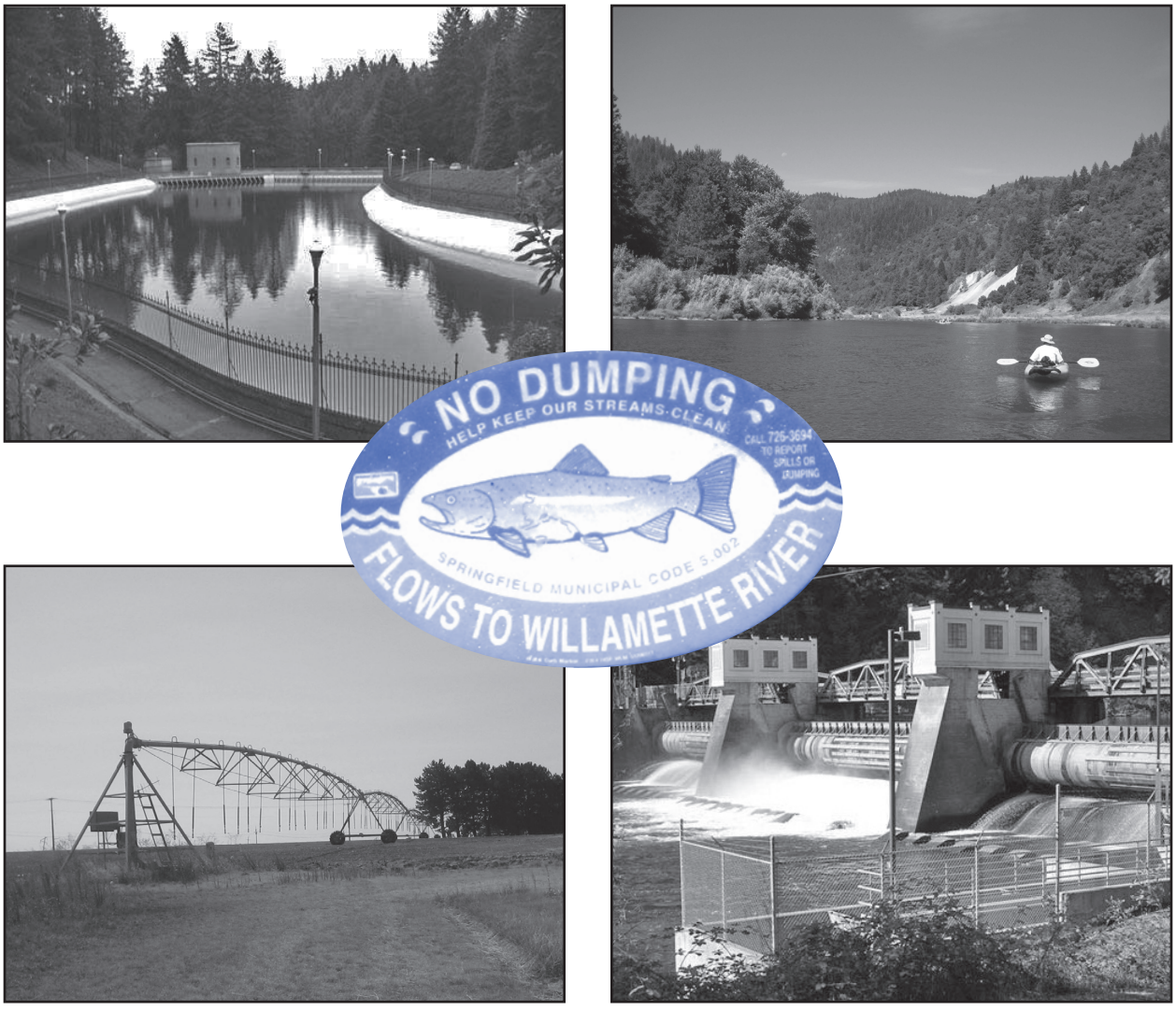
Water In Oregon-Not A Drop To Waste

PART 2: ISSUES AND PERSPECTIVES



LEAGUE OF WOMEN VOTERS® OF OREGON EDUCATION FUND

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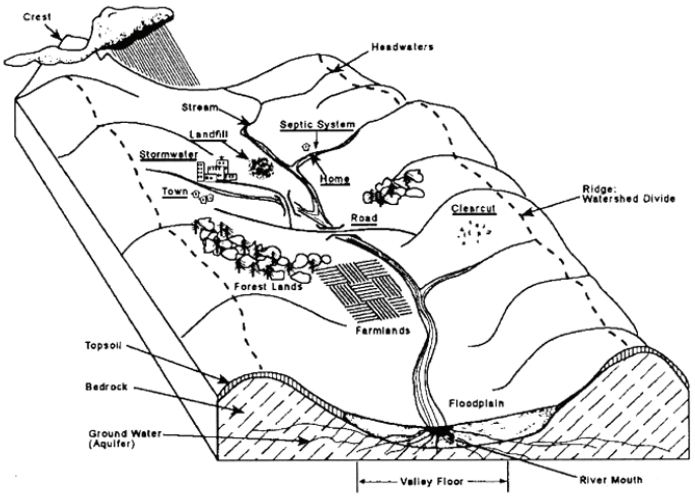


Illustration of a watershed

WATER IN OREGON– NOT A DROP TO WASTE
PART 2: ISSUES AND PERSPECTIVES 2010

Introduction

In Part 1 of this study, the League of Women Voters of Oregon Education Fund (LWVOREF) examined the current status of laws in Oregon. The state has a complex volume of laws that addresses water quantity and quality. Within its scope is the capacity to regulate almost all aspects of Oregon's water. How effectively these laws are implemented varies greatly and depends upon funding. These laws have evolved over time to adjust for newly recognized needs. For example, the Prior Appropriation water rights regulations now have options for changing rights for more current needs, for transfers of rights and for temporary transfer of rights. Since 1955 increasing emphasis has been placed on the need to maintain minimum stream flows, and in-stream rights have been introduced. The Water Resources Department (WRD) has acted to restrict groundwater use in areas where there are indications of diminished groundwater.

