TACOMA WATER
TACOMA PUBLIC UTILITIES

INTEGRATED RESOURCE PLAN

2025

Acknowledgements

Tacoma Water recognizes the following organizations and individuals for their contributions to the 2025 Integrated Resource Plan.

Integrated Resource Plan Public Advisory Committee Members

- **CASCADE WATER ALLIANCE**
  Melina Thung
- **CITY OF FIFE**
  Tim Osborne
- **CITY OF TACOMA ENVIRONMENTAL SERVICES**
  Dana Deleon
  Kyle Amoroso
- **CITY OF TACOMA LONG-RANGE PLANNING**
  Adam Nolan
  Maryam Moeinian
  Stephen Atkinson
- **COVINGTON WATER DISTRICT**
  Tom Malphrus
- **KENT WATER**
  Kevin Swinford
  Paul Johnson
  Rodney Langford
- **LAKEHAVEN WATER AND SEWER DISTRICT**
  John Bowman
- **SOUTH TACOMA NEIGHBORHOOD COUNCIL**
  Kit Burns
- **TACOMA AND PIERCE COUNTY DEPARTMENT OF HEALTH**
  Michelle Harris
- **TACOMA PUBLIC UTILITIES**
  Rosa McLeod
- **TACOMA WATER**

  BUSINESS SERVICES
  Marc Powell

  CUSTOMER EXPERIENCE AND CONSERVATION
  Ryan Cox

  DEMAND FORECASTING
  Andrew Zaremba

  PLANNING AND ENGINEERING
  Corey Nelson
  Daniel Reisinger
  Glen George, project manager
  Jason Moline
  Kim DeFolo
  Stuart Vaughan

  LEADERSHIP TEAM
  Jessica Knickerbocker
- **WASHINGTON STATE DEPARTMENT OF HEALTH**
  Deborah Johnson

Contact Information

www.MyTPU.org/TacomaWater

Tacoma Public Utilities: (253) 502-8600
Tacoma Water: (253) 502-8384

Technical and Consulting Support Provided by HDR

Jeff Hansen
Ted Shannon
Mika Vogt
Leanne Raaberg

Contents

Acronyms

AFY – Acre-feet per year

AMI – Advanced metering infrastructure

AWSP – Additional Water Storage Project

CFS – Cubic feet per second

CMIP5 – Coupled Model Intercomparison Project, Phase 5

EPA – Environmental Protection Agency

FIRO – Forecast-informed Reservoir Operations

FDWR – First Diversion Water Right

GPL – Gravity Pipeline

HCP – Habitat Conservation Plan

IRP – Integrated Resource Plan

JBLM – Joint Base Lewis-McChord

MGD – Million gallons per day

OASIS – Optimizing Aquifer Storage for Increased Supply

PAC – Public Advisory Committee

PFAS – Per- and polyflouroalkyl substances

RAS – Resource Adequacy Standard

RCP – Representative Concentration Pathway

RWSS – Regional Water Supply System

SDWR – Second Diversion Water Right

SSA – Sole Source Aquifer

SSP – Second Supply Project

STGPD – South Tacoma Groundwater Protection District

USACE – U.S. Army Corps of Engineers

USGS – U.S. Geologic Survey

WYSDM – Water Yield, Supply, and Demand Model

Public Utilities Board Resolution

the 2025 Integrated Resource Plan was approved by the Public Utilities Board in Board Resolution No. _____ on _____, 2025.

EXECUTIVE SUMMARY

Tacoma Water, a division of Tacoma Public Utilities, developed an Integrated Resource Plan (IRP) in 2018 to improve its ability to manage available water supplies, plan for new supplies as needed, and protect streamflow for fish in the Green River. This 2025 update builds on the prior plan.

Historically, water utilities treated water needs ("demand") as an independent factor and developed supplies sufficient to meet those needs. This has been changing in recent decades. Utility managers, regulators, and customers now understand that water demand can be managed, just as supply can be increased. Tacoma Water has promoted water conservation by its customers since the 1980s and maintains a Water Shortage Response Plan to reduce water use during droughts or other supply shortages. This IRP incorporates supply and demand in a single analysis and addresses trends and uncertainties in both.

Tacoma Water convened an IRP Public Advisory Committee (PAC) to assist in updating the plan. The PAC met on five occasions to review stages of IRP development and provide input on the approaches used and expectations for future conditions that will influence water needs in Tacoma and Pierce County.

Tacoma's water sources include the Green River and local groundwater supplies. Together these sources serve the City of Tacoma, other communities adjoining the City or located near its supply pipelines, and Tacoma's Regional Water Supply System partners in King County. Historically, the Green River has supplied most of Tacoma Water's needs, with groundwater used only in the summer months. However, this supply balance is shifting, with the utility projecting to more fully utilize its groundwater rights in the future to mitigate climate change impacts on the Green River supply and provide reliability in meeting demand growth.

Recognizing the importance of its groundwater supplies, Tacoma Water is investing heavily in these resources, through rehabilitating existing wells to optimize their production, planning for the addition of treatment to address emerging and newly regulated contaminants such as per- and polyfluoroalkyl substances (PFAS), and analyzing the impacts of future land use changes throughout the recharge area on aquifer levels.

Resource Adequacy Standard

Tacoma Water established a Resource Adequacy Standard (RAS) that serves as a "yardstick" for determining whether water supplies are sufficient to meet demands now and in the future. The RAS states that Tacoma Water's "sources and system will be sufficient to meet demands such that mandatory curtailments will occur not more than once in 25 years, as a long-term average." Mandatory curtailments are a normal but infrequent step that utility managers can use to require the system's water customers to reduce water use, in order to get through a drought or other temporary supply shortage. The IRP examines how often mandatory curtailments would be needed under various combinations of future supply and demand conditions. If the RAS is met under a majority of likely conditions, Tacoma Water's resources are considered adequate.

Water Yield, Supply, and Demand Model

As part of the 2018 IRP project, Tacoma Water developed a sophisticated computer model of water supply and demand, called the Water Yield, Supply, and Demand Model (WYSDM). As part of this IRP update, WYSDM was refined to reflect water management changes made in recent years. WYSDM can model current and historical conditions and scenarios, representing alternative future conditions. It can also provide insight into how climate change might affect supply and streamflow. WYSDM greatly improves Tacoma Water's ability to make decisions on use of limited water supply during a drought or other temporary shortage.

Tacoma Water also used WYSDM to determine the firm yield of the supply system. For this IRP, firm yield is defined as the maximum water quantity that can be produced with 95% confidence from the existing Green River supply and groundwater production facilities, such that mandatory curtailment of customer consumption would not be needed more than once every 25 years on average. Tacoma Water's firm yield ranges from 108 to 159 million gallons per day (MGD), depending on climate model, with an average of 128 MGD.

Tacoma Water's supply sources, including planned enhancements over the coming decades, are sufficient to meet needs through the 2060s.

Conservation Program and Water Shortage Response Plan

As part of the 2018 IRP process, Tacoma Water assessed and updated the demand-management programs already in place: the Water Conservation Program and Water Shortage Response Plan. The conservation program is a regular and ongoing program, while the Water Shortage Response Plan applies only during occasional droughts or other supply shortages. These demand-side solutions complement the use of supply-side solutions, while helping to protect stream flows, meeting customer expectations, and controlling the costs of developing and operating the water supply system. In 2024, Tacoma Water completed deployment of a new tool that will be instrumental in supporting its conservation efforts: advanced metering infrastructure (AMI). The AMI system provides the utility with near real-time data regarding water consumption, allowing for faster identification and resolution of leaks and enhanced monitoring of usage trends. More detail on the conservation program and AMI is provided later in this report.

Planning Scenarios and Modeling Results

Numerous factors will influence future supply and demand conditions, including population and economic growth, climate change impacts on western Washington State, changes in societal attitudes regarding water use, technological advances, and customer adoption of water conservation practices. Although Tacoma Water lost its largest water-using customer in 2024 due to the closure of an industry on the Tideflats, water demand is projected to continue growing as housing density increases and other potential wholesale deliveries come online. With input from the PAC, Tacoma Water developed a range of planning scenarios that represent potential future supply and demand conditions. These scenarios were modeled in WYSDM, and the results were compared against the RAS and other metrics of system performance.

WYSDM results for the planning scenarios suggest that in all but the most stressed scenarios, Tacoma Water's supply sources will remain adequate through the 2060s.

In order to safeguard against the most stressed conditions, Tacoma Water considered a range of additional water supplies that could contribute to future system reliability. These included using more groundwater, storing water in local aquifers, expanding surface water supplies, contracting with other utilities in the Puget Sound region, and developing reclaimed water supplies, desalination, and advanced water conservation practices. The systems and infrastructure that would most likely be employed in the near future are detailed later in this report. Others, like desalination, will be further explored in a future version of the IRP.

Three solutions were selected for ongoing and future development:

1. Tacoma Water plans to continue to work with the federal government (U.S. Army Corps of Engineers) to complete the Additional Water Storage Project (AWSP) Phase 2 at Eagle Gorge Reservoir, which would add additional storage to support fisheries and provide some municipal storage benefit.
2. Tacoma Water will explore the feasibility and cost of enhancing its groundwater production and treatment facilities to make optimal use of its existing groundwater rights.
3. Tacoma Water plans to implement long-term aggressive "peak shaving" strategies. These are demand management actions that reduce peak summer water use, retaining water in storage as a buffer for the supply system in the fall.

When added to current system capabilities, these projects are expected to achieve the RAS, even under the most stressed scenarios that were evaluated using WYSDM.

Future Updates

Tacoma Water will periodically revisit and update the IRP and continue to improve its supply and demand management programs to ensure they are performing efficiently and effectively for customers, stakeholders, and the environment. A recommendation to increase the frequency of the IRP to coincide with other planning efforts at Tacoma Water is also being considered.

1

INTRODUCTION

What is an Integrated Resource Plan?

An Integrated Resource Plan (IRP) incorporates supply and demand into a single analysis and addresses trends and uncertainties in both.

This IRP is one of several planning documents that Tacoma Water uses to make its **Strategic Plan** operational.

The Resource Planning Process

1. **IDENTIFY THE FACTORS** that will influence water supply and demand in the future.
2. **DEVELOP MODELS AND METRICS** to analyze future water supply and demand.
3. **DEFINE AND ASSESS ALTERNATIVE SCENARIOS** of population growth, economic activity, technology, and climate conditions.
4. **ANALYZE FUTURE RESOURCE PERFORMANCE –** Are Tacoma Water's existing water resources sufficient to handle a range of future conditions?

   If the answer is "no", identify new water supplies and/or ways to reduce water needs in the future.
5. **DEVELOP A LONG-TERM RESOURCE STRATEGY AND ACTION PLAN.**

Historically, water, power, and other utilities conducted supply and demand analyses separately. Demand was viewed as an independent factor, and supplies were simply sized to meet those demands. This approach has changed in recent decades. Water and power managers, government regulators, and informed citizens now view customer demand as a variable that can be managed, just as supplies can be managed. Integrated Resource Planning brings supply- and demand-side solutions into a single framework.

In 2015, a severe drought placed significant stress on Tacoma's water system. At the same time, some Tacoma citizens expressed concerns over how water is allocated, particularly to large new industries. In response to these concerns, Tacoma Water decided to improve the capabilities of its supply forecasting methods and take a fresh look at how current and future water demands align with available supplies. The 2018 IRP resulted from these activities.

Further, in considering options to keep supply and demand in balance, the IRP examines both supply management options and demand management options. Tacoma Water convened a Public Advisory Committee (PAC) to contribute to the integrated planning vision and approaches, so that a wide range of views could be equitably applied to the planning effort.

The IRP will lead to a better balance of the various constituent needs, support regional economic vitality, honor Tacoma Water's commitment to and desire for the health of the Green River ecosystem, and support the treaty rights of the Muckleshoot Indian Tribe to a sustainable fishery. The IRP enables Tacoma Water to take stock of its needs and resources, update forecasts, and produce new management tools to create an even more robust and resilient system for the future.

The IRP both informs and is informed by other Tacoma Water strategic planning efforts, such as the Water System Plan and the South Tacoma Wellfield PFAS Treatment Evaluation. Additional implementation details pertaining to the water supply management strategies defined in the IRP (e.g., the timing and funding of needed capital projects) will be further explored in tactical planning documents such as the Capital Improvement Plan and the Wells Master Plan.

Tacoma Public Utilities administration building

Tacoma Water Today

Tacoma Water, a division of Tacoma Public Utilities, has been providing water to local communities ever since the City purchased Tacoma Light and Water in 1893. Tacoma Water has expanded its supply portfolio and infrastructure and continually updates management practices to meet the needs of a changing customer base and satisfy evolving state and federal requirements.

Currently, Tacoma Water directly serves approximately 353,000 people in the City of Tacoma and in nearby communities in Pierce and King Counties. An additional 350,000 people may receive water from Tacoma Water through partner and wholesale connections. This includes residential, commercial, and industrial customers. Currently, the average winter-season demand is 35 million gallons per day (MGD), and the maximum daily demand in the summer is 85 MGD. Tacoma Water also has the ability to sell water in bulk to other cities in Pierce County and maintains a partnership with three water utilities in King County that partnered with Tacoma Water to develop new supply and transmission capacity in recent decades.

Tacoma Water has made substantial commitments recognizing the value of water as an environmental resource. It follows stringent protocols and engages with partner agencies to protect Green River flows and fish runs during low-flow periods, working closely with stakeholders on the Green River to ensure environmental commitments are met, consistent with State law and an agreement with the Muckleshoot Indian Tribe.

As Tacoma, Pierce County, and the adjoining region continue to grow, Tacoma Water will work to meet community needs, while balancing those needs with environmental sustainability and economic vitality in its planning and operations.

TPU MISSION

We deliver clean, reliable services essential to quality of life.

TPU VISION

We will be a trusted community partner, where employees are proud to deliver equitable, affordable utility services.

