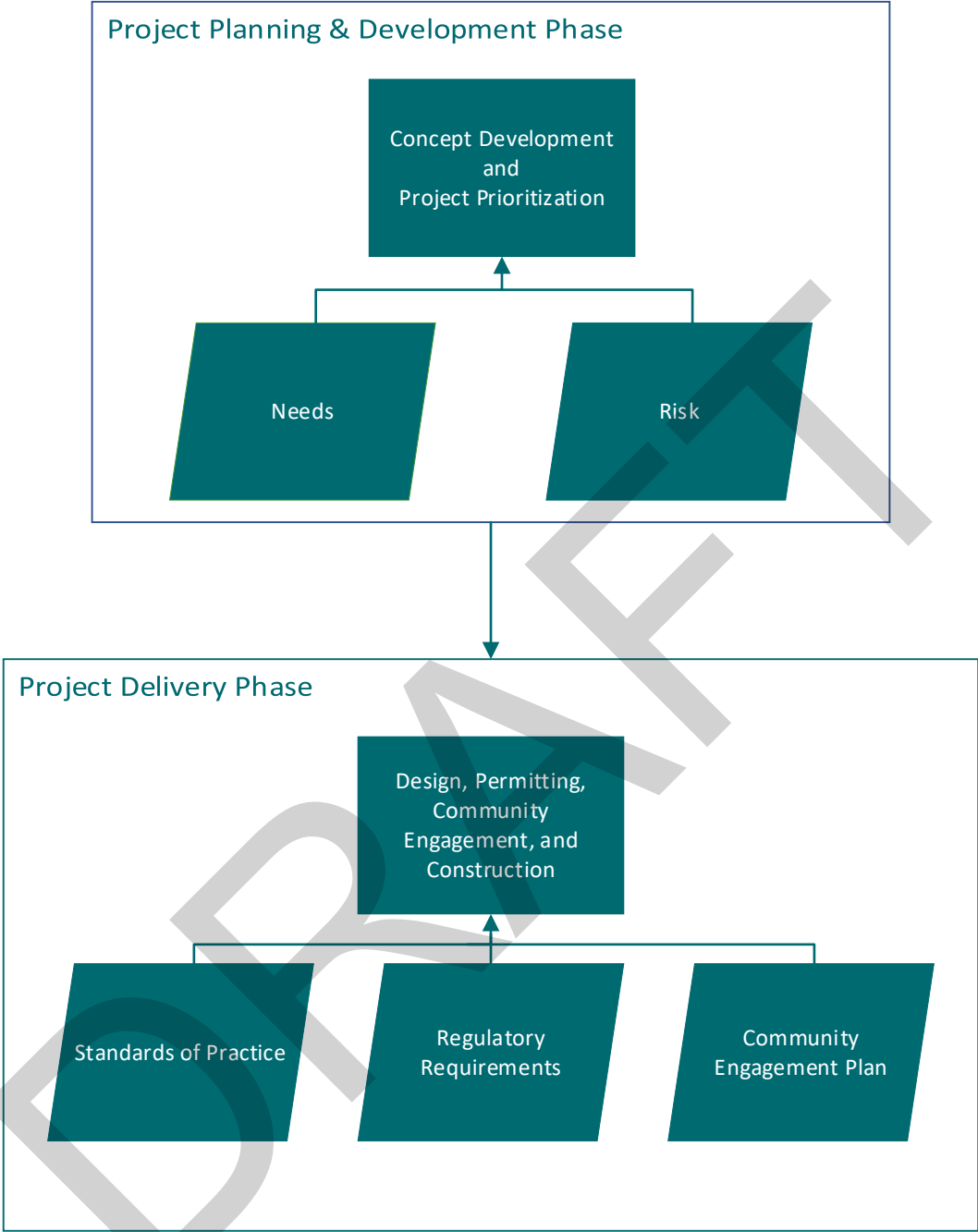


Figure 2. Generalized capital planning process.