Water quality regulations have expanded from the initial regulation of water treatment plants and end-of-pipe industrial pollution to new requirements focusing on nonpoint source pollution. Working within the requirements of the Federal Clean Water Act, the Department of Environmental Quality (DEQ) issues permits for all end-of-pipe discharges to Oregon's waters and for stormwater (nonpoint discharges from many municipalities, industries and construction sites). The DEQ is evaluating levels of pollution in Oregon waters and has released a list of 118 priority persistent pollutants found in the water.

The Public Health Division of the Department of Human Services has assisted in the development of risk assessments of the sources for all public water supplies in Oregon and sets standards for water quality to support human health and safety. Other departments protect wetlands and stream habitats.

Yet challenges and paradoxes remain with how water is managed. For example, it is publicly owned, but privately used.

In Part 2 of the study, the League committee interviewed thirty-five stakeholders throughout the state to gather as many perspectives on current need as possible. (See appendix A for interview questions.) From those interviews the committee identified the most frequently expressed concerns and has endeavored to present the differing perspectives on each issue.

Early in the interviewing process, the League found that differing perspectives come from differing needs. For example, farm communities, so important to Oregon's economy, have a strong economic stake in maintaining water rights that allow them to grow the most profitable crops, and "locally grown" has become a theme for many of Oregon's restaurants and farmers' markets. For recreation, fisheries and aquatic habitat, the concerns seem to be the drop in stream flow and pollution associated with runoff. Each group has a strong argument for improving and expanding the practices that have sustained them. Oregon has reviewed its land use planning through the Big Look Task Force and is beginning the process of developing an Integrated Water Resources Strategy (IWRS) to review its water management structure. These two components of planning for Oregon's future need to be strongly linked using an understanding of current stakeholders' perspectives. The challenge is identifying pathways to protect both the quality and quantity of our waters while maintaining the viability of our communities and addressing the future impacts of population growth and climate change.

In this document, you will be presented with a discussion of current water issues. This is intended to give the you the opportunity to look at water

issues and regulatory gaps from various perspectives and consider the complex challenges that agencies, politicians and residents must address to protect this essential resource.

How Water Is Managed

The rivers, streams, lakes and groundwater in Oregon have a complex array of state managers. These statewide departments then interact with local and federal governments and special districts, including wastewater and drinking water utilities that have regulatory responsibilities. (See Table 1.)

Many of those interviewed for this project described the regulatory process as "fragmented" and "siloed," attempting to address all problems with one-size-fits-all solutions. Municipalities, utilities, local planning agencies, agricultural groups and industries are often required to communicate with several different agencies. Citizens also find this confusing. Since each department has different responsibilities and priorities for water, reaching agreement can be both time consuming and sometimes frustrating.

Cooperation

Interviewees spoke of the need for cooperative watershed approaches that sometimes step outside the siloed regulatory framework used now to address water problems. Clean Water Services (CWS) in Washington County has been working to address warm temperature issues in the Tualatin River. After determining through computer modeling that the expensive process of refrigerating water prior to discharge from the treatment facilities would have

Table 1: State Agencies with Water Management Responsibilities

Department of Land Conservation and Development	DCLD	Administers Land Use Planning Goal 6 (protect air, water and land quality)
Department of Environmental Quality	DEQ	Prevents and reduces pollution of the waters, implements Federal Clean Water Act
Department of State Lands	DSL	Oversees the protection of wetlands, submerged and submersible lands
Oregon Business Development Department	OBDD	Provides loans for water and wastewater infrastructure finance
Department of Agriculture	ODA	Regulates agricultural activities including permitting of Confined Animal Feed Operations
Department of Forestry	ODF	Administers the Oregon Forest Protection Act and works to protect streams from poor forestry practices
Department of Fish and Wildlife	ODFW	Addresses issues of quality and volume of water as fish and wildlife habitat
Oregon Department of Energy	ODOE	Manages the permits of hydro-electric facilities
Oregon Drinking Water Program of Public Health Division	OPHD	Regulates drinking water quality in water supply systems
Oregon Watershed Enhancement Board	OWEB	Completes watershed restoration activities and is responsible for Oregon's strategy for sustainable watershed health and salmon plan
Water Resources Department	WRD	Tracks existing water rights, approves new water rights and approves transfers of water rights

See *Water in Oregon -Not a Drop to Waste: Part 1* for additional information

minimal effect on reducing stream temperature, CWS partnered with other stakeholders in an innovative water quality trading approach. The team looked at the entire watershed and developed an approach that increased the flows in the river's tributaries in combination with planting a natural shade canopy along those tributaries. The team determined that this process would be more effective in reducing Tualatin River temperatures. Since initiating the project, they have pumped water to the tributaries using existing water rights on Hagg Lake, and with volunteer partners they have planted over eight million native trees and shrubs that are most resistant to potential climate change along these smaller streams. To achieve these result CWS worked with WRD, DEQ, ODA, ODF, farmers, environmental groups and local communities. Flows in the river have increased and temperature appears to be cooling. However, whether ideal temperature can be achieved is still in question on the broad, slow flowing Tualatin River. Measuring success of the project is also difficult since historical data on actual fish populations and habitat prior to Oregon settlement are limited.[1]

Examples of cooperative water management include projects on the Deschutes, the Umatilla, and the Tualatin Rivers, the removal of dams on the Rogue River, the removal of the Marmot Dam on the Sandy River, the Albany-Millersburg Wetland Project and the progressing work on the Klamath Basin. All utilize a watershed approach. Portland, along with neighboring communities, is using this approach on Johnson Creek to both reduce flooding down stream and to protect water quality. Repeatedly in interviews the effectiveness of this localized approach was stressed. However, watershed approaches sometimes conflict with the one-size-fits-all nature of statewide regulations, limiting attempts to be innovative and to apply local knowledge.

