OREGON BUSINESS COUNCIL

SECURING OREGON'S WATER FUTURE

Oregon Business Council Water Task Force
Revised, 2022

CONTENTS

ACKNOWLEDGEMENTS

This report is dedicated to Oregon's water stakeholders, a passionate, smart, committed community whose guidance helped to shape this analysis of Oregon's water challenges and opportunities. Thank you. In equal measure, we also thank the Oregon Business Council directors and their senior executives who served as members of the OBC Water Task Force. From that first rough draft in early 2020, you stuck with this project, energizing the inquiry, bringing leadership and guidance, and learning more about the complexities of water issues than you ever imagined.

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INTRODUCTION

For more than a decade the Oregon Business Council has recognized the value of managing Oregon's water resources to grow our economy, protect our natural systems, and provide all Oregonians with abundant, affordable clean water. In 2013, OBC supported efforts by others to combine private and public funds to spur investments in water systems. In 2017 and 2018, OBC invested in efforts by the Harney County and North Santiam watersheds to estimate the economic value of water, value that was defined by local stakeholders to include economic, social, cultural, and natural systems benefits. While these investments in water management were important, they were only pieces of the larger water management challenge that Oregon must meet now and well into the future.

Our goal is to frame water management in a way that enables policy makers to discuss difficult but critical water issues. This report represents the start of a conversation.

In 2019 OBC took up the challenge to comprehensively frame Oregon's water needs for future generations. In part this was inspired by what we learned in the Harney County and North Santiam project and in part by Governor Kate Brown's call, the year before, for a 100-Year Water Vision for Oregon. OBC began the Water Project in a fall retreat of OBC directors and water experts hosted by Scott Campbell at his Silvies Valley Ranch. In 2020 we hired nationally known water policy expert Martin Doyle to guide this effort. Doyle's research into Oregon's water challenges included input from as many as 75 different Oregon water scientists, advocates, and legal and policy experts. The project was led by OBC's Water Task Force chaired by Portland General Electric CEO Maria Pope. The group included six other OBC directors and three senior executives, and it was staffed by OBC consultant John Audley. This report, endorsed by OBC's board of directors, is the product of that effort.

The goal of the project and this report is to frame water management in a way that enables policy makers to discuss difficult but critical water issues, to apply widely accepted science, and to adopt a shared approach to modernizing Oregon's water management systems. This report represents the start of a conversation. Although this paper benefits from wide input, it solely represents the position of the Oregon Business Council. And it is part of a longer process. We remain open to input from others, we are willing to adjust our thinking, and we are excited to see where it takes us all.

Note: This document is an update and re-issue of the paper we published in April of 2021. The balance of that year Mother Nature and Oregon lawmakers, in their separate ways, combined to rewrite the agenda for modernizing water systems management. 2021 brought one of the worst drought seasons in Oregon's history along with record-setting heat. The pivotal importance of water and its management hit home as communities throughout Oregon found themselves short of water for livestock, irrigation, recreation, and basic human needs. During the 2021 session the Oregon Legislature, drawing on state and federal funds, made an unprecedented investment of $530 million dollars, expanding the capacity of agencies and stakeholders to address Oregon's water management needs. This shift in circumstances compelled us to rethink and revise the recommendations in Section 9, focused on the next three years. The rest of this paper remains unchanged, as does our commitment to water management modernization.

EXECUTIVE SUMMARY

Oregon's future economic advantage must be founded on sustainable, affordable, and efficient water management, based on disparate groups sharing the responsibility to find workable solutions to make necessary adaptations of our water management system.

Oregon's water management system must be modernized so that it encourages and rewards innovative solutions to multiple water management challenges, reduces compliance and enforcement costs, provides greater protections for our most critical natural resource, and ensures that all Oregonians have access to affordable, quality water.

Water is a defining aspect of Oregon. It enhances our quality of life. It sustains our diverse and vibrant ecosystems. And it shapes culture and identity for many people and communities. Managed properly, water can give Oregon a comparative economic advantage over other western states. It can be a strategic asset to grow and sustain our economy, protect and enhance our natural systems, and enable all Oregonians to live more prosperous lives.

Despite the central role of water, Oregon relies on a water management system designed to serve another era. This system is ill suited to the demands of a growing population, shrinking rural communities, and the effects of climate change. Outdated regulatory cultures, policies, and governance structures that comprise this legacy system constrain people and communities from developing or adopting water management solutions that match Oregon's evolving challenges. Water permitting efforts often prompt costly litigation that results in stalemate rather than outcomes. That leaves people and communities without solutions to their water needs while draining state agency and water user resources. Successive budget reductions force state agencies with water roles to take on more management tasks without fully understanding the way particular hydrologic systems work, how specific ecosystems function, or the negative consequences of inaction. Uncertainty and fear of regulatory response, combined with long delays in agency process, make it extremely difficult for water users to manage their water budgets or invest in the future. As a result, water users and water-dependent businesses are reluctant to invest in water saving methods and technologies – even when the costs of investment might be low relative to the potential return. Our one-size-fits-all approach to water management leaves Oregon's

SUMMARY OF FINDINGS

- Despite some constraints, Oregon has a comparative strategic advantage in water resources over other western states.
- Over-allocation and seasonal variability are putting greater pressure on both groundwater and surface water availability for all purposes, including instream environmental health.
- Increasing water service costs and decreasing federal funds are pushing up water rates, making water less affordable for low-income customers.
- Affordability challenges are exacerbated by the economic impacts of the Covid-19 pandemic and wildfires.
- The current water data management system is inadequate for water policy making, planning, management, problem solving, and investment. Agency budgets are inadequate to address this constraint.
- The prior appropriation doctrine in water law assures certainty for water users that is valuable to system stability and investment decision making.
- Water use permitting has been ineffective and inefficient, fueling adversarial conditions, inaction, and delay.
- Oregon has a history of adapting water laws, policies, and practices that respond to changing conditions and priorities, but the most significant reforms took place 25 years ago.

unique basins without the tools they need to manage water and engage citizens in outcome driven processes. It is time to modernize Oregon's water management system in all its facets[1] – legal, operational, and financial – to meet the diverse needs of our communities, cultures, economy, and ecosystems.

Based on a review and analysis of Oregon's current water resources and policies, as well as trends in critical constraints on water availability and use, the Oregon Business Council recommends that Oregon modernize its water management system balancing four key goals:

- Adopt regional approaches to water management that allow local stakeholders greater creativity in implementing water management programs designed to meet multiple benefits, and which are evaluated on their merits at the local level.
- Modernize water data infrastructure to increase the use and usefulness of data that is already being collected, while reducing the costs of reporting such data by the regulated community, and decreasing the costs on the state and local governments for monitoring and data management.
- Reform Oregon's water permitting process to be more responsive to unsustainable conditions, and to the timely needs of communities.
- Ensure water affordability and equity across and within Oregon's disparate communities.

Along with these four goals, we support the initial findings of Governor Brown's 100-Year Water Vision effort. Local Oregonians must expand their capacity to make informed water management decisions. And we must develop a new approach to financing and paying for water infrastructure repair and expansion.[2] We applaud the 2021 Oregon Legislature for making an unprecedented $530 million investment in water management improvement,[3] an important first step to address deeply rooted water management challenges.

Finding common ground among these goals will not be easy. Charting a course beyond decades of siloed efforts to make advances in water management will be daunting. Moreover, the timing has to be right to build on the progress made by state legislators in 2021. In this moment of Oregon history members of the Oregon legislature are appropriately focused on meeting the challenges of the COVID-19 pandemic and its associated economic downturn; and Oregon leaders are grappling with the effects of systemic racism. We recognize that it is prudent to adopt a staged effort in which legislators and stakeholders engage in an informed, intentional, and deliberative process over the next few years.

The Oregon Business Council supports efforts led by the National Policy Consensus Center and the Association of Oregon Counties to prioritize elements of water management systems modernization. We recommend that legislators and water stakeholders participate in these and other processes that contribute to the preparation for a major modernization of Oregon water management in the 2022 election and the 2023 legislative session.

OBC recommends that legislators and water stakeholders prepare for a major modernization of Oregon water management.

The water challenges that Oregon faces, and will continue to face, will shape the very future of the state. But if appropriately managed, Oregon's water can be an equitable resource for communities, the foundation of resilient ecosystems, and a strategic advantage for the economy for decades to come.

1. WHY WATER MATTERS TO OREGON'S FUTURE

Water contains many paradoxes. While fundamental to life, it is typically taken for granted. Adam Smith described this in the Wealth of Nations as the diamond-water paradox: while water is essential, we value diamonds far more.

This paradox is certainly true in Oregon. Water has been the foundation of Oregon's communities, ecosystems, and economy since its founding. Yet because it has typically been plentiful, water has often been an afterthought, falling in a long line of other natural resource concerns that come and go, garnering attention during disasters or crises, but otherwise largely ignored.

Among western states, Oregon has tremendous water-based comparative advantages and opportunities.

However, as population growth, over-allocation, species decline, and climate change become increasingly tangible across the state, the true value of water in Oregon is becoming more apparent, along with the constraints imposed by our past habits and decisions. We rely on archaic water management practices, whether they take the form of cumbersome permitting processes or aging infrastructure to store and deliver water for its many purposes. We ignore the burden that the costs of water impose on the most vulnerable in our communities and state. We under appreciate the precarious hydrologic condition of some of our rural and tribal communities. And we forget that our water-based ecosystems are essential to retain and attract a competitive work force. We treat water as an afterthought rather than as the essential element in our state that it truly is. Quite simply, Oregon under values its water.

While water challenges are common across the western states, Oregon also has tremendous water-based comparative advantages and opportunities. If Oregon's water resources are managed in a way that reflects their true value, the state has the opportunity to outshine the West in four critical areas:

1. Ecosystems: watersheds can be restored to support diverse stream and river ecosystems, including salmon, and be the basis for healthy and sustainable forests and rangelands.
2. Agriculture: Oregon has an advantageous position for producing a range of high-value crops. As other western states face their own water challenges with greater constraints, Oregon can capitalize economically on its water advantages.
3. Quality of life: attracting talent for an increasingly competitive work force will be critical in the coming decades; affordable, clean water at the tap and access to healthy rivers and watersheds for recreation will be an essential advantage for attracting a diverse, talented work force.
4. Rapidly changing industry: water is critical to industries, some of long standing in Oregon (agriculture, electric power), and others that are newer (microchip manufacturing, data service centers, brewing).

Across the state, there is growing appreciation and recognition of how critical water will be for our future. If managed appropriately, and if truly valued, Oregon's water can be transformed from a challenge to an opportunity. Indeed, the Oregon Business Council believes water presents not just an opportunity, but rather, a clear strategic advantage economically and a cornerstone of our communities and ecosystems.

2. WATER QUANTITY, QUALITY, AND ECOSYSTEMS

Oregon's diverse geography, geology, and hydrology create widely varying water resource conditions and challenges.[4] While Oregon's western region can receive nearly 200 inches of precipitation, Eastern Oregon receives less than 20 inches annually. The majority of precipitation throughout Oregon comes between October and March. Because of this variability in timing and location, and because the rainy season runs counter to the high seasons for water demand (mainly between May and September), inter-seasonal water storage has been, and will continue to be, a significant topic for water management in Oregon. In addition, because of the history of allocation, most surface water in Oregon is fully allocated for summer months when it is most needed for both in-stream and out-of-stream uses.

In addition to the wide variations in surface water across the state, Oregon has profoundly different geologies which create different groundwater resources. While most regions of Oregon have aquifers which produce some water, the Willamette Valley, High Cascades, and Deschutes-Columbia geologic provinces enjoy particularly productive aquifers. However, similar to surface water, in many regions, groundwater aquifers are no longer able to support additional development either due to over-allocation of existing water rights or due to contamination (e.g., from nitrates).

Degraded surface water quality is a growing concern throughout Oregon, especially as the quantity of water declines in some regions.

