

# SPU's RISK AND RESILIENCY ASSESSMENT AND FRAMEWORK

2019 Final Report



**Seattle  
Public  
Utilities**

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# Section 1: Introduction

**O**rganizations today are faced with multiple risks and uncertainties as they work to fulfill their missions. Being resilient offers a powerful way of addressing risks comprehensively, managing uncertainty, and taking advantage of new opportunities. For Seattle Public Utilities (SPU), resiliency is the capacity to recover in the face of sudden or gradual stressors that impact utility services and the community.

SPU delivers essential water, drainage and wastewater, and solid waste services – all fundamental for public and environmental health. Seattle has been a leader in making utility investments that have multiple, long-term community benefits. After the Great Seattle Fire of 1889, the citizens of Seattle voted to create a public water system and develop the Cedar River water supply system. Seattle’s water, drainage, wastewater, and solid waste utilities have faced many challenges over the years and have evolved to improve services and reduce pollution impacts. As a community-centered utility, SPU seeks to proactively address community needs and risks to improve resiliency.

In 2017, Seattle City Council requested that SPU “prepare a risk and resiliency management assessment.” SPU delivered the status report to Council on August 1, 2018. This final report details risks to SPU and provides examples of ongoing efforts to be resilient, equitable, and affordable. Sections 2-8 provide descriptions of various risks and SPU’s progress in addressing those risks. Section 9 describes SPU’s next steps to advance this work throughout the utility to best serve the community.

SPU faces a variety of challenges: a changing climate, the threat of natural disaster, technological advances, inequity, economic variability, competition, and an aging workforce. In order to be resilient, SPU needs to look to the future and be positioned to adapt to risks and opportunities as they arise. SPU has developed a comprehensive risk and resiliency framework that includes the broad areas of operational and strategic risks. This framework helps SPU to assess vulnerabilities, identify new risks, and develop strategies and solutions that support utility and community resiliency. SPU’s goal is to optimize utility investments that address multiple risks at the same time.

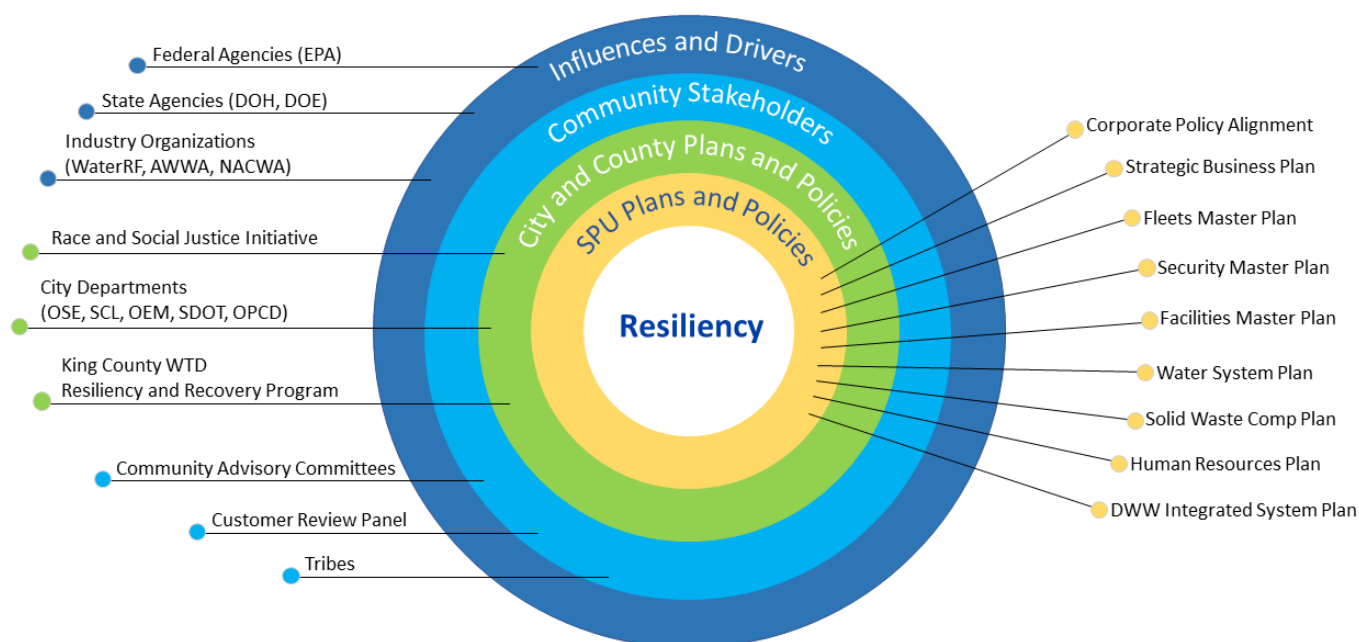
In accordance with the City of Seattle’s Race and Social Justice Initiative, risk and resiliency strategies will strive to address systemic and institutional racism and will direct attention to disadvantaged communities. SPU recently conducted a series of Racial Equity Toolkit meetings with subject matter experts from across the utility. These meetings helped SPU to identify and develop responses to the disparate impacts these risks can have on vulnerable communities. The aim of this ongoing work is to embed the equity lens within the risk and resiliency framework and utility plans.



## Planning Integration

SPU is working directly with lines of business to connect this work to their policies, programs, projects, comprehensive and capital plans, and daily operations. The risk and resiliency framework is being incorporated into the Solid Waste Comprehensive Plan amendment and the Drainage & Wastewater Integrated System Plan. SPU's Strategic Business Plan will also incorporate risk and resiliency as one of the main priorities for the utility.

SPU is working with a variety of federal and state agencies, community partners, and tribes, and has shared this work with the Community Advisory Committee and the Customer Review Panel. The risk and resiliency framework integrates with other efforts such as the City of Seattle's Resilience Strategy and the All-Hazards Mitigation Plan as well as King County's Wastewater Treatment Division's Resiliency and Recovery Program. SPU is also working with the Environmental Protection Agency on the best way to develop resilient stormwater infrastructure in response to regulations. As the diagram below shows, partnerships are critical to fostering resilient utility services that support the whole community.



## Goal Statement

The risk and resiliency goal statement serves to guide how SPU applies its risk and resiliency framework to policies, programs, plans, projects, and operations.

- *To make “no-regrets” investments in infrastructure, operations, and people that improve SPU’s ability to provide critical utility services in the face of future disruptions, changes, and opportunities.*