Watershed Approach

Watersheds (also called drainage basins or catchments) are surface water bodies and the land and groundwater area that drains to them. In the past, stream restoration often focused on "bank to bank" issues—the water body itself plus land near the banks of that water body (called the riparian zone). Beginning in the late 1980s, watershed restoration began to cover "ridgeline to ridgeline" aspects, such as the land, its uses, vegetation types and air quality. * The "watershed approach" is a framework to address today's water resource challenges. The framework looks at the entire hydrologic watershed and considers the stressors (air and water) that impact the watershed. The approach integrates multiple programs (regulatory and voluntary,) is based on science, is aided by strategic watershed plans and is using adaptive management. The approaches encourage "stakeholders" to work cooperatively on projects designed to meet water quality standards and protect water resources in a specific watershed. Stakeholders can include private landowners or organizations as well as federal, state and local agencies. ** One example of a watershed approach might be volunteers from watershed councils, school districts, local businesses or others collaborating with public agencies to lower stream temperatures by maintaining streamside plantings.

*http://www.epa.gov/owow/nps/watershed_handbook/factsheet.html. Retrieved 2-10-10.
**http://www.epa.gov/owow/watershed/approach.html . Retrieved 2-10-10.

Recording of information

Effective water management is also hampered by a lack of recorded information. Water rights have not been adjudicated (settled by judicial procedure) in many areas. For years the construction of private wells was not tracked. Although construction is now recorded, information on the quality and available quantity of the water is not known. Similarly, most septic systems are not required to be regularly inspected. While many publications report that

water is over allocated in summer months – actual data on surface flows and groundwater levels are not complete. (See section on data)

Funding

Funding for state water agencies is also a challenge. The Portland Bureau of Environmental Services provides funding for the salary of the DEQ employee who reviews submittals required for its stormwater injection system. Fifty-two wastewater treatment facilities pay extra fees to cover the salary costs for two state employees who track and evaluate scientific data for the toxics program.

In addition to state and local regulations, the federal Clean Water Act (CWA) mandates identifying and addressing pollution problems in surface waters. DEQ is responsible for implementing the CWA in Oregon. Once impaired water is identified, the state must design an approach for addressing the impairment by establishing a pollution limit, known as Total Maximum Daily Load (TMDL), for the identified water body. This process requires staff and funding and must be done on a timeline.

Under the CWA, citizens may take legal action if they identify CWA violators in circumstances where enforcement is not occurring. Violators may include industries, wastewater treatment facilities, the EPA, state agencies and individuals. Successful lawsuits may ensure that steps are taken to correct the problem in a timely fashion. Settlements may result in polluters paying fines that are awarded to the U.S. Treasury and can be used in environmental projects. Other consequences are that time is lost and monies can be redirected from correcting the problems to paying fines and legal fees.[2]

Communication

Planning for water protection and use is often hampered by a lack of communication among agencies and between agencies and the public. Water management is not always considered during local land use planning decisions. Public meetings held on county and municipal levels allow citizens to participate in the land use decision making process, but the state water agencies do not often join in at the local level. Land use approval processes do not necessarily consider the impacts of new projects on the local water supply. State water decisions are made through separate processes.

Interviewees expressed concern that development issues, such as demands on local water supplies and runoff from impervious surfaces, may not be considered in the local permitting process. Increased interaction among state agencies, local government units and the public involved in zoning and planning hearings could head off future problems. Once again the lack of staff and siloed approaches can reduce effective management.

Local planning departments, state agencies, and local contractors do not always exchange information or inform property owners of their legal responsibilities. For example, a church was built in a rural area in southern Oregon, and local building officials did not inform the church's owners about the drinking water regulations for their well, which served the congregation. The church's well system by definition should have been registered as a regulated system. The failure was only discovered when a public health official drove past the site. When informed, the church immediately brought the system in to compliance. This lack of communication fortunately did not result in a health issue to the public.

Other interviewees expressed concern about the process of communication between agencies and the public. They noted that in considering regulations for water, agencies make an effort to communicate yet often those individuals impacted feel that their requested input was more a government formality than a decision-making tool.

The state's recently initiated IWRS may address interdepartmental communication. The current

regulatory structure has only limited flexibility for recognizing priorities outside of current agency responsibilities.

> "What stands out is the need of a new generation of water professionals, able to handle complexity and able to incorporate water implications of land use and of ecosystem health in integrated water resources management. It will for those reasons be essential and urgent to upgrade the educational system to producing this new generation."
> Malin Falkenmark*
>
> * Falkenmark, Malin, Water Resources Management, 2007, Vol. 21, pgs. 3–18

The Use Of Data

Efficient management of the quality and quantity of water is dependent on our knowledge of how the natural system works, how it has worked in the past and the implications for the future. The understanding is accomplished through the collection of data. Data are gathered by agencies, universities, private and environmental organizations without a universal repository. Gathering of data must be ongoing and is hampered when there is a lack of historical data to use for comparison. (However, future climate change may limit the value of historical data.)

Gathering water quality data may be costly. The cost per water quality test sample runs from less than $10 to over $1000. In the case of trace toxins, sampling equipment, methods, and analysis require high standards to avoid contamination and to provide accurate results. Needless to say these processes are expensive and require trained personnel. Interviewees pointed out that often funding for data collection is the first budget cut. In several instances, DEQ has addressed this problem by relying on permitted entities to do the tests themselves and to provide the funding for agency staff.[3] Comments included that raw data are not "sexy"; however, a long record of creditable data is important.

Maintaining consistent quality standards can complicate the use of data. Samples must be collected correctly. Data gathered by different methods with varying quality control is not comparable. For many trace toxins, the safe levels have not been determined. Additionally interactions between chemicals in the water may affect their toxicity. Standards set for chemicals in drinking or habitat water may be outdated, and levels set for TMDLs may not reflect the characteristics of specific sites.

Several interviewees also suggested that existing data are not adequately used in developing water quantity and quality management practices. Hydrologic modeling and studies of the impacts of land activities on water quality and quantity should be applied to management decisions. Interviewees in forestry suggested looking at existing data, as there have been enough studies done on forestry practices for good management decisions. Rick Hallmark, Coos County Public Health Department, cited an example where digital information on the locations of all public water systems was sent to county governments, but without any mandates to use the information. He expressed concern that currently there is a lack of vision and strategic planning.