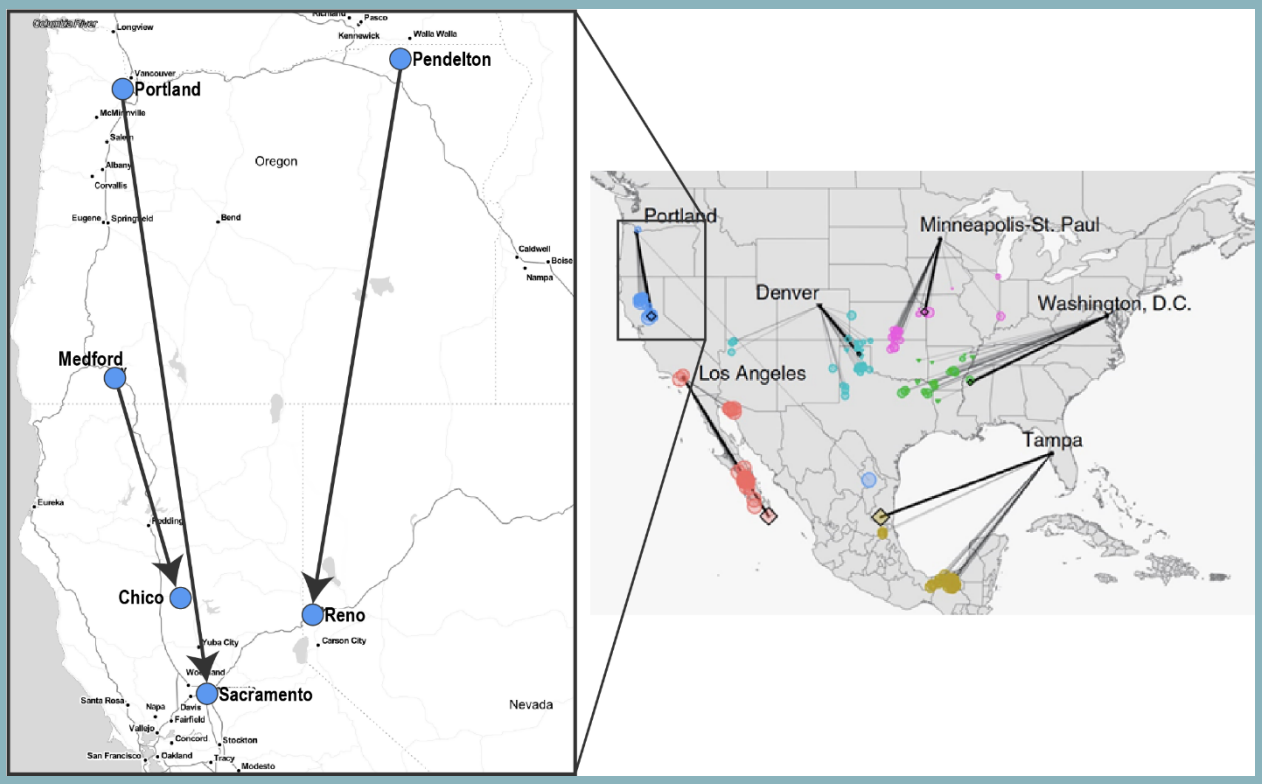
Degraded surface water quality is a growing concern throughout Oregon, especially as the quantity of water declines in some regions (as flow or quantity decreases, the concentration of pollutants increases). The 2017 Integrated Water Resource Plan reports that, in 2017, over 70 lakes and reservoirs, as well as over 24,000 miles of streams, were rated as impaired and not meeting water quality standards. Groundwater quality has also been degrading, and a number of studies have demonstrated problems related to nitrate, bacterial, and arsenic contamination.

Finally, Oregon's water resources intersect with its ecosystem resources, most notably through its endemic and diverse species. Here again, Oregon faces water management challenges which have only increased over time. Native salmonids (e.g., salmon, steelhead, and trout) are a charismatic aspect of Oregon's environment and culture, yet 15 of the 23 species of salmon and steelhead found in Oregon remain listed under the federal Endangered Species Act. Despite considerable efforts at recovery over the past 30 years, none has been delisted[5], and the continued degradation of water quality and quantity will likely create sustained challenges to any recovery.

The Changing Hydrology of Oregon

Given these issues, it is reasonable to expect high uncertainty for the future of Oregon's water, yet this future will also be inevitably affected by several over-arching trends. Warming temperatures caused by climate change will result in a change in the timing of precipitation events, with winter precipitation coming increasingly as rain instead of snow, and with a decline in overall snow pack.[6] For a more practical sense of the changes that are likely, current climate projections suggest that by 2060, Portland will have the climate of Sacramento; Medford, that of Chico; and Pendleton, that of Reno (Figure 1).[7] In terms of water supply, most regions have already experienced a decline in spring snowpack as more precipitation falls as rain instead of snow. The result is higher streamflow in the winter and spring, with much lower streamflow in the summer months.

Figure 1. By 2060 Oregon cities will have the temperature of cities in California and Nevada today.



As with regional precipitation variability discussed earlier, these changes in climate will increase reliance on storage and groundwater. High-altitude snowpack has traditionally provided the most effective storage. With higher average temperatures, precipitation as rain instead of snow combined with earlier melt events will deprive communities of relatively even stream flows. To have the same amount of water in the summer or early fall (whether for drinking water, irrigation, or environmental needs), a greater amount of storage would be needed.

Yet while climate change will pose significant challenges for Oregon, it is important to place Oregon in its broader western context. In particular, the amount of precipitation received in Western Oregon is rivaled by only a few other areas of the west, the Cascade Range in Washington and a small portion of northern California. Most western states are more similar to the drier, eastern portions of Oregon.

Along with this hydrological advantage, studies suggest that climate change will have limited effect on Oregon's total annual precipitation. A climate simulation of 35 models had a mean increase in annual precipitation of 5 percent by 2050, although the range of models varied between -30 to 40 percent change in precipitation.[8] While there is considerable uncertainty, Oregon can expect total precipitation to remain consistent in the coming decades.

Oregon also has an unusual geology which creates substantial aquifers, including some with considerable recharging characteristics. The Cascade Mountains are a relatively young mountain range consisting of volcanic rocks and porous material. This allows melting snow and rainwater to quickly infiltrate and recharge the aquifer. This recharge is the main source of groundwater as well as surface water for much of central Oregon. Water emerging from springs contributes to the Metolius River, Deschutes River, and much of the Klamath Basin.[9] This groundwater also contributes to the Willamette Basin on the western slope of the Cascades. Along with the fact that the aquifer sits largely beneath U.S. Forest Service land (and has remained unallocated to date), this means that the aquifer serves as a type of annually recharged hydrologic battery for several of Oregon's major river systems. The aquifer is regularly recharged, and subsequent emergent flows are consistent and cold, and thus sustain downstream

summer flows in otherwise hot, dry conditions. Over the long-term, assuming that this system is not significantly altered, Oregon has a consistent water source for two of its major basins.

The other significant regional groundwater system is the Columbia River Plateau. This aquifer covers 20 to 25 percent of the state and consists of several layers of lava flows that create a highly fractured groundwater system with isolated pockets of groundwater that are no longer recharged. While water pumped from fragmented sections cannot be recharged naturally, they do provide opportunities for developing aquifer storage by artificially refilling these natural reservoirs. Some 20 projects currently exist, for example, aquifer storage and recovery wells in Beaverton and Salem.

While other western states have geologic conditions comparable to Oregon, other than Washington and northern California other western states do not have consistent precipitation to naturally recharge aquifers, nor do they have a large surface water supply like the Columbia River (see Figure 2) to potentially recharge aquifers. This combination of surface water and rechargeable aquifers is a significant resource for Oregon's long-term water future.

Finally, it is important to bear in mind that the Columbia River is considerably larger than most any of its counterparts in the United States except the Mississippi (Figure 2). It dwarfs any other Pacific-draining river of the U.S, as well as the western rivers which drain eastward (i.e., Missouri, Arkansas). The average annual flow of the Columbia River is ten times the average flow of the Colorado River. This flow volume makes tremendous hydropower possible, which is why the Columbia produces about three and a half times as much hydropower as the Colorado.

Over the very long term, water is the primary asset of the Pacific Northwest.

In sum, Oregon will face challenges in water resources in the coming decades commensurate with changing climate, particularly the impacts associated with the loss of snowpack and the precipitation shift from snow to rain at high altitude. These challenges are occurring against a backdrop of other pressures on the water resource: allocation of surface water, degraded water quality, and strained groundwater aquifers. At the same time, Oregon also has sufficient water resources for a future that is not possible in other western states, particularly as the effects of climate change become more evident across the West. While there are hydrological differences across the state, Oregon is better positioned than most of the western U.S. Indeed, as hydrological conditions worsens in other states with far more water scarcity (California and Arizona, among others), Oregon could become the home of the West's most dynamic, high-yield, and diverse agricultural economy along with other water-based economic activities. This advantageous hydrologic positioning, in comparison to the rest of the West, supports the notion that over the very long-term, water is the primary asset of the Pacific Northwest.

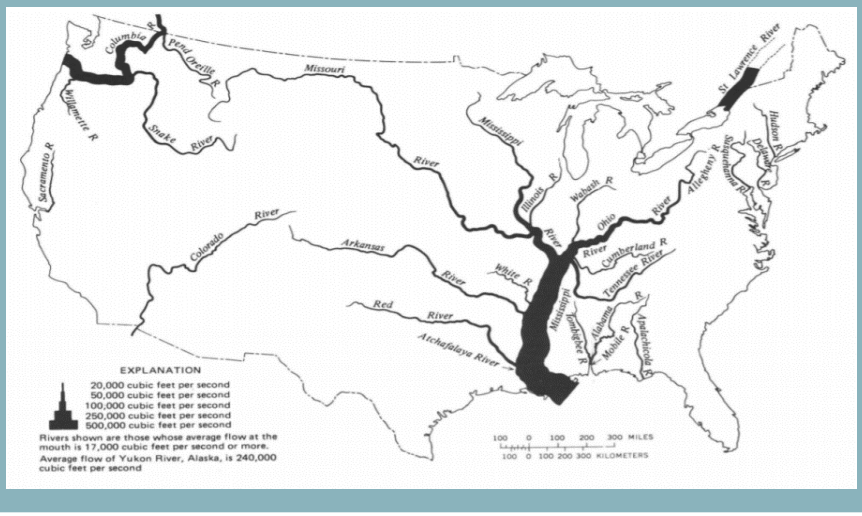


Figure 2. Relative size and location of the largest rivers in the United States (from Iseri and Langbein, Large Rivers of the United States, USGS Circular 686, Washington, DC, 1974).

3. WATER USE IN OREGON

Water withdrawals and use in Oregon have been changing over time along with population and climate.[10] Of the 6,580 million gallons per day (MGD) (7.37 thousand acre-feet[11]) withdrawn for use each day in Oregon, more than three quarters (5,100 MGD) comes from surface water, while a much smaller amount (1,480 MGD) comes from groundwater. Seventy eight percent of these water withdrawals goes to irrigation, which is 10 times greater than the amount withdrawn for public water supply or industrial water uses (Table 1).

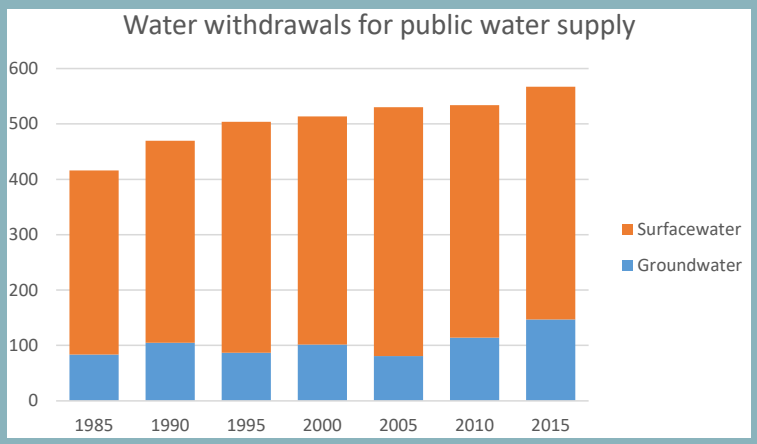
But while the population and economy of Oregon have grown, the water withdrawn has actually remained constant or even declined. Water withdrawals for irrigation have declined 13 percent – from a high of 6,860 MGD in 1990 to 5,160 in 2015. Industrial water use has declined by two-thirds, from 380 MGD in 1995 to 105 MGD in 2015 (Table 1). Water use for public water supplies has increased 13 percent, from 503 MGD in 1995 to 567 MGD in 2015, although population served by public water supplies has increased by 58 percent over the same time period. Given these trends, Oregon like most of the U.S., has seen per capita water use decline over recent decades.