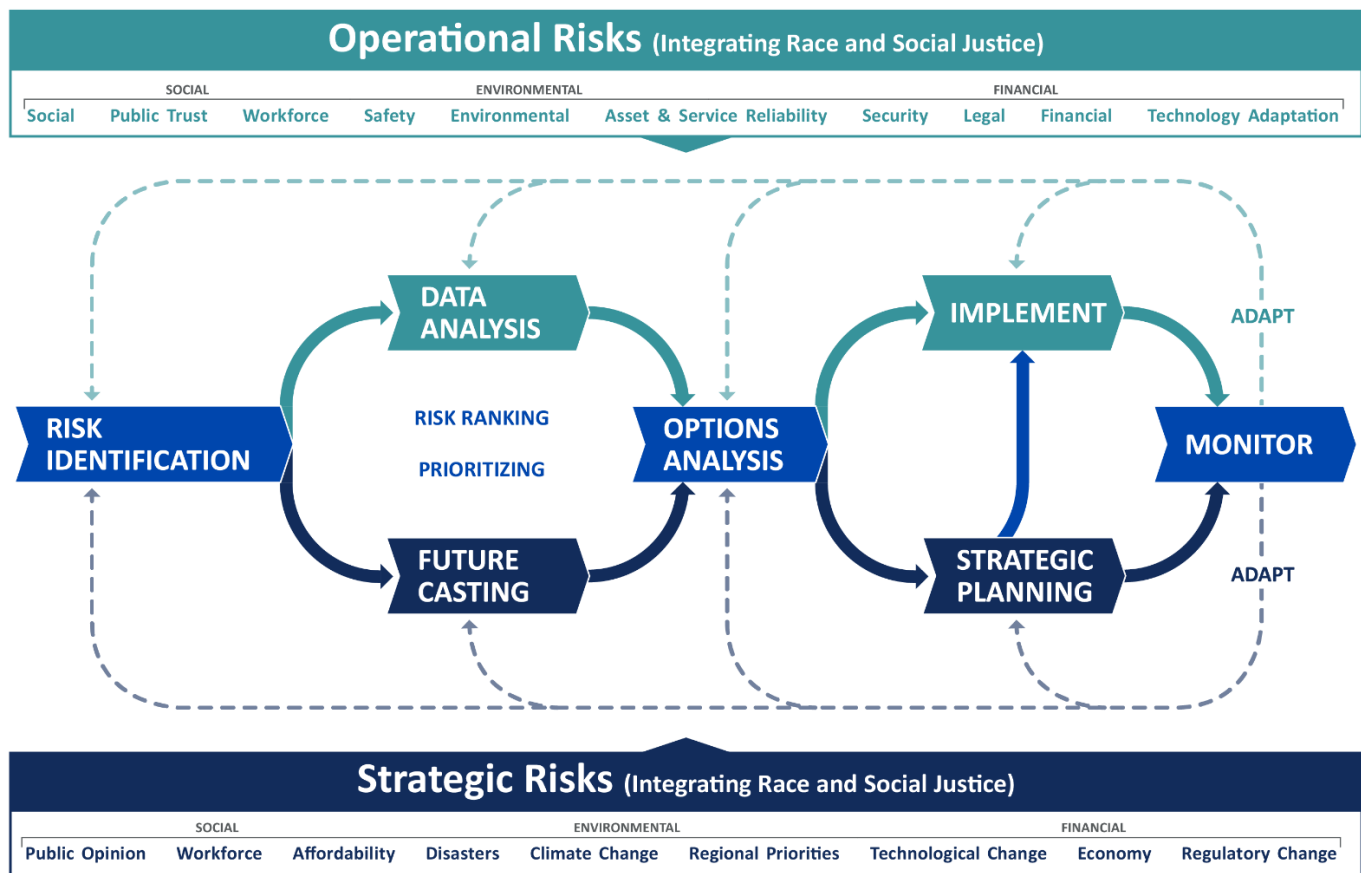
## Risk Focus Areas

The table below shows the seven strategic risk areas SPU has identified. Sections 2-8 address these focus areas and provide a description of the risks as well as SPU's accomplishments in addressing these risks.

Climate Change	Disasters	Investment Priorities	Economy	Market Forces	Technology	Workforce
Drought	Earthquake	Regulatory-driven	Affordability	Ability to site facilities	Emerging and changing systems	Institutional knowledge loss
Extreme downpours	Terrorism	Projects and programs initiated by others	Population growth	Availability of raw materials	Independent systems	Skill availability and development
Sea level rise	Cyberattack	Aging, substandard infrastructure and facilities	Loss of customers and revenues	Recycling markets and revenues	New treatment techniques	Retention and turnover
Wildfires	Dam failure		Cost of debt			Marketplace competition
Air quality degradation	Volcanic eruption					
Temperature rise	Flooding					
	High winds					

## Planning Process

SPU has developed a risk and resiliency planning process that brings together the assessment and management of both operational and strategic risks. SPU has had an operational risk framework since 2004. Programs, such as safety, security, and claims, are examples of ways that SPU manages operational risks. SPU also has been assessing and managing long-term, strategic risks, such as climate change and disasters. The following diagram shows SPU's planning process to comprehensively manage risk.



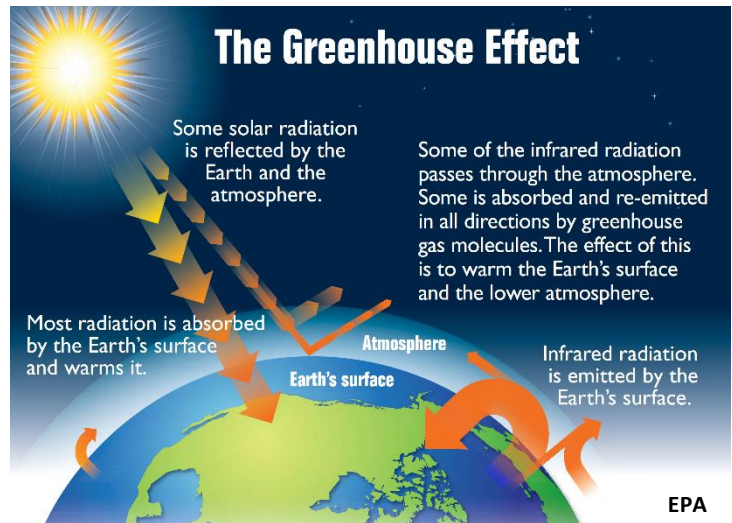
#### Brief Description for the Risk and Resiliency Planning Process:

1. *Risk Identification* – Identify risks within SPU and the industry.
2. *Future Casting and Data Analysis* – Develop and manage data, models, and scenarios that will assist in planning for a variety of possible futures.
3. *Risk Ranking and Prioritization* – Rank risks according to established measures and determine how this informs the prioritization of various bodies of work.
4. *Options Analysis* – Identify risk reduction options and assess cost-benefit, affordability, and impacts to vulnerable communities.
5. *Strategic Planning* – Determine how best to carry out and integrate selected options by exploring partnering, phasing, and additional planning.
6. *Implementation* – Plan how to initiate projects and programs, making sure they are incorporated into ongoing efforts.
7. *Monitoring* – Track the change in risk status and the effectiveness of strategies and controls.
8. *Adaptation* – Make changes as needed by returning to relevant steps in the planning process.



## Section 2: Climate Change

**G**lobal warming puts more energy into the earth's atmosphere, which results in rising temperatures, changing weather patterns, more powerful storms, and melting ice caps and glaciers. The water cycle is particularly impacted. In the past, infrastructure engineers could assume, for the most part, that the future would conform to historical trends; now there is increasing uncertainty. Puget Sound climate patterns are changing and are expected to continue to do so in the coming decades. Climate change is impacting infrastructure systems, staff, and the communities SPU serves. SPU is a leader in assessing and working to adapt to a changing climate.



### Drought

**Description:** SPU's water supply system historically relies on snowpack as a means of additional storage to meet demands during dry summer months. Snowmelt is more predictable than spring rains and releases water more slowly and over a longer period into the summer. Declining snowpack, rising temperatures, and more intense precipitation will result in an increase in the number and length of droughts.

**Impacts:** SPU's two water supply reservoirs, located in the mountains, are vulnerable to drought conditions. Drought years that produce little to no snow stress the system's capacity to provide sufficient water for people and fish.

#### Progress:

- *Climate Change Assessments:* SPU has completed three climate change assessments that focus on potential impacts to water supply availability, reliability, and streamflow. The 2002 assessment focused on reductions in snowpack and water supply. The 2007 assessment emphasized scenario planning and included some adaptation options. In 2015, the assessment shifted toward system vulnerabilities under multiple future scenarios. The assessments help SPU identify triggers for when to pursue more expensive adaptation options for water supply.
- *Water Demand Forecasting:* Uncertainty analysis is incorporated into SPU's long-term water demand forecast. This forecast is used to help make important long-term policy and investment decisions dependent on the future demand for water. Computer modeling factors in uncertainties around modal inputs and assumptions such as demographic growth, future water rates, conservation programs, and efficiency standards.

- *Morse Lake Pump Plant:* In 2015, SPU installed a new floating pump station and refurbished an existing pump plant for backup use on Chester Morse Lake, the largest of SPU's two water supply reservoirs. These pumps allow SPU to access high quality water when the lake level is low. This project improves SPU's resiliency during droughts while maintaining instream flows for aquatic habitat.
- *Water Shortage Contingency Plan:* This plan provides guidelines to manage water supply and demand in the event of water shortage, such as a drought or system failure. SPU has activated this plan six times in response to droughts over the last 20 years.
- *Climate Change Project Analysis:* SPU assesses potential climate change impacts for all proposed capital projects. An integral part of the economic analysis is considering how the project options might be affected by climate change in the form of altered precipitation patterns, warmer temperatures, reduced snowpack, and sea level rise. The analysis also considers the carbon footprint of these options.

## Extreme downpours

**Description:** The city of Seattle is experiencing an increase in extreme rain events. Due to climate change, storms that were predicted to occur once a century now occur every 25 years.