Many of those interviewed stressed the need for a watershed approach that looks at the interaction of all the data. Such an approach requires cooperation from the local to the state level. Gail Achterman, Director of the Institute for Natural Resources, Oregon State University, suggested a need for an accurate system to measure and monitor water - both usage and discharge. With adequate funding and newer technologies, on-going monitoring of streams could track information on both water quality and quantity and catch problems earlier. She noted that Portland General Electric achieved significant

water management improvements when it installed such a system for its hydroelectric operations in the Clackamas Basin. She suggested a system that is integrated including DEQ, watermasters and others involved in water management, such as irrigation districts and other water users. Such a system could be funded through fees based on water usage.

How data collection should be funded and managed remains the final challenge. Should the user pay? Should the user or the state perform the test? Is there a role for private industry? Can volunteers collect data? What level of testing is required? How should information be tracked? What procedures need to be in place to ensure information is used correctly? How is the data translated for public consumption?

Specific Challenges For Water

The Federal Clean Water Act (CWA) was passed in 1972 with a goal of making the waters of the United States swimmable and fishable by 1985. In 2010, it is obvious that the original drafters of the CWA drastically overestimated our ability to address the problems of our waters. A recent editorial in the New York Times observed:

> Rightly celebrated as one of this country's most important environmental statutes, the 1972 Clean Water Act has greatly improved the quality of America's waters, turning contaminated rivers and lakes into swimmable, fishable and even drinkable waters. But even its staunchest allies agree that the act has grown old and fallen well short of its goals, crippled by uneven and sometimes nonexistent enforcement by state and federal agencies …— and by shortcomings in the law itself. [4]

Although many of the visible problems, such as raw sewage directly discharging into rivers, have been addressed, other challenges have come to the forefront. One urgent challenge is availability of sufficient high quality water. Many working with water resources now recognize that restoring, conserving and protecting our waters is a multifaceted task that cannot be performed within a siloed framework. This section outlines some of the current challenges facing our waters.

Addressing Water Rights

The principle of "first in time-first in right," called prior appropriation, has been the basis for Oregon water use law since 1909. This approach originally only applied to surface water. The fundamental doctrine has evolved over time. The first person granted a water right has priority over all later rights and is entitled to use that full right in times of shortage before all others may use theirs. Water rights under prior appropriation are tied to the land and specify amounts, type of use and point of diversion. Regulations specify that the use must be beneficial without waste. "Waste" is not legally defined. In 1955, water law expanded to include groundwater, and by 1987 water rights had evolved to include in-stream uses and to allow the right holder to transfer point of diversion, timing and type of use.

Klamath Falls, Oregon

Records of water rights remain incomplete. Prior to 1909, some water uses, such as sovereign tribal treaty rights and those of early farmers, were not documented. Additionally, when property was sold, the water rights went with the land, and new ownership was not always tracked. Record keeping is further complicated because of permit-exempt wells. Many interviewees expressed some level of

dissatisfaction with the Oregon law based on prior appropriation, but they also indicated that change is not currently likely nor necessarily the solution. Fred Ziari of IRZ Consulting, who works extensively with agriculture, asked, "What is the point of changing it? What are you going to replace it with? ... (we)need to manage our water." Other interviewees pointed out that the many court cases, legal activities and even infrastructure for water are bound up in prior appropriations.

Bill Gaffi of Clean Water Services, Washington County, noted that many, if not most, in-stream water rights do not have old enough priority dates to be protective of environmental flows under the prior appropriation doctrine. Stanley Petrowski, president of the South Umpqua Rural Community Partnership, who works with the Beaver Project in Umpqua Valley, also noted that the mandatory use of water from a water right can be a "foolish" use of water resources. Conservation of water is perceived as being penalized, since the current system is "use it or lose it."

Farmers and irrigation districts expressed support for the current system and explained that when farmers can depend on a known water supply for irrigation, they can plan for crops and seek loans necessary for purchases of seed and equipment.

Municipalities as well indicated that they were able to plan for growth with knowledge of the water supply. For example, Portland has put together a long term plan based on known Bull Run water rights and projected population. On the other hand, some municipalities and water districts have expressed concern about future scarcity of water supplies because of their junior water rights.[5]

Lorna Stickel of the Portland Water Bureau stated:

> The Western States Water Council and specific states have identified water rights structure to be both an impediment and an opportunity for adaptation to climate change impacts. The impediments are largely related to the rigid nature of the prior appropriation structure in the western states. This system has resulted in paper over-appropriation of many surface and groundwater systems that will present increasing enforcement challenges and create additional conflict between user groups. The laws and codes present significant roadblocks to seeking innovative solutions tied to the legalistic structure of water rights and the extreme importance that owners of water rights attach to being able to retain certainty…The opportunities are there also however, because of the development of more flexible methods such as water banking, split season leasing or leasing in general, more inclusive definitions of beneficial uses, allowed temporary transfers of water rights within water districts or purchase of rights during critical time periods, and loosening up the cancellation statutes so that rights can't be lost if transfers or leases are utilized.

In general, interviewees also agreed that Oregon's WRD was understaffed. Kent Madison, of Madison Farms in Echo, Oregon mentioned the slow processing of water transfers made planning difficult. Many farmers pay extra to expedite the process, but even then find it slow. Legislation passed in 2009 sets up a pilot project to allow these transfers without the slow permit process and still requires adequate record keeping and tracking.

Challenges of staffing and funding have also limited opportunities to maintain current water rights data. Gail Achterman expressed concerns over the lack of solid data and staff to track and use the data. Water rights cannot be managed without adequate information about flows and groundwater quantities. Her concerns were reinforced by many other interviewees who suggested that a stronger commodity approach to water would allow adequate funding to develop the data to understand our water supply. Achterman also expressed the need to solve problems locally.