Table 1. Total water withdrawals by water-use category, in million gallons per day (MGD). (Data from USGS National Water Information System).

Year	Public supply	Domestic	Industrial	Irrigation
1985	416	80	293	5,709
1990	470	64	284	6,860
1995	504	68	378	6,168
2000	514	76	195	6,077
2005	530	78	172	5,711
2010	534	67	26	5,257
2015	567	74	105	5,158

An additional trend worth noting is that public water supplies in Oregon are increasingly dependent on surface water rather than groundwater. The population served by groundwater sources has remained relatively consistent at approximately one million residents, and perhaps it has even declined. However, the population served by water systems based on surface water has been steadily and significantly increasing. As of 2015, public water systems serving over three quarters of the population relied on surface water while less than a quarter relied on groundwater, and there is an increasing trend of withdrawing surface water for public water supply (Figure 3). By contrast, as illustrated in Figure 4, withdrawals for irrigation from both surface and groundwater sources have been declining.

Figure 3. Total water withdrawals for public water supply in Oregon in MGD (USGS water use information system).



It is important to note, however, that the amount of water withdrawn, and the trends over time, varies tremendously across the state, and varies between surface water and groundwater. While only a subset of counties has increased surface water withdrawals since 1985 (primarily in the western and northeastern regions, Figure 5), almost all counties have increased groundwater withdrawals (Figure 6).[1] These data indicate that water use (just like geology, climate, and population) is quite different from one region of Oregon to the next. The data also indicate that groundwater management is as critical a challenge for the future as surface water has been in the past.

Figure 4. Total water withdrawals for irrigation in Oregon in MGD (UDGS water use information system).

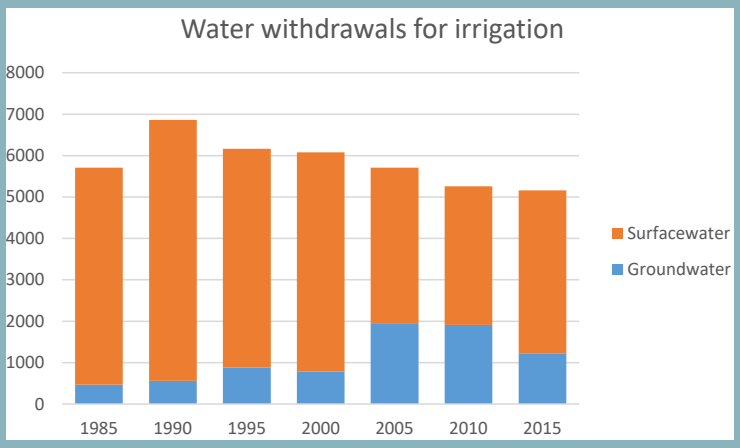


Figure 5. Changes in surface water withdrawals, by county, from 1985 to 2015. Data from USGS National Water Information System, integrated and visualized through nicholasinstitute.duke.edu/ reservoir-national-trends/use/#

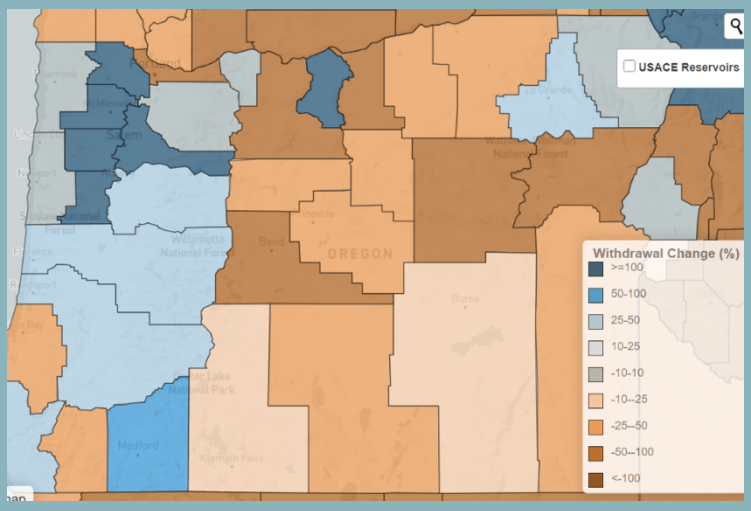
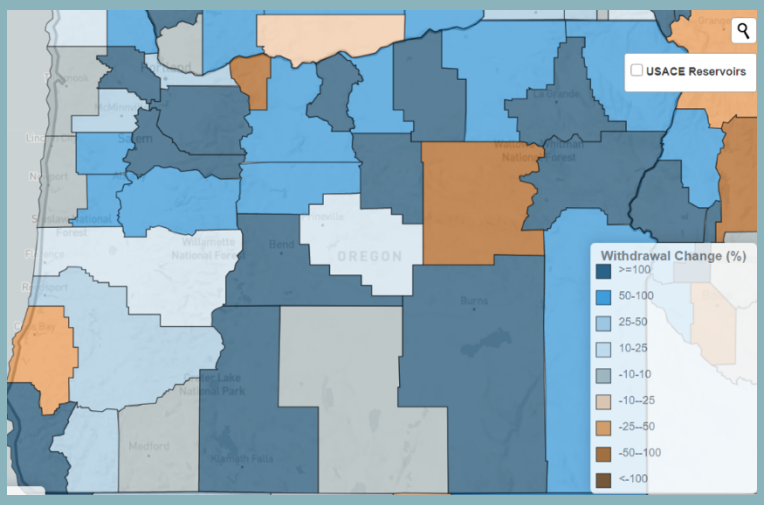


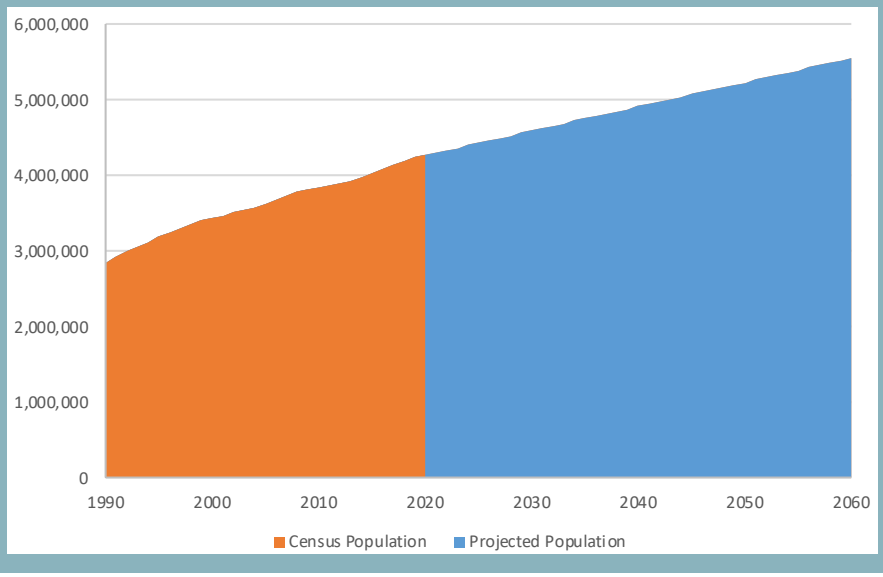
Figure 6. Changes in Groundwater withdrawals, by county, from 1985 to 2015. Data from USGS National Water Information System, integrated and visualized through nicholasinstitute.duke.edu/ reservoir-national-trends/use/#



Water in Cities and Communities

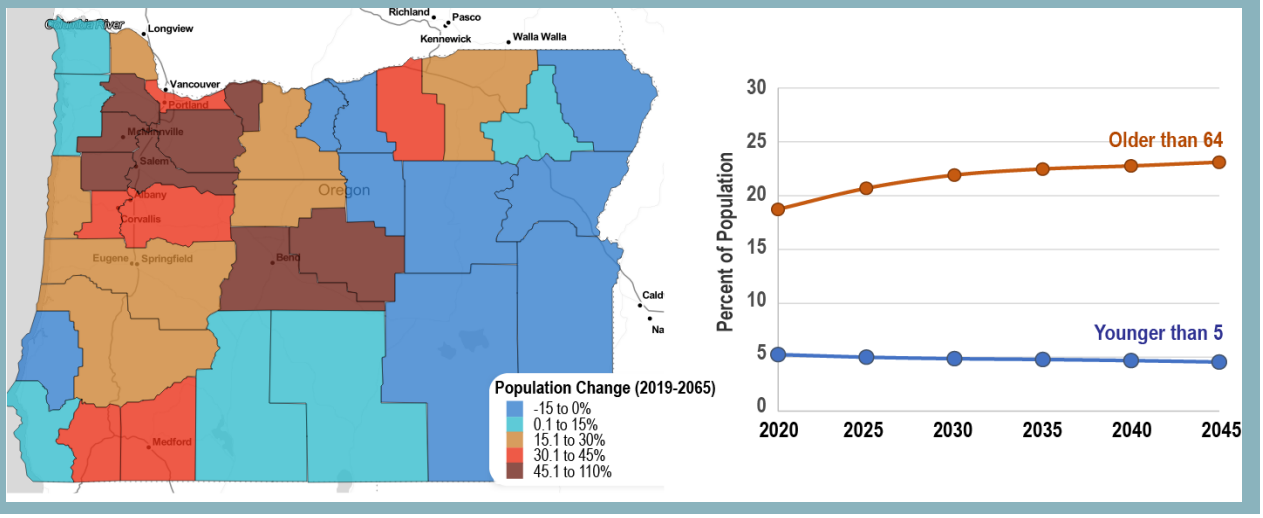
The changes in water use are indicative of broad-scale trends in the population of Oregon. The number of people living in Oregon is projected to steadily increase from 4.22 million now to 5.86 million by 2060 (a 38.9 percent increase, Figure 7). However, there is large variation in how population is expected to change across the state.[12] Populations in nine rural counties are projected to decline. At the same time, populations in seven counties are projected to grow in aggregate by more than 45 percent as people increasingly move to urban areas (Figure 8). In addition to these overall changes, the population of Oregon is also expected to become slightly older. Those 65 and older will increase by 23.4 percent, and go from 18.7 percent of Oregonians in 2020 to 23.1 percent in 2045. The state is also becoming more racially diverse, particularly with the Latino community growing from 4 percent of the population in 2000 to over 13 percent in 2019.

Figure 7. Population change in Oregon, 1990 – 2060. Note that the population in Oregon is projected to be ~6 million by 2060. All data from Portland State University's Population Research Center.



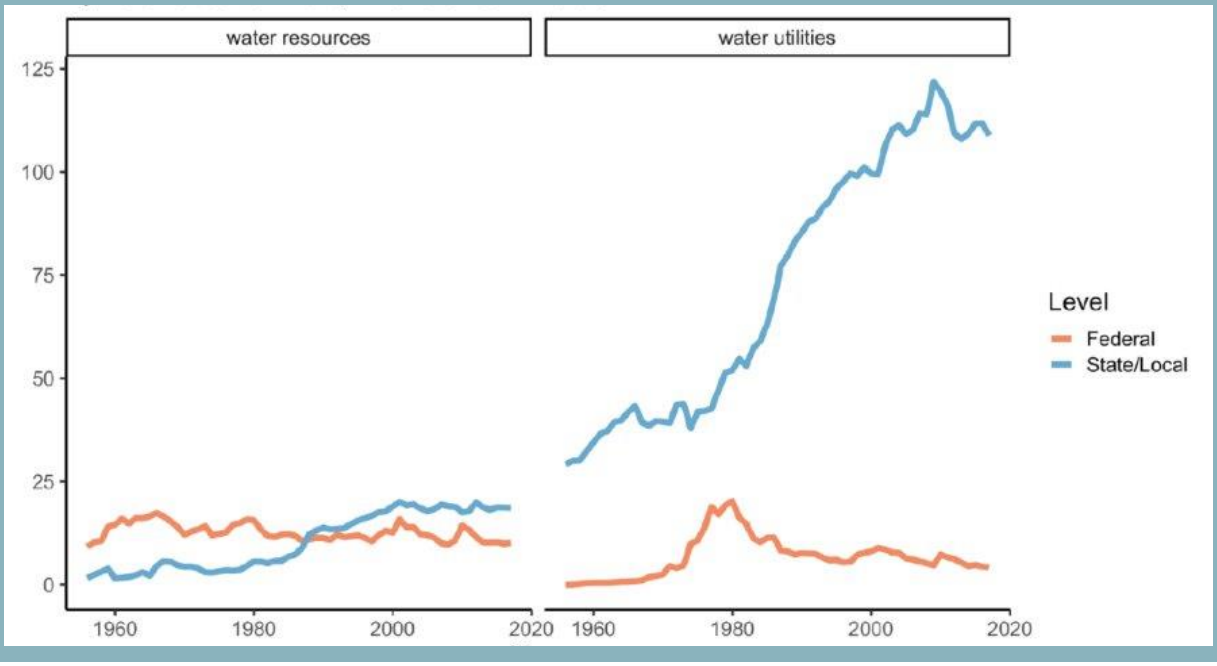
These changes in population have the greatest impact on public water providers, the utilities that we depend upon to deliver potable water and manage our waste. These utilities are responsible for covering the cost of providing basic water services – in the rhetoric of the water industry – charging the full cost of water. Costs must cover the operations and maintenance of each utility, and they must also increasingly cover the costs of financing the infrastructure itself.