**Impacts:** Extreme rain events pose capacity and water quality challenges for the drainage and wastewater system. With more inflow during peak rain events, the City's ability to remain in compliance with federal regulations for combined sewer overflows (CSOs) will grow more challenging. Extreme rain events can also increase sewer backups, localized urban flooding, and landslides, which have greater impacts on vulnerable communities (see 'Flooding' in the Disaster Section). In addition, extreme downpours can elevate turbidity in SPU's water supply systems, creating challenges for water treatment in the Cedar system.

### Progress:

- *Drainage & Wastewater Integrated System Plan:* This plan provides an overall system analysis that includes climate change, growth impacts, flooding, water quality, and asset age and criticality, as well as equity and environmental assessments. The plan is being developed through engagement with the community, City departments, and partner agencies and organizations.
- *Drainage & Wastewater Models:* These models investigate anticipated climate change impacts on the stormwater system. There is an already-evident trend of more intense rain events and flooding. Results of this work will be considered in selecting and prioritizing projects and programs in the forthcoming Integrated System Plan. The possible long-term impacts of increased intensity and volume of rainfall on CSOs are an important part of this work given federal and state regulations.
- *CSO Sizing Approach Implementation Guidance 2017:* This guidance provides sizing parameters for CSO infrastructure based on anticipated climate change impacts. Recently planned CSO projects have been up-sized to deal with known changes in rainfall and additional projected changes in order to avoid overtaxing the system in future decades. This approach is based on comprehensive modeling and the best available science with the intent of balancing costs and system longevity.



- *Green Stormwater Infrastructure (GSI) Expansion Initiative:* GSI uses nature-based processes to lower the impact of polluted runoff on the environment and reduce flooding while maximizing community benefits. GSI increases the resiliency of the drainage and wastewater system in the face of climate change and urban growth by providing system capacity, redundancy, and emergency water supply. This initiative will accelerate the use of GSI through partnerships, innovation, and removal of barriers to implementation.
- *Duwamish Valley Infrastructure Investment:* SPU is making significant investments in South Park's Lower Industrial Area to address drainage, flooding, and stormwater quality. SPU is also partnering with the City of Seattle's Duwamish Valley Program and the South Park community to ensure these investments align with community priorities. The Center for Community Investment has given SPU a grant to work with City departments, outside partners, and the community to leverage these investments while building community capacity.

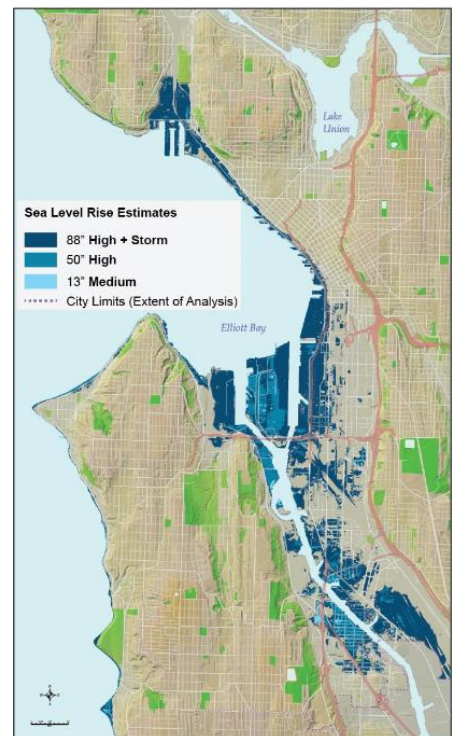
## Sea level rise

**Description:** Seattle's Puget Sound shoreline has already risen more than six inches in the past century. By 2100, sea level rise (SLR) is projected to increase by another two to four feet. Water levels associated with storm surges and king tides that now occur annually will eventually become monthly, even daily events.

**Impacts:** SLR affects the extent and frequency of coastal flooding, particularly in areas such as the Duwamish, Interbay, and Alki. Impacts to these areas also include saltwater intrusion, corrosion, and loss of near-shore habitat and use. When high tides coincide with extreme rainfall, portions of the drainage system are briefly not able to discharge properly and back up, potentially flooding nearby areas.

### Progress:

- *Sea Level Rise (SLR) Maps:* SPU has been mapping SLR for the last ten years to develop high resolution maps. SLR has been incorporated into the City's *Stormwater Manual*. The Drainage & Wastewater Line of Business developed and now applies their *Sea Level Rise Guidance* specifications to all new projects. All new infrastructure projects must be able to accommodate expected SLR within the project lifespan. As an example, the forthcoming South Park Pump Station will be raised by at least two feet to accommodate higher water levels.
- *Duwamish Valley Climate Change Adaptation Strategy:* SPU is partnering with the United States Army Corps of Engineers (USACE) on a sea level rise adaptation strategy in the Duwamish Valley. A 2017 USACE study found benefits to investing in infrastructure to protect the South Park industrial area. This study is the first step in joint work by the USACE and the City to fund and construct sea level rise infrastructure projects in this area. The next steps will include a detailed feasibility study and broader engagement with City departments and affected businesses.



## Wildfire

**Description:** With a warming climate, the fire seasons are getting longer and there are more fires. Warmer temperatures and droughts increase the flammability of forest fuels and thereby increase fire intensity. Even the forests on the west side of the Cascade Mountains are now starting to be impacted. As a result, wildfire risk could be increasing in Seattle's two forested mountain watersheds. These watersheds provide Seattle's drinking water supply and serve as protected nature reserves.

**Impacts:** Wildfires in the watersheds could impact water quality and supply as well as habitat.

### Progress:

- *Watershed Management:* SPU manages a closed watershed (no public access) and controls activities in the watershed during periods of high fire danger. SPU has a wildfire protection crew, equipment to respond to forest fires, and mutual-aid agreements with other agencies.
- *Watershed Wildfire Modeling:* SPU is working with partners including the City of Portland Water Bureau, Washington State University, University of Idaho, and the United States Forest Service to conduct wildfire modeling to assess potential impacts to municipal water quality and supply. This collaborative modeling effort will inform risk management strategies.
- *Cedar River Watershed Habitat Conservation Plan (HCP):* SPU has updated the watershed forest protection and restoration strategies in the HCP. These strategies resulted from a forest vulnerability assessment based on projected climate change, including the impacts of drought, snow loss, and forest insects and diseases. These strategies include forest thinning and planting different tree species that are better adapted to a changing climate. SPU is monitoring forest growth, disturbances, and mortality.



## Air quality degradation

**Description:** Air quality is expected to worsen due to increased heat waves and wildfire smoke. For the past three summers, the city has been blanketed in smoke from wildfire events. Atmospheric warming is expected to intensify ground-level ozone and increase the prevalence of airborne allergens and air pollutants.

**Impacts:** Decreased air quality can negatively impact SPU employees, particularly operations and maintenance staff. Vulnerable populations, especially those with existing respiratory conditions, will be most impacted.

### Progress:

- *Air Quality Safety Program:* SPU created a program to educate and train employees on safety measures during periods of degraded air quality. This program includes issuing protective respirator masks and monitoring air quality and the risks from smoke related to wildfire events. SPU is also partnering with other departments on a citywide effort to protect employees.

## Temperature rise

**Description:** Seattle has averaged only a handful of extreme heat (90 ° +) days per year during the past few decades. By 2100, it is estimated that more than two weeks of extreme heat are projected each summer.

**Impacts:** Rising temperatures increase the likelihood of water quality incidents, including bacterial outbreaks and algal blooms. Warmer temperatures stress wildlife habitat and salmon recovery efforts. More frequent heat waves will also impact SPU staff and equipment, such as HVAC systems. Lower-income and minority communities will likely be most impacted by hotter summers.

**Progress:**

- *Heat Island Maps:* SPU is working with King County's Department of Natural Resources and Parks to better understand and quantify the ways in which land cover affects heat. The first ever complete urban heat island mapping project will take place during the summer of 2019 and is expected to inform community and infrastructure planning.
- *Heat Stress Training:* Providing crews with heat stress training and warnings when higher temperatures are expected. SPU's Safety Team provides cooling supplies and equipment to operations and maintenance staff when temperatures climb beyond 85 °.
- *Fleet Reduction and Electrification:* SPU is working on fleet reduction and electrification to help mitigate climate change impacts and meet City goals. As the fleet is replaced, SPU is selecting cost-effective electric vehicle options. SPU is also installing electric vehicle charging stations, back-up generators, and exploring the use of solar powered charging stations so the fleet can function during an emergency when fuel and power is limited.