Climate Adaptation Measures

Each department has taken their own approach to implementing climate change adaption and social equity measures into their capital planning process. The existing and recommended adaptation measures are grouped by the interviewed departments shown in Figure 1. Each adaptation measure is organized into either the Project Planning & Development Phase or Project Delivery Phase of the flowchart shown in Figure 2. Information about how all departments can further incorporate climate

change and social equity in their capital planning process can be found in the Overall Recommendations section of this memorandum.

Departments and Offices

Environmental Services

Existing Climate Adaptation and Social Equity Measures

Environmental Services incorporates social equity into the Project Planning & Development Phase of their capital planning process. For example, Environmental Services uses the City's Equity Index when working with Public Works on planning stormwater or wastewater pipe installation projects that correspond with streets projects. Environmental Services also incorporates social equity and climate change into the Project Delivery Phase of their capital planning process. Social equity is incorporated in the design and community engagement processes through developing green stormwater infrastructure (GSI) in areas with a low equity index score and incorporating citizen feedback about localized flooding issues. Climate change is incorporated by upsizing stormwater pipes during design to account for increased flow rates. Environmental Services is also currently in the process of investigating incorporation of a climate change-based design storm into their Standards of Practice (Stormwater Management Manual [SWMM]).

Recommended Climate Adaptation and Social Equity Measures

Environmental Services oversees solid waste, surface water, and wastewater management within the City. Each division should consider incorporating climate change into the Project Planning & Development Phase and Project Delivery Phase of their capital planning process.

Recommendations for each of the divisions are outlined below:

- ▶ **Solid Waste Management Division:** In the Solid Waste Management Plan, discuss contaminated site management at the Tacoma Recovery and Transfer Station due to flooding from extreme precipitation events. Consider collaborating with Emergency Management on Disaster Debris Management Plan to ensure compliance with regulations and minimize the impact to the environment and human health.
- ▶ **Surface Water Management Division:** Finalize the implementation of a climate change-based design storm in the SWMM and work with Metro Parks Tacoma and Public Works on implementing GSI projects. GSI has many co-benefits related to climate change and social equity including, but not limited to, the following:
 - Reducing impacts of higher temperatures (climate change)
 - Beautifying neighborhoods (social equity)
 - Reducing respiratory and heat-related illnesses (social equity)
 - Improving air quality (social equity and climate change)
 - Reducing flooding (climate change)

Incorporating climate change-based standards into SWMM requirements that apply to the public may be a controversial action due to uncertainty with climate projections and costs to developers for larger stormwater facilities. An interim step could be to develop a standard of practice that is followed on City projects, particularly conveyance projects, until SWMM requirements can be defined and adopted.

- ▶ **Wastewater Management Division:** Consider investigating additional odor control at the North End Wastewater Treatment Plant, Central Wastewater Treatment Plant, and wastewater pump stations. This is due to increased hydrogen sulfide production caused by increased temperatures. Work with Surface Water Management on implementation of a climate change-based design storm to prepare for increased inflow and infiltration (I&I) in wastewater collection systems. This would include incorporating sea level rise (SLR) and saltwater intrusion into the design process and integrating findings from the Shoreline SLR Assessment when planning for new capital projects.

Public Works

Existing Climate Adaptation and Social Equity Measures

Public Works incorporates social equity into the Project Planning & Development Phase of their capital planning process. As described above, Public Works uses the City's Equity Index when prioritizing Tacoma Street Initiative with Environmental Services and considers equity on their other transportation infrastructure projects as well. Public Works has also **started to investigate how climate change will change water levels, storm drainage, and vegetation requirements, which may potentially impact the planning and design of their capital projects.**

Recommended Climate Adaptation and Social Equity Measures

Public Works should continue to investigate climate change and incorporate it into their capital planning process. It is recommended that Public Works investigates the impacts of flooding on physical road damage, road closures, and network disruptions (e.g., electrical networks for streetlights and traffic lights). This can be included as a Risk in the Project Planning & Development Phase of the capital planning process. Public Works should work alongside Tacoma Rail and the Port of Tacoma on intermodal projects to ensure networks are in place during extreme climate events.