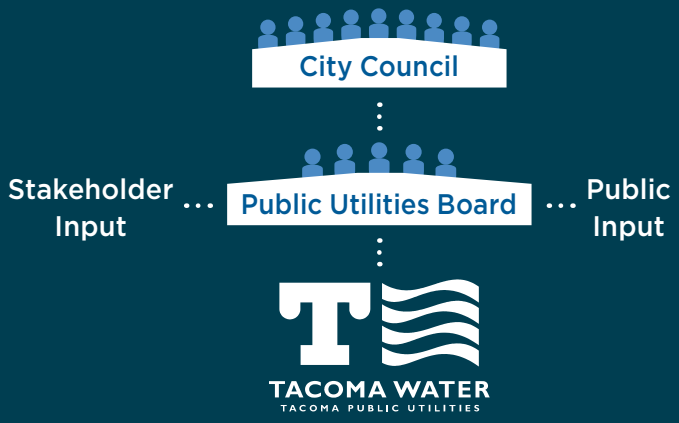
TACOMA WATER VALUES

- Safety
- Belonging
- Customer focus
- Integrity
- Respect

GOVERNANCE

Tacoma Water is governed by the Public Utilities Board, appointed by the City Council. As a public utility, Tacoma Water considers diverse community needs, stakeholder concerns, and public input.

The utility operates as an "enterprise", funding its operations, infrastructure, and debt service entirely from water sales. It is the largest water provider in Pierce County and second largest in Washington State, serving urban, suburban, and even some rural customers.

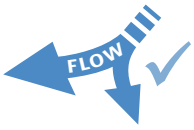


FACTS & FIGURES

Direct Retail Service population served in 2023:
approx. 353,000

Numerous **rebates** and **free services** geared toward reducing customers' water use

Uses surface water from **Green River** and groundwater from **local aquifers**



Green River **diversions** are **managed carefully** under a Habitat Conservation Plan and an agreement with the Muckleshoot Indian Tribe

Green River

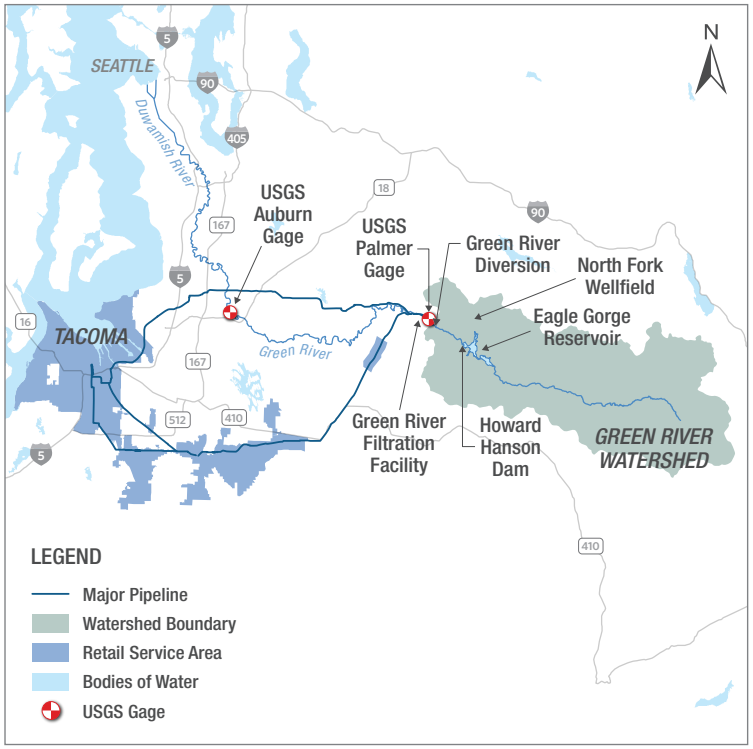
Water Supply Sources

Surface Water

Tacoma Water's primary water source is water diverted from the Green River. Water originates in the Green River Watershed, a forested valley in the Cascade Range northeast of Tacoma. In the fall and winter months, the Green River is primarily fed from frequent rain events; in the late spring and early summer months, river flow is augmented by melting snow in the higher elevation areas of the watershed. Local inflow from groundwater and augmentation from stored water supports stream flow from mid-summer into fall until the rains return.

Tacoma Water has water rights on the Green River which include the First Diversion Water Right (FDWR) for 113 cubic feet per second (cfs) and the Second Diversion Water Right (SDWR) for 100 cfs. The FDWR can only be used if river flows at the Auburn gage are above 250 cfs. This is true more than 99% of the time, but this water is not able to be stored. The SDWR is conditional based on Green River flow measured at the Palmer gage and the Auburn gage. Therefore, the SDWR is only available for about 60% of the year. However, water from the SDWR may be stored behind Howard Hanson Dam in the spring and withdrawn later at any rate, allowing Tacoma Water to store up to 20,000 acre-feet of water and withdraw it during the peak summer season. The surface water system is shown in Figure 1.1.

Figure 1.1 Green River Watershed and supply system



Groundwater

Tacoma Water owns and operates wells in and around the city to provide additional supply. In a typical year, groundwater pumping has historically supplied approximately 3 to 11% of total water supply, usually during the summer period when customer needs increase or in the fall after much of the stored surface water has been depleted. However, wells can be operated as a substitute source of supply whenever the Green River source is insufficient to meet demands.

Tacoma Water relies on both surface water and groundwater to reliably meet customer needs for water.

The advantage of groundwater is its reliability; the aquifer will normally recharge every year during the wet winter season, and if the wells are not pumped at full capacity for an extended period of time, the aquifer can produce ample water through the dry season. However, groundwater is not sufficient by itself to meet the total summer demand, nor can it supply all parts of Tacoma's sprawling supply network. It has an additional downside of elevated cost: pumping groundwater from wells requires more electrical power than water supplied from the Green River. The cost and complexity of groundwater use has been increased by the closure of Tacoma Water's largest industrial customer. This resulted in a significant reduction in demand in the Tideflats, where groundwater from the South Tacoma wells is most easily conveyed. Additional pumping is required to move this water to other portions of the city.

In addition, water treatment costs will rise in the future to address new and changing water quality requirements, such as those related to per- and polyfluoroalkyl substances (PFAS). Tacoma Water is actively planning how best to balance the costs with supply reliability of its groundwater resources.

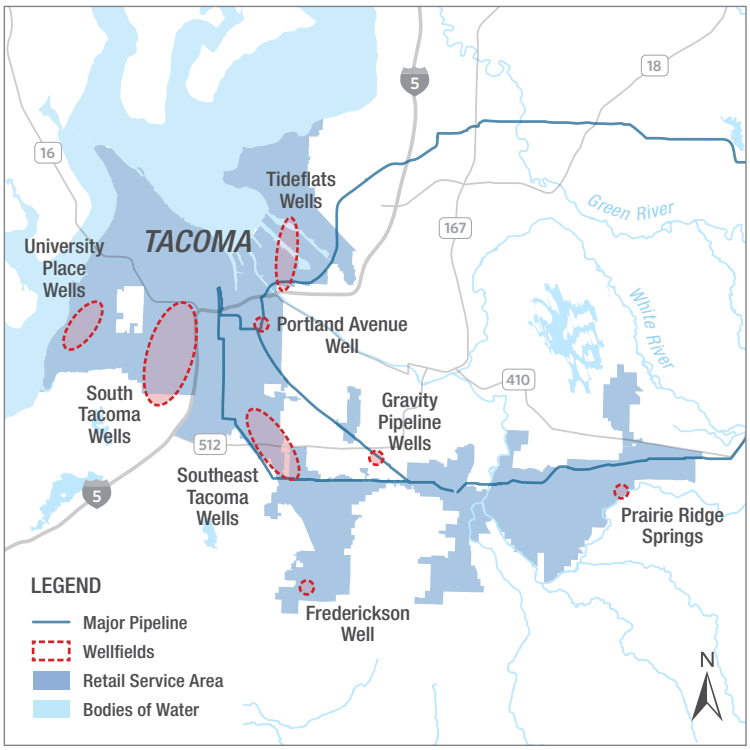
Water Rights

An evaluation of water rights available to the system is an important part of any system-wide analysis. Along with the physical capabilities to supply water, the legal right to use the water must be monitored and ensured.

Tacoma Water has sufficient water rights to meet anticipated future needs. These water rights include two surface water rights from the Green River and groundwater rights for the water system's wells, which are located in multiple regions of the water service area, depicted in Figure 1.2.

As the community continues to grow and evolve, Tacoma Water will require changes to some of its water rights. Extensions to several water right permits will be required in the near future. During the last decade it has become increasingly difficult for water systems to manage their water rights due to uncertainties in legal interpretation and the administration of these rights. Tacoma Water is active with industry and regulatory associations to monitor developments and provide input as the water rights landscape changes.

Figure 1.2 Tacoma Water's wellfields



The Benefits of a Diverse Supply

Every year sees different weather conditions and customer water use patterns; both of these factors carry an element of uncertainty. Having supplies from both surface water and groundwater allows Tacoma Water to be highly resilient in the face of these uncertainties and to control impacts of changing water withdrawals from the Green River.

Contractual Relationships

Several agreements and permits shape how and when Tacoma Water can use its surface water sources. These affect how the supply system can be operated under different conditions. The various provisions and commitments affecting flow management and water diversions have been incorporated into the Water Yield, Supply, and Demand Model (WYSDM), developed as part of the IRP project.

Muckleshoot Indian Tribe

The Muckleshoot Indian Tribe holds treaty rights to certain natural resources in the Green River basin, and federal courts have recognized its legal standing along with the federal government and Washington State in managing these resources. Tacoma Water is committed to respecting tribal rights as it exercises its water rights to Green River water supplies, under Washington State law.

In 1995, the City of Tacoma and the Muckleshoot Indian Tribe signed an agreement regarding management of resources in the Green and Duwamish River system. The agreement addresses Tacoma Water's use of its First and Second Diversions. Among other provisions, the agreement states that Tacoma Water shall provide guaranteed minimum continuous instream flows in the Green River. Natural inflows, water stored in Eagle Gorge Reservoir, and pumping groundwater to meet a portion of system demand help meet this commitment.

U.S. Army Corps of Engineers

Howard Hanson Dam is located approximately three river miles upstream of the Green River Diversion Dam and is owned and operated by the United States Army Corps of Engineers (USACE). Its primary function is to reduce flood risk for communities in the Green River Valley by storing high volumes of winter runoff and releasing them gradually. Another authorized function of Howard Hanson Dam is augmentation of in-stream flows in the Green River downstream of the dam during the summer-fall low flow period. The Additional Water Storage Project (AWSP) at Howard Hanson Dam added municipal water supply to the project purposes. Tacoma Water's access to this supply is defined in a 2003 Project Cooperation Agreement with USACE. With the planned 2030 completion of AWSP Phase 1 which installs fish passage facilities at Howard Hanson Dam, Tacoma Water and its project partners will be able to divert the full 20,000 acre-feet of water stored in the spring and then released in the summer and fall from Howard Hanson Dam for municipal use. Historically, Tacoma Water and its partners have donated 10,000 acre-feet back for use by the resource agencies to supplement streamflow at levels that promote fish survival and reproduction. Tacoma Water additionally plans to continue work with USACE to implement AWSP Phase 2, which would add additional storage to support fisheries and provide some municipal storage benefit at Eagle Gorge Reservoir.

Water stored behind Howard Hanson Dam may be maintained until late fall each year, when flood control season begins. At that time, remaining water is released downstream, so the reservoir can absorb high runoff events in the winter to minimize flooding downstream. This means there is no carryover of stored municipal water from one year to the next.

Green River

Eagle Gorge Reservoir

Habitat Conservation Plan

Tacoma Water is committed to implementation of a Habitat Conservation Plan (HCP) for its Green River operations, issued in 2001. This was part of obtaining an Incidental Take Permit from the National Marine Fisheries Service and U.S. Fish and Wildlife Service under Section 10 of the federal Endangered Species Act.

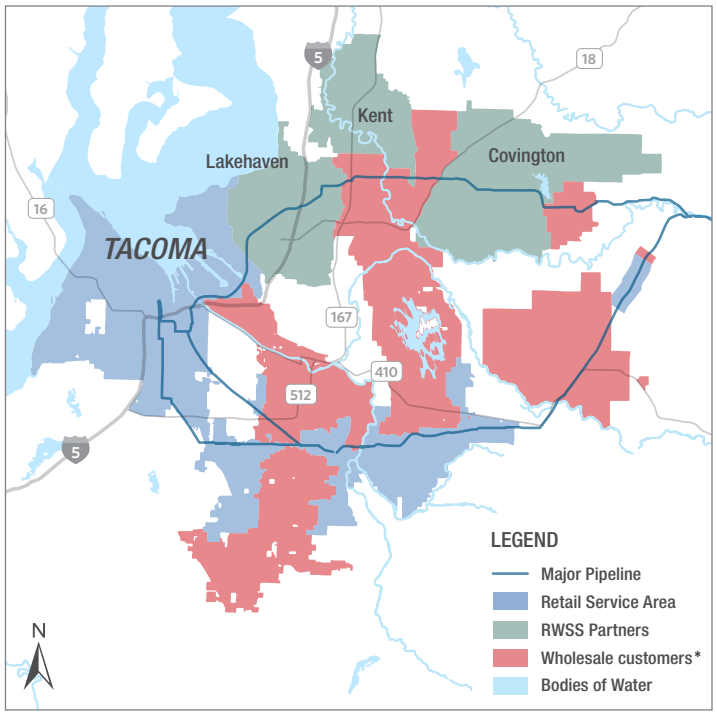
Out of the numerous actions listed in the HCP, one section is particularly critical with regard to water supply availability from the Green River. The HCP guarantees minimum instream flow at the Auburn gage, above the state-mandated level. Required flows are the same as those described under the Muckleshoot Indian Tribe Agreement.