# Section 3: Disasters

According to the City of Seattle Office of Emergency Management, Seattle faces the highest number of hazard types of any major American city. Disasters cause loss of life, public health issues, and property and environmental damage. Lower income and minority communities tend to suffer the most from disasters. For SPU, disasters damage infrastructure and facilities and disrupt the delivery of critical services. This can impact other downstream systems such as firefighting capability.

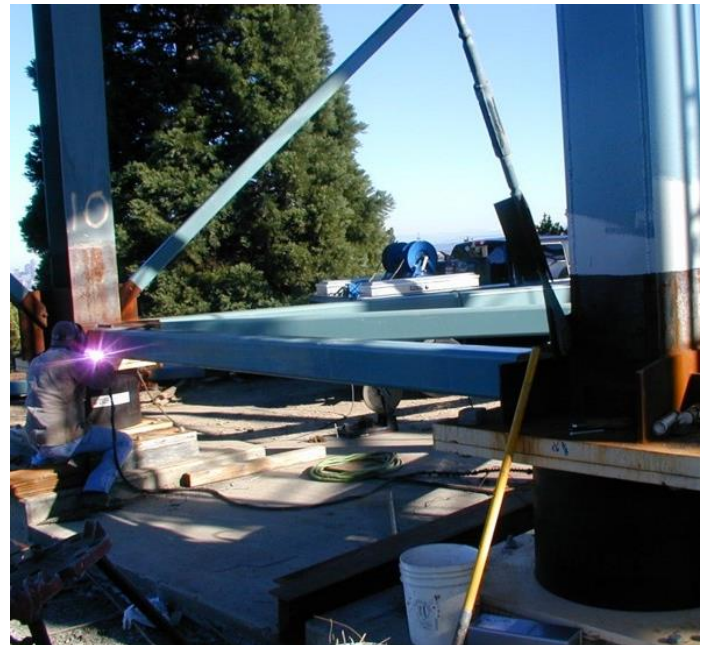
## Earthquake

**Description:** Washington State has the second highest earthquake risk in the nation, following California. The Seattle area is prone to multiple earthquake types, ranging from Seattle Fault events to large scale Cascadia Subduction Zone events. In the last few decades, there has been new mapping of faults and cataloging of past seismic events. Impacts include ground movement, liquefaction, landslides, tsunamis, and seiches. Secondary impacts include fire, property damage, limited mobility, and loss of power.

**Impacts:** Damage to SPU's infrastructure will disrupt potable water provision, wastewater disposal, and solid waste collection and disposal. SPU will face more difficulty in responding to broken assets due to damaged roads, bridges, facilities, and other systems. Communities located in liquefaction zones, such as Georgetown and South Park, are even more vulnerable to earthquake impacts.

### Progress:

- *Water System Seismic Study 2018:* This study modeled impacts of a magnitude 7.0 Seattle Fault Zone earthquake and a magnitude 9.0 Cascadia Subduction Zone earthquake. The study identifies over \$850 million of seismic investments over the next 50 years. Improvements include installing earthquake isolation valves on reservoirs and upgrading high-risk portions of the water system.
- *Seismic Investments:* Following the 1990 water system seismic study, SPU has spent more than \$100 million on seismic upgrades to transmission pipelines, pump stations, storage tanks, and other projects. Several reservoirs have been seismically upgraded with the goal of minimizing water losses after an earthquake.



- *Drainage and Wastewater System Seismic Study 2019:* A seismic study will be conducted to determine the impact of significant earthquake events on the drainage and wastewater system. The 2011 Tohoku earthquake, 2010 Christchurch earthquake, and the 1995 Kobe earthquake, all caused significant damage to drainage and wastewater systems, which prompted efforts to study impacts in Seattle.
- *Disaster Debris Management Plan:* This plan covers earthquakes, floods, and high winds. Only two jurisdictions in Washington State have Federal Emergency Management Agency-approved plans: SPU and Snohomish County. The plan designates staging areas within the City for debris and works in partnership with the Port of Seattle and the University of Washington.
- *Solid Waste Management Plan Amendment 2019-2020:* SPU is amending its 2011 Solid Waste Management Plan to integrate risk and resiliency objectives among other updates. The Plan details how SPU will manage the City's solid waste for the next twenty years and is required to be updated every five years. The Solid Waste Line of Business is also working to ensure the resiliency of their contractors that provide collection, hauling, processing, and landfill services.
- *All-Hazard Planning:* SPU plans for all hazards and the impacts those hazards have in common. The Continuity of Operations Plan (COOP) supports the continuation of SPU essential utility functions in an emergency. The Emergency Operations Plan (EOP) supports the restoration of core utility services in an emergency. The Comprehensive Emergency Management Plan (CEMP) and the SPU Hazard Identification and Vulnerability Assessment (HIVA) both serve as umbrella guiding documents.
- *Replacement Pipe/Materials Stockpiles:* Water system replacement pipe and other materials are being stockpiled at remote sites. An earthquake or other disruption could result in widely dispersed damage and impact transportation networks. Locating replacement parts near where they are needed will support repair work. Staff is also addressing the impact of power outages by providing back-up generators at all critical facilities.
- *Back-up Power:* SPU is developing a plan for back-up power units and extending the life of back-up power for security systems. The Security Team performs an annual assessment of facilities and tracks crime trends to better understand the measures needed to counteract vandalism, terrorism, and power outages.
- *Emergency Management Training and Exercise Program:* This program includes Incident Command System training and a quarterly exercise series. SPU also implements an After-Action Review process that identifies corrective actions and engages business units to make improvements. Additionally, SPU carried out a campaign to encourage staff to prepare their families for emergencies. To return to work after a disaster, staff must feel confident that their families are taken care of.
- *Water Supply Forum:* SPU is one of the co-founders of the Water Supply Forum that is comprised of water systems in King, Pierce, and Snohomish Counties. Staff have been involved in the development of the *Regional Water Supply Resiliency Project* to assess regional water systems for earthquake, climate change, drought, and water quality risks. The forum identified actions to be taken by water utilities including installing earthquake resistant piping and providing emergency potable water.

- *Mutual Aid Systems:* SPU is a member of a variety of mutual aid systems which provide equipment and personnel in the event of a disaster. SPU is part of the Washington Water/Wastewater Agency Response Network, the regional Pacific Northwest Emergency Management Arrangement, and the National Emergency Management Assistance Compact. These networks help SPU to be more resilient to disasters.

## Terrorism

**Description:** SPU infrastructure and services, due to their critical and life-sustaining nature, are potential targets for terrorist attack.

**Impacts:** Terrorism can target SPU infrastructure and facilities such as pipelines, pump stations, treatment plants, and reservoirs. Contamination of the water supply is of particular concern. Impacts to the drainage and wastewater system could result in releases of untreated sewage into surface waters.

### Progress:

- *EPA Water Infrastructure Act of 2018:* SPU is working on an Environmental Protection Agency (EPA) required risk assessment that will examine physical vulnerabilities in infrastructure, sites and facilities. This is a continuation of work that SPU has been performing for years to ensure the safety of the water system.
- *All-Hazards Planning\*\** (see progress item under Earthquake)
- *Emergency Management Training and Exercise Program\*\** (see progress item under Earthquake)
- *Mutual Aid Systems\*\** (see progress item under Earthquake)

## Cyberattack

**Description:** A cyberattack involves a malicious, deliberate act that compromises data or critical infrastructure systems through disruption, theft of private information, fraud, or extortion.

**Impacts:** SPU can be impacted by cyberattacks on its operating systems for water, drainage and wastewater, and billing. Unauthorized access of personally identifiable or sensitive information could impact public trust and result in legal costs.

### Progress:

- *Computer Systems Protection:* SPU is working with the Department of Homeland Security and other organizations testing and ensuring systems are protected by following industry best practices.
- *All-Hazards Planning\*\** (see progress item under Earthquake)
- *Emergency Management Training and Exercise Program\*\** (see progress item under Earthquake)



## Dam Failure

**Description:** SPU operates fourteen dams of various sizes located mostly upstream of densely populated communities. All SPU dams are regulated by either the State Department of Ecology or the Federal Energy Regulatory Commission. Most of the dams are rated as High Hazard by the State or Federal regulators.