Management and Budget

Existing Climate Adaptation and Social Equity Measures

Management and Budget oversees the execution of the CFP. Each project within the CFP is required to answer 14 questions to group the projects into tiers. This ensures that the projects align with Tacoma 2025 goals as well as other planning document goals (e.g., Puget Sound Regional Council Plans, Transportation Master Plans, etc.). Out of the 14 questions, four questions relate to climate change and social equity. These questions are summarized below:

1. Does the project improve the equitable access to public facilities and services? (social equity)
2. Does the project align with Tacoma 2025 or other City priorities? (climate change and social equity)
3. Does the project reduce greenhouse gas emissions or support the adaptation of climate change? (climate change)
4. Does the project meet growth patterns and projected needs and/or serve new development and redevelopment? (Is the project in a mixed-use center?) (climate change and social equity)

In addition to the CFP, Management and Budget staff have been collaborating with other City departments on organizing an internal team to evaluate capital project prioritization called the Capital Planning Committee. This team has been investigating how to include climate change and equity into capital projects with a focus on city-owned building projects.

Recommended Climate Adaptation and Social Equity Measures

Capital Facilities Plan

Management and Budget should consider rephrasing and elaborating on the CFP questions above to include more climate change adaptation and social equity measures. It is recommended that the questions are rephrased to say how the projects plan on incorporating climate change adaptation and social equity measures as opposed to asking if they do so. This would suggest that climate change adaptations and social equity considerations are required instead of recommended.

It is also recommended that Question #3 is split into two questions. This is due to the fact that reducing greenhouse gas emissions is a mitigative measure while the rest of the question focuses on adaptive measures. This would allow for both climate change mitigation and adaptation to be required as opposed to one or the other. In regard to social equity, Management and Budget should consider asking how the project plans on including the City's Social Equity Index. This can be done by rephrasing Question #1 as the following: "How does the project incorporate the City's Social Equity Index (e.g., improve the equitable access to public facilities and services)?"

Capital Planning Committee

Management and Budget staff should continue to convene the Capital Planning Committee on a regular basis. The committee should consider expanding their focus to include other capital projects as it becomes more established and collaborate with members of the Climate Adaptation Strategy Steering Committee when discussing climate change adaptation and social equity measures.

Tacoma Public Utilities

Tacoma Power

Existing Climate Adaptation and Social Equity Measures

Tacoma Power does extensive planning related to climate change. In 2020, Tacoma Power developed an Integrated Resource Plan. This plan included refining their climate change modeling efforts with more recent climate change projections (e.g., temperatures and inflows) to understand the impact on future loads and generations. This could be considered a Risk in the Project Planning & Development Phase. Tacoma Power is also planning for change in how they maintain their lands, forests, and facilities due to climate change as well.

When building or remodeling facilities, Tacoma Power uses the Leadership for Equity Assessment & Development (LEAD) tool. They use this social equity tool to ensure they are identifying best public transportation available, following Americans with Disabilities Act rules, and providing excellent customer service to all people.

Recommended Climate Adaptation and Social Equity Measures

Tacoma Power should continue to work on their climate adaptation planning and incorporating social equity into their projects. It is recommended that Tacoma Power continues to plan for flooding events, especially for climate susceptible infrastructure (e.g., utility pole structures in the floodplain) to ensure adequate service to their customers. Tacoma Power should also consider using the City's Equity Index to be consistent with other departments when considering equity in their capital planning process.

Tacoma Rail

Existing Climate Adaptation and Social Equity Measures

Tacoma Rail currently does not incorporate social equity or climate change adaptations in their capital planning processes. Climate change, specifically sea level rise, is being considered for future rail infrastructure projects.

Recommended Climate Adaptation and Social Equity Measures

Tacoma Rail should continue to work with the Port of Tacoma on intermodal projects and start to coordinate with Public Works to minimize the loss of freight during extreme climate events. Tacoma Rail should also consider investigating the interaction between extreme climate events and railway management. This could include incorporating a warning and monitoring system to ensure the safety of Tacoma Rail's assets. Tacoma Rail should also plan for maintaining bank stability near their rail lines that may be impacted by more severe flooding events. This can be incorporated as a Risk in Project Planning & Development phase.