Figure 8. (Left) Projected population by county from 2019 to 2065. (Right) Projected change in age distribution from 2020 to 2045. All data from Portland State University's Population Research Center.



But while demand for services is growing, changes in funding models for public water utilities have made their task more difficult. In the past, water service infrastructure was funded through federal grants (with the introduction of major environmental regulations such as the 1972 Clean Water Act and the 1974 Safe Drinking Water Act). However, since the mid-1980s, the federal government has played a declining role as a source of funding for water infrastructure, leaving local and state governments to cover the bulk of the costs (Figure 9). This has shifted the focus to water rates and how they are set as utilities are left to fully finance the costs of capital improvements, operations, and maintenance.

Figure 9. Public spending on water utilities by level of government from 1956 to 2017 (billions). Data from Congressional Budget Office, 2018.



4. WATER AFFORDABILITY

In 2019, a survey of water service providers in Oregon found that the average water rate was $41 for 5,000 gallons (typical household water use), while the average wastewater rate was $51.[13] However, rates are increasing across Oregon, in large part because water service providers in Oregon face compounding challenges. Increasing regulations, aging infrastructure, and rising costs of materials/labor all drive up costs of providing basic water services. Moreover, disasters – from floods to wildfires – can damage infrastructure or make water treatment more difficult, further increasing costs for the utility overall.

Based on the 2019 surveys, over the past five years water utilities have had to increase water rates on average 7.7 percent. Utilities in some regions increased rates by over 11 percent. Wastewater rates have increased on average 8.4 percent over the same time period, with some regions seeing 12 percent increases over the five-year period.

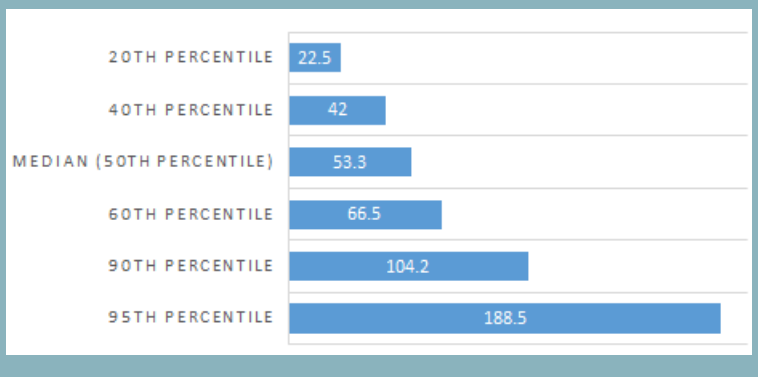
A growing number of people are hard pressed to afford their water bill each month.

While these types of water rate increases may go unnoticed by many Oregonians, a growing number of people are hard pressed to afford their water bill each month. There is growing recognition that water affordability is a growing problem across the U.S. Low-income people and working families technically have access to drinking water and wastewater services, but frequently can't afford to pay their water bills. This inability to pay water bills can lead to cascading consequences: shutoffs, evictions, liens, or even foreclosures. Water affordability also has implications for public health across the state.[14]

Most Americans are able to afford basic water services, but in every community, rates impose burdens on lower income people, including elderly and disabled residents. While the EPA and others have often compared water bills to the median household income ($53,300 in Oregon), those at the median do not typically struggle with water affordability. It is those at the lower end of the income distribution that do struggle, in particular the 20th percentile of Oregon households that must survive on an income of $22,500 per year or less (Figure 10).

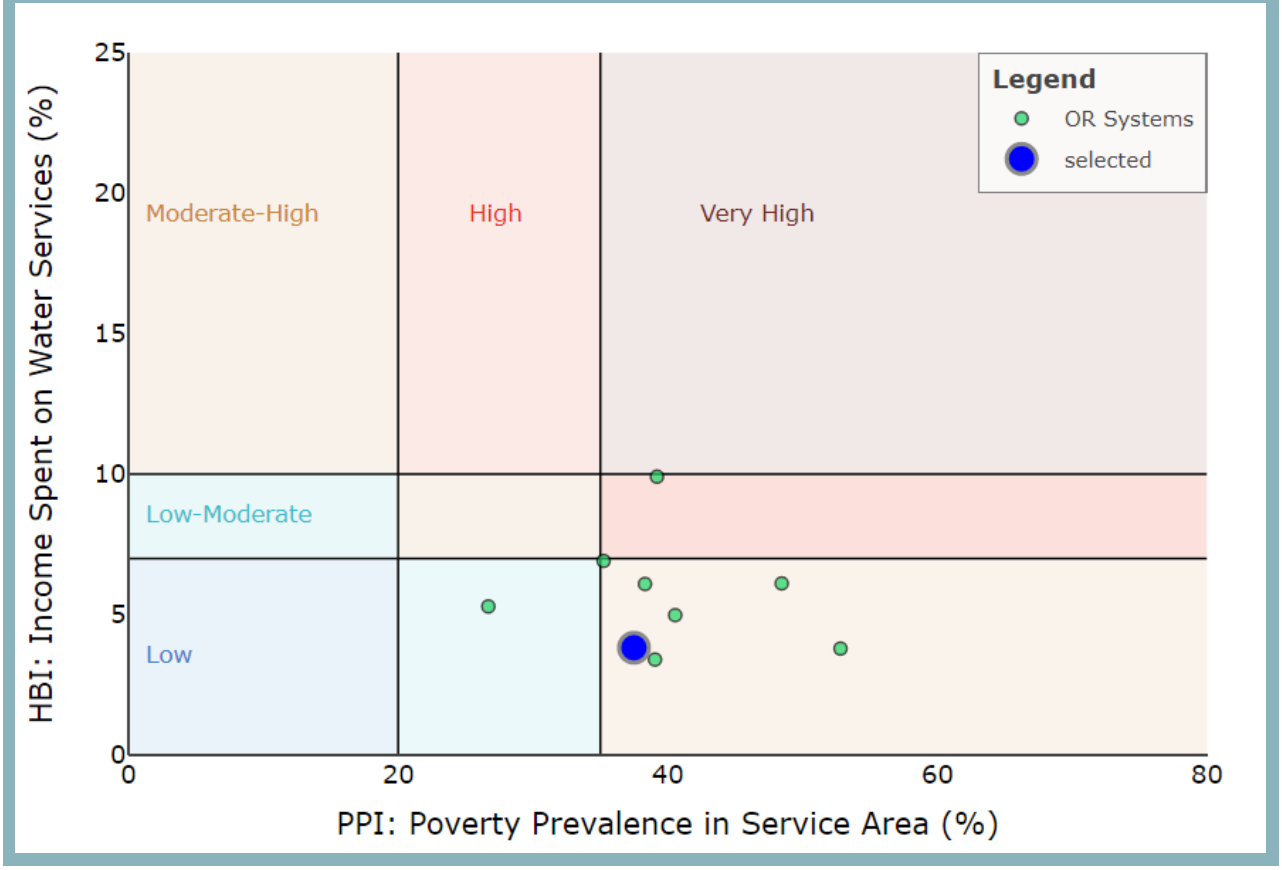
With respect to water affordability, water bills do not typically change with income. Thus, when we think of water affordability, we need to think about how much of a person's monthly income is spent on water bills. The households we are most concerned with are those at the bottom of the income distribution. Across the U.S., the lowest 20 percent of earners pay from 4 to 19 percent of their monthly household income for water and wastewater services.[15] While there is no particular threshold at which we might say that water becomes unaffordable, we might consider a low-income family (i.e., one making $22,500 per year) spending 5 percent or more of their monthly income on water services to be an indicator of concern. We refer to this value of percent of income spent on water by the 20th percentile household to be the household burden indicator (HBI). For nine utilities analyzed in Oregon, the HBI median was 5.3 percent.[16]

Figure 10. Household income percentages for Oregon, with specific median household income in thousands of dollars.



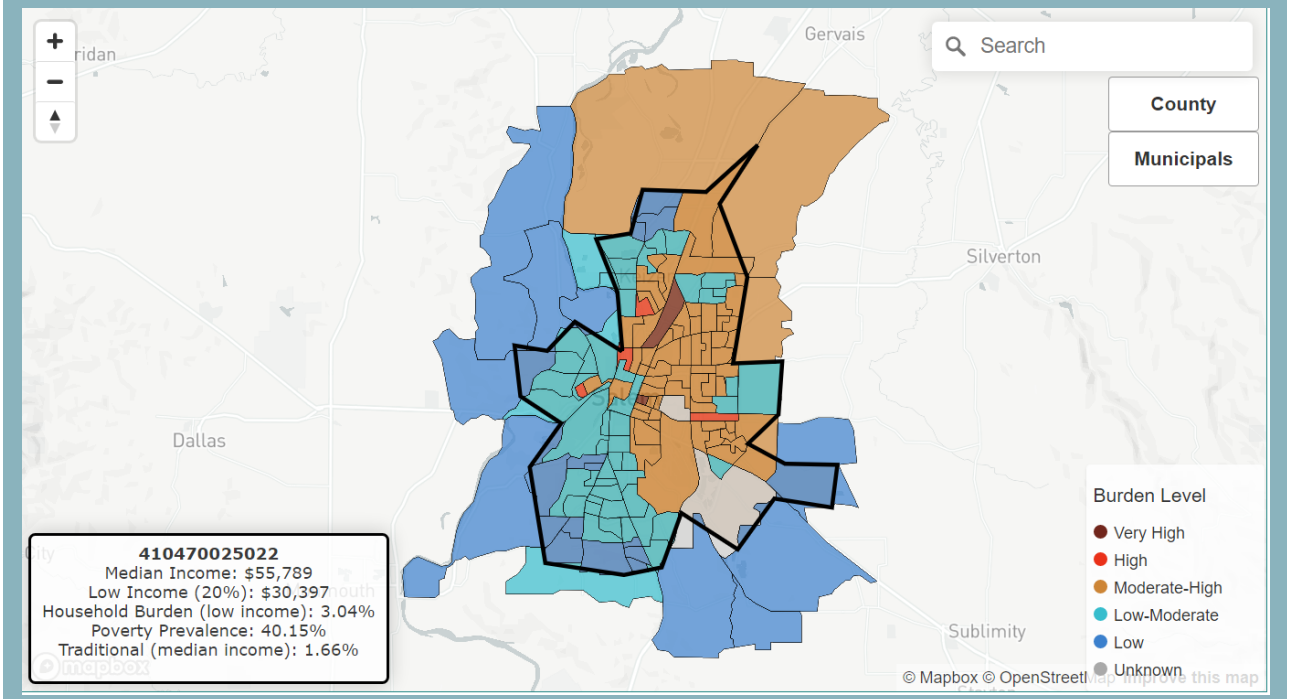
Within Oregon, water affordability challenges vary across cities, and even within cities. Using a data-enabled water affordability visualization tool,[17] we can quantify affordability for that set of nine cities in Oregon. For instance, for Salem, we find that poverty prevalence is just over 37.5 percent, and that those at the 20th percentile income pay 3.8 percent of their monthly income for water (blue dot on Figure 11 below shows Salem; other cities in database are in green dots). While most of the other cities have similar affordability metrics, we can also note ones with particular challenges, such as Tillamook, where those at the 20th percentile pay 9.9 percent of their monthly income on water bills.