An essential element of the HCP is its adaptive management framework, which provides an ongoing process to evolve the strategy for managing water releases from Howard Hanson Dam to meet downstream flow needs. This involves frequent communication with the Green River Flow Management Committee, which is an interagency committee consisting of representatives from the Muckleshoot Indian Tribe, Tacoma Water, natural resource agencies, and other groups. USACE considers input from the committee to adjust the refill and release regime based on a short-term planning horizon. In drought situations, the parties have historically agreed to institute consensus-derived water use restrictions to make the best use of the available resource.

The HCP also calls for Tacoma Water to provide funding support to USACE for a downstream fish passage facility at Howard Hanson Dam and for a monitoring and research program to support conservation of listed species and for purposes of adaptive management. Tacoma Water has fulfilled all its other commitments under the HCP and is partnering with USACE on this important new fisheries project.

The HCP includes numerous other actions aimed at improving the fisheries resource in the Green River basin, as well as actions to protect a wide array of non-fish species.

Figure 1.3 Tacoma Water wholesale customers and RWSS partners



**Cascade Water Alliance, a wholesale customer, is not shown on the figure as it is physically unable to take water at this time.*

Wholesale Water Contracts

Tacoma Water serves water directly to retail service customers in Tacoma, other communities in Pierce County, and some in southern King County. In addition, Tacoma Water has contracts to deliver water on a wholesale basis to the following water purveyors in Pierce and King Counties, also depicted in Figure 1.3:

City of Fife	Rainier View Water Co.	Coal Creek Water Society
City of Auburn	Firgrove Mutual Water Co.	City of Enumclaw
City of Bonney Lake	City of Puyallup	City of Black Diamond
Cumberland Co-op	Summit Water	Valley Water District
Mountain Terrace		RSN Enterprises
Fruitland Mutual Water Co.		Lake Meridian Water District

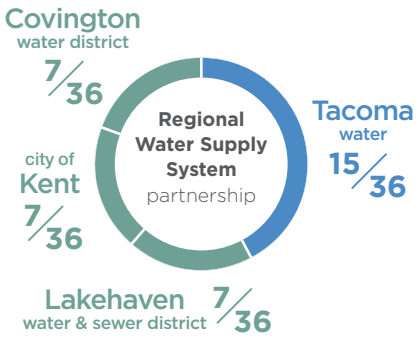
Tacoma Water has an evolving contract with Cascade Water Alliance, an organization comprised of seven suburban King County water purveyors.

Regional Water Supply System

In 1979 Tacoma Water requested Washington State Department of Ecology resume processing and act on its 1933 application to develop a second water right on the Green River, which would add to the allowed diversions from Tacoma's original 1913 claim. Tacoma Water also developed a plan to construct several new facilities, including a new water treatment plant and a new transmission pipeline (Pipeline 5, or the Second Supply Pipeline) to deliver that water to its retail service area. Ultimately the water right was granted and the facilities were constructed. These actions together are called the "Second Supply Project" or SSP.

At the same time, certain communities located along the Pipeline 5 route in King County expressed an interest in partnering with Tacoma Water to finance the project, in return for a share of the SSP water. The communities that joined the partnership are the City of Kent, Covington Water District, and Lakehaven Water and Sewer District. The project also includes certain related facilities, including portions of storage capacity behind Howard Hanson Dam, operated by USACE.

Figure 1.4 Breakdown of RWSS shares



This partnership is also known as the Regional Water Supply System (RWSS). The SSP/RWSS became operational in October 2005. The SSP Partnership Agreement defines the rights and obligations of the participants. Tacoma Water has a 15/36 Participant Share, and the City of Kent, Covington Water District, and Lakehaven Water and Sewer District each have a 7/36 Participant Share in the SSP, depicted in Figure 1.4. Only the SDWR is included in the RWSS. Tacoma's FDWR is solely used for the needs of Tacoma Water.

Water Conservation

Tacoma Water serves approximately the same amount of water annually as it did in the mid-1960s, with about a 50% increase in population. This is due to changes in the industrial and commercial base, improved technology and metering, and conservation programming. Tacoma Water has promoted water conservation by its customers since the 1980s.

The conservation program is updated regularly to incorporate new technologies, build on past water savings, and promote positive customer engagement. Conservation is integral to Tacoma Water's values of serving its customers equitably and efficiently while protecting environmental resources.

2018 Water Conservation Program Update

Tacoma Water updated its water conservation goal and plan in 2018. The actions identified are being implemented over a 10-year period from 2018 to 2027. The conservation program and water use efficiency goal will be updated next in coordination with the 2029 Water System Plan update.

The conservation program aids Tacoma Water in meeting its water use reduction goals, contributes to ongoing environmental stewardship, and provides customer opportunities to use water more efficiently.

Although the costs of operating the utility are largely fixed rather than proportional to annual water production, conservation is a way to lessen or avoid the need to find and develop expensive additional sources in the future. Tacoma Water has a portfolio of existing water rights that could be further developed, but new water rights are generally not available. Moreover, conservation helps avoid a need to upsize existing distribution infrastructure (such as pipes, pumps, and reservoirs) that would only be fully utilized during peak hours of perhaps a handful of the hottest days each year.

In support of its conservation objectives, and to enhance operational efficiencies, Tacoma Water recently upgraded its entire metering system to advanced metering infrastructure (AMI). AMI allows near real-time monitoring of water deliveries and is useful for detecting abnormal water use patterns, often indicative of a leak. This can help conservation efforts by allowing for closer tracking of water use patterns and faster rehabilitation of leaking pipes. AMI data will be useful to both the utility and its customers in analyzing water consumption trends and identifying opportunities for increased water savings. AMI can also enable dynamic pricing to support conservation efforts, if needed in the future.

A well-designed conservation program can provide numerous benefits:

- **Cost effectiveness:** New supply sources and infrastructure can be costly to develop. Conservation can delay and sometimes avoid the need for certain projects, saving ratepayers from unnecessary costs.
- **Environmental stewardship:** Less water diverted from the Green River means more water for aquatic species and a healthier Green River ecosystem.
- **Energy savings:** Reduced water use means less energy is needed to treat and distribute water, and also less energy is used to heat water in residences and businesses.
- **Customer satisfaction:** Equipment rebates and fixture giveaways save customers money. Reducing water use leads to lower water bills for participating customers (though the resulting loss to utility revenue must be made up by other means or sources).

Program Development

The conservation program is presented as a package of actions, or "measures", that Tacoma Water and customers will implement to save water across multiple uses.

Tacoma Water used a multi-step process to develop its goal and compile potential measures into a final conservation plan:

1. **SCREENING:** Initial selection of potential measures for consideration based on relevance and potential effectiveness in achieving Tacoma Water's conservation goal.

2. **VALIDATION:** Quantitative evaluation of which measures would be the most effective in achieving Tacoma Water's goals.

3. **PACKAGING:** Conservation measures grouped together to eliminate redundancy and address multiple goals. These packages were presented to the PAC for feedback during the 2018 IRP development, which led to the creation of a final package of measures that was selected as the conservation program for implementation over the next 10 years. Savings from this package generated the updated goal of reducing peak, population-adjusted water use among Tacoma Water's retail customers by 6.65%.

Targeting Outdoor Use

Domestic uses ("indoor use") occur in generally consistent patterns throughout the year. In contrast, outdoor water use occurs almost entirely during the dry season. Outdoor water use (especially landscape irrigation) can nearly double total water use during the summer.

River flows taper off after the snowmelt season is over, at which point storage in Eagle Gorge Reservoir becomes an important component of the water supply until the rains return in the fall. Reduction of peak demands can reduce withdrawals from the river and stretch the water stored in the reservoir. For these reasons, the conservation plan targets peak season uses of water.

The Program

Highlights:

- Equitably includes all customer classes, all times of the year
- Peak season savings up to 278,000 gallons per day
- Outdoor efficiency measures for residential and commercial customers
- Loans and grants for service line replacement available to residential customers
- ~$500,000 annual budget, plus staff time

The conservation package chosen for implementation is focused on maximizing peak-season savings. It includes a diversity of measures across customer classes and water uses.

Water Conservation Economics

- The water utility operates as an enterprise such that annual revenues must cover annual costs.
- Anything that reduces water use also reduces revenue.
- When revenue dips unexpectedly, it must be made up elsewhere because most costs of operating the utility are largely fixed and do not change proportionately with water use.
- Impacts to individual customers can be reduced by enlarging the customer base, for example by adding industrial and wholesale customers.

Customers and the Environment

Tacoma Water uses water conservation as a best management practice for balancing the needs of the Green River Watershed, the customers, and the utility.

IRP Public Advisory Committee

Tacoma Water formed a Public Advisory Committee to provide stakeholder input during development of the IRP. The questions posed and comments provided at PAC meetings helped Tacoma Water shape the IRP analysis and this document.

The IRP Public Advisory Committee met five times and provided input on:

Purpose and objectives of IRP	Updates to the Water Yield, Supply, and Demand Model	Influence of "Home in Tacoma" housing shift on future demands
Future scenarios of population growth, economic development, and technological changes	Treatment of climate change in the IRP process	Water conservation program continuation
Regulations in the South Tacoma Groundwater Protection District (STGPD)	Future wholesale water demands and treatment in WYSDM	Communication of results in IRP

See Acknowledgements page for a list of organizations represented on the IRP PAC.

Water Station

2

KEY FACTORS FOR THE INTEGRATED RESOURCE PLAN

Tacoma Water must continually plan for the future to ensure reliable water service as the Tacoma area grows and changes. Development of new water supplies can take decades, so planning for the future requires a long view of social, economic, and natural resource conditions.

Weather Variability and Drought

Snowpack and rainfall patterns in the Puget Sound region can vary sharply from year to year. Some winters deliver damaging floods, and some summers are unusually hot and dry. Dry winters can also be problematic by reducing snowmelt that feeds the Green River.

Dry conditions reduce Tacoma Water's surface water supply and stress fish populations in the Green River, its tributary creeks, and other local streams. Many of Tacoma Water's actions during dry years are driven by its responsibilities for protecting fish and the related set of agreements with the state, federal government, and Muckleshoot Indian Tribe.

In developing the IRP, Tacoma Water drew on weather and streamflow data from the 103-year period stretching from 1915 to 2017. Significant droughts occurred in the early 1900s and in 1987 and 2015. In fact, snowpack in the Green River Watershed was at a historic and alarming low in 2015. Each of these past droughts illustrates the need for vigilance in maintaining adequate water supplies for extreme dry periods.

Most droughts can be sufficiently managed by reductions in discretionary water uses (known as "curtailment"). It is important to keep in mind that occasional curtailment is not failure; it is a cost-effective means of managing the water system. Infrequent curtailment enables Tacoma and its customers to deal with the variable climate of the region and minimize impacts to the natural environment.

Fortunately, multi-year droughts have been rare over the past 100 years in the Puget Sound region. The pronounced pattern of wet winters, coupled with available storage capacity, help to buffer Tacoma Water from multiple-year events.

Tacoma's Water Supply

Green River has high flows in winter and spring with lower flows in the summer due to a reduction in rainfall. This pattern is shown in the historical streamflow levels shown in Figure 2.1. Tacoma Water's FDWR provides access to the Green River water, even in low flow conditions. However, Tacoma Water works to protect environmental river flows and will not fully use this right for water supply in the summer. Tacoma Water's FDWR usage in a typical year is shown in Figure 2.2. To provide a more robust summer water supply, Tacoma Water and the RWSS partners use the SDWR to store water in Eagle Gorge Reservoir. Typical SDWR usage is shown in Figure 2.3, and Eagle Gorge Reservoir Storage is shown in Figure 2.4.

Figure 2.1 Historical natural Green River streamflow

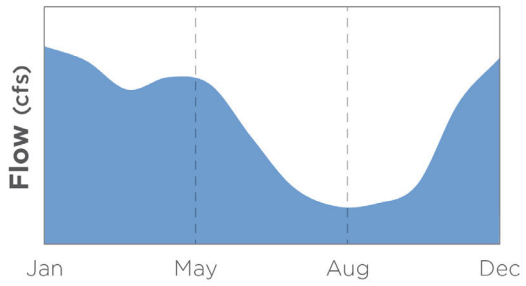


Figure 2.2 Typical First Diversion Water Right

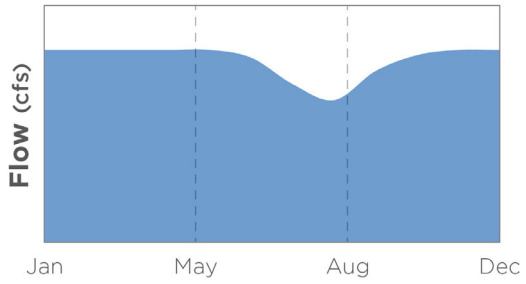


Figure 2.3 Typical Second Diversion Water Right *excluding stored water*

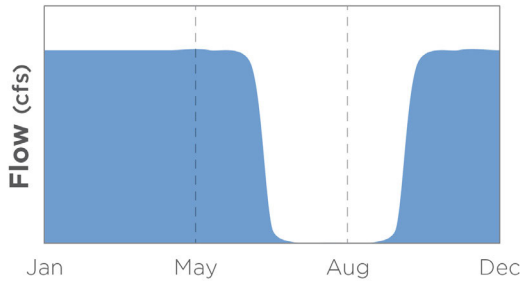
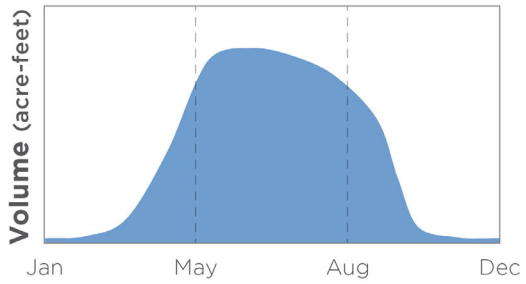


Figure 2.4 Eagle Gorge Reservoir total storage



Climate Change

Government scientists and university researchers in the Pacific Northwest and other regions have predicted that our climate will become warmer and that extreme weather events are likely to become more frequent. Climate change is a worldwide phenomenon that is occurring now and is expected to impact societies in the coming decades. Specific effects can vary substantially from one region to another, including the types, rates, and magnitudes of change.