Tacoma Water

Existing Climate Adaptation and Social Equity Measures

In 2015, Tacoma Water conducted a vulnerability assessment that considered natural threats to their system. Similar to Tacoma Power, Tacoma Water also developed an Integrated Resource Plan in 2018 that documented supply resource needs due to the impacts of climate change. This included investigating the impact of drought conditions on Tacoma Water's well assets. In addition to incorporating climate change into their planning efforts, Tacoma Water also uses the Equity Index during Concept Development and Project Prioritization in the Project Planning & Development phase.

Recommended Climate Adaptation and Social Equity Measures

Tacoma Water should investigate the influence of climate change on source water quality (e.g., temperature), which can potentially impact treatment and performance at the Green River Water Filtration Facility and storage at the McMillin Reservoir. This can be incorporated as a Risk in the Project Planning & Development phase of capital planning process. Tacoma Water should also consider the impacts of saltwater intrusion on their well assets as a Risk in Project Planning & Development phase as well.

Park District

Metro Parks Tacoma

Existing Climate Adaptation and Social Equity Measures

Metro Parks Tacoma incorporates social equity into the Project Planning & Development Phase of their capital planning process. This includes using the City's Equity Index during Concept Development and Project Prioritization. Metro Parks Tacoma also incorporates climate change into the Project Delivery Phase of their capital planning process as a design driver. For example, sea level rise projections are a design criterion in the renovation and redevelopment project at Owen Beach.

Recommended Climate Adaptation and Social Equity Measures

Metro Parks Tacoma should collaborate with Environmental Services on incorporating GSI into parks projects (see co-benefits of GSI in the Environmental Services section above). This could be incorporated as a Need for all parks projects in the Project Planning & Development Phase. In addition, Metro Parks Tacoma should consider developing waterfront and shoreline parks to reduce the impacts of flooding on inland areas. Similar to the Owen Beach project described above, sea level rise projections should be incorporated in all future waterfront and shoreline park projects to ensure the parks' facilities can adapt to extreme climate events.

Summary

Five city departments and Metro Parks Tacoma, interviewed during this study, are currently incorporating climate change and social equity into their capital planning processes. Management and Budget is also considering climate change and social equity in the CFP and the Capital Planning Committee.

Of all departments interviewed, Environmental Services, Tacoma Power, Tacoma Water, and Metro Parks Tacoma currently incorporate climate change into their Project Planning & Development Phase. Climate change is also being incorporated into the Project Delivery Phase by Environmental Services and Metro Parks Tacoma. It should be noted that Public Works and Tacoma Rail have started investigating the incorporation of climate change into their capital planning processes.

Environmental Services, Metro Parks Tacoma, Public Works, and Tacoma Water use the City's Equity Index in their Project Planning & Development Phase. All departments (excluding Management and Budget) incorporate social equity into the procurement process to incentivize minority and women-owned business enterprise (MWBE) contractor participation in their projects during the Project Planning & Development Phase and Project Delivery Phase.

Overall Recommendations

Each department has started and has the potential to include more climate change and social equity considerations in their capital planning processes. Many recommendations can be applied across multiple or all departments. Overall recommendations for climate change and social equity are discussed in more detail below. The relationship between these recommendations and the City's Crosswalk between Climate Adaptation Planning Actions and Adaptation High Priority Actions are summarized in the last section of this report.

Climate Change

Similar to Tacoma Water, City departments and Metro Parks Tacoma should assess the vulnerability of their current assets to climate change to gain a better understanding of the risks at a project scale. The Shoreline Condition Assessment & Monitoring Program will develop information that can be used by all departments during their assessment. The results from these vulnerability assessments can be incorporated as a Risk in the Project Planning & Development Phase.

City departments and Metro Parks Tacoma can also incorporate climate change in their Standards of Practice similar to what is being considered by Environmental Services. This includes incorporating climate change language into design standards, manuals, and checklists. Two examples of cities incorporating climate change language into Standards of Practice include the City of San Francisco,

California and New York, New York. The City of San Francisco has developed Guidance for Incorporating Sea Level Rise in Capital Planning (2020a) and is requiring all projects within their “Sea-Level Rise Vulnerability Zone” (or 1-in-100-year storm plus 66 inches of sea level rise) to follow their Sea Level Rise Checklist (2020b). New York City Mayor’s Office of Resiliency has developed Climate Resiliency Guidelines (2020) to incorporate climate change, such as storm surge and sea level rise, during design and construction.