Rick George, Program Manager, Environmental Planning/Rights Protection of the Confederated Tribes of the Umatilla Indian Reservation,

expressed a need for defining and adjudicating tribal water rights. Although their rights date back to the Treaty of 1855 and beyond, they are "implied rights" that are not clearly defined in Basin decrees, and as such they are generally not honored as senior water rights. To avoid lengthy litigation, the Umatilla Nation has worked with farmers and irrigation districts in the area to address this problem by crafting solutions that protect existing water-based economies and at the same time allow the Tribe to restore stream flows and water supplies and adjudicate its rights. However, conflicts between tribal rights and water right holders in other areas continue to be problematic as illustrated by long-standing water conflicts in the Klamath Basin of Oregon and California. In February 2010, an interstate agreement was signed to begin the process of dam removal on the Klamath River.[6]

Because the prior appropriation doctrine predates recognition of environmental needs and land use planning, implementing appropriate legislation can result in conflicts difficult to resolve. Perhaps the biggest conflict has been the reduction in stream flows and its impact on fisheries, habitat and recreation. Lower stream flows create additional problems that include concentration of pollutants, a reduction in dissolved oxygen and increased water temperatures. In-stream water rights are now included in the prior appropriation laws; most are junior rights, and low flows still occur.

Comments from long time professionals in the fisheries field included a description of the prior appropriation approach to water management as "the single largest impediment to protection and restoration of aquatic resources." Those working in fisheries referred to prior appropriation as a "broken" model that is a complete impediment to any goals for the protection and restoration of aquatic resources – including salmon – that need water in the ground and in streams.

The conflict between retaining water in-stream and the out-of-stream needs of large users is further compounded by requirements of the Endangered Species Act (ESA).

In conclusion, the future of prior appropriation must be considered in terms of the complexity of the existing system, legal constraints and the need to logically connect the disconnect between water quality and quantity. The question remains: how can water quantity management be better integrated with the issues of water quality, protection of fisheries, habitat, land use planning and climate change?

Addressing Future Water Demands

In 2007, the Oregon Legislature provided limited funding to the WRD to begin work on a statewide water demand forecast, to compile an inventory of potential conservation projects and water storage sites, and to provide monies for community planning grants.

Using current water rights data, state population projections and irrigated acreage, the project team calculated today's total statewide annual water demand as approximately 9.1 million acre-feet. In 2050 they assumed the demand would increase to 10.3 million acre-feet. These projections were considered the "base case" and did not take into account the potential effects of climate change or conservation actions. Each of those issues could change the estimated demand range to between 7.4 to 11.3 million acre-feet. The projections show an increased demand for in-stream needs for ecological purposes.

> The project partners developed a spreadsheet to help policymakers and stakeholders experiment with their own assumptions in a number of areas that affect overall demand for water, including: population growth, per capita use of water, irrigated acreage, crop requirements, and irrigation efficiency.[7]

Oregon has the potential to control some of the future water quantity demand in Oregon, although exempt wells cloud the issue. But, more accurate data of true usage and demand is required to develop

cost-effective and efficient methods for addressing water quantity needs for the future. Tamra Mabbott, Umatilla County Planning Director, suggested the state develop "water budgets" on a watershed basis to determine strategies to meet needs. She stressed that there is significant variation across the state and this planning approach would better serve local needs. Other interviewees stressed the need for integrated planning and looking at water storage. As Bill Gaffi of Clean Water Services (Washington County) pointed out "conservation does not help with summer environmental flows if there are downstream water right holders that have access to the conserved water."

Oregonians must also link sufficiency with water quality. It is not enough to have water quantity alone. Oregon needs enough high quality water to satisfy all water needs.

Addressing Stream Flow

Oregon is flush with water in winter, but water becomes a limiting resource in summer. Oregonians use significantly more water in summer than in winter. The natural levels of streams and rivers decrease due to removal of water for irrigation, residential, commercial and agricultural uses. Throughout history Oregonians have channeled streams, built canals for irrigation, tried to control flooding, and changed the natural patterns of water to suit human needs. All this has resulted in significantly decreasing flows in the rivers and streams so that stream flow and habitat are no longer adequate for the natural breeding patterns of fish. The Federal Endangered Species Act (ESA) creates mandates to protect native fish and has required action to correct low water flows.

Endangered Species Act

The Endangered Species Act (ESA) will play some role in future water management decisions in Oregon. The Federal Endangered Species Act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend.

While the federal law, passed in 1973, is most often used due to its broader scope, the state of Oregon does have an ESA, enacted in 1987 and amended in 1995. The federal ESA affects all public and private lands and is implemented by the Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service's National Oceanic and Atmospheric Administration (NOAA). Oregon's ESA covers actions of state agencies on state-owned or state-leased lands with Department of Fish and Wildlife (ODFW) responsible for fish and wildlife while the Department of Agriculture (DOA) is responsible for plants.

Just which species is affected and which agency is involved depends upon legal definition, and procedures can vary. Oregon has 35 native fish species noted as "at risk" in the 2005 Native Fish Status Report while 27 Pacific salmonoid species have been listed by NOAA Fisheries' Office of Protected Resources since 1991.*

As the state's streams and lakes provide essential habitat for these species, both federal and state ESAs have the potential to affect water rights in Oregon.**

The ESA could require that water be used to protect a species regardless of other impacts. Could water be allowed to flow freely in streams to help restore a salmon run, even through other uses such as irrigation, navigation, domestic supply and power generation might be affected negatively?

The ESA remains a "wild card."

*(Draft Ecology and Ecosystems Issue Paper, Oregon Integrated Water Resources Strategy, Oregon Water Resources Department, Nov. 19, 2009. Retrieved January 28, 2010 0from www1.wrd.state.or.us/pdfs/11_19_09_Ecology_Ecosystems_Issue_Paper.pdf.

** Additional information about the federal programs in place in Oregon can be found at the following websites: U.S. Fish and Wildlife-Oregon (http://www.fws.gov/oregonfwo) and Northwest Region of NOAA-Fisheries (http://www.nwr.nmfs.noaa.gov).