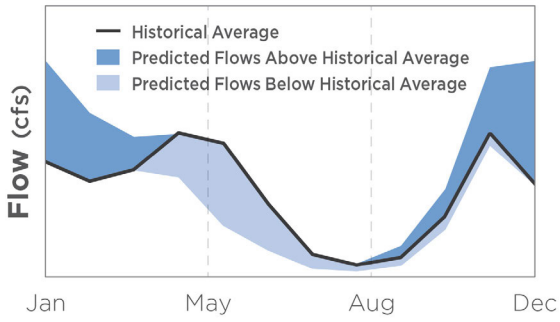
In the Puget Sound region, climate change models predict warmer weather year round, drier summers, and wetter winters. However, climate change is forecasted over large time scales and thus carries uncertainty in how it will manifest in day-to-day weather. For example, average temperature increases may be different in summer months than in winter months. Land elevation, proximity to water bodies, and vegetation also affect local conditions. Tacoma and Pierce County are diverse in these characteristics.

Climate change is expected to impact both supply and demand. From the demand perspective, increased summer temperatures will create more water demand for lawn irrigation, absent other changes in irrigation practices. Peak season demands could be affected strongly relative to year-round demands.

Warmer winter weather in the Green River Watershed may reduce the amount of water stored annually in snowpack. The winter surface water supply may therefore be plentiful, but flows from snowmelt could be reduced substantially during spring and summer. Based on an average of the outputs from 10 climate models, climate change is anticipated to reduce late winter and springtime (February to June) flows in the Upper Green River on the order of 10% and summertime (July to September) flows on the order of 20%, when comparing future (2040s to 2070s) conditions to historical flows. Flows in the Green River could dip more frequently to minimum flow levels that must be protected. Unless new storage capacity is created, this would reduce Tacoma Water's ability to divert surface water for municipal supply.

Figure 2.5 displays the predicted range of future Green River flows based on 10 climate change models.

Figure 2.5 Climate change effects on Green River flow



Time of Emergence

It is difficult to know whether a particular drought or other weather event was caused by climate change. Extreme weather events have always happened, and weather is quite variable. For example, some of the worst droughts in the Puget Sound region over the last 100 years occurred during the 1920s. However, climate change is expected to increase the likelihood of extreme weather.

"Time of emergence" focuses on predicting the time at which climate change emerges from the background noise of historical natural climate. It is impacted by the magnitude of projected change relative to historical variability. Ecosystems and engineered systems evolved, or were designed, to manage conditions within a historical range of variability. When conditions move significantly outside this normal range, impacts may be experienced. The concept of time of emergence is used to try to determine when, as well as where and how, climate change will force systems adaptation.

Future climate cannot be predicted precisely, so a range of plausible futures is considered to study how sensitive systems are to these changes. In general, researchers predict accelerating impacts from the early decades of the current century to the later decades. Thus, water managers must anticipate more substantial changes with the passing decades.

Port of Tacoma

Changing Water Needs of Large Industries

The Tacoma and Pierce County economy has historically included a mix of government, service sector, and industrial employment. While industrial activity has undergone major changes since the 1980s, this sector remains a healthy contributor to the region's employment base and household income.

Tacoma Water's largest single customer for decades was located in Tacoma's Tideflats area, but this customer ceased operations in late 2024. This represents a major shift in Tacoma's water demand, both spatially and in absolute terms. While there is potential for other industries to move into the Tideflats area, demands in this portion of the system will be markedly reduced for the coming years, compared to the past. Without this demand, running the groundwater wells in South Tacoma will become more challenging due to the need to convey this water to parts of the city other than the Tideflats. Yet groundwater is expected to remain an important water source for Tacoma Water, to balance climate change effects and meet long-term needs.

Tacoma Water serves a variety of other industrial facilities within Tacoma and its neighboring communities and occasionally receives inquiries from other industrial enterprises seeking to locate facilities within the Tacoma Water service area. From a long-range planning perspective, Tacoma Water seeks to maintain sufficient capacity in its supply system to allow businesses conforming to local land use requirements to locate within the service area.

The IRP addresses potential future needs for large increments of supply by monitoring the surplus quantity of water above projected demands. This is water that Tacoma Water could make available for large new users entering the regional economy. At the same time, Tacoma Water will monitor plans from existing large users and the implications that their usage poses for water supply. Large changes in industrial needs could require substantial system adjustments with associated financial implications.

Seismic Risk

Tacoma and Pierce County lie on a fault zone that has seen significant earthquakes with a return period measured in the low thousands of years. The entire coastal Northwest faces additional and more frequent risks from earthquakes along the Cascadia Subduction Zone. Tacoma Water has partnered with other water systems in King, Pierce, and Snohomish Counties to assess regional seismic risks and has also undertaken its own seismic vulnerability assessment.

While the IRP does not directly address seismic risks, the actions recommended here overlap and interact with actions the utility has taken or may take in the future to manage water supply risks to its customers and potential damage to its infrastructure from major earthquakes.

Well facility on South Tacoma Way

Groundwater

Groundwater will play an increasingly important role in Tacoma Water's supply portfolio, both in terms of mitigating climate change impacts on the Green River supply and supporting future increases in demand.

Groundwater Quantity

The majority of groundwater currently used by Tacoma Water comes from the South Tacoma Wellfield. Tacoma Water is investing significantly in the rehabilitation of these wells and those in the Gravity Pipeline (GPL) Wellfield. The current rehabilitation plan projects the total combined operational capacity of these sources increasing from the near-term level of 30 MGD to approximately 42 MGD in the 2040s and 46.8 MGD in the 2050s. Typically operated over the 5-month period of May through September, this represents a total annual amount of approximately 21,500 acre-feet in available groundwater from existing sources by 2061.

Additional improvements beyond the planned rehabilitations in the South Tacoma and GPL Wellfields could be implemented further in the future to fully utilize the approximately 36,000 acre-feet per year (afy) available in annual water rights from these two core groundwater supply areas.

As described in the Results section, the utility has additional groundwater rights associated with other wells that are currently not utilized but could be put into use to bolster its supply. In total, Tacoma Water has up to approximately 38,000 afy available in groundwater to support future needs.

Because of its importance, Tacoma Water is closely evaluating its groundwater resources and the impacts that future development may have on the recharge area contributing water to its wells. From a regional perspective, the aquifer systems that supply water to Tacoma's wells, referred to as the Central Pierce County Sole Source Aquifer (SSA) area, are large and have a high rate of recharge. There have been no significant decreases in Tacoma's groundwater levels since monitoring began in a concerted way in the 1950s. Even during drought years (like 2015) when Tacoma Water relied heavily on its wells in the summer months, aquifer levels recovered by winter, reflecting the reliability of this resource.

That said, it is critical to consider land use changes and their influence on groundwater availability. A key analytical tool in this ongoing management of groundwater is the U.S. Geological Survey (USGS) Southeast Puget Sound Groundwater Flow Model, released in 2024. Tacoma Water intends to build upon the framework of this regional model to understand the complex groundwater system that supplies its wells and evaluate a range of operational and future land use conditions to determine the optimal use of the resource into the future. Because of the large extent of the SSA recharge area (470 square miles), changes to land cover and land uses in close proximity to Tacoma's wells are not the most significant influences on recharge amounts. The City and Tacoma Water plan to increase coordination with neighboring land use jurisdictions (i.e., other cities and Pierce County) to ensure land use management practices are aligned with respect to protecting this critical resource.

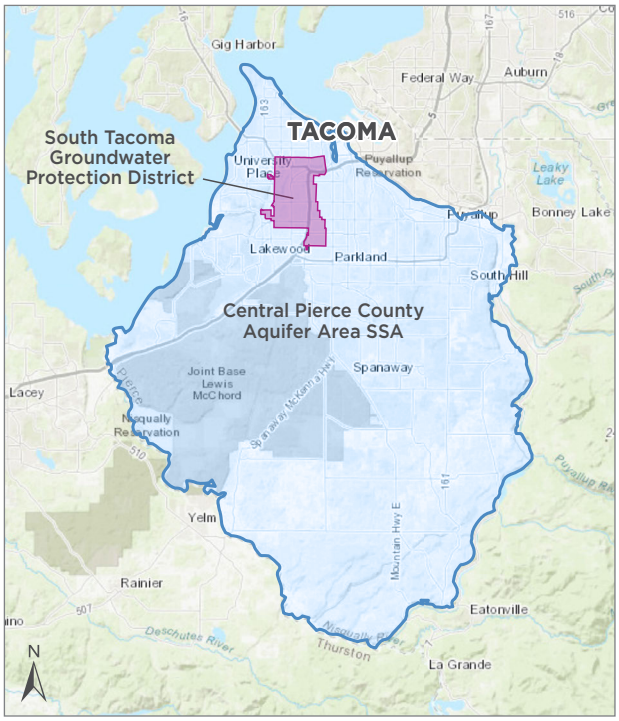
Groundwater Quality

Water quality is a key consideration in managing groundwater. Tacoma has taken a very proactive approach to groundwater quality protection, with one of the first major steps being the establishment of the South Tacoma Groundwater Protection District (STGPD) in the 1980s. The ordinance defining the STGPD declared the South Tacoma area (approximately 10 square miles in extent) to be environmentally sensitive due to the high potential for contamination of the underlying aquifer system. The ordinance, which has been updated over time, put into place land use regulations pertaining to hazardous substances, best management practices, a permitting framework for new or modified facilities, regulations pertaining to stormwater infiltration, and inspection and enforcement processes. Tacoma Water, in partnership with Tacoma Planning and Development Services, is evaluating updates to the municipal code that would build upon the protective nature of the STGPD while also maintaining compliance with the State's Critical Aquifer Recharge Area requirements. This may involve extending some of the protections of the STGPD to other areas, based on assessment of risks to the aquifers, which in turn is a function of surficial geology, groundwater flow characteristics, and coordination of activities and regulations among neighboring land use jurisdictions. The STGPD and Central Pierce County SSA are shown in Figure 2.6.

Tacoma Water also provides treatment to address known and potential groundwater quality contamination. The most prominent example of this historically is the Time Oil Superfund Site. Time Oil was a business enterprise that handled bulk oil at a site in South Tacoma for several decades during the mid-20th century. Business operations at this site left a legacy of soil and groundwater contamination, including migration of contaminated groundwater offsite, impacting a large area beneath the city. In the 1980s the U.S. Environmental Protection Agency (EPA) took over management of the site, under the Comprehensive Environmental Response, Compensation, and Liability Act commonly known as "Superfund."

The plume of contaminated groundwater originating at the Time Oil Superfund site affects aquifers underlying the South Tacoma Wellfield. Therefore, effective containment and clean-up of the Time Oil plume is in the best interest of the City of Tacoma. Tacoma currently operates an air-stripping system at its Well 12A to remove contamination from groundwater pumped from this particular well. In addition, pumping at Well 12A helps to keep the plume from spreading south to other, larger Tacoma Water production wells.

Figure 2.6 Central Pierce County Aquifer and STGPD extent



The management efforts at the Time Oil Superfund site have been very successful. The concentrations of contaminants in the groundwater have decreased by orders of magnitude compared to what they were in the 1980s. This positive result has led to regulatory oversight shifting in recent years from the EPA to Washington State. Tacoma Water is committed to continuing to optimize its treatment facilities and operational practices to best manage this part of its supply portfolio.

Tacoma Water is also focused on addressing more recently regulated contaminants. PFAS are a human-made class of chemical compounds, commonly called "forever chemicals." In response to research showing these chemicals have negative consequences for human health, the EPA has recently started to regulate the allowable quantities of these chemicals in drinking water. Tacoma Water has multiple wells which are affected by PFAS in the groundwater, as a result of legacy contamination within the groundwater recharge area. As groundwater becomes more important to the City's water supply, Tacoma Water may need to construct treatment facilities to make these wells safer to use. Planning is underway to identify the optimal, cost-effective approach for removal of PFAS to support maximum use of Tacoma's wells.

Equipment inside well 11A facility

Downtown Tacoma

Population and Economic Growth

The Puget Sound region has been growing rapidly for four decades and is expected to continue this pace of growth. The presence of leading technology-sector businesses, aerospace industries, an active U.S. military presence on Joint Base Lewis-McChord, ports supporting agricultural trade, and the region's lifestyle attractions have all contributed to growth. In addition to these, University of Washington, Tacoma remains a major employer in Tacoma.

Despite these trends, the future can never be predicted with certainty. Water planners must account for either increased growth or slower growth in the coming decades. A population growth projections based on the 2021 Pierce County Coordinated Water System Plan growth rate is shown in Figure 2.7.

Factors that may affect growth in Pierce County specifically during the coming years and decades include:

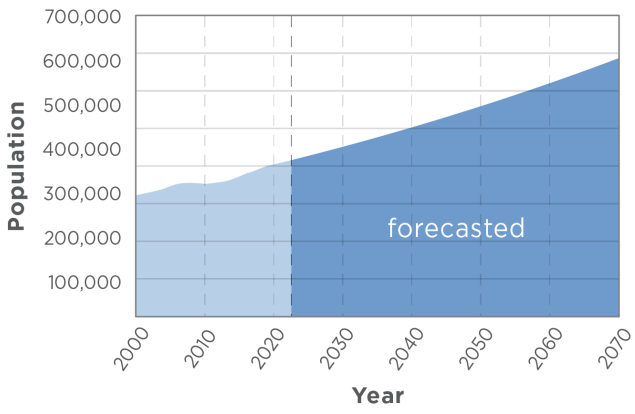
Housing affordability: Housing prices in Seattle and King County have risen rapidly, making Pierce County communities more affordable in comparison. Workers employed in King County may increasingly choose to live in Tacoma, particularly as public transport is improved, such as through planned light rail extensions connecting Tacoma to other regional metropolitan centers. Additionally, through the "Home in Tacoma" project, Tacoma's residential zoning now supports more middle housing, such as duplexes and townhomes, which will further support housing affordability in Tacoma. Suburban areas in eastern Pierce County have also been expanding their housing stock. Currently, over 9,000 residential units are expected to be developed in the next 10 years.