**Impacts:** A dam failure would impact people and property in downstream communities and SPU's water supply and storm detention systems.

**Progress:**

- *Tolt Dam Failure Exercise:* In May 2019, SPU partnered with Seattle City Light to lead a full-scale exercise that included regional response agencies. The Tolt Dam provides both power generation and roughly one third of SPU's drinking water supply. While the risk of dam failure is very small, the exercise allowed responders to practice, build relationships, test plans and procedures, and review lessons learned together.
- *Emergency Action Plans (EAP):* SPU developed EAPs for all high-hazard dams that could impact communities in the event of a dam failure. The EAPs clarify roles and notification responsibilities and are periodically exercised to test readiness of responders and stakeholders. EAPs were developed in collaboration with other City departments, affected communities, and emergency management agencies.
- *Dam Safety Program and Programmatic Plan:* SPU's utilizes this program and plan to actively monitor dam performance and to ensure safe operations.

## Volcanic eruption

**Description:** Washington State is home to five active volcanoes located in the Cascade Range east of Seattle. Potential eruption impacts include blast, lahar, and ashfall.

**Impacts:** Ashfall can impact water quality, pipes and drains, vehicles, energy, and transportation systems.

**Progress:**

- *All-Hazards Planning\*\** (see progress item under Earthquake)
- *Emergency Management Training and Exercise Program\*\** (see progress item under Earthquake)
- *Mutual Aid Systems\*\** (see progress item under Earthquake)



## Flooding

**Description:** SPU grapples with three flood types: major river flooding, coastal flooding, and urban and small stream flooding.

**Impacts:** In addition to safety impacts, floods can damage SPU infrastructure and private property. The increased frequency and severity of flooding due to climate change will lead to greater costs for claims, repair, and up-grading infrastructure.

### Progress:

- *Wet Weather Readiness and Response Plan:* This plan identifies resources within SPU to prevent, prepare for, respond to, and recover from flood events to minimize adverse flooding impacts.
- *Sewer Backup Protection:* SPU developed a policy to provide guidance to SPU projects and programs to fund installation of backwater valves on customer property when the public sewer system can cause sewer backup on the property. In recent years, SPU has installed backwater valves in Broadview, South Park, and downtown.
- *Claims Process:* SPU developed a process to help customers impacted by events, including flooding, to quickly activate the claims process. SPU also helps place customers in emergency housing when these types of events are caused by SPU asset failure and when a customer's home is uninhabitable. SPU does this through direct placement into temporary housing or by partnering with non-profits and other City Departments.
- *All-Hazards Planning\*\** (see process item under Earthquake)

## High winds

**Description:** SPU's systems can be impacted by winds over 60 mph and gusts over 90 mph. Winds of these intensities have become more frequent in the Puget Sound region.

**Impacts:** Power outages caused by high winds impact operations and systems. High wind events also frequently block roads with debris and make it more difficult to respond to emergencies. Impacts to SPU watershed operations include loss of power, communications, and road access.

### Progress:

- *Disaster Debris Management Plan\*\** (see progress item under Earthquake)
- *All-Hazards Planning\*\** (see progress item under Earthquake)
- *Back-up Power\*\** (see progress item under Earthquake)

# Section 4: Investment Priorities

**SPU** is one of many City of Seattle departments guided by the Mayor and City Council and is affected by citizen initiatives and other governmental agencies like King County, Washington State, Sound Transit, the Port of Seattle, and the Federal Government. Projects, programs, regulations, and citizen initiatives can result in new requirements for SPU and create added costs for regulatory compliance and maintaining public trust. In addition, up-grading and replacing aging infrastructure, adding new infrastructure, and adjusting for climate change and disaster impacts are costly but essential improvements to utility systems. All these initiatives can cause SPU to reprioritize projects and redirect programs, ultimately putting pressure on rates and impacting affordability.

## Regulatory-Driven

**Description:** Regulations can result in new requirements with associated costs for compliance while also addressing important concerns and needs.

**Impacts:** SPU invests in new projects and programs to meet new and evolving regulations. This can lead to a re-prioritizing of work and higher utility rates.

### Progress:

- *Ship Canal Water Quality Project:* SPU entered a consent decree with the Environmental Protection Agency, the Department of Justice, and Washington State Department of Ecology in 2013 to reduce sewer and combined sewer overflows into Seattle's local water bodies. The Ship Canal Water Quality Project, which will reduce these overflows, was built to maintain compliance with this decree. This is a joint project with King County that will cost \$570 million. Seattle's share is \$390 million.



- *Regulatory Review and Collaboration:* SPU is tracking, reviewing, and commenting on federal and state rules, policies, and permits that impose new requirements. The goal is to mitigate risks around regulatory compliance while maximizing the value of investments. SPU routinely provides written comments and in-person meetings to describe potential impacts to utility business. When possible, SPU provides alternative approaches that meet regulatory goals by reducing the impact to ratepayers.
- *Joint Operations and System Optimization Plan:* SPU is collaborating with King County Wastewater Treatment Division on the Joint Operations and System Optimization Plan approved in 2017. The goal is to improve drainage and wastewater system performance through collaboration and information sharing. The plan works to ensure compliance, maximize the capture and treatment of flows, and reduce operating costs.
- *Long Term Control Plan:* SPU is working on a financial capability assessment that informs the update to the Long Term Control Plan for combined sewer overflows. This analysis will incorporate new methods of evaluating the affordability of the plan that go beyond the Environmental Protection Agency guidelines. The outcome will also be used to negotiate with regulators about how best to maintain affordability, protect public and environmental health, and meet regulations.
- *Water Treatment Requirements:* SPU manages 100,000 acres of forested land that comprise the Cedar River and the South Tolt Watersheds. City ownership of watershed lands allows SPU to control access which safeguards water quality. Due to the high degree of protection of the Cedar River watershed, SPU is not subject to more costly federal and state treatment requirements from this source.

## Projects and programs initiated by others

**Description:** Many agencies, including the City of Seattle, can adopt projects or programs that affect SPU's finances and operations and force a reprioritization of current work plans. Voters also can propose or repeal legislation through ballot measures.

**Impacts:** Future initiatives can force SPU to relocate or replace assets sooner than anticipated, resulting in new unplanned for, and unfunded costs. This work may also provide strategic opportunities to address infrastructure improvements and build partnerships.

### Progress:

- *Right of Way Cooperation and Shared Cost Program:* SPU is working with a variety of transportation agencies on the Right of Way Cooperation and Shared Cost Program. Major initiatives, such as Move Seattle, have significant impacts on SPU infrastructure project selection and prioritization. SPU strives to improve right of way coordination to reduce impacts on the public during construction activity and to otherwise prioritized projects.

## Aging, substandard infrastructure and facilities

**Description:** SPU manages extensive infrastructure systems that include reservoirs, treatment plants, piping networks, pump stations, transfer stations, landfills, and more. Growth generates the need for greater system capacity, adding more wear and tear to the system, and making it more complicated to work in the right-of-way.

**Impacts:** Portions of the system, particularly in the piping network, are approaching a century or more in age. The piping systems are below ground and costly to access, repair, and replace. The need to address seismic and climate change risks will require expensive system upgrades.

### Progress:

- *Asset Management Program:* SPU is managing infrastructure assets to achieve optimal value. SPU's Asset Management Program develops plans for asset classes to guide their management through operational, maintenance, and investment recommendations. Each plan integrates risk criteria such as impacts to public and environmental health, regulatory compliance, and service interruptions. As an example, the Drainage & Wastewater Pipe Rehabilitation Program completed 12 miles of work in 2018, the highest annual amount in SPU history.
- *Water Main Rehabilitation and Replacement Program:* SPU's water system includes over 1,630 miles of water main pipes. The average age of these pipes is more than 70 years. SPU proactively rehabilitates and replaces water pipes based on a risk profile that includes the history of leaks and breaks. Rehabilitation includes lining the interior of the pipe and/or adding cathodic protection.
- *Cathodic Protection Program:* Cathodic protection is a method used to minimize the rate of corrosion by shifting the corrosion process away from metal pipes and onto more easily corroded "sacrificial" pieces of metal. Cathodic protection systems have been shown to extend the life of pipes and reduce the risk of failures as the pipes age. SPU installs and maintains these systems on sections of water mains and transmission pipes where feasible and cost-effective.
- *Solid Waste Transfer Stations:* SPU has completed two new Solid Waste transfer stations - the South Transfer Station in 2013, and the North Transfer Station in 2016. These facilities are built to withstand seismic events, process material more quickly, and hold more material during shipping delays.