Legislators recognized this problem and amended prior appropriation laws to create in-stream water rights to protect the flow for fish; however, these rights are junior to many existing rights. The creation of water lease transfers allows for both short and long term conservation leases. But, convincing those holding old water rights to use conservation leases is difficult because they fear that they might not have the water they need in the future. Interviewees noted that very little has been changed since 1987 when the in-stream rights were enacted. Most streams remain over-allocated and result in low flows in the summer and early fall during the period of highest demand.

Lower Deschutes River

Several successful projects are underway to address low flow issues. Recognizing the problem of low flows on the Middle Deschutes as it moved through Bend, the Deschutes Water Alliance (DWA) was formed. (It includes the Deschutes Basin Board of Control, representing seven irrigation districts, the Central Oregon Cities' Organization, the Deschutes River Conservancy, and the Confederated Tribes of Warm Springs.) Through the DWA, a water bank has been established.[8] The goals are to restore stream flows and to protect habitat while simultaneously allowing adequate water supply for agricultural, commercial and municipal use[9].

A water bank is a mechanism designed to facilitate the transfer of water use entitlements from one location or use to another. A water bank functions like an intermediary, or broker, similar in some ways to a financial bank that acts as a broker or clearinghouse between savers and borrowers. In the case of water banks -- and unlike some brokers -- there is some kind of public sanction for its activities.[10]

Another successful stream flow project is underway on the Umatilla River where tribal, agricultural, environmental and community groups and state and federal agencies have worked together to return fish to the Umatilla River. The project, described as a "bucket for bucket" trading system, allows water removal from the Columbia for agricultural use, and in exchange water rights holders agree not to withdraw water from the Umatilla. In essence the water removed from the Columbia is replaced by the water from the Umatilla. The flow of the Umatilla remains higher. Success has been measured in the return of salmon to the Umatilla for three yearly breeding seasons. A 2009 record run of salmon was reported.[11] Antone Minthorn, Chairman of the CTUIR Board of Trustees, summarized why he feels the Umatilla Basin Project has been so successful:

> Our tribal philosophy has been to negotiate rather than litigate. If we have to, we will litigate to protect our treaty-reserved rights, but we have seen that we can create solutions, which meet everyone's needs by sitting down with our neighbors, listening to each other, and developing our own solutions. [12]

Addressing Groundwater Contamination and Loss

Historically, water regulation focused on surface water. The Federal Clean Water Act concentrates on rivers and streams and does not consider possible contamination of water deep below the surface.

However, groundwater aquifers supply private wells, irrigation and municipal water systems as well as base flow to Oregon's many streams and rivers. In some areas of the state, the aquifers have become contaminated or have become dangerously low so that both the DEQ and the WRD have restricted their use. In coastal groundwater, as aquifers are depleted, salt water intrusion from the ocean may occur, and the development of brackish waters is a risk.

Presently, knowledge about groundwater quality and quantity is limited. The WRD summarized the status in a fact sheet published in 2003 when it had assessed only about 15% of the groundwater supplies. WRD also has declared groundwater restrictions in seven areas because of overuse. DEQ has examined the quality of groundwater for less than 7% of the state's lands. Testing over the last 20 years has identified 35 of 45 areas that displayed some contamination. The data show nitrate is the most commonly detected contaminant, followed by pesticides, volatile organic compounds, and bacteria. Additional data collected from over 14,000 residential drinking water wells at the time of a real estate transaction show the percent of wells with nitrate levels above the federal drinking water standard (10 mg/L) varies from 0% to 18% across the state.[13]

Some groundwater has naturally high levels of pollutants and may not be suitable for human use. Other groundwater may become contaminated when pollutants seep through porous ground into the aquifers. A major source of contamination has been agriculture. Use of excessive fertilizer and pesticides can be linked to groundwater contamination. Improperly constructed or deteriorating septic systems also can cause problems in groundwater. Also contributing are industries such as mining. Another challenge in addressing groundwater use is examining the role of the individual user with a private well or septic system.

Oregon does not require permits for wells that serve three families or fewer. These exempt wells are only required to meet construction standards. An exempt well for a single homeowner is permitted to draw 15,000 gallons per day and in addition irrigate up to one half acre. The estimated average use for households in municipal systems is 80 to 100 gallons of water per day per person.[14] It is estimated that there are over 230,000 of these exempt wells in Oregon.[15] Some of the older wells are not recorded. In the 2009 Oregon Legislative Session, proposals were introduced to reduce or record the withdrawal level, but these were not passed. Legislation was passed to increase fees for construction of new wells and to require a detailed mapping of exempt well sites. The fees and map information will to be used to monitor and manage groundwater resources.[16] The legislation also requires testing wells for arsenic at the time of sale.

Each year about 3,800 new exempt wells are drilled, including 550 in groundwater critical or groundwater limited areas.[17] With the recent developments in the technology of well drilling, the use of groundwater for agriculture, irrigation, and domestic consumption has steadily grown. Interviewees expressed some concerns about the impacts of exempt wells on the quantity and quality of groundwater. Exempt wells withdraw water at an unmonitored rate. As explained by Tamara Mabbott, Umatilla County, no one really knows just how much groundwater is being used. In addition, old and improperly abandoned wells can be a source of contaminants. John C. Buckhouse, OSU Extension Range Management Specialist, Emeritus, explained that "properly installed wells and septic systems are essential" for groundwater protection. Having current hydrological data on the state's water basins would also be helpful as agencies, developers, farmers, and other water users attempt to plan for conservation and protection of water.

Newer subdivision, West Eugene

During the 2007 and 2009 Legislative Sessions, the permitting and regulation of domestic wells was debated. At present, beyond their construction, exempt use domestic wells are neither regulated nor monitored. Jeff Stone, the Director of Governmental Relations, for the Oregon Association of Nurseries (OAN), has predicted changes in the rules about exempt wells. Already, controversy exists among rural residents and others about the idea of measuring the water withdrawn from exempt wells. Others in Eastern Oregon observed that there is a perception that if water metering measurement equipment is installed on exempt wells, it will be ultimately used by policy makers to further reduce the water available to the user.