Business opportunities and competitiveness: Large businesses may choose to put operations or headquarters in Tacoma where property values and wage rates relative to King County can help their competitiveness. Conversely, large employers could choose to leave the region due to competitive pressures.

Joint Base Lewis-McChord (JBLM): JBLM is a large military base south of Tacoma. Due to its size and proximity, it has significant influence on the economy and population of Pierce County and adjoining counties. This includes military and civilian employees working at the base, as well as service industries, school districts, and other employers that meet the needs of JBLM employees and their families.

Future changes in the scale or nature of U.S. military operations or Pentagon redirection in the distribution of personnel across the United States could either increase or reduce the number of personnel stationed at JBLM. This would affect the population and economic activity throughout Tacoma Water's service area.

Figure 2.7 Service area population growth (2021 Pierce County Coordinated Water System Plan growth rate)



Technology

New technologies are improving water system operational efficiencies and facilitating customer water conservation. Water-efficient technology, in concert with other best management practices, has contributed to reducing total demands in utilities all over the country, even in regions experiencing rapid population growth.

The effects on water use can be measured in two ways: the quantity of water use reduction from a single action and the trend toward "saturation" of a given water-saving technology across the customer base. Water savings can be multiplied when many or most customers adopt them. However, the public's adoption of new technologies or water-saving behaviors is not automatic.

Technology for Water Utilities

Advances in water system technology have improved system monitoring, maintenance procedures, and conservation. The recent adoption of AMI is one example of Tacoma Water incorporating new technologies to allow for better water use monitoring and management.

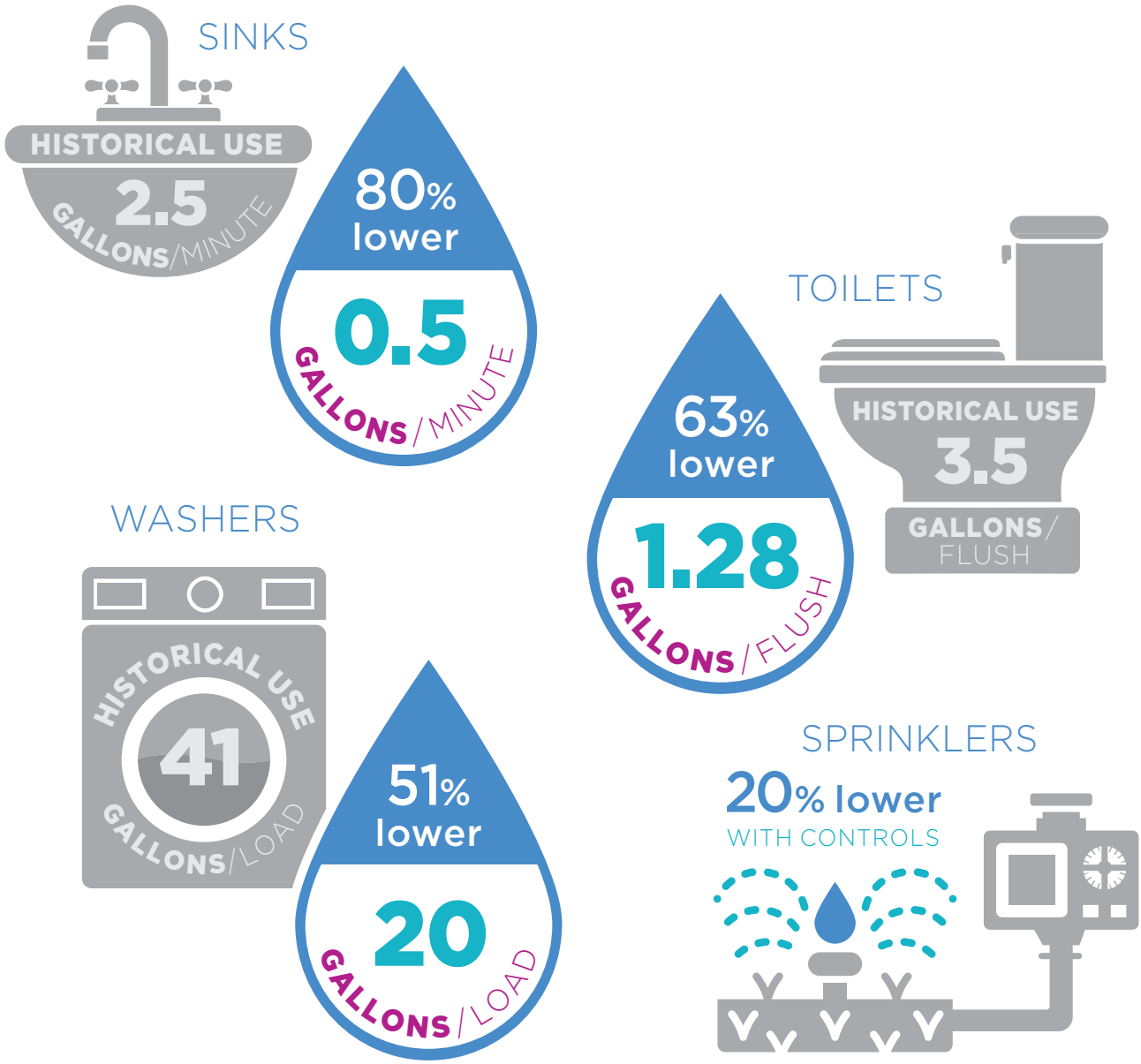
In addition, technology for finding and fixing leaks in water distribution mains and large-diameter transmission pipelines is constantly evolving. Tacoma's ongoing program to find and fix leaks is expected to continue producing water savings.

Technology for Customers

Customers can install high-efficiency water fixtures in their houses such as low flow shower heads, faucets, and toilets. Efficient fixtures have the same effectiveness as normal fixtures but use less water per minute or per flush. Fixtures are a one-time installation and provide year-round savings. During the peak season, weather sensors, soil moisture sensors, and irrigation controllers can monitor rain and soil conditions and adjust lawn watering times accordingly, to reduce water use. In addition, customers can adopt new "norms" of landscaping practice, moving away from irrigation-reliant vegetation to native plants and hardscape materials that do not require supplemental irrigation and yet look attractive year round. Tacoma Water's conservation program, described previously, financially supports customers adopting these technologies.

As available technology is implemented, new breakthroughs may occur, creating opportunities for even more conservation savings.

Advances in Water Fixture Efficiencies



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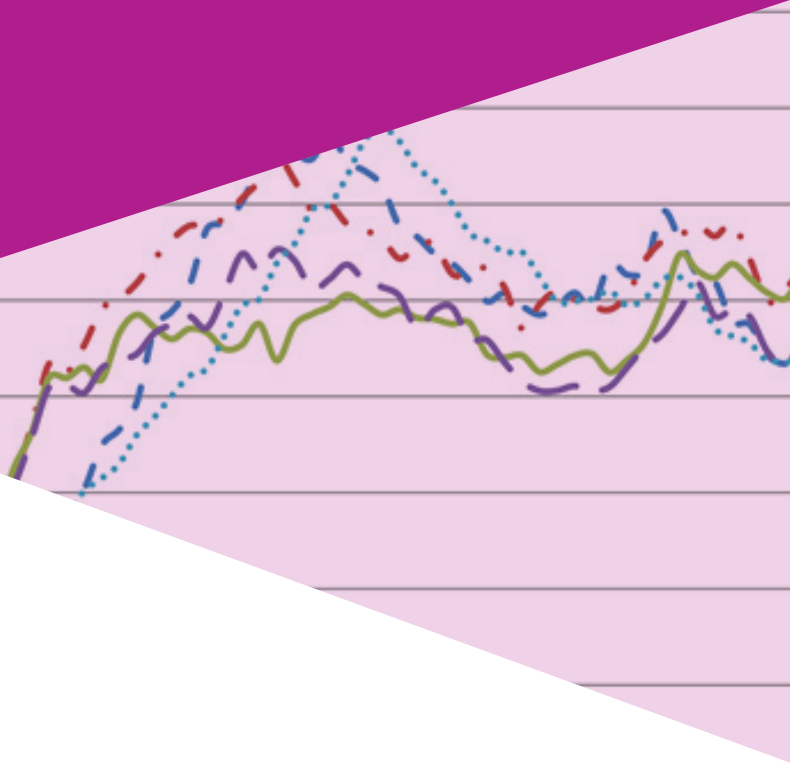


ANALYTICAL TOOLS

Forecast of Water Demand

Tacoma Water prepared a demand forecast in 2024 which examined growth patterns among different categories of water demand. This forecast is based on regressions of historical time and climate factors, and it forecasts demands out to 2070. The conversion of Tacoma's metering infrastructure to AMI allowed regressions to be specific to different account types, which enabled the demand forecast to capture factors such as the shift toward middle housing and different expected growth rates between household and commercial units.

Account types included single-family, multifamily, commercial, and fire service, among others, and differentiated between accounts inside and outside the city limits within the water service area. The projected single-family household demand is shown in Figure 3.1, based primarily on population growth rates projected for Tacoma within the 2021 Pierce County Coordinated Water System Plan.

Figure 3.2 shows the projected total customer demand, including wholesale but excluding RWSS partner demands, which are met solely through their shares of the SDWR and municipal storage. Additional wholesale demand is shown which represents a potential future contract being considered by Tacoma Water. Note that after ramping up to a peak in the early 2060s, this component of demand decreases, reflecting the nature of the contract currently being negotiated. This will provide Tacoma Water flexibility in how best to manage its supply portfolio to meet other long range water needs beyond this timeframe.

Figure 3.3 shows the retail demand projection, with historical years, based on the 2021 Pierce County Coordinated Water System Plan growth rates. Figure 3.4 shows the seasonal demand curve, averaged from 2000 to 2021.

Tacoma Water's demand forecast incorporates assumptions about the future application of water conservation programming based on the 2016 Residential End Uses of Water Report from the Water Research Foundation. As a result, per-account demands are forecasted to continue decreasing due to conservation; however, the demand model shows these effects to be less significant than increases attributed to climate change toward the latter half of the analysis period.

Figure 3.1 Single family demand

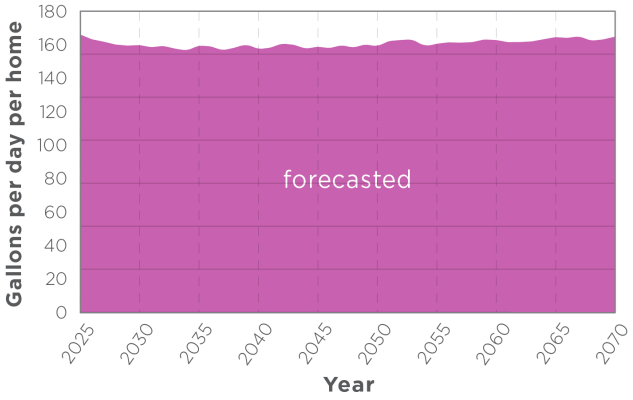


Figure 3.2 Total customer demand

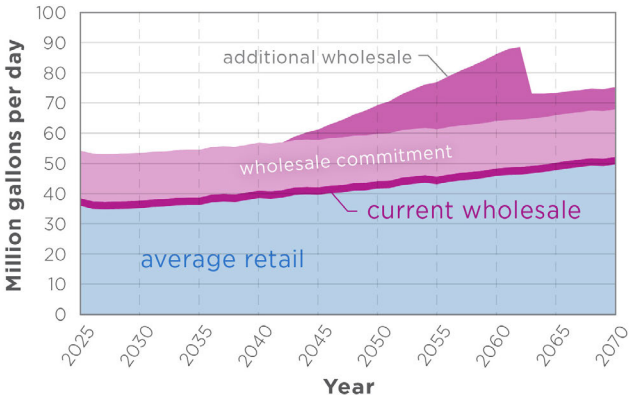


Figure 3.3 Total retail demand

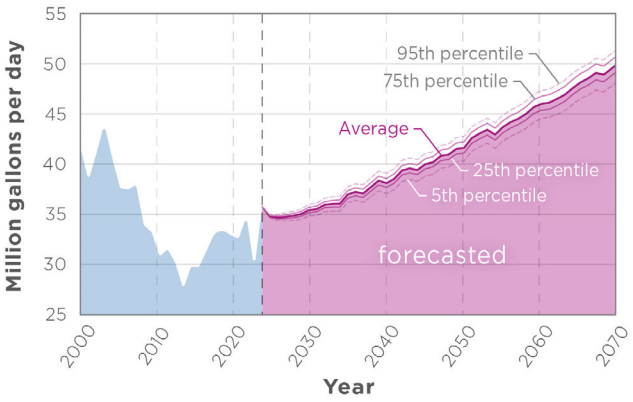
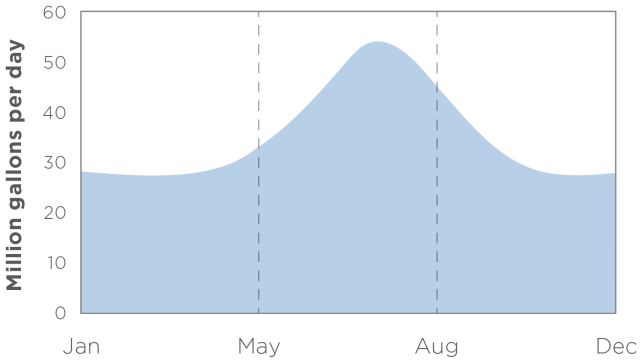


Figure 3.4 Seasonal water demand (2000-2021 average)



Climate Models

Climate scientists have developed complex global circulation models of Earth's climate systems, which have been combined with assumptions about the impacts of future human activity on greenhouse gas production to simulate future worldwide temperatures and precipitation. Global climate model results can be downscaled and applied to a watershed hydrology model to predict future weather and streamflow conditions for a range of climate scenarios.