Figure 11. Output from the water affordability dashboard for nine cities in Oregon. The selected city in this case is Salem.



While there are certainly differences between cities and utilities, there are also areas of particular challenges within cities and communities (Figure 12). For example, in northeastern regions of Salem, poverty prevalence approaches 50 percent, and the lowest 20th percentile within some census blocks pay closer to 10 percent of their monthly income on water bills. Similarly, in the western portion of Hermiston, households pay more than 10 percent of their monthly income on water bills, as do those in parts of eastern Portland and central Medford.

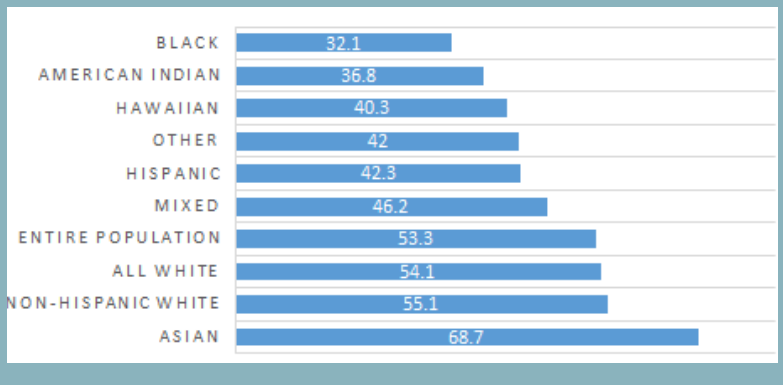
Figure 12. Example of household affordability at the utility and census block scale (Salem City).



Water affordability places low-income residents on one side of a conundrum and the water utility on the other side, because in the end, water and wastewater services are not free. Water utilities face the relentless demands of updating infrastructure, responding to new regulations, and providing reliable service (in terms of delivery and quality) to residential, commercial, and industrial water users alike.

Without subsidies from the state or federal governments, water utilities must charge enough to recover all their costs, i.e., the true cost of water. At the same time, utilities are increasingly unable to raise rates because their lowest income ratepayers, afflicted by income stagnation, cannot absorb the additional cost. Further, covid-related damage to local economies has made the rising cost of water less affordable to many families and businesses.

Figure 13. Median household income (in thousands of dollars by race in Oregon. U.S. Census).



Water affordability also intersects with racial equity. Regardless of the causes or history, income varies by race across the U.S., and within Oregon (Figure 13). Low-income households pay a disproportionately higher amount of their monthly income for basic water services, and because racial minorities have systemically lower incomes, racial minority households pay (on average) a greater portion of their household income for water services than the population as a whole.

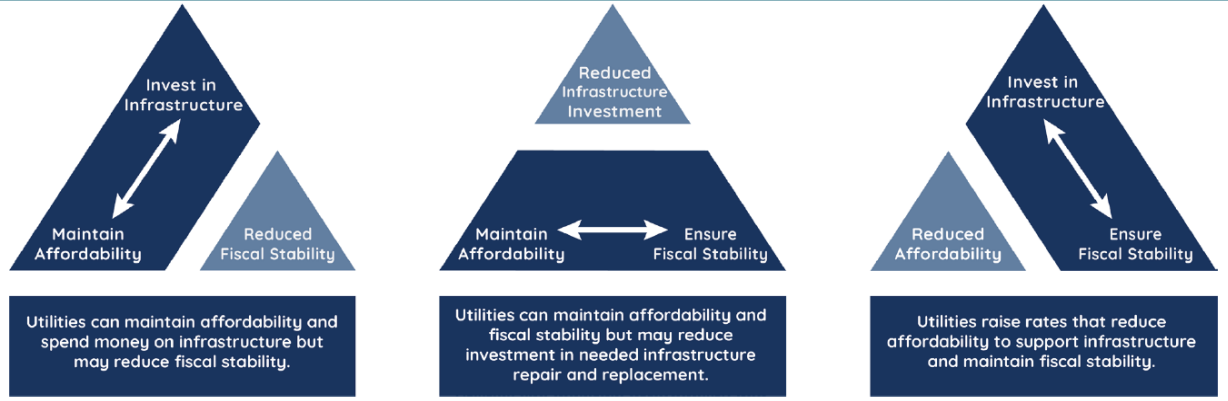
Finally, it is important to note that issues of water availability and equity are not just issues of affordability, and they are not just issues affecting cities. There are a number of communities around the U.S. without access to basic drinking water or sewage services. These are often in rural areas, as well as tribal communities. The U.S. Water Alliance estimates that 1.4 million people in the U.S. lack such basic

water services, with a disproportionate number of these from African American, Latino, or tribal communities.[18] Deficient basic water services are also present in cities. In a recent study of major metropolitan areas in the United States, Portland rated second in the nation for percentage of urban households lacking piped water.[19]

Inadequate water service access and affordability are likely to grow in the coming decades.

Inadequate water service access and affordability are likely to grow in the coming decades. And it is likely that rural regions will struggle with affordability the most. Based on population projections illustrated in Figure 8, water service providers in many rural regions of Oregon will be faced with stagnant or declining populations. This creates profound challenges for water services and affordability. A decline in population will reduce revenue, yet water utilities will still have to sustain infrastructure and operations, as well as continue to comply with ever-increasing regulations. This creates a "trilemma" where water utilities serving declining populations must face competing choices to sacrifice their financial stability (for example, through downgraded credit ratings), curtail their investment in infrastructure or operations, or reduce the affordability of water service by raising rates on the remaining population. This poses a downward spiral already occurring in many areas of the U.S., and it is likely to occur in Oregon in the coming years.[20]

Figure 14. Trilemma for water service providers faced with decisions when confronting increasing costs of operation coupled with decreasing population and associated revenue.



5. THE ECONOMIC VALUE OF WATER

Water has a wide range of economic values. It's important to understand these values as a foundation for policy making and investment decisions. Some of these values can be directly monetized (e.g., agricultural production, mining, industrial production). In other cases, such values are more difficult to monetize or assess (e.g., recreation, cultural importance). Unfortunately, there are few studies which attempt to quantify or even estimate the economic value of water and its use in Oregon.

One such a study, however, in the North Santiam Watershed (NSW), illustrates the usefulness of water valuation. In this drainage, water is valuable for ecosystem health, habitat, recreation, aesthetics, power generation, municipal and industrial supply, agriculture, cultural/tribal purposes, and public health. While some of these services can be directly monetized (e.g., irrigated agriculture produces almost $60 million per year in the NSW), other services are more difficult to directly quantify, but equally large. Prior to 2020 wildfires in the basin, water related recreation, for example, generated approximately $36.5 million annually.[21] These are first estimates, but the scale of these estimates is consistent with values quantified elsewhere. In Washington's Yakima Basin, a similar analysis demonstrated an extremely large economic value of water (and its careful management). Estimates of crop production were $1.8 billion, and agricultural production and processing from water-dependent firms generated over $13 billion. Outdoor recreation generated $1.2 billion in value. And along with the benefits to tribal communities, water-dependent economic sectors accounted for 40 percent of employment in the basin, much of which is rural.[22]

Understanding and Monitoring Changes in Oregon's Water Resources

As noted earlier, almost all aspects of our water resources in Oregon are changing, from precipitation to groundwater levels to customer demand, treatment, use, and conservation. Given these dynamics and regional variability it is essential to monitor and document water resource conditions, trends, and innovations. Unfortunately, Oregon has limited capacity in water system monitoring and data management.

It is essential to monitor and document water resource conditions, trends, and innovations. Oregon has limited capacity in this regard.

To be clear, water users and managers throughout the state already make use of different types of information, and they do so as much as possible. In addition, the state has invested resources in careful scientific studies to better understand critical issues. For instance, in the case of groundwater, the state has conducted four studies (Deschutes, Willamette, Klamath, and Harney) that contribute to clear understanding of the hydrogeology driving aquifer changes and behavior. However, according to the 2017 Integrated Water Resources Strategy, there are five other priority groundwater studies that are needed but are either stalled or not started for lack of adequate funding. Until such studies are completed, surprising little is known about the geology and aquifer characteristics of these basins, and thus how best to manage them.[23]

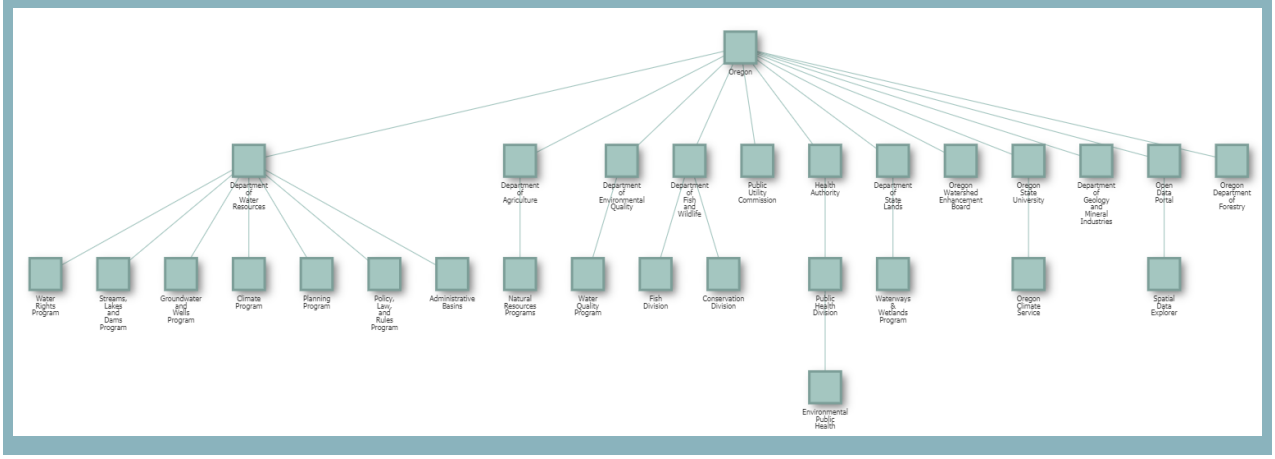
While such studies provide the most comprehensive, up-to-date data and basic science on critical water issues, other data sources are less available for groundwater and surface water understanding. Many sources of data are not sufficiently scaled or updated to be useful for water management. For instance, wells drilled prior to 1955 are not required to be registered with the state, and those wells since 1955 have very coarse location data that are inadequate to supplement full basin studies.

Similarly, inadequate resources limit the state's ability to maintain and process surface flow records from its network of stream gauges. This has created a backlog of unprocessed data, limiting information about

surface water resources in different regions of the state. This problem extends to water quality as well. For example, groundwater quality staffing has decreased from 12 to 5, limiting the geographic scope and frequency of data collection and analysis for surface water quality.

Even where data is available, all too often it is rendered less useful by fragmentation in format, collection, storage, and accessibility across multiple jurisdictions and agencies. While water problems often intersect and overlap jurisdictions, the data that we rely on to track these challenges is typically captured in formats particular to the entity collecting it, and often accessible only to those entities collecting it. Because of the variety of different agencies and organizations that collect data or have data reported to them, there are a vast number of water data formats and storage locations. In Oregon, at least 15 different agencies or programs collect or require water resource data, which then report those data within 12 additional hierarchical agencies or departments. (See Figure 15. Each box represents a particular type of data, and each hierarchy represents a different flow of data). In most cases, data required for one agency are collected and stored in different formats from those data collected or stored for other agencies. Further, the same kind of data collected for the same purpose may be stored in one location for one county or basin, but in a completely different location for the adjacent county or basin. This situation is not unique to Oregon, as other states have equally, or even more complicated water data systems.

Figure 15. The various organizations and agencies in Oregon collecting water-related data. This hierarchy is based on external review of best findable information from agency/departmental websites. This inventory and similar inventory visualizations for other states is available at internetofwater.org/public-data-inventory/.