- *Watershed Headquarters Building:* SPU completed the new Watershed Headquarters building in 2018. This facility supports field and office staff and can function as an incident management center outside of city limits, but will primarily serve watershed-related emergencies such as wildfire. This LEED Gold building uses on-site geothermal energy for HVAC and can support future solar power generation. In 2019, SPU will erect a radio tower to improve adverse weather communications.
- *Flood Control Projects:* SPU is being awarded over \$17 million dollars from the King County Flood Control District for projects that address significant flooding problems in three priority areas of the city. The projects are drainage improvements in South Park neighborhood, culvert replacement in West Duwamish, and addressing flooding in Broadview neighborhood.
- *In-City Facilities Master Plan 2016/2018\*\** (see progress item in Market Forces/Ability to site facilities)



# Section 5: Economy

Changes in the economy affect the growth and vibrancy of the City and customers' ability to pay for their utilities. Economic conditions impact revenue streams, rates, labor costs, construction costs, debt costs, and SPU's ability to provide affordable services. SPU strives to balance the costs of maintaining utility systems and making needed upgrades while keeping rates affordable.



## Affordability

**Description:** Seattle is becoming increasingly unaffordable and this puts pressure on SPU customers' ability to afford utility services.

**Impacts:** Increased costs make it more difficult to find the balance between maintaining and upgrading infrastructure systems and services while achieving affordability.

### Progress:

- *Affordability and Accountability Initiative:* A central purpose of this initiative is to improve service, provide better value, and increase the utility's focus on accountability and affordability. A plan has been developed with the following focus areas: Capital Planning and Delivery, Efficiency and Improvement, Customer Assistance, Partnership Opportunities, Regulatory Alignment, Budgeting and Financial Management.
- *Utility Assistance Programs:* SPU's Utility Discount Program (UDP) provides eligible customers with a 50% discount on their SPU bills, and the Emergency Assistance Program (EAP) provides a 50% discount for customers at risk of shutoff. In 2018, approximately 32,000 households were enrolled in UDP and 884 households were provided emergency assistance.
- *Low-income Water Conservation Program:* Since 2001, this program has provided free fixtures and installation for qualified single-family and multi-family customers. By the end of 2016, the program had served over 6,000 single family households and nearly 20,000 multi-family households.
- *Water Supply Demand Management\*\** (see this progress item under Loss of customers and revenues)

## Population growth

**Description:** The City of Seattle’s population continues to grow rapidly. Growth creates more demand for services, puts pressure on resources, drives up construction and land costs, and creates a burden on infrastructure. Future population growth could also result from people moving to Seattle to escape more pronounced climate change impacts elsewhere.

**Impacts:** Despite the growth in the customer base, overall consumption has continued to decline due to conservation practices and the shift toward multi-family housing. Growth has also significantly increased the cost of housing and worsened traffic congestion. Recent surveys found that 75% of SPU field staff and 60% of office staff now live outside the city. Increased traffic congestion makes it more difficult for staff to commute, get to job sites, and respond to emergencies.

### Progress:

- *Budgeting and Forecasting:* SPU is tracking economic trends and factoring them into budgeting and forecasting. Seattle’s recent economic and population growth has increased the costs of construction, property, and labor. In the past, population growth would increase revenues through higher demand for water and wastewater services. As anticipated by SPU forecasters, water demand has been flat over the last decade as increased water use efficiency has offset the growth in the customer base.
- *Affordability and Accountability Initiative\*\** (see progress item under Affordability)

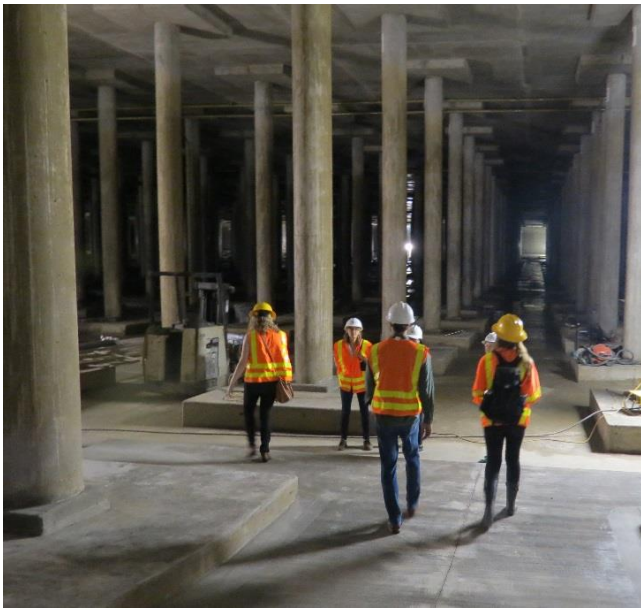
## Loss of customers and revenues

**Description:** Relatively high costs for utility services and/or other factors can drive customers to seek other providers. An economic downturn can lead to a decrease in consumption/revenues of SPU services with little decrease in the cost of providing those services.

**Impacts:** Loss of major retail or wholesale customers can reduce associated revenues, which can result in increased rates for remaining customers. Loss of revenues due to an economic downturn can result in rate increases, staff reductions, or reduced services.

### Progress:

- *Water Supply Demand Management:* Effective demand management has led to a large decrease in total water demand despite large population growth. Since 1990, water use per person has shrunk from 152 to fewer than 90 gallons per day. This has allowed SPU to avoid developing expensive new supply sources. This was achieved through conservation programs, rate structure changes, and efficiencies. Demand management supports resiliency and affordability while providing more water for in-stream flows.
- *Affordability and Accountability Initiative\*\** (see progress item under Affordability)
- *Budgeting and Forecasting\*\** (see progress item under Population boom)
- *Financial Policies\*\** (see progress item under Cost of debt)



## Cost of debt

**Description:** When local governments and utilities pay high interest on debt, less money is available for providing services and this can impact rates and affordability. High levels of debt can impact bond ratings and the cost of borrowing. SPU and the City of Seattle have good financial health. This allows SPU to borrow at low interest rates, thereby reducing overall project costs.

**Impacts:** New regulatory requirements, City and County initiatives, and other factors can result in the need to take on higher levels of debt. SPU will likely incur significant expenditures to undertake seismic, climate change, and other system-wide improvements to be resilient. SPU will have to balance how to fund needed system upgrades while keeping rates affordable.

### Progress:

- *Financial Policies:* SPU has adopted financial policies that provide for long-term financial health and contingency funding for disruptions. The City and Utility's strong financial health allows SPU to achieve low cost financing. SPU works to support a predictable rate path with gradual changes as households with limited means are hit hardest by rate spikes.
- *Affordability and Accountability Initiative\*\** (see progress item under Affordability)
- *Water Supply Demand Management\*\** (see progress item under Loss of customers and revenues)
- *Budgeting and Forecasting\*\** (see progress item under Population boom)

# Section 6: Market Forces

**SPU** is impacted by market-based actions taken by other businesses, organizations, states, and countries. SPU's market connections include the ability to site facilities, obtain raw materials, and sell commodities like recyclables. Market forces can increase SPU's cost of doing business but also provide opportunities for bringing in more revenue to offset costs.

## Ability to site facilities

**Description:** As the City becomes denser through infill and up-zoning, land acquisition costs increase. Siting industrial-type facilities in areas with a growing mix of residential development also becomes more challenging. In addition, site selection is restricted by flooding, climate change, and seismic considerations.

**Impacts:** SPU is faced with higher costs for siting and building facilities.

### Progress:

- *In-City Facilities Master Plan 2016/2018:* SPU completed an In-City Facilities Master Plan in 2016 that was updated in 2018. This plan provides a facility condition and needs assessment with an investment plan for the next 30 years. Investing in resilient facilities will be essential to supporting emergency response and service restoration in a variety of disasters, particularly earthquakes.

## Availability of raw materials

**Description:** The availability of raw materials changes with market conditions, foreign relations, government agreements, and wars.