Tacoma Water considered multiple global circulation models described in the fifth phase of the Coupled Model Intercomparison Project (CMIP5), an assessment of world climate projections by the Intergovernmental Panel on Climate Change.

Through guidance from climate experts, Tacoma Water considered 10 climate change models that represent a range of future precipitation and temperature conditions. All global circulation models considered used the Representative Concentration Pathway (RCP) 8.5 greenhouse gas emission pattern, which assumes emission rates continuing to follow recent trends through the end of the 21st century and is the high end of greenhouse gas emission scenarios in CMIP5.

SCENARIO	SURFACE WATER	GROUND-WATER
Historical/ Pre-Climate Change	**89%**	**11%**
Future/ Climate Change*	**80%**	**20%**

* Average of all climate scenarios

Table 3.1 Average water supply provided by surface water and groundwater sources

Tacoma Water's approach is in line with similar efforts by USACE, Cascade Water Alliance, and Tacoma Power, which have recently conducted similar analyses for their systems and were consulted in development of this IRP.

The University of Washington Climate Impacts Group, in conjunction with King County, developed a set of downscaled climate-impacted hydrologic data for the Green River Watershed, based on the different climate scenarios. This data is used to inform the demand forecast and future source water availability in WYSDM. The shift toward more water being provided from groundwater and less from surface water sources under these climate scenarios is depicted in Table 3.1.

Eagle Gorge Reservoir at low water level

Planning Scenarios

Planning scenarios consolidate and quantify speculations about future changes. This opens the door for modeling and informed decision-making. For the IRP, Tacoma Water developed a range of potential future conditions which could affect future water needs.

Three factors were considered which could impact future water supply and demand:

- Rates of population growth and economic development
- Technological changes and levels of customer participation in water conservation programs
- The severity of changes in western Washington's climate

To address this range of uncertainty in development of this IRP, Tacoma Water ran WYSDM for 10 different climate models, representing a range of potential future climate conditions. For each climate model, 100 distinct retail water demand conditions were developed with a normal sampling of potential population growth and conservation targets based on recent data.

The following assumptions went into the retail demand calculations:

- Population will grow at the rate developed in the 2024 demand forecast, sampled around 0.85% growth per year. The growth rate is consistent with Pierce County's 2021 Coordinated Water System Plan and gives a modest population increase.
- Conservation will reduce water demand by a set percentage target, sampled around 15% of water consumption, by 2081, with most savings happening in the near future and tapering out toward the latter half of the century.
- Large commercial customer demands will be constant throughout the analysis period.

From the 100 demand forecasts developed for each climate model, the 5th, 25th, 50th (average), 75th, and 95th percentiles were calculated to be run in WYSDM and combined with supply projections under the distinct climate futures.

In addition to the retail water demands, these demand components were included with the following assumptions:

- Existing wholesale customers will use their full contracted demands. Demands associated with new wholesale customers are assumed to begin by the mid-2040s and increase to a peak by the early 2060s.
- The RWSS partner demands will remain at the current levels into the future, as no significant changes were identified through discussions with them during the IRP update process.

By including this range of future conditions in the analysis, which totals 50 distinct WYSDM runs (10 climate scenarios and 5 retail population scenarios), many different future conditions are encompassed. Some of these conditions are statistically more likely than others, but inclusion of this full set of conditions allows Tacoma Water to be aware of more severe scenarios which could create stress in the system. In the coming years, as more population, conservation, and climate data becomes available, Tacoma Water can look at the range of scenarios and see which ones the utility is trending towards and can then plan more specifically for those conditions.

Tacoma's groundwater resources play an important role in the utility's ability to meet future needs. This analysis assumes the existing groundwater wellfields will continue to undergo rehabilitation over time, as discussed in Section 2. While the specific rehabilitation schedule is subject to change, planning scenarios assumed reliable yields of 30 MGD in the short-term, then increasing to approximately 42 MGD by the 2040s, and 46.8 MGD after 2050. These values reflect maximizing the use of existing South Tacoma and GPL Wellfield infrastructure. Details regarding the nature of well improvements (e.g., their timing and costs) will be determined in tactical planning efforts like the Wells Master Plan. Such plans will also incorporate the direction for additional groundwater treatment, as informed by the South Tacoma Wellfield PFAS Treatment Evaluation.

While WYSDM is capable of exploring demand and supply scenarios through the 2070s, the years 2041 and 2061 were selected as the focus for this analysis. Future wholesale demand, and therefore overall demand on the system, is expected to peak in 2061, driving the selection of this year for the long-range analysis. Year 2041 was selected as an intermediate time period, 20 years prior to 2061 and before additional wholesale deliveries are assumed to occur.

Tacoma waterfront

RESOURCE ADEQUACY STANDARD

Water sources and system will be sufficient to meet demands such that mandatory curtailments will occur not more than once in 25 years, as a long-term average.

Resource Adequacy Standard

During development of the 2018 IRP, Tacoma Water developed a Resource Adequacy Standard (RAS). Through discussions with the PAC, the RAS was retained for use in this IRP update. The RAS is a basis for determining whether water supplies will remain sufficient to meet service area demands, including annual variations and future growth and development.

The RAS is a fixed measure of system performance that can be applied over a range of natural hydrologic conditions, assumptions on growth rates, and improvements to the supply system. The WYSDM tool described later in this section provides a means for testing Tacoma Water's supply system against the standard.

In the event the standard cannot be met, there are a range of possible measures that could be taken. These include demand-side measures to hold demand within supply limits, operational changes in how stored water is managed, and/or capital projects to add new supplies or increase storage capacity. All of these responses are considered in this IRP.

The RAS recognizes that occasional curtailment of water use is one of the standard responses available within the community's "toolkit" for managing droughts. This is more practical and cost-effective than building a system that would be immune to any possibility of water shortage.

Water Yield, Supply, and Demand Model

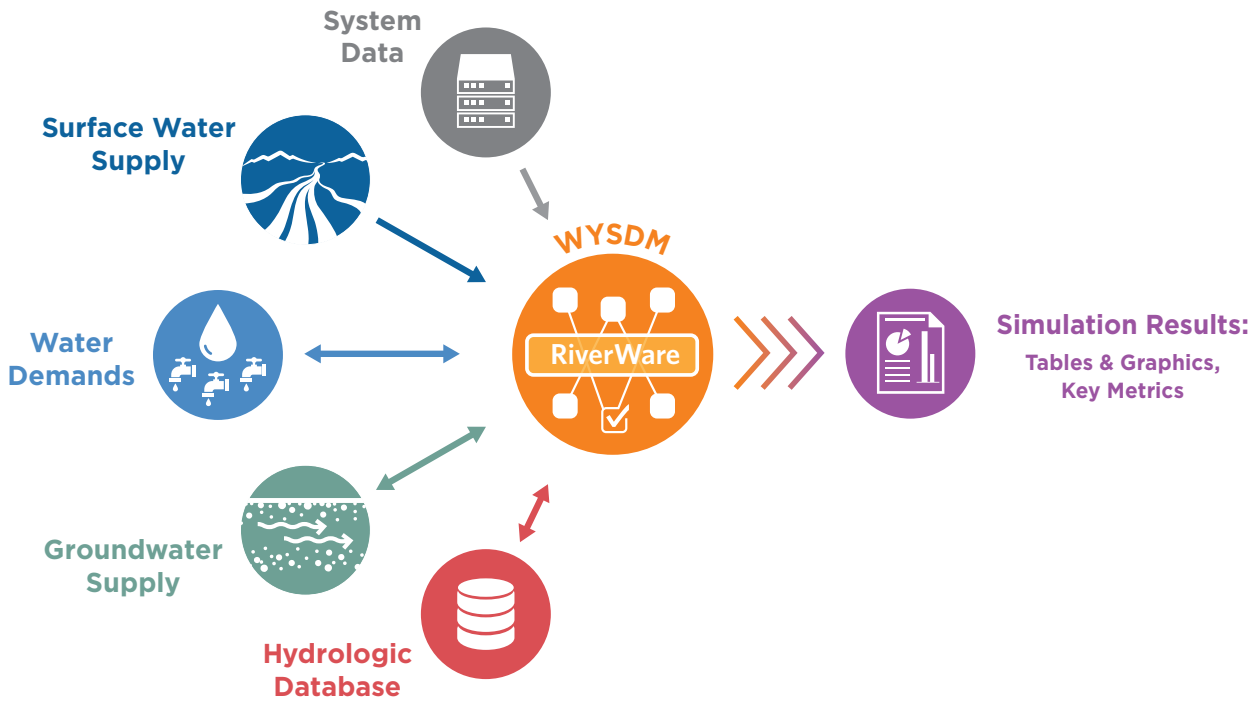
Tacoma Water developed a computer model called the Water Yield, Supply, and Demand Model as the primary tool for analyzing reliability of the water supply system. WYSDM allows Tacoma Water to evaluate water supply reliability under a wide range of conditions, predict the effects of future operations on supply reliability, and test ways to improve reliability. The modeling software enables Tacoma Water to make refinements and adjustments over time, as water supply, demands, and other conditions change.

WYSDM simulates key physical and operational features of the Tacoma Water system to estimate the ability to meet demands on the system. These include:

Physical features: Physical components of the system include Eagle Gorge Reservoir (the seasonally impounded lake behind Howard Hanson Dam), local inflows upstream of the Auburn gage, Tacoma's various wells, the Green River Filtration Facility, and major water transmission pipelines (see Figures 1.1 and 1.2). Delivery points to wholesale customers and RWSS partners are included. The model also includes additional water supplies of Eagle Lake (a natural lake in the Upper Green River Watershed), internal covered reservoirs, and the Lakehaven intertie. Hydrologic and climate characteristics are also represented in the model.

Operational features: Operational features are modeled to represent how water is stored, diverted, and transferred to Tacoma Water's retail and wholesale customers or RWSS partners. Operational components include the legal framework under which Tacoma Water operates including water rights, Howard Hanson Dam operational constraints, and required stream flows in the Green River under the agreements described previously.

Water demand: The model includes representations of demand based on output from Tacoma Water's econometric demand model.



WYSDM Water Source Assumptions

As part of this 2025 IRP update, several updates were made in WYSDM to reflect water management changes that have occurred in recent years or will occur in the near future. The primary changes made are outlined below.

Green River

Tacoma Water's Green River water supply is constrained by the FDWR and SDWR, which are available based on minimum flow requirements along the river, detailed in Water Supply Sources and integrated into WYSDM.

Eagle Gorge

Under the SDWR, Tacoma can store water in Eagle Gorge Reservoir for later use. This water availability is further influenced by:

- **Additional Water Storage Project Phase 1, Fish Passage Facility (i.e., completion of AWSP Phase 1)**

  In the past, Tacoma and the RWSS partners voluntarily donated up to half (a maximum of 10,000 afy) of their stored Eagle Gorge water for fish habitat purposes. To complete AWSP Phase 1, downstream fish passage facilities will be built at Howard Hanson Dam, allowing Tacoma Water and the RWSS partners to use their full municipal storage of 20,000 afy. This is expected to be operational in early 2031, and WYSDM incorporates these assumptions for planning years 2041 and 2061.

- **Forecast-informed Reservoir Operations (FIRO)**

  Historically, USACE was only able to rely on historical probabilities when transitioning from winter flood management to conservation filling of the reservoir. Under potential FIRO improvements, USACE could use weather forecasts to inform their water management decisions, creating a greater chance of Tacoma's portion of the reservoir water right being filled by enabling USACE to fill the reservoir earlier in the year. This is anticipated to take effect in the late 2020s or early 2030s. WYSDM assumes FIRO will allow filling of the reservoir considerably earlier than existing conditions and applies these assumptions for planning years 2041 and 2061.

Groundwater wells

WYSDM assumes total combined operational well capacity for the South Tacoma and GPL Wellfields ramps up from a near-term level of 30 MGD to approximately 42 MGD by 2041 and 46.8 MGD by 2061. Typically operated during the 5-month period of May through September, the total annual volume of groundwater available from existing sources in 2061 is assumed to be approximately 21,500 acre-feet.

Eagle Lake

In addition to Eagle Gorge Reservoir, Tacoma Water maintains Eagle Lake which serves as an emergency water source. Water can be extracted from Eagle Lake under the FDWR at 100 cfs when Eagle Gorge storage is less than 1,300 acre-feet. WYSDM assumes 2,500 acre-feet in total is available from this supply source each year.

Internal covered storage

After Green River, Eagle Gorge, groundwater, and Eagle Lake water supplies are exhausted, WYSDM assumes 30 million gallons of water are available from internal covered storage facilities, not restricted by use rate. This will help with short duration, high peak water use.

Lakehaven Intertie

After Green River, Eagle Gorge, groundwater, Eagle Lake, and internal storage supply sources are exhausted, WYSDM assumes 3 MGD of water is available from an intertie with the Lakehaven Water and Sewer District, contingent on contractual requirements or constraints.

Curtailments

On the rare occasion when a supply shortage is anticipated in WYSDM, demand reduction curtailments are applied throughout the year at levels varying by month and peaking in summer. In the model, mandatory curtailments are assumed to provide up to a 30% reduction in demand in July and taper off to 0% through the winter months. Voluntary curtailments are assumed to reduce demands one-third as much.

Modeling Uncertainty

Tacoma Water and many other water purveyors have historically used deterministic models (without statistical variation in supply or demand characteristics over time) to inform management decisions. Deterministic modeling is useful in generating information about specific supply or demand predictions. For example, it can be used to test system performance against a specific, worst-case scenario.