Abandoned exempt wells have their own impacts on the quality of groundwater. If a well is not properly closed off (or capped) as required, it can provide a conduit for carrying contaminants into the groundwater. Recently, Benton County teamed with Linn-Benton Community College and received a federal grant to conduct a local assessment of abandoned wells in that county. More listings of wells occur in state record books than there are current households in the area. The team intends to determine the approximate locations of abandoned wells and conduct corresponding field investigations to discover the status of those wells, leading to increased conservation and protection of the groundwater.[18, 19]

Homeowners with wells frequently also have septic systems. Improperly operating septic systems can leak pollutants into local surface and/or groundwater. The La Pine area of Oregon was subdivided into residential lots in the1960s, and homes with wells and septic systems were built on parcels as small as one half acre. Over 4000 individual wells and over 100 small water systems were created with many wells little more than 50 feet deep. Testing of the La Pine groundwater revealed high levels of nitrates. Federal funding was obtained and further testing was done to determine the source of the contamination. Agriculture and grazing were eliminated as the source.

DEQ, U.S. Geological Survey and Deschutes County performed an additional year-long study of the groundwater. The test results showed that although the groundwater is relatively slow-moving, 10% of the wells showed nitrates above ambient levels, leading to a conclusion that the groundwater is in the early stages of contamination. With porous and permeable pumice soils, shallow groundwater and relatively dense development using septic systems, a real threat to groundwater quality in the La Pine area existed. Result of the studies showed that many of the existing individual septic systems contribute to the nitrate problems. Additional funding was obtained for financial assistance to upgrade systems. Deschutes County updated its code to require the improved septic systems. A referendum defeated the code changes. At present the conflict remains in limbo because some of the public is suspicious of the science and the agencies and regulatory bodies. The appropriate agencies may apply current standards but otherwise are unable to act to protect the groundwater. [20, 21, 22]

Elsewhere, the DEQ has identified three groundwater management areas: Lower Umatilla Basin, Southern Willamette Valley and Northern Malheur County, which have higher than acceptable levels of nitrates in the groundwater. Each one has developed a voluntary plan to reduce nitrate concentrations.[23]

Human demand has put significant stress on the level of groundwater aquifers. Water use by agriculture

in the Umatilla area of Eastern Oregon lowered the aquifers to the extent that they have been named as a "critical groundwater area" and have restrictions on current water use. Six other critical groundwater areas across the state are listed, and a number of other areas have been placed on the "limited groundwater areas" list and may have future water use restricted.[24]

During interviews the League discovered concerns that groundwater is not covered in the Total Maximum Daily Load program, that the actual amount of groundwater is unknown and that adequate information on private, exempt wells and on the quality of septic systems is lacking. Once again, lack of communication between governmental levels, shortage of staff, inadequate data and funding were cited by interviewees as part of the problem. Several interviewees noted that those using private wells see the water as their own and neither pay their fair share nor appreciate the value of the water.

Addressing Temperature

The temperature of water in lakes and streams has risen as human activities increase. Point source discharges, runoff from warm surfaces and heating in areas where natural riparian ground cover has been removed, all increase stream temperature. The reduced flows in summer due to increased water use allow for significant warming. Climate change may also raise water temperature. Without knowledge of historical water temperatures, a number of interviewees question whether TMDL standards for water were appropriate or could be achieved, particularly because much of the temperature increase comes from non-point source runoff. It is known that in the summer many portions of our streams and lakes reach high temperatures that encourage algal growth and stress native fish. All interviewees remained committed to the importance of improving the cold-water habitats of our waters.

Preventing Point Source Pollution

Long before the Federal CWA was passed, Oregon began addressing the problem of pollutants entering state waters. After the Federal CWA was enacted, Oregon passed legislation allowing it to administer the requirements of the act. The initial target of the CWA was to identify and to control discharges of pollutants from the end of pipes or ditches, called Point Source (PS) discharges. All PS dischargers in Oregon must obtain a permit for their pollution discharge. National Pollution Discharge Elimination System (NPDES) permits are required for all point source pollution that directly discharges to waters of the United States. Oregon also issues Water Pollution Control Facilities (WPFC) permits for pollution discharges of water that do not flow directly into waters of the United States (discharges to a contained lagoon or to land). Both types of permits require monitoring and reporting and establish standards for the levels of pollutants that can be in the discharge. DEQ has over 800 facilities under NPDES and WPCF *individual* permits that are site specific; about 70% are for the treatment and disposal of sewage. In addition, the DEQ "currently utilizes 29 different NPDES and WPCF *general* permits that regulate such discharges as boiler blow down, non-contact cooling water, wash water from vehicle and equipment cleaning, seafood processing, petroleum hydrocarbon cleanups, small domestic onsite sewage systems, etc." These general permits are used by many smaller dischargers.[25]

Although these PS discharges are regulated, they still add a significant poundage of pollutants to Oregon's waters. Each permit specifies a maximum allowable level of the identified pollutants. However, this permit may not set limits for other pollutants that might be in the water from the point source. Additionally, the permits allow for a mixing zone at the site where a discharge enters the waters of the state. Within this mixing zone may be higher levels of pollutants than the approved concentration for acceptable water quality. Many stakeholders remain particularly concerned about the permitted

pollutant level in discharges, the pollutants that are not regulated and mixing zones.

Despite compliance with regulation, pollutants continue to enter our waters. The Oregon Environmental Research and Policy Center released a report entitled *Wasting our Waterways*. Each year federal regulation requires industries to provide the poundage of specific chemicals that they release into the air or water. The resulting list is published as the Toxic Release Inventory (TRI). *Wasting our Waterways* analyzed the data from the 2007 TRI and determined that approximately 2.85 million pounds of toxic chemicals were released to Oregon's waters. The report gave two major recommendations: 1) the United States should revise its strategy for regulating toxic chemicals to encourage the development and use of safer alternatives and that 2) the United States should strengthen Clean Water Act protections to all of America's waterways and improve enforcement of the Clean Water Act.[26]

In some cases the public perception has been that only a zero discharge of pollutants is acceptable. Interviewees commented that the public is not generally aware that every microliter of water has been polluted to some extent at some time – there is no naturally available pure water.