**Impacts:** SPU's construction and maintenance projects are impacted by sudden changes in raw material prices such as the price of steel.

### Progress:

- *Ship Canal Water Quality Project Analysis:* SPU is evaluating the impact of construction market conditions on the design and construction of the Ship Canal Water Quality Project. This analysis broke down costs between raw materials, property, and skilled labor for purposes of improved budget planning and transparency with customers, elected officials, and the public.

## Recycling markets and revenue

**Description:** Revenue from recyclable materials is subject to market fluctuations and foreign government decisions. Many commodity markets exist offshore and are subject to trade agreements.

**Impacts:** These markets can change, having a negative or positive impact on SPU contractors' ability to sell recyclables. Revenues received from the sale of sorted recyclable commodities support on-going programs and keep customer rates down.

### Progress:

- *Recyclable Processing Contract:* SPU developed a recyclable processing contract that provides protection against upward and downward market swings. The contractor is paid a set fee to process recyclables and the revenue from selling the recyclables is reimbursed to the City. This helps the contractor stay in business during periods of low prices and ensures that SPU recycling services are not disrupted. The benefits of recycling are further augmented by the avoided costs of landfill disposal.
- *Responsible Recycling Task Force:* SPU is working with regional partners to address changes in international recycling markets as part of the Responsible Recycling Task Force. This was prompted by China's Blue Skies Policy that significantly tightened the standards and costs for the import of specific materials, including mixed plastics and mixed waste paper. These restrictions have impacted costs to sort and process materials and caused a significant price drop in recyclable commodities. The Task Force explored how to improve and expand domestic markets for recyclables and published recommendations in January 2019.





# Section 7: Technology

New and rapidly evolving technologies present opportunities and challenges for SPU. Advancements can eliminate jobs while creating new jobs that require training. The rate of change can create a burden on SPU's ability to stay current. New platforms usually require costly integration and employee training. New technologies can also increase efficiency and help to recruit and retain employees. Emerging technologies are often heralded with benefits that need to be tested before potential adoption. The internet provides new ways for customers to connect with SPU services, but economic, racial, and language barriers to access these services need to be considered.



## Emerging and changing systems

**Description:** The increasing pace of technological change could require SPU to make system upgrades that drive up costs due to software licenses, training, and resourcing technology projects and initiatives. Emerging technologies can also alter the way work is done, rendering certain tasks or systems obsolete. Technology can also help to optimize existing systems. For example, an array of sensors throughout the piping network could assist in monitoring flows and detecting backups, leaks, and other issues.

**Impacts:** Technological changes have the potential of improving overall system efficiency, helping to focus investments, and improving safety. In addition, the increased speed and complexity of change can drive demand for tech-related equipment replacement and employees with new skills. All these changes have associated costs, which can impact efficiency, service quality, and rates.

### Progress:

- **Data Management:** SPU staff in collaboration with Seattle IT are developing a data governance program and providing data management resources. SPU staff have been identified as Business Owners for over 150 technology applications that support SPU work. SPU will also create a guide to data access to give staff the information they need to leverage data resources.
- **Privacy Program:** SPU created a privacy team to embed the City's privacy policies into SPU computer applications, projects, and contracts. This effort to responsibly manage personal information helps maintain employee and customer privacy as SPU navigates technological change.



- **Robotics:** SPU is researching new ways to use robotics to investigate the condition of SPU infrastructure. Any use of robotics will include a partnership with the City and strict compliance with the City's Privacy Policy.

## Independent systems

**Description:** There are ongoing advancements in decentralized systems for treating and collecting storm and wastewater and disposing of solid waste. Decentralized systems may also support resiliency after disasters and other disruptions.

**Impacts:** Loss of customer-base to decentralized water systems may reduce revenues. However, decentralized systems could assist SPU in delaying the need to develop costly new water supplies and help manage drainage flows.

### Progress:

- **Decentralized Systems:** SPU is exploring the role of decentralized systems in providing a more distributed and resilient utility system. SPU is an active member on the National Blue-Ribbon Commission for Non-Potable Water Systems which is developing water quality criteria and operational guidelines, assisted in the City's two Living Building Pilot programs, and is working with agencies and non-profits to develop clear statewide rulemaking for design, permitting, and operation.

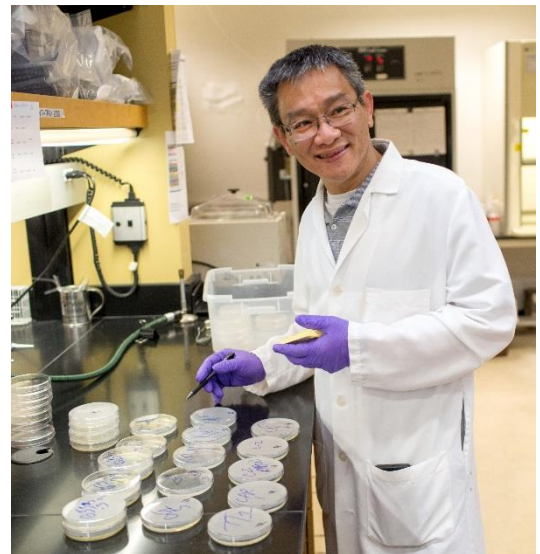
## New treatment techniques

**Description:** Discovery of new contaminants, stricter water quality standards and regulations, and new treatment techniques may require new or enhanced treatment systems.

**Impacts:** SPU could be required to install costly new treatment equipment or even build new treatment facilities for its water, wastewater, and stormwater systems.

### Progress:

- **Water Treatment:** SPU's water treatment plants use ultraviolet radiation and ozonation for treating micro-organisms like Giardia and Cryptosporidium. SPU's burying of in-city treated water reservoirs prevents contamination while allowing open space and park usage on the surface.



# Section 8: Workforce


SPU employees are the organization's most important asset. Hiring and retaining employees with the right skills and protecting institutional knowledge is critical for executing SPU's Mission. Reduced skill availability in certain job categories, loss of institutional knowledge from retirement or departure, speed of turnover, and market competition all impact SPU's ability to deliver high quality services. Workforce challenges also provide opportunities to create a diverse and equitable utility that reflects the community SPU serves.

## Institutional knowledge loss

**Description:** As workers retire or depart, SPU loses the knowledge and history they have. As the 'boomer' generation continues to retire, an increased institutional knowledge loss is expected.

**Impacts:** Recent estimates indicate 46 percent of SPU employees are eligible for retirement within five years. Without sufficient transfer programs or succession planning, this loss of knowledge has the potential to reduce the efficiency of operations and affect service quality.

### Progress:

- *Skills and Knowledge Transfer:* SPU is managing a series of programs that address workforce risks led by the Skills and Knowledge Transfer Team. There are two mentoring programs that pair new and longer-term employees. One is a traditional six-month program, and the other is a collaboration to identify solutions to workplace challenges. The Pathways to Leadership, Utility 101 lunch-time presentation series, and guided tours of the water and solid waste systems also facilitate knowledge transfer and training.
- 
- *Procedures and Manuals:* SPU is updating procedures and manuals and maintaining those documents on SPU's SharePoint site for easy reference. The Fleets and Warehouse Division is a leader in this effort. They pair newer employees with those nearing retirement to ensure knowledge transfer and use special projects as an opportunity to cross-train employees and further employee development.
  - *Apprenticeship Program\*\** (see progress item under Skills availability and development)

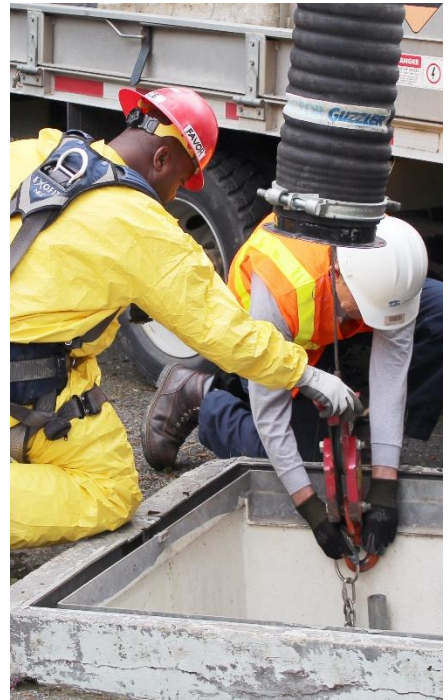
## Skill availability and development

**Description:** SPU's positions are diverse, and many require highly technical skills or multiple years of experience. Skill gaps exist where there are not enough candidates in certain categories, both internally and externally.