Since there is uncertainty about long-term effects of climate change, it is important to note that capital improvements should be planned and designed to withstand the range of potential climate conditions anticipated over their useful life.

Social Equity

In regard to social equity, City departments and Metro Parks Tacoma should consider expanding inclusion requirements in their procurement processes in the Project Planning & Development Phase or Project Delivery Phase. This can include incorporating social equity requirements during the Request for Proposals or bid stage of the project. City departments and Metro Parks Tacoma should continue to use the Equity Index to ensure that projects are prioritized for areas with a low Equity Index score and incorporate Tacoma-Pierce County Health Department’s Health-in-all-policies Tools during the Project Planning & Development Phase. As part of the Community Engagement Plan, the departments should reach out to a diverse group of stakeholders and incorporate their feedback as a Need in the Project Planning & Development Phase. Projects should also continue to be prioritized in vulnerable neighborhoods that are more susceptible to receiving the negative impacts of climate change based on the City’s Equity Index.

Climate Change and Social Equity

In the Project Planning & Development Phase, both climate change and social equity should be added as scoring criteria for capital projects. This can be incorporated as a general criterion or requiring that the project meets specific desired outcomes (e.g., reducing the risk of losses from flooding, in an area of Low or Very Low opportunity on the City’s Equity Index, etc.). An example of this type of CIP scoring criteria is currently being done by the City of Oakland, California (2018) and is summarized below:

- ▶ Collaboration: Combine city projects to save time and money (8 points)
- ▶ Economy: Benefit small Oakland businesses and create local job opportunities (13 points)
- ▶ Environment: Improve the environment and address **climate change** (11 points)
- ▶ **Equity**: Investment in underserved communities (16 points)
- ▶ Existing Conditions: Renovate or replace broken or outdated City property (13 points)
- ▶ Health/Safety: Improve safety and encourage healthy living (16 points)
- ▶ Improvement: Build new and upgrade a city-owned property (8 points)
- ▶ Project Readiness: Ready-to-go projects without delay (5 points)
- ▶ Required Work: Areas where the city may be held financially and legally responsible (10 points)

Climate Adaptation Planning Actions and Adaptation High Priority Actions Crosswalk

Recommended adaptation measures summarized in this technical memorandum align with the following high priority climate adaptation actions:

- ▶ Capital project standards & tools
- ▶ Capital project planning, prioritization, and implementation
- ▶ Neighborhood-specific investments
- ▶ Shoreline condition assessment & monitoring program

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Appendix E: Potential Climate Adaptations for City Policies & Procedures

Name	Title, Plans, and Chapters	Potential Climate Adaptations	Examples
Tacoma Municipal Code (TMC)	<p>Title 2 – Building and Development Code</p> <p>Title 13 – Land Use Regulatory Code</p>	<p>Require large new buildings to incorporate solar or living roofs.</p> <p>Require development to implement measures to reduce heat island effects, such as incorporating roof reflectivity requirement on new and replaced residential roofs.</p> <p>Develop a Flood Damage Protection Ordinance or Sea Level Rise Flood Damage Ordinance.</p> <p>Promote public benefits and climate adaptation through bonus building capacity.</p> <p>Consider adding the National Healthy Housing Standard to referenced technical codes.</p>	<p>City of San Francisco’s Planning Code, Section 149, Better Roofs; Living Roof Alternative.</p> <p>City of Los Angeles’ Cool Roofs Ordinance.</p> <p>Island County Code, Title XIV – Buildings and Construction, Chapter 14.02A – Flood Damage Prevention Ordinance.</p> <p>City of Olympia’s Sea Level Rise Response Plan.</p> <p>City of Miami’s 21 Zoning Code (Miami 21), Section 3.14, Public Benefits Program (Florida).</p> <p>City of Auburn’s Construction Administrative Code, Section 15.07.010, General.</p>