6. LAWS AND REGULATIONS

Like other western states, Oregon's system of water rights is based on the doctrine of prior appropriation. These are its tenets:

1. Waters of the state belong to the public, and the state may vest in individuals or entities the right to use water by granting authorization in the form of a permit or other mechanism.
2. Water rights authorizing the use of water typically include limitations on the purpose for which water may be used, the amount of water that may be used, the place of use, and the location of the point of diversion.
3. The appropriated water must be put to a state-recognized beneficial use.
4. Water rights have a priority date, and a water right is junior to previously established rights and senior to any that might be established in the future.
5. If water under a vested water right is not put to beneficial use, the user may forfeit or abandon thatright.

Importance and Limitation of Prior Appropriation Doctrine

The appropriation doctrine has received criticism on a variety of fronts, and there have been calls to reform this approach to allocating available water for use.[24] Whether these criticisms are warranted, the prior appropriation doctrine is fully ensconced in the western U.S., underlying not only water resource systems but the very property rights and property values central to the western economy and its culture. Therefore, it is important to recognize the benefits that it provides, particularly the role that it plays in providing some source of hydrologic certainty in semi-arid conditions.

More so than most any other allocation approach, the prior appropriation doctrine creates certainty for water users. Developing water resources requires considerable investment to store, divert, transport, and apply water for any use. Further, because of the vagaries of precipitation in the West, water uses – whether for irrigated agriculture or public water supply – are often impossible to plan without some ability to increase hydrologic certainty. Uncertainty would most likely undermine the ability or interest of potential users to invest in high-cost water development activities, let alone build their own businesses or communities. Critically, the prior appropriation doctrine provides a far greater amount of certainty for water users than could be provided by other water rights systems.[25] By assigning a known quantity of water for users who, through their seniority, have a sense of their ability to receive a full water allocation from one year to the next, the prior appropriation doctrine has enabled a level of water security that led to its very early adoption in disparate regions of the West, and its adoption in other arid regions worldwide, such as Australia.[26]

More so than most any other allocation approach, the prior appropriation doctrine creates certainty for water users.

Irrigated agriculture and other farming and ranching uses are not the only beneficiaries of the certainty derived from prior appropriation. Public water suppliers also rely on the doctrine to create certainty for their customers and residents, whether businesses or the many individual residential water users throughout Oregon.

The prior appropriation doctrine is an important condition for water marketing or transfers: markets are predicated on property rights and the ability to transfer those rights under certain conditions. Of the various types of water allocation systems that exist in the U.S., the prior appropriation doctrine recognizes the right to use water as a property right, and thus has been aligned with water marketing, and such market variants as water leasing and in-stream environmental flow leasing/purchases.[27]

Further, water markets are an important element of water management for a variety of purposes, including conservation. The provision of forfeiture for nonuse (i.e., "use it or lose it" typically created to protect against speculation by claiming rights without actual use) means that a right can be lost if the water is not used for a certain period of time. Without the ability to market/transfer water, the forfeiture provision does not incentivize conservation (such conservation would lead to loss of some portion of the water right). But when water markets are combined with conservation being recognized as a beneficial use, the prior appropriation doctrine can provide certainty for rights holders as well as incentives for conservation.

Impediments in Oregon's Water Law and Policy

Like other western states, Oregon has adapted its water rights system over several decades as conditions changed. A particularly large number of changes were made in the 1990s, generally to adjust the existing system to enable conservation and increase the efficiency of permitting. While these were largely viewed as positive adaptations, Oregon's system of water laws and regulations, continues to be plagued by ineffectiveness and inefficiencies in water rights permitting and water rights permit transfers. For example, imprudent granting of surface water withdrawal permits over the past decades led to over-allocation of water in several basins in Oregon. But even as adjustments were being made to address this problem, permitting for groundwater withdrawals led to over-allocation of withdrawals from several aquifers. The critical decline of groundwater levels in Harney County, for example, can be traced to ineffective permitting.

Permitting in Oregon has been inefficient for all manner of purposes.

Permitting in Oregon has been inefficient whether for the processing of applications for new water rights permits, extensions of time to develop permits, or transfers of water rights to new uses, new points of diversion, or new places of use. Water rights are overseen by the Oregon Water Resources Department (OWRD) and the Oregon Water Resources Commission. The Director of OWRD is responsible for implementation and administration and the Commission is responsible for policymaking and overall supervision of the agency. Rules promulgated by the Commission in 1992 led to exceedingly long delays related to permit applications. In the mid-1990s, the system came to be regarded as inadequate due to long delays and the frustration and uncertainty that such delays created. These delays were often associated with objections raised as part of the permit application review process. From 1993 to 1994, over 5,000 individual objections were filed, and by 1995, the OWRD had over 6,000 permit applications pending (which would also generate additional protests).[28]

Because much of the surface water in Oregon has been appropriated, most demand and applications going forward will be related to water right transfers, or changes to existing water rights. If a water right holder seeks to use water for an alternative purpose, to use the water in a different location, or to divert water from a different location, the right holder in most cases must file a transfer application with OWRD. Importantly, any changes in water use in Oregon – whether the use of new technology, conservation for in-stream flows, or transfers as part of water marketing – will likely involve an application to transfer an existing water right. Thus, in the same way that water development in previous decades may have been limited by the pace of processing new water right permit applications, current-day innovation and adaptation of water use can proceed only at the pace of the water rights transfer process.

OWRD workflow delays present in the mid-1990s have continued to the present, although OWRD has reduced the scale of the problem (Table 2). The 1995 law and policy adjustments (described below) helped somewhat to standardize the permitting process and alleviate some of the backlog (partly through temporary hires to assist). However, as the complexity around permitting has since evolved, OWRD has continued to lag behind the pace of demand. While much of the same administrative process complexity

that existed in the mid-1990s continues today, the breadth and depth of the review process for both new permit and transfer applications have only increased.

Table 2. Workload and water right permit/transfer application numbers for 2018 - 2020. Transfer applications refers to all types of transfers. Data provided by OWRD via personal communication.

	Applications Received for Water Permits of All Kinds		Final Orders Issued		Pending Applications at End of Calendar Year**		Permits Awaiting Final Certification
Calendar Year	Water Right Permits	Transfers	Water Right Permits	Transfers	Water Right Permits	Transfers	
2018	379	284	208	281	724	350	1,157
2019	222	244	375	260	571	302	1,197
2020	254	234	357	289	468	265	1,224

** OWRD refers to this as "Workload at End of Year," and includes pending applications received during the calendar year and prior years. Some are pending due to the normal application process, some because they are contested and awaiting assignment to an administrative judge for hearing.

The inherent difficulties that OWRD faces in processing water use-related applications have been exacerbated by reductions in agency resources necessary to carry out the work. The current OWRD is funded with general funds and these have been systemically cut over the years. Along with these declining resources, OWRD has been consistently subjected to litigation, which has resulted in legal fees absorbing a larger and larger portion of its shrinking budget. OWRD has become what could be considered an under-resourced agency with significant responsibilities, particularly given the complexities of the regulatory framework.

The inherent difficulties that OWRD faces in processing water use-related applications have been exacerbated by reduction in agency resources necessary to carry out the work.

There are other difficulties associated with the ways that applications for a water right are handled. Under Oregon law, an applicant seeking a water right permit submits an application to OWRD, and the agency arrives at a proposed decision based on the application, any comments from the public, and potentially input from other state agencies, such as the Oregon Department of Fish and Wildlife and the Department of Environmental Quality. However, the proposed decision is then subject to protest by any individual or entity, regardless of whether they provided comments to OWRD before it arrived at its proposed decision. The protest is then addressed in a contested case proceeding, overseen by an administrative law judge, with the contested case hearing occurring at some later point in time (potentially, or even often, years later), which leads to evidence being introduced that did not exist at the time of the initial permit application or even OWRD's proposed decision. The record in effect remains open through the end of the hearing. Due to the complexity of the decisions and the limited resources, there are very few hearings each year (only 3 occurred in 2019), despite the fact that as of the end of 2020, there were some 137 protests of proposed OWRD permitting-related decisions in need of a hearing. This has the potential effect of freezing or calcifying the entire water rights system.

As an example, East Valley Water District, a water district in the Willamette Valley with service territory located near Mt. Angel, submitted an application for new water storage in early February 2013, following years of studies and examining various alternatives.[29] OWRD proposed to issue the permit in mid-2014. As allowed under Oregon law, protests were then submitted by third parties objecting to OWRD's proposed decision. Some five years after the initial application, and four years after OWRD's proposed decision, the contested case hearing was held in mid-2018, which involved the introduction of reams of

new evidence by the opponents, much of which was not in existence at the time of the application or the Department's initial decision. A decision was rendered by the administrative law judge in 2019, and as of January 2021, the matter is before the Oregon Court of Appeals, with briefing yet to occur. This type of delay creates substantial uncertainty for any conceived project.[30] In a similar case, a cherry orchardist in the Hood River basin filed a permit application for a new groundwater right in April 2016, with OWRD proposing to issue the permit in May 2017.[31] However, protests were filed the following month by third parties, and as of January 2021, there had been no subsequent actions. The applicant has been informed that it may be years before a hearing on the protests will take place. Thus, the permit applicant remains in limbo with no options to proceed, despite OWRD having proposed to issue the permit years ago, based on the record before it at the time. Without a hearing and a final decision, there is no potential for the new business activity contingent on the pending water right permit.

Because of these types of challenges, OWRD has developed an approach of attempting to resolve protests through negotiated resolution before resorting to the formal administrative hearing contested case process. OWRD's experience is that negotiated solutions (which necessitate multiple parties and perspectives being represented) typically result in preferable outcomes and can be accomplished with less costs for the parties involved. Indeed, most parties are interested in participating in settlement negotiations prior to starting the formal hearing process. However, even when negotiations occur, they can take considerable time, and OWRD does not control the pace of the discussions; in some cases, the negotiations can proceed quickly, while in others they can remain dormant for many years.

Based on available information, a number of OWRD's proposed decisions on the pending applications (Table 2) have been protested and are now awaiting a hearing (Table 3). Some of these protests involve proposed actions on applications other than applications for new water right permits or transfers (e.g., applications for extension of time to develop water under a permit). The backlog has been around for years and will continue under the current regulatory and budget framework, as the pace of negotiations or hearings is simply inadequate to quickly process the protests already pending. At the end of 2020, 137 protests were awaiting hearing; in that same year, OWRD received 9 new protests, while 10 protests were resolved through settlement. If the state is able to take only around five cases per year to hearing (only three hearings occurred in 2019), then processing the number of protests already in existence would require nearly three decades. Because each protest of a proposed decision by OWRD on a permit application is, effectively, a court trial, the pace to process such hearings (amidst declining budgets) would not be expected to improve.

Table 3. Number of protests currently being considered by OWRD. Data provided by OWRD via personal communication.

	Number of Protests Filed Per Time Period					
Protest type	**In 2020**	**2018 – 2019**	**2016 - 20117**	**2011 - 2015**	**Prior to 2011**	**Total**
Instream water right	0	0	15	0	61	76
Water right permit*	2	13	7	1	5	28
Transfers	4	4	1	0	0	9
Permit extensions of time	3	7	7	4	2	23
Other (protested cancellations)	0	1	0	0	0	1

* Includes surface and groundwater

These challenges do not only affect irrigated agriculture; they also affect municipal water suppliers as well as environmental conservation groups looking to improve in-stream flow conditions. In one of the more egregious examples, which is not atypical for many in-stream water right applications, the Oregon Department of Fish and Wildlife filed an application with OWRD in 1990 for a new in-stream water right in the Deschutes Basin.[32] OWRD proposed to issue the water right in 1996; yet similar to the earlier

examples, a protest which followed (filed by a third party in 1996) has resulted in the permit application sitting in limbo for nearly a quarter of a century. The matter was finally assigned to an administrative law judge in late 2019, only to have the matter withdrawn due to OWRD's lack of funding and legal resources. And of course, if and when the application ever reaches a hearing, the record will remain open for new evidence until the end of the hearing, much of which was likely not even contemplated in the early to mid-1990s.

The inability to process permits in a timely and efficient manner stifles innovation and discourages any type of experimentation or adaptation of water use.