**Impacts:** These issues can result in longer vacancies, a less skilled workforce, and decreased production. Competition can reduce the pool of eligible candidates, push wages up, and result in longer vacancy times.

### Progress:

- *Apprenticeship Program:* SPU is restarting the registered apprenticeship programs for pipe workers in the Water and Drainage & Wastewater Lines of Business. Filling key operations and maintenance staff positions is becoming more challenging with retirements and competition from other employers. These programs address institutional knowledge loss by involving long-term operations and maintenance staff in curriculum design and teaching. Apprenticeship opportunities also serve the goal of supporting a more diverse workforce.
- *Skills and Knowledge Transfer\*\** (see progress item under Institutional knowledge loss)
- *Procedures and Manuals\*\** (see progress item under Institutional knowledge loss)



## Retention and turnover

**Description:** High turnover increases the need for training and leads to decreased knowledge and experience. Employee retention is impacted by professional development opportunities, training and mentoring, workload, performance management, and market competition. As the economy booms, the turnover speed increases.

**Impacts:** SPU's service delivery and costs are impacted by rates of retention and turnover.

### Progress:

- *New Employee Orientation Program:* This program includes three levels of orientation. On the first day, new employees receive a two-hour session that includes SPU and City of Seattle basic information. Within the first month of employment, employees will receive a four-hour session to increase their knowledge about working for SPU. Within the first quarter of employment, new supervisors will receive a four-hour session to prepare them for their roles of managing staff.
- *Apprenticeship Program\*\** (see progress item under Skills availability and development)
- *Skills and Knowledge Transfer\*\** (see progress item under Institutional knowledge loss)

## Marketplace competition

**Description:** Private and non-profit sectors as well as other public organizations compete with SPU for skilled candidates. Governments face stiff competition from the private sector's higher wages. Competition may also drive up wages for positions requiring specialized and in-demand skills. While government jobs have certain advantages over other sectors, there are also tradeoffs.

**Impacts:** Seattle's rising cost of living and long commutes negatively impact employees' quality of life, creating competition with employers closer to workers' homes. Interest in the public sector fluctuates and impacts SPU's ability to hire a diverse and skilled workforce.

**Progress:**

- *Recruitment Strategy:* SPU is enhancing its recruitment strategy to increase the candidate pool for open positions. As the recruitment market shifts and demographics change, SPU is implementing more creative ways to attract talent. With the addition of a new Recruitment Manager and an additional recruitment staff position, SPU will move toward a community-centered outreach approach for filling vacancies.

# Section 9: Next Steps



SPU recognizes that managing risk and resiliency is key to sustaining vital public services. This has been a central feature of how the Water, Drainage & Wastewater, and Solid Waste services have evolved to meet new challenges and opportunities. In recent decades, the diversity and magnitude of recognized risks has grown. As a community-centered utility, SPU has undertaken this recent effort to be more systematic and integrated about risk management.

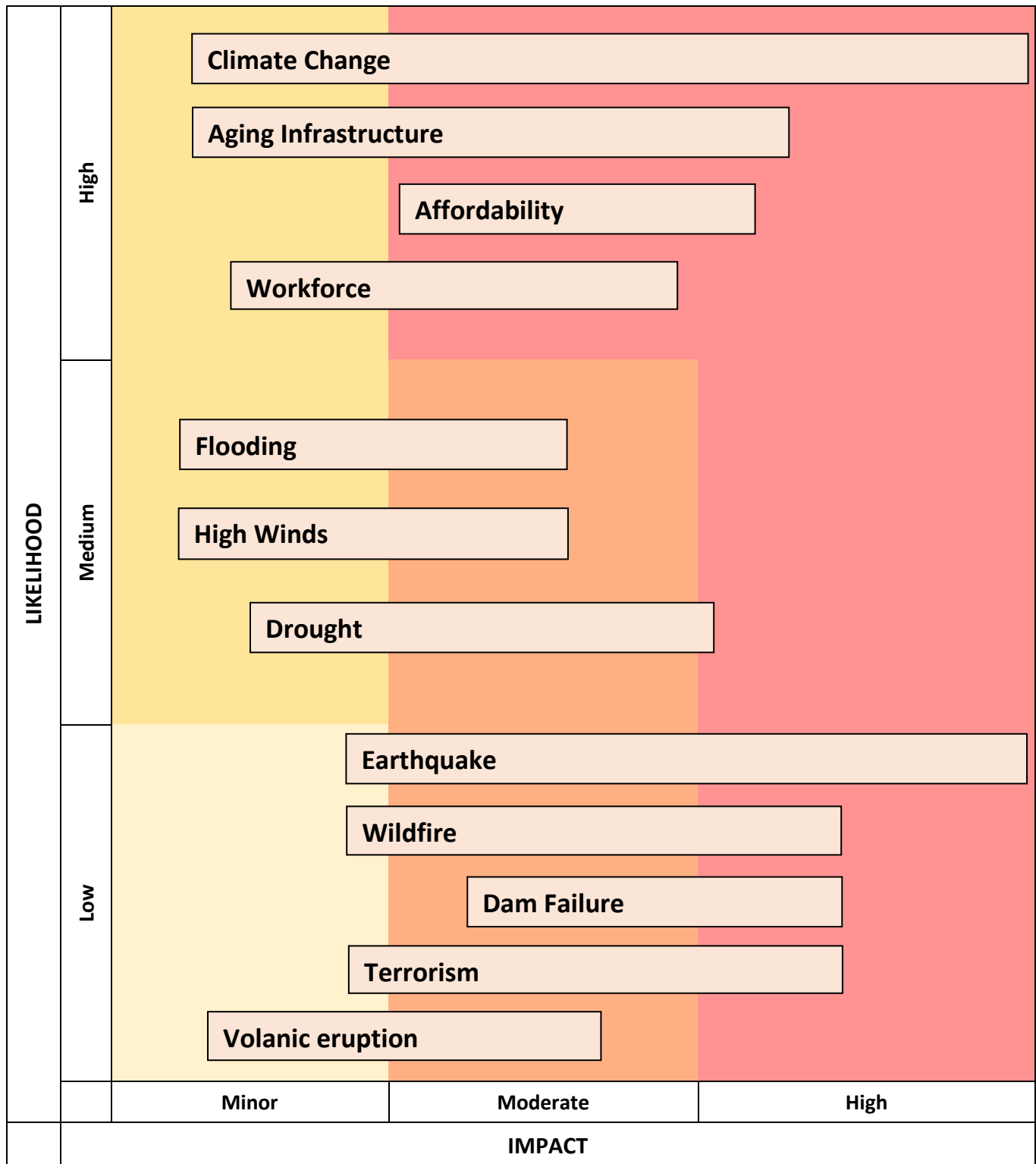
This report has described each of the strategic risk categories along with progress assessments. Some risk areas, such as climate change and disasters, have been on the radar for several decades and are being addressed by a variety of programs and projects. Other categories, such as technology, are developing rapidly and require increased focus. The framework assists SPU's business units to optimize investments that comprehensively address risk and improve resiliency.

Next steps include:

- A vulnerability matrix detailing the most significant risks for SPU
- A complete inventory and assessment of existing work for high priority risk areas
- Identification of critical interdependencies with other agencies and organizations
- Identification of disparate community impacts and opportunities to take equitable and corrective actions
- A prioritization of work that addresses high priority risk areas
- Cost benefit analyses of projects and programs that support risk reduction
- Efforts that address multiple risk areas while optimizing public benefits
- Further development of data sets, models, and scenarios
- A workshop to explore potential future impacts of technology on service delivery
- Communication and outreach with agency and community partners

SPU's risk and resiliency framework will continue to evolve. As this work develops, SPU will share progress and seek feedback from a variety of partners and stakeholders. SPU does not have a crystal ball to see the future, but risk and resiliency efforts improve the utility's ability to adapt to disruptions, changes, and opportunities. This all aligns with SPU's mission to provide vital services to the community that are affordable, equitable, and resilient.

# Appendix A: Impact-Likelihood Matrix



❖ This chart is very high level and is provided for illustrative purposes only.