<p>Title 12 – Utilities</p>	<p>Provide language to support recommendations in in the Right-of-Way Design Manual including the following: reclaimed water, permeable pavement use for shared paths, and alternative pavement options for roads.</p>	<p>City of Olympia’s Municipal Code, Chapter 13.24, Reclaimed Water. City of Issaquah’s Municipal Code, Chapter 18.07, Required Development and Design Standards, 18.07.050 Impervious Surface. City of Battle Ground’s Municipal Code, Chapter 12.116, Transportation Standards, 12.116.080 Transportation Facilities – Traffic Calming Measures.</p>
<p>Title 19 – Shoreline Master Program</p>	<p>Prepare for changing base flood elevations. Develop a plan for stormwater outfalls and culverts being inundated (may require tide gates and/or pinch valves to accommodate an increase in flooding). Increase setback distances on coastal bluffs over time. Prioritize the evaluation of contaminated areas to ensure they can withstand sea level rise. Consider bigger buffers around shorelines to combat accelerated coastal erosion. Incorporate climate change into Critical Area Ordinance.</p>	<p>City of Port Orchard’s Shoreline Master Program. City of Langley’s Shoreline Master Program, Policy 6 (2013). City of Burien’s Shoreline Master Program, Policy 4 (2019). City of Ocean Shores’ Shoreline Master Program, Policy B (2018). City of Port Angeles’ Shoreline Master Program, Critical Areas (Geological Hazardous Areas), Regulation 2 (2014). City of Bainbridge Island’s Ordinance No. 2020-17, Critical Area Ordinance. San Juan County’s Shoreline Master Program, General Environmental Protection (2021).</p>

Open Space Program	Strategic 20-Year Passive Open Space Plan	Develop an addendum to address climate change in the open space planning process to include nature-based climate solutions.	City of Burlington's Climate Change Addendum to Open Space Plan (Vermont).
Right-of-Way Design Manual (Design Manual)	Chapter 1 – Introduction and General Requirements	No recommendation	Not applicable
	Chapter 2 – Right-of-Way/Site Permitting and Local Improvement Districts	No recommendation	Not applicable
	Chapter 3 – Site Development Permit and Right-of-Way Construction Plan Format	No recommendation	Not applicable
	Chapter 4 – Street Design	Identify other pavement options such as resin-based pavements, colored asphalt, and colored concrete for use in the public right-of-way.	U.S. Environmental Protection Agency's Reducing Urban Heat Islands: Compendium of Strategies, Cool Pavement.
	Chapter 5 – Illumination	No recommendation	Not applicable
	Chapter 6 – Traffic Signalization	No recommendation	Not applicable
	Chapter 7 – Channelization and Signing	No recommendation	Not applicable

Chapter 8 – Pedestrian Facilities	No recommendation	Not applicable
Chapter 9 – Tree and Vegetation Management	<p>Revise tree list and other planting requirements to create more resilient urban habitat and expand urban forest canopy. For example, consider whether approved plant species are climate adapted, per the definition in the City's Urban Forest Manual, and whether it's appropriate to remove species that are short lived and/or prone to pest issues (e.g., Himalayan Birch <i>Betula jacquemontii</i>, Rosaceae family).</p> <p>Consider whether the City's Urban Forest Manual should expand the definition of climate adapted species, such as defining other approved species besides street trees.</p>	<p>City of Shoreline's Climate Impacts & Resiliency Study.</p> <p>City of Seattle's 2020 Urban Forest Management Plan.</p>
Chapter 10 – Shared-Use Paths	Include permeable pavement as a paved surface option or recommendation.	Snohomish County's Engineering, Design, and Development Standards, Chapter 4, Road Elements and Features, 4-07 Shared Paths.
Chapter 11 – Stormwater and Wastewater Sewer Design	Incorporate climate change projections (e.g., increased precipitation intensity) into design storm events.	<p>City of Olympia's Sea Level Rise Response Plan.</p> <p>City of Boston's Climate Resilient Design Standards & Guidelines for Protection of Public Rights-of-way.</p>
Chapter 12 – Water Plans	Consider adding reclaimed water into the design manual.	City of Olympia's Engineering, Design, and Development Standards, Chapter 10, Reclaimed Water.
Chapter 13 – Construction Related Permits and Easements	No recommendation	Not applicable

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