It is important to appreciate how these seemingly innocuous issues surrounding the processing of water use applications have cascading consequences for water management in Oregon. Most notably, the inability to process permits in a timely and efficient manner stifles innovation and discourages any type of experimentation or adaptation of water use, ensconcing the status quo regardless of its benefits or detriments. The current process for making decisions on applications for new water right permits, water right transfers, and other water rights-related actions has resulted in a system that creates stalemate rather than innovations or solutions. Further, it introduces crippling uncertainty to any potential changes in water management by individuals, businesses, local governments, and even conservation advocates.

Previous Evolutions of Oregon Water Law and Policy

It is important to appreciate that Oregon has, in the past, adapted its water laws, policies, and practices to changing circumstances and needs. In the mid-1990s water users and stakeholders were as frustrated with water law and policy as their counterparts are today. In response to this, reform advocates submitted at least 80 water-related bills in the 1995 legislative session, and more than 30 passed (with five vetoed by then-Governor Kitzhaber). The goals of this adaptation, at the time, were to 1) simplify water management; 2) reduce bureaucracy when possible; 3) promote incentives for watershed improvement; and 4) sustain gains accrued for in-stream and environmental protections.

Here are some of the key changes that resulted:

- Water right permits could be amended (SB 516).
- Temporary transfers were created (HB 2184).
- In-district transfers were authorized (SB 494).
- Incidental agriculture uses were allowed to be made of irrigation water without a formal transfer (HB 3225).
- Short-term authorizations were established for certain junior water uses (SB 2184).

All of these statutory changes allowed for more flexibility in how and where water could be used. At the same time, instream water protections and conservation mechanisms were enhanced.

- In-stream flows were clarified to mean the minimum amount of water necessary to support the public use requested by an agency (SB 674).
- Minimum perennial stream flows could be converted into in-stream water rights (SB 55).
- Groundwater withdrawals could be regulated if they measurably reduced surface flows of a state scenic waterway (SB 1033).

This era also resulted in notable evolution and adaptations of water management practices.

- HB 3183 created the concept of aquifer storage and recovery (ASR), and established limited license periods to test ASR projects.
- HB2376 created an expedited process for approving small storage ponds, which effectively recognized that certain types of uses do not need as much scrutiny as others, allowing administrative resources to focus on broader, more substantive impacts.

Beyond the 1995 session there have been other important changes through the years in Oregon which should not overlooked, including:

- Enactment of the In-stream Water Rights Act (1987), which allows state agencies to apply for instream water rights on equal footing with other water rights
- Amendments to the In-stream Water Rights Act, which allow voluntary transfers of water instream under the in-stream lease and in-stream transfer statutes
- Allocation of Conserved Water statute, which allows a user to move water that has been conserved to new lands in exchange for placing at least 25 percent of the conserved water in stream or in an aquifer
- The loan fund (2013), which allows netting 25 percent of the water saved from projects to stay in stream, or more, depending on how much of the project was publicly funded.

In sum, Oregon has demonstrated a willingness and ability to adapt and evolve its water law and policy in response to changing conditions and priorities. By far, the legislative reforms from a quarter century ago were the high point of that inclination.

7. SUMMARY FINDINGS

It is useful at this point to summarize the importance, circumstances, challenges, and constraints of Oregon's water resources, as documented in the six sections above. These findings set the foundation for finding a path forward and outlining specific steps in the next three years for securing Oregon's water future.

- Oregon enjoys a comparative advantage in water relative to other western states; however, that advantage is constrained by tremendous regional variability, uncertainty associated with changing climate, and demographic changes which affect availability and demand.
- Over-allocation and seasonal variability are putting greater pressure on both groundwater and surface water availability for all purposes, including instream environmental health. However, these challenges differ across regions, depending on geology, precipitation patterns, population, and economy.
- The costs of water services are increasing while federal funds are decreasing, resulting in rising water rates for municipal water customers, which makes water less affordable for low-income customers.

Oregon has a history of adapting its water law, policy, and practice in ways that respond to changing conditions and priorities. However, the most significant reforms occurred 25 years ago.

- Affordability challenges are being exacerbated by unexpected shocks to communities and water systems, most notably the economic effects of the Covid-19 pandemic and myriad effects associated with wildfire damage.
- The current water data management system is inadequate for water policy making, planning, management, problem solving, and investment. Agency budgets are inadequate to sufficiently address this constraint.
- The prior appropriation doctrine approach to water law provides certainty for water users that is valuable to system stability and investment decision making. The doctrine has already been adjusted in Oregon in important ways to enable conservation.
- Permitting of water use (including authorizing transfers) has been ineffective and chronically inefficient, creating staggering delays across uses and geography, and fueling adversarial conditions, inaction, and delay.
- Oregon has a history of adapting its water law, policy, and practice in ways that respond to changing conditions and priorities in its regions, communities, and economies. However, the most significant reform effort took place 25 years ago.

8. A PATH FORWARD

The primary challenge facing Oregon's water future is water management. Because the status quo is insufficient to meet current challenges, let alone those of the future, Oregon must overhaul its water management system. Water management should be modernized across the board. New models and approaches must be adopted that reward innovation, reduce regulatory costs, and increase accountability. Such models must be far more responsive to specific needs across the breadth of our communities.

Four Goals for Water Management Adaptations

To move forward, water stakeholders must accept the shared responsibility of finding a balance among four key goals to water management:

- Adopt regional approaches to water management that allow local stakeholders greater creativity in implementing water management programs designed to meet multiple benefits, and which are evaluated on their merits at the local level.
- Modernize water data infrastructure to increase the use and usefulness of data already being collected, while reducing the costs of reporting such data by the regulated community and decreasing the costs on the state and local governments for monitoring and data management.
- Reform Oregon's water permitting process to be more responsive to unsustainable conditions and be more responsive to the needs of communities in need of timely decisions.
- Ensure water affordability and equity across and within Oregon's disparate communities.

Along with these four, Governor Kate Brown's Water Vision efforts highlight two additional facets of a successful water management strategy for the future in Oregon:

- Build the local capacity for water management to ensure that any approaches and strategies developed are enabled by capacity co-developed within the local community.
- Identify how to pay for and finance water infrastructure by maximizing and optimizing the use of funds (including federal funds) and exploring opportunities for alternative funding and financing for novel water management approaches.

Finding common ground among these goals will not be easy, but adapting water management practices in ways that address them will be necessary elements to any needed and significant change in water management in Oregon. The water challenges that Oregon faces, and will continue to face, will shape the very future of the state. But if appropriately managed, Oregon's water can be a resource for communities, the foundation of resilient ecosystems, and a strategic advantage for the economy for decades to come.

Well managed, Oregon's water can be a resource for communities, the foundation of resilient ecosystems, and a strategic advantage for the economy for decades to come.

Lessons from Inside and Outside of Oregon

As Oregon envisions a path forward in water management, it need not craft solutions and adaptations from scratch. It should look to other states for ideas, innovations, and lessons learned. There are also local innovations within Oregon which could be scaled statewide. Here's a cursory look at the kinds of recent innovations Oregon might well consider.

Regionally Based Water Management

A number of states with widely varying conditions across their geography have developed a region-specific, basin-specific approach to water planning strongly grounded in science. Oregon has begun to adopt this approach as a starting point, but other states have embraced it more formally. For example, in Washington, the Yakima Integrated Plan was developed through a collaboration of irrigators, state agencies, federal agencies, and tribes. The plan is specific to the Yakima basin and is recognized by state and federal agencies, allowing a level of coordination and increased funding that would not have been possible without this jointly developed, region-specific approach. The legislation for the Yakima Integrated Plan does not pre-authorize any specific project or eliminate (or reduce) permit requirements, but it does provide a level of state and federal commitment, as well as local group coordination, that has allowed projects to proceed at a pace and scale not possible otherwise.[33]

California has taken a similar approach for groundwater through the Sustainable Groundwater Management Act (SGMA). In this case, recognizing the differences between aquifer conditions and withdrawal rates across California's geography and geology, the state created groundwater management units (geographic areas) with plans specific to local groundwater conditions. From there, the state allowed those units to create their own management organizations (Groundwater Sustainability Agencies) and their own plans for achieving groundwater sustainability. That is, the state delegated decision making and management approaches to local entities subject to state-level priorities for sustainability. It is important to note that SGMA is very much a management approach in progress, so its implementation and adaptation can provide important lessons on the effectiveness of regional management approaches to groundwater.[34]

Within Oregon, the Deschutes River Conservancy (DRC) provides an example that is similar in many ways to the Yakima approach. The key approach that both of these programs have adopted is to harness and maximize the benefits that come from basin-scale planning and coordination, particularly when coordinated across varying sectors (e.g., agriculture, conservation, municipal jurisdictions, tribes). The efforts of the DRC at enabling local projects to conserve water and then putting that conserved water into streams for conservation, has created opportunities to put conserved water to use where it is most needed ecologically. One of the implications for expanding this model could be to allow a watershed or basin-based organization to transfer water. This would allow water transfers to be more timely and efficient, particularly in critical windows of time. While the authority to grant or issue transfer permits may not be viable, there could be guidelines and accountability at the basin level, with a local organization having some operational flexibility within those parameters.[35]

This approach is in some ways similar to "group compliance permits", a watershed-scale management approach used in North Carolina, New York, and Virginia (among others). Within a watershed, point sources subject to regulatory water quality permits under the National Pollutant Discharge Elimination System are grouped and assigned individual source limits, the sum of which defines a cap for the group of permit holders. Individual permit limits are waived so long as the overall sum stays below the cap. This allows flexibility, both short-term and long-term, for meeting overall regulatory requirements while increasing the feasibility of local initiatives and innovations.

It is worth noting that there are also extreme cases of regional approaches, and these involve adopting quite different regulatory approaches (and even laws) specific to a particular geographic region. At the most extreme, the state of Nevada has implemented a pilot program that has adapted the prior appropriation doctrine in a limited geographic area, the Diamond Valley. In this closed basin, where the state of Nevada has allowed irrigators (for decades) to pump more than twice the amount of water than is sustainable, the state engineer approved a groundwater management plan – specific to this basin alone – that would gradually reduce allowed pumping, eventually reaching a rate that matched recharge. The innovative aspect of the plan, however, was adopting a shares-based water rights allocation in which each share would represent a certain amount of water. Over time, the amount of water represented by each

share would decrease, and over a proposed 35-year period, gradually reduce over-pumping. In addition, this approach would establish a more functional market (an approach modeled on that used in Australia). While a majority of irrigators supported the plan, as did the state engineer, (because it was preferable to curtailment) there were vocal opponents, and in the spring of 2020, a district court judge ruled that the approach contravened Nevada water laws. Thus, the approach remains untested.[36]

Modernizing Water Data Infrastructure

Data is a fundamental foundation for 21st century water management, and several states are exploring the development of what is being referred to as modern water data infrastructure – *an integrated system of technologies which includes common data standards, formats, and tools designed to make water data easy to find, access, and share online*. To be clear, modernizing water data does not mean requiring new data to be collected or reported. Neither does it mean centralizing water data in a single database. Rather, it is modernizing how data *already required or collected* is managed. Such an approach would increase the usability of data already collected, reduce the costs of reporting data, and, over time, reduce the costs of managing and making use of data. It may also demonstrate to water users the value of water use data in their management and budgetary decisions, encouraging an expansion of water data collection to capture a complete understanding of water use in Oregon.

Modernizing water data does not mean requiring new data to be collected or reported, but rather modernizing how data already required or collected is managed.

Other states have already been moving toward modernization of water data. New Mexico, for example, passed the Water Data Act in 2019, which directed its various natural resource agencies to develop an integrated Water Data Service. The process used in New Mexico was based on convening multiple working groups to ensure that the approach taken would lead to usable products, i.e., a water data system that improved the potential for data to inform water management, whether for water users, utilities, conservation groups, or regulatory agencies.[37]

California has also been modernizing its water data through the Open and Transparent Water Data Act (AB 1755). In many ways, this initiative is linked to the SGMA, based on the idea that new approaches to water management required new approaches to information. But California also saw that its water systems would benefit from data integration.