However, system variables that control supply and demand, such as rainfall, streamflow, and wholesale customer demand, are uncertain and vary. There are a range of possibilities each system variable may exhibit year-to-year, and not all possibilities are equally likely to occur. Therefore, WSDYM allows the water supply system to be tested under a wide range of conditions. The model can be run deterministically, but also provides options for statistical analysis of variable conditions.

WYSDM's database includes approximately 100 years of historical streamflow and meteorology data, from years 1914 to 2024. For future conditions, 10 climate change models provide runoff and temperatures for years 2010 to 2070. These 10 scenarios encompass hotter and drier conditions, shifted winter flows, and hotter and wetter conditions. In this IRP, all climate scenarios were run in WYSDM to represent the range of uncertainty until emerging trends point to a more specific future. Coupling each climate model with a range of future retail water demand provides guidance on understanding system vulnerabilities.

Green River

Uses of WYSDM

WYSDM is a flexible tool that can be used in two distinct modes to answer questions about long-term capacity or short-term management options.

Long-term capacity planning: WYSDM can use scenarios to examine how changes in future decades could alter the balance between water supply and customer demand. Scenario simulations help to identify conditions under which the RAS may not be met and point toward the need for additional supply, reduced demand, or changes in operational practices. Scenario runs can also help to quantify the magnitude of shortages and the approximate timeline for when shortages might begin occurring. With this information in hand, Tacoma Water can make better-informed plans for the future.

Short-term management options: WYSDM can also be used within a single year to monitor system performance and explore the effects of operational decisions made from month to month (or day to day). Tacoma Water's analysts can input current system conditions and simulate end-of-year outcomes based on a range of climate conditions that have occurred in past years or ensemble forecasts provided by the National Weather Service's River Forecast Center. The user can also test different operational decisions and select the ones with the best outcomes. This will allow water shortage responses to be better informed and quantified and avoid excess focus on unlikely combinations of conditions.

Firm Yield

Water systems commonly use "firm yield" to measure the water demand they can meet with high reliability. For this IRP, firm yield is defined as the maximum water demand that can be met with 95% confidence from the existing Green River supply and groundwater production facilities, such that mandatory curtailment of customer consumption would not be needed more than once every 25 years on average. Tacoma Water's firm yield for climate scenarios up through 2070 ranges from 108 to 159 MGD, depending on climate scenario,

Green River filtration facility

with an average value of 128 MGD. This includes water available for Tacoma Water's direct retail customers, wholesale customers, and RWSS partners. This firm yield value is larger than that depicted in the 2018 IRP (107 MGD), reflecting recent and expected future changes to management of the Green River supply through completion of AWSP Phase 1 (which allows Tacoma and its partners to fully utilize their municipal storage, through implementation of the associated fish passage facility) and FIRO (which allows reservoir filling to begin earlier in the year than it has in the past).

Application to the Integrated Resource Plan

To develop this IRP, Tacoma Water simulated a range of scenarios described previously and tested whether current facilities would be sufficient to meet the RAS. Tacoma Water then used WYSDM to assess how different projects or programs would perform to overcome any deficiencies. The simulation results are presented in the following section.

4

RESULTS, CONCLUSIONS, AND PATH FORWARD

Resource Performance

Tacoma Water used outputs from WYSDM to assess system reliability and to examine the effects of alternative supply solutions on reliability in the future.

Selected model outputs pertinent to the IRP include:

- Number of voluntary curtailments expected in any 25-year period
- Number of mandatory curtailments expected in that time frame (values of once in 25 years or less achieve the RAS)

The range of planning scenarios described previously were run through the model using demand and climate change patterns expected by 2041 and 2061. These use the baseline supplies outlined in WYSDM Water Source Assumptions. Figures 4.1 and 4.2 show the WYSDM results for the 50 scenario runs for 2041 and 2061, respectively. Each climate model's five demand scenarios are plotted as a clustered set of boxes based on the climate model's local precipitation and temperature change relative to historical. The climate models toward the upper left of the graph represent hotter climate scenarios with modest precipitation increases, while models toward the bottom right represent wetter scenarios with a less significant temperature increase. Retail water demand scenarios for each climate model are arranged from lowest to highest, from left to right (5th, 25th, 50th, 75th, and 95th percentiles). Boxes marked as exceedances represent runs where there was more than one mandatory curtailment per 25 years, exceeding the RAS, while remaining boxes represent RAS passes.

The scenarios circled in black in Figure 4.2 were selected as representative for different possible futures, detailed below:

- The Least Stressed model run represents a relatively cool and wet climate future with less retail demand growth.
- The Most Likely run is a middle-of-the-road climate scenario with average demand growth.
- The Seasonally Stressed scenario represents a climate future with seasonal shifts in rainfall which trigger summer supply shortages with average retail demand growth.
- The Most Stressed model run has a relatively hot and dry climate future with high retail demand growth.

Figure 4.1 RAS performance under potential climate futures in 2041

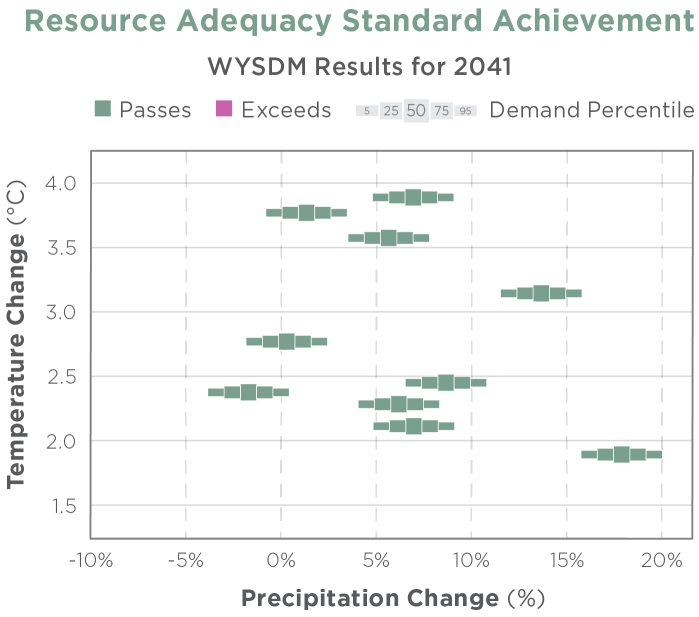
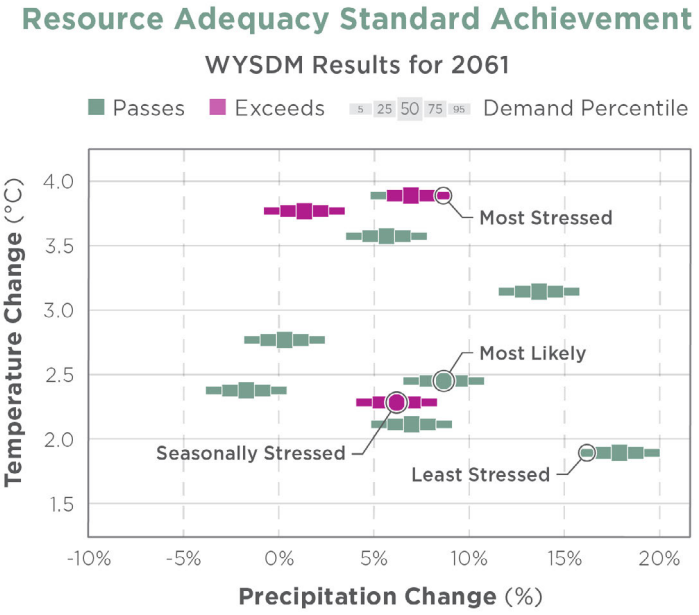


Figure 4.2 RAS performance under potential climate futures in 2061



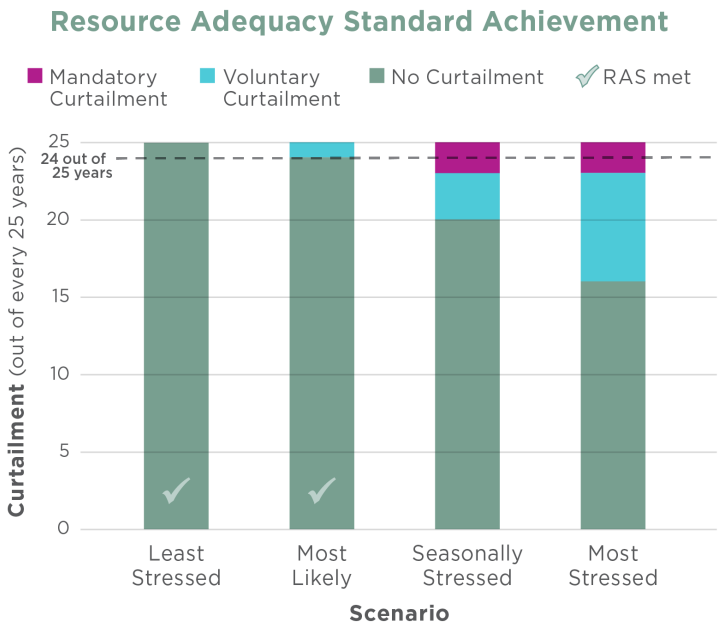
These four scenarios are shown with more detail in Figure 4.3 and Table 4.1 for 2061. The results indicate that in 2041, water resources will be adequate in all scenarios run in this analysis; therefore, 2041 results are not depicted further.

The results indicate that in 2041, water resources will be adequate in all scenarios run in this analysis.

Figure 4.3 illustrates the relative proportions of years with no curtailment, voluntary curtailment, and mandatory curtailment. Voluntary curtailment is implemented in years with minor water shortages, while mandatory curtailment is implemented in years with significant shortages. The dashed line at 24 years represents a long-term average of 24 out of 25 years (i.e., 96% of the time). Mandatory curtailments occurring less than once in 25 years remain above that line, indicating the RAS is achieved. Mandatory curtailments occurring more than once in 25 years extend below the line and indicate the RAS is not achieved. Voluntary curtailments are shown for information but do not affect the RAS. However, if voluntary curtailments occur too frequently, they could cause customers to become dissatisfied or become ineffective at reducing demand. Table 4.1 summarizes the relevant WYSDM outputs for the four representative scenarios.

In 2061, water resources will be adequate in all but the most stressed conditions. RAS exceedances in 2061 are confined to the hottest and driest climate scenarios and one intermediate climate model, which experiences a strong seasonal shift in precipitation, resulting in drier summers and creating water supply shortages. Uncertainty in future climate conditions drives variations in RAS passes and exceedances more so than differences in retail demand scenarios, with the majority of retail demand scenarios having the same RAS outcome for each climate model.

Figure 4.3 Potential for exceedance of the RAS in select scenarios in 2061



	Least Stressed	Most Likely	Seasonally Stressed	Most Stressed
Number of voluntary curtailments (out of 25 years)	0	1	3	7
Number of mandatory curtailments (out of 25 years)	0	0	2	2
Is the RAS met?	Yes	Yes	No	No

Number of curtailments represents the long-term average, standardized to the expected frequency in any 25-year period.

Table 4.1 2061 WYSDM outputs for select scenarios in 2061

Unutilized Water

Tacoma Water's water rights are infrequently used to their full allowance. For example, a large quantity of winter flows are not utilized due to lower winter demands. During flood control operations at Howard Hanson Dam, the reservoir pool is kept low so that if large storms occur, the reservoir can be filled up to minimize flood conditions downstream. While the pool level is held down, water cannot be stored for later use. This is referred to as "unutilized water."

Quantity and timing of unutilized water provides insight into which water supply improvements will be most valuable. The model suggests most curtailments result from lack of storage in the later summer months. Supply solutions that allow for water to remain in storage, or increase the total volume of storage that can be reliably filled, are most likely to improve Tacoma Water's long-term water security.

Alternatives Evaluated

In developing the IRP, Tacoma Water considered a range of alternative solutions that could contribute to future reliability of the water system if needed.

Alternatives can be grouped in six categories:

- Groundwater Supplies
- Surface Water Supplies
- Storage Facilities
- Interties with Other Systems
- Demand Reduction
- Reclaimed Water

Projects within each category were compiled from prior regional studies conducted by the Water Supply Forum, as well as Tacoma Water's own planning documents. From an initial list of 33 distinct options, Tacoma Water selected five options for detailed analysis using WYSDM during development of the 2018 IRP. Factors considered in narrowing the list of alternatives included whether they are already on track for development, the magnitude of expected supply benefits and costs, the expected complexity of implementation, and the degree to which they will contribute to resiliency against drought and climate change. Since the last IRP was developed, the AWSP Phase 1, fish passage facility is well underway, scheduled to be completed in 2030, and is being included in all WYSDM runs. Therefore, it has been removed as an alternative in this iteration of the IRP.

Tacoma Water crew

Alternatives

Develop Expanded Groundwater

Tacoma Water does not currently make full use of its groundwater rights. As described earlier, plans are already in place to rehabilitate existing well facilities in the South Tacoma and GPL Wellfields, increasing combined operational capacity of these sources to 46.8 MGD by 2061. Typically operated over a 5-month period (May through September) this translates to a total annual supply of approximately 21,500 acre-feet. Under this alternative, additional improvements (beyond the current rehabilitation plans) are implemented at the South Tacoma and GPL Wellfields such that the full water rights associated with these core groundwater supplies (approximately 36,000 acre-feet annually) may be utilized.

Increased pumping of groundwater during the spring and early summer would improve the utility's ability to hold surface water in Eagle Gorge Reservoir into the late summer and fall. The specific approach to maximizing use of these groundwater rights (i.e., which existing wells might be modified versus where new wells might be developed, and on what schedule) will be determined as part of future tactical planning efforts, such as through an update to the Tacoma Water Wells Master Plan. If needed, Tacoma Water also has an additional approximately 2,000 acre-feet in annual water rights associated with other wells located throughout the city that would require additional investment to be used, but which could be brought online if deemed necessary to help bolster supply reliability.