Ensuring Water Affordability and Equity

Virtually every community has vulnerable individuals and families – including elderly, disabled, and low-income residents – who struggle to pay their water bills. Water utilities are aware of the financial difficulties faced by many of their customers. To address this issue, utilities across the U.S. (including several in Oregon) have developed customer assistance programs that make use of bill discounts, flexible terms, special rate structures, and other means to help financially constrained customers maintain access to water services. These programs help customers retain or restore access to water services and avoid penalties and fees, but also help utilities improve their financial health by saving on administrative and legal costs incurred from debt collection and service termination and reconnection.[38]

In addition to assistance programs, some states are exploring how to use financing at the utility level to incentivize affordability within the community. The State Revolving Fund (SRF), a federal-state partnership with the U.S. Environmental Protection Agency, provides subsidized loans to water and wastewater utilities. This reduces the cost of capital, and thus reduces the costs for ratepayers. Some states are exploring how to apply the SRFs to both affordability and green infrastructure. In Maryland, legislators proposed a plan that would refocus how the state's drinking water and clean water SRFs are used in two key ways. First, forest protection (and management) can receive funding (due to water quality benefits), as would green infrastructure projects – including ones led by nonprofits – to treat

storm water runoff (similar approaches are used in Ohio, Iowa, Washington, Vermont and other states). The proposed changes to Maryland's Drinking Water SRF would add a new priority around environmental justice intended to increase efforts to replace toxic lead water pipes, consolidate failing, small private utilities, and support green infrastructure that mitigates hazards in disadvantaged communities. And the proposal would set aside 2 percent of the federal capitalization grant for planning and design assistance grants for lower income communities.

Building Local Capacity and Financing Water Infrastructure

Oregon has placed considerable focus on building local capacity to participate in water management, most notably through the creation of the Oregon Watershed Enhancement Board, or OWEB. This agency, and the series of approaches and programs that it has adopted, has proved to be a model for other states in how the state government can enable local capacity relevant to specific regional challenges such as aquifer depletion.

The coordinating and enabling role that OWEB plays for local capacity could also be useful for enhancing the potential to develop funding from a variety of sources. Navigating the wide array of federal and state funding can be difficult, particularly for small or poorly resourced water management systems such as utilities and irrigation districts. Many states have contemplated better ways to coordinate funding development – both federal and state – because the various funding programs have different goals, dollar levels, eligible applicants, eligible projects, timelines, and application processes. While very large cities may have little difficulty with these complexities, medium sized utilities, and especially small utilities find this process daunting and unnecessarily complicated. As a result one funder may have too few takers while another has too many applicants and has to turn projects away.

The coordinating and enabling role that OWEB plays for local capacity could also be useful for enhancing the potential to develop funding from a variety of sources.

To address such difficulties, many states have developed coordinating bodies. One good example is Arkansas which developed the Water and Wastewater Advisory Committee (WWAC) in 1992. All federal and state agencies work together along with the regulatory agencies and technical assistance providers to advise communities regarding which funding entity or entities would be the most advantageous and appropriate for the type of water need and the scale of funding needed. The WWAC has a unified application to start the process and its decisions are not binding on the parties. The WWAC helps ensure all agencies are able to spend their funds and that all entities (or as many as possible) receive the necessary funding.

Texas has a similar program – the Texas Water Infrastructure Coordinating Committee (TWICC) – which focuses on coordinating the efforts of all the water and wastewater funding in the state as well as the regulatory agencies and technical assistance providers. TWICC helps address emergency conditions such as drought and floods, and compliance problems, such as arsenic. Another innovative program in Texas is the "CFO to Go" program developed by the Texas Water Development Board (comparable to the OWRD), where the state agency contracts with accounting firms to provide certified public accountants to small systems facing budgetary or financial challenges. This service and financial guidance is free to the systems that apply. Systems are under no obligation to use them, but the service and guidance are intended to help mitigate the risks of limited human capital, scarce financial resources, or reporting requirements that overly burden many small, under-resourced water management entities.

9. RECOMMENDED FOCUS THE NEXT THREE YEARS

Oregon's water management challenges are substantial, particularly when considered over long timelines like 50 or 100 years. In the same way that Oregon made important water policy reforms in the 1990s, it is time to do so once again. These changes should be based on the four goals described above – regionalizing water management, modernizing data infrastructure, reforming permitting, and ensuring affordability – as well as investing more in local capacity and developing a financial plan to pay for infrastructure maintenance and expansion. But understanding and appreciating the water management system and the importance of these goals requires some base level understanding of water in Oregon and many of its management facets.

Specific water policy adaptations and changes should be developed with an intentionality that more fully represents the diversity of Oregon's communities and hydrology.

While these four goals should be the general basis of adapting water policies, the specific adaptations and changes should be developed with an intentionality that more fully represents the diversity of Oregon's communities and hydrology. We support the Oregon legislature's decision to authorize the National Policy Consensus Center to steer a working group through a year-long process designed to reach consensus on key aspects of water management systems modernization. We also support the Association of Oregon Counties effort to gain valuable knowledge at the community level through stakeholder dialogues and discussions of the water challenges affecting people from all walks of life. OBC will use its technical and analytical skills to provide information to the groups involved in these efforts; water management must remain a high priority for 2023.

Legislative Elections

Oregon's need for water policy reform should be a central issue for both gubernatorial and legislative elections, and candidates should expand their understanding of the issue and its importance to Oregon's future. OBC will raise water sustainability as a core issue of concern for the incoming administration, and will exert what influence it can to ensure that candidates articulate their own understanding of water in Oregon and their vision for how to implement water policy changes in the future. We will encourage other organizations to also emphasize water management reform as they develop their priorities for candidates, working together to ensure that a new administration and legislature are prepared to move forward to fully realize the incredible value of water to Oregon's economy, natural systems, communities, and cultures.

END NOTES

1. The water management system in a state includes its laws, regulations, agencies, infrastructure, data (including management systems), and funding/financing.
2. In her February 11, 2020 letter to the members of the Oregon legislature, Governor Brown summarized the work of the Water Vision: Community Capacity, Water Investment Governance, Water Funding, Engaging Oregonians, and Data and Information Systems. With the addition of funding and community capacity, we believe that our four pillars capture all these findings. While our report will not focus on capacity building and funding, they are nonetheless central to sustainable solutions to meeting Oregon's water management needs. See https://www.oregon.gov/oweb/Documents/OWV-Gov-Letter-to-Legislature.pdf
3. Legislature Passes Landmark Water Package, https://www.oregonlegislature.gov/courtney/Documents/2021-Water-Package-Release.pdf
4. This summary is a distillation of the excellent review provided in pages 17 through 22 of the Integrated Water Resource Strategy (2017).
5. It is worth noting that several species have been delisted including the Oregon chub and Modoc sucker
6. Mote et al. 2019. Fourth Oregon Climate Assessment Report by the Oregon Climate Change Research Institute.
7. Fitzpatrick, M.C. and R.R. Dunn. 2019. Contemporary climatic analogs for 540 North American urban areas in the late 21st century. Nature Communications 614.
Note: https://fitzlab.shinyapps.io/cityapp/. The mapping tool provides a range of 'matched' cities for the future. We provide matched cities that have similar familiarity/size to those in Oregon, although they may be slightly different than what are initially provided in the mapping app.
8. Ibid.
9. OSU. Well Water Program. Underground Story of Water in Oregon.
10. For a data integration and visualization of factors relevant to water resources in Oregon (including precipitation, droughts, population), see nicholasinstitute.duke.edu/reservoir-national-trends/. These data were compiled relevant to large reservoir management across the US, but provide relevant data visualization at the national, state, and county levels.
11. An acre-foot of water is a unit of volume equal to the volume of a sheet of water one acre in area, one foot deep.
12. Data obtained from Portland State University's Population Research Center. Population Forecasts.
13. League of Oregon Cities, Water Rates Survey Report, February 2020.
14. Schimpf, C. and C. Cude. 2020. A systematic literature review on water insecurity from an Oregon Public Health perspective. International Journal of Environmental Research and Public Health 17, 1122, doi:10.3390/ijerph17031122.
15. The Invisible Crisis: Water Unaffordability in the United States May 2016 By Patricia A. Jones And Amber Moulton Unitarian Universalist Service Committee
16. The cities included in the current dataset were Hermiston, Lincoln, Medford, Newport, Ontario, Pendleton, Portland, Salem, Tillamook.
Put another way, to pay a typical water bill in these utilities would require working 9 hours at the federal minimum wage.
17. Water affordability data and visualizations are available for 9 water utilities in Oregon at people.duke.edu/~lap19/www/afford_ws/rates_map.html. These utilities can be compared to more than 960 other utilities from four other states (PA, NC, TX, CA). Data are based on digitized water and wastewater rate structures, municipal boundaries (assumed to be comparable to service area boundaries), and US Census data.
18. US Water Alliance. 2019. Closing the Water Access Gap in the United States: A National Action Plan. The publication notes that water and sewer pipelines laid out in the 1960s, when federal subsidies were present, were often not extended to African American or Latino communities; these infrastructure footprints have remained as the costs for infrastructure expansion have grown and federal subsidies have been removed.
19. Meehan, K., J.R. Jurjevich, N.M.J. Chun, and J. Sherrill. 2020. Geographies of insecure water access and the housing-wtaer nexus in US cities. Proceedings of the National Academy of Sciences 117: 28700-28707.
20. Doyle, M.W., L. Patterson, E. Smull, and S. Warren. Growing options for shrinking cities. Journal of the American Water Works Association 112: 56-66.
21. ECONorthwest, 2019. Importance of Water in the North Santiam Basin: An Economic Description. Prepared for North Santiam Watershed Council. January 30, 2019.
22. ECONorthwest, 2017. Water Security for the Yakima River Basin's Economy, Communities, and Watersheds. Prepared for the Yakima River Basin Water Enhancement Project Workgroup Economic Subcommittee, June 14, 207.
23. The basins identified for additional studies are: Walla Walla Sub-basin (Umatilla); Umatilla Sub-basin (Umatilla); Fifteen Mile Creek (Hood Basin); Grande Ronde Basin; Powder Basin.
24. Tarlock, A.D. 2001. The future of prior appropriation in the New West. Natural Resources Journal 41: 769-793.
25. Schutz, J. 2012. Why the Western United States' prior appropriation water rights system should weather climate variability. Water International 37: 700-707.

26. The prior appropriation doctrine emerged somewhat independently in the 19th century in both California mining settings and amongst early Mormon settlements in Utah; Chapter 3 in Worster, D. 1985. Rivers of Empire: Water, Aridity, and the Growth of the American West. Oxford University Press. Chapter 5 in Doyle, M. 2018. The Source. WW Norton.
27. Chong, H. and D. Sunding. 2006. Water markets and trading. Annual Review of Environment and Resources 31: 239-264. Chile has also used a prior appropriation doctrine type approach to water allocation, although its present system is a hybrid type approach.
28. Achterman, G.L. and P.D. Mostow. 1996. Senate Bill 674: Increasing the flow rate of Oregon's water rights permitting process. Willamette Law Review 32: 187-216.
29. Water Right Application No. R-87871
30. It is worth noting that in this specific case, while the administrative law judge and the OWRD Director both recommended approving the permit application, the Commission voted to deny the application, yet it took six years to get this final decision.
31. Water Right Application No. G-18285
32. Water Right Application No. IS-70695
33. See yakimabasinintegratedplan.org for overview; this resource also provides a number of technical reports and annual reports to the Washington legislature which provide insight on the pace and scale of changes possible through the integrated partnership.
34. For overview see water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management;
35. There are clearly challenges of group compliance, most notably the potential for pollution 'hot spots' (the concentration of impacts in one area and restoration in another); see generally Doyle et al. 2014. Optimizing the scale of markets for water quality trading, Water Resources Research 50: 7231-7244.
36. Rothberg, D. 2020. District judge strikes down state-backed groundwater market for violating 'first in time, first in right' rule. The Nevada Independent, May 1.
37. See newmexicowaterdata.org; note that this portal and available data are still very much in development and so do not reflect what is intended to be eventually available on the system.
38. Drinking Water and Wastewater Utility Customer Assistance Programs EPA 2016.
In Oregon, example programs exist in Tualatin Valley Water District, Eugene Water and Electric Board, and the City of Gresham, among others.
https://www.tvwd.org/district/page/new-bill-assistance-program-qualified-customers-waterwastewater-balances-paid-march-1
http://www.eweb.org/residential-customers/income-based-assistance
https://greshamoregon.gov/Utility-Financial-Assistance/