OASIS

The Lakehaven Water and Sewer District is developing an aquifer storage and recovery program named "Optimizing Aquifer Storage for Increased Supply" or OASIS. During periods of high flows in the winter, Lakehaven plans to divert water from the Green River and pump it into an aquifer below the district. Some of this water could be available to Tacoma Water in the summer to use as an alternative supply, allowing more water to remain in storage in Eagle Gorge Reservoir to satisfy demands in late summer.

Additional Water Storage Project

Phase 2

(Reservoir Pool Raise)

Following AWSP Phase 1, further permitting and negotiation of AWSP Phase 2 can begin. Phase 2 would raise the pool elevation of Eagle Gorge Reservoir by 10 feet, increasing storage capacity by 12,000 acre-feet. Of this, 9,600 acre-feet would be reserved to support streamflow at times to be determined by tribal and resource agencies, and the remaining 2,400 acre-feet would become available to Tacoma Water and its RWSS partners. Various issues such as shoreline protection mitigation measures would need to be resolved as part of Phase 2.

Aggressive Peak Shaving

During hot, dry periods in the summer, residents and businesses use substantial amounts of water for landscape irrigation. This creates a "peak" in demand that must be met with increased supply. The summer peak in demand coincides with seasonal conditions when less rain is falling and natural streamflow declines. Moreover, while rainfall typically increases again in the fall in western Washington, the date of renewed rainfall can vary from September to December in any given year.

Tacoma Water modeled a scenario in which the normal peaking pattern of water demand is reduced by 25%. This generates a more modest peak and decreased annual water demand. This demand pattern could allow for water to remain in storage into the late summer. However, it would require substantial changes in customer behavior through modifications to turf and landscape design, permanent reductions in residential and commercial irrigation uses within the water service area, and changes in the rate structure.

Model Results for the Alternatives

Results from WYSDM simulations indicate that each alternative would improve water supply availability and help Tacoma Water achieve the RAS even under the stressed scenarios in 2061. These results focus on the Most Stressed and Seasonally Stressed scenarios because these scenarios did not achieve the RAS in the pre-solution runs. Figure 4.4, similar to Figure 4.2, shows RAS results for all scenario runs under the alternative solutions in 2061. Figure 4.5, similar to Figure 4.3, illustrates the relative numbers of years with curtailment and shows whether the RAS is met in the Most Stressed and Seasonally Stressed scenarios. Table 4.2 also summarizes this information. The results for the baseline supplies outlined in WYSDM Water Source Assumptions in Section 3 are included for reference.

The results for 2061 show:

- Development of expanded groundwater supply would result in no RAS exceedances.
- Aggressive peak shaving would allow for RAS achievement in the Most Stressed scenario with rare voluntary curtailments but would not significantly change curtailment in the Seasonally Stressed scenario.
- The OASIS project would allow for RAS achievement in the Most Stressed scenario but would not significantly impact the Seasonally Stressed scenario or voluntary curtailment frequency.
- AWSP Phase 2 was not found to impact the frequency of mandatory or voluntary curtailments, likely because years with curtailments are typically limited by their ability to fill the available storage rather than the storage capacity itself.

These solutions were tested in isolation and no additive benefits were modeled. If several of these alternatives were implemented together, the outcome would likely be better than any individual solution implemented on its own.

Figure 4.4 RAS performance of alternatives under potential climate futures in 2061

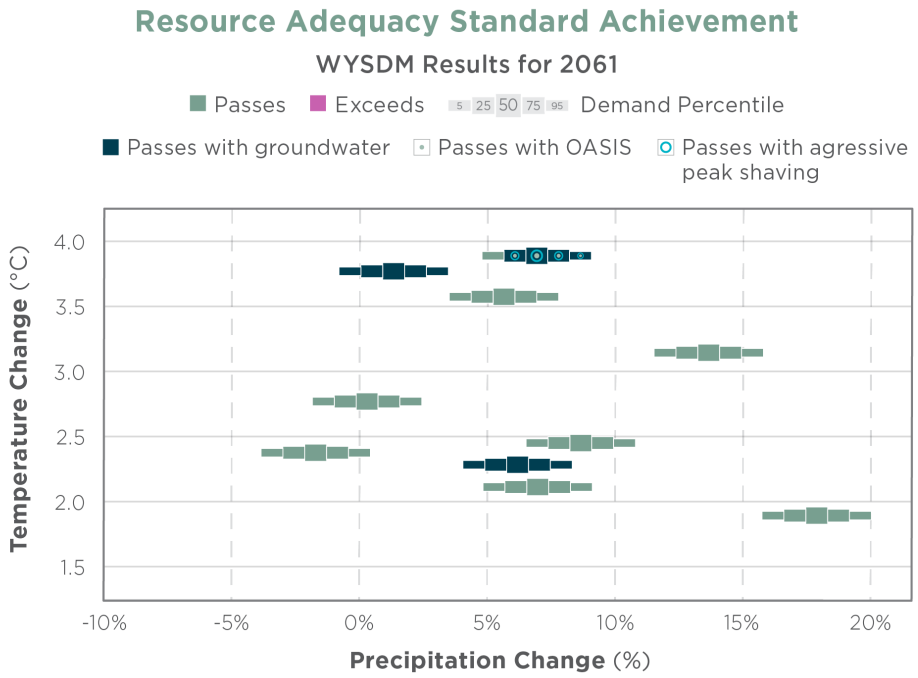
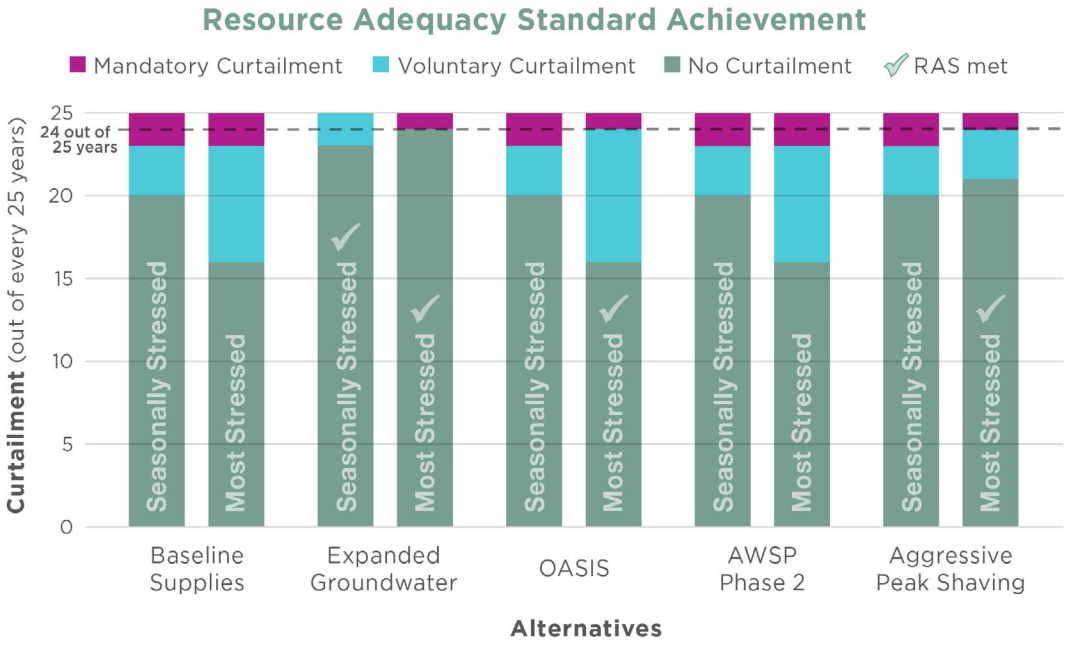


Figure 4.5 Potential for exceedance of the RAS for alternatives in the stressed scenarios in 2061



Green River

	Baseline Supplies	Expanded Groundwater	OASIS	AWSP Phase 2	Aggressive Peak Shaving
Seasonally Stressed					
Number of voluntary curtailments (out of 25 years)	3	2	3	3	3
Number of mandatory curtailments (out of 25 years)	2	0	2	2	2
Is the RAS met?	No	Yes	No	No	No
Most Stressed					
Number of voluntary curtailments (out of 25 years)	7	0	8	7	3
Number of mandatory curtailments (out of 25 years)	2	1	1	2	1
Is the RAS met?	No	Yes	Yes	No	Yes

Table 4.2 WYSDM outputs for resource alternatives in the stressed scenarios in 2061

Downtown Tacoma

Resource Strategy and Action Plan

Analysis of Tacoma Water's supply system using WYSDM demonstrates that the system has ample water to meet customer needs under normal conditions. It takes a record drought, such as the one in 2015, to put substantial stress on the system. Furthermore, Tacoma Water meets the RAS in all scenarios in 2041. Expanding Tacoma Water's groundwater supply to fully utilize the South Tacoma and GPL Wellfields' annual water rights would enable Tacoma Water to meet the RAS through 2061, even in the stressed scenarios and very high assumed wholesale demand. OASIS and aggressive peak shaving implementation would also help Tacoma Water achieve the RAS under the Most Stressed scenario. Although not specifically analyzed, implementation of multiple future supply alternatives in combination would provide even better reliability in meeting the RAS. These combinations will be explored in future IRP updates.

Water Shortage Response Plan

Although it will only need to be used on rare occasion, Tacoma Water maintains a Water Shortage Response Plan, which was updated in 2018 in conjunction with the development of the prior IRP. The Water Shortage Response Plan includes specific actions the utility and its customers can take to reduce demands during droughts or other water supply shortages. This provides policy and the operational guidance for applying water use curtailment as a normal part of Tacoma Water's management practices. Employing curtailment at intervals that are acceptable to the public per the RAS helps to control the overall cost of supplying water, and helps to protect the Green River's aquatic ecosystem during dry years.

Currently, Tacoma Water's Water Shortage Response Plan outlines voluntary and mandatory demand curtailment levels for water shortage conditions. AMI could potentially inform an update to these levels by allowing for variable pricing based on usage tier or peak usage hours.

Additional Water Storage Project

Tacoma Water and USACE are actively working to complete AWSP Phase 1, fish passage facility. The RWSS partners will receive the 10,000 acre-feet potentially available when this phase of the AWSP has been completed.

Expand Groundwater Supply

WYSDM outputs show that development of expanded groundwater supply from the South Tacoma and GPL Wellfields (Tacoma Water's core groundwater sources) could significantly improve supply reliability. Tacoma Water owns groundwater rights for these wellfields that are not being fully utilized, and the various aquifers the wells pull from have enough capacity and annual recharge to supply their full groundwater right of approximately 36,000 afy.

Multiple projects could improve Tacoma Water's groundwater supply, including well rehabilitation, installation of pumps with larger capacity, and drilling new wells at strategic locations. Tacoma Water needs to conduct more evaluations, including completing the South Tacoma Wellfield PFAS Treatment Evaluation, before deciding which groundwater developments would be most beneficial. These decisions will interact with parallel efforts regarding water treatment for PFAS and corrosion control, seismic resiliency, and the overall costs of development.

Aggressive Peak Shaving

The WYSDM results in Figures 4.4 and 4.5, as well as Table 4.2, indicate that imposing aggressive peak shaving would reduce mandatory and voluntary curtailment frequency in the Most Stressed scenario. An aggressive peak shaving approach would require extensive coordination with Tacoma Water's customers through the existing conservation program and/or significant changes to the rate structure. To achieve the level of peak shaving assumed in this alternative, the conservation program would need to increasingly promote water conservation approaches such as low- or no-irrigation landscape designs or allowing grass to go dormant through the summer. This approach has not been employed much in the Pacific Northwest but is being increasingly used in more water-constrained areas in the country and world.

With respect to its retail water rate structure, Tacoma Water has a larger fixed fee component and smaller variable fee based on water consumption. Modifying this structure such that the consumption-based component comprises a larger portion of a customer's cost would encourage more water conservation by increasing customer awareness of their water usage and directly tying this to their water bill.

Action Plan

In the near term, Tacoma Water will undertake improvements to enable its existing groundwater supplies to provide optimal production and reliability. Over the longer term, the groundwater improvements will be coupled with more aggressive peak shaving strategies to achieve multiple benefits. The basis for this approach includes:

- The proposed groundwater system improvements can use existing water rights and leverage existing facilities. Changes to the groundwater system can be carried out in phases to match changing conditions, enabling costs to be spread over time.
- Improvement of groundwater supplies offers significant benefits for seismic resiliency in addition to drought resiliency.
- The utility adopted a conservation goal that targets peak season water-use reductions.
- In the near term, customers have an expectation that they will be able to irrigate their existing landscapes. Transitioning to a reduced peak demand may involve costs to replace existing turf and other landscape materials. This can be achieved best using a planned approach over time, in collaboration with customers and the communities Tacoma Water serves.

In addition, Tacoma Water will advance the other future supply alternatives discussed in this IRP through the following:

- Lobbying the federal government at the appropriate time to implement the AWSP Phase 2 project.
- Coordinating with Lakehaven Water and Sewer District, and other regional partners, in future planning and implementation efforts related to OASIS.

The resource landscape will change in the future. Tacoma Water plans to revisit the IRP process periodically to ensure it is always using the most relevant information for long-term planning and keep a regular schedule for updating next steps to maintain resource adequacy.

Cost Considerations

Costs of supply alternatives will be weighed carefully in applying this resource strategy. As a next step, Tacoma Water will evaluate a range of alternatives for augmenting its groundwater production, seeking the most cost-effective combination of demand management, well production, water treatment, and delivery to meet resource goals as well as other objectives. Contributions from the federal government's implementation of the Additional Water Storage Project will also be taken into account. Since additional groundwater production will address longer-term needs, investment in these facilities can be phased over time. Decisions on new capital investments will undergo the same, rigorous process of evaluation and decision-making as other capital projects.

Pipeline 1 original construction

www.MyTPU.org/TacomaWater