As the government tightens controls on PS pollutant discharges, industry has argued for use of cost-benefit analysis while many environmental groups have pushed for setting pollution release targets that would steadily and rapidly drop to zero discharge.[27] As environmental controls tighten and more complex technology is required, industry, as a PS pollution discharger, will adapt and improve, but these changes will be most successful if economic factors are considered and adequate time is allowed for both adding improvements and evaluating methodologies. Some industry may move to less regulated locations, even leaving the country, and others may close.

Wastewater treatment is the major category of permitted PS pollution dischargers. The wastewater treatment industry includes both private and public waste treatment facilities. Their ability to remove pollutants from discharges has increased greatly since the CWA was enacted. Most treatment facilities are using secondary and may use specific tertiary treatment of all water prior to discharge. As more attention is directed toward specific chemicals and toxics found at low levels in water, the treatments will become more specific and more expensive. The Portland Bureau of Environmental Services sees reducing the level of trace toxics as a current challenge. While removing these chemicals at the source (the manufacturing process or eliminating them from the retail market) might provide the best solution, it also requires consumer education and willingness to forgo purchase of products containing these chemicals, such as phthalates contained in plastics, building materials, cosmetics and detergents.

Many NPDES permitted wastewater treatment systems include a sewer system (the pipes delivering sewage to the treatment center). These sewer systems can overflow and release raw sewage or sewage and rainwater into the environment. NPDES permits include requirements for taking steps to eliminate these problems and require public notification when overflows occur.

The two types of sewer systems are combined and sanitary sewer systems. The combined sewer system has only one set of pipes that carries both stormwater and wastewater. Under normal circumstances all the water is carried to the wastewater treatment plant. In the event of heavy rain, the capacity of the combined system may be surpassed, and the system overflows. These overflows are called Combined Sewer Overflows (CSO). A sanitary sewer system carries only wastewater. Older sanitary sewer systems may have illicit connections or infiltrations that allow rainwater to enter the system. During heavy storms, the infiltration of stormwater results in an overflowing sanitary system (called a sanitary sewer overflow - SSO) that releases polluted water.

Requirements vary for permits issued for combined or sanitary sewer systems, but both systems are now being required to eliminate overflow problems. In cases where systems fail to meet requirements, DEQ or the federal Environmental Protection Agency (EPA) may take action. A number of Oregon communities are working to improve their systems under various consent agreements with DEQ and EPA. For wastewater utilities, these costs are paid for by increased rates.

Portland has both types of sewer systems and is investing over a billion dollars to control these overflows. Its approach includes: reducing the water entering its combined sewer system through installing street sumps and sedimentation manholes; building separate sewers for stormwater in some neighborhoods; encouraging homeowners in targeted neighborhoods to disconnect downspouts from the sewer system; removing West Hills streams from the combined sewers; and installing a complex system of big pipes to provide capacity to retain stormwater until it's treated at the plant.[28]

Other communities are facing similar challenges. Addressing these will require significant dollars, but funding for infrastructure improvements has steadily decreased since the 1970's. One theme consistent throughout interviews for this project was the need for funding to maintain, upgrade and improve infrastructure. Jeanne LeJeune from the Water Resources Commission commented that we willingly pay significant sums for incidentals such as cable TV and cell phone programs yet balk at any increase in sewer or water rates that are part of protecting our drinking water and preventing pollution. To upgrade the infrastructure will require educating the public to understand the need for financing these improvements.

Preventing Nonpoint Source Pollution

Nonpoint source pollution (NPS) is the "elephant in the room." Pollution from NPS results when stormwater or water from other sources moves across exposed land, pavement, roofs and other impervious surfaces in rural and urban areas. As water flows over impervious surfaces, the water picks up pollutants and carries them to a water body. It can transport oil, car drippings, soil, nutrients, pesticides, fertilizers, pet waste and other materials and is warmed by heated surfaces. In addition, the federal EPA views NPS as a major water pollution problem. During the summer, in many lakes, such as Tenmile Lakes in southwestern Oregon and Devils Lake in Lincoln City, a layer of slime forms from algal buildup as the result of high nutrient content from runoff.

Stream temperatures are increased by runoff heated by flowing over warm impervious surfaces and from warm point sources as well as shallow water exposed to the heating of sun. These processes stress the native cold-water fish. Nutrients and pesticides are carried in water flowing off agricultural fields, home gardens and lawns, as well as from point sources. Sediment washed from cleared land, construction sites and urban runoff can block the sun and impact fish survival. Because exact sources of these runoff components cannot be pinpointed, the task of reducing the problem is daunting, and the education challenge is far-reaching.

One frequently observed result of NPS pollution is summer algal blooms in many water bodies. The lower stream flows, warmer temperatures and higher nutrient levels in runoff, including nitrates and phosphates, encourage excessive growth of algae (bloom). When the algae die the decaying materials remove oxygen from the water resulting in fish kills. Specific algae, sometimes present in the water, are toxin producers and can put humans and animals at risk. Several incidents of toxic (blue green) algal blooms were reported in Oregon in summer 2009.

Over time agricultural practices such as liberal irrigation and fertilization and failure to maintain riparian buffer zones have contributed significantly to the problem of NPS pollution. As several interviewees observed, many farmers now recognize

the need to be environmentally aware and have learned that the use of fertilizer, pesticide and energy are costly and should be prudently managed.

Confined Animal Feed Operations (CAFO) can contribute to runoff problems. Animals produce significant waste that is collected and may be spread as fertilizer. The Oregon Department of Agriculture (ODA) works with farmers to develop plans to avoid pollution. While the large CAFOs must obtain NPDES permits and have management plans in place, smaller animal feed operations are not required to have permits. In addition, free-range animals grazing near streams may increase stream contamination.

Logging activities are frequently seen as a source of erosion that deposits sediment in streams. Soil scientists and hydrologists indicate old roads are more of a problem than is actual timber harvesting.[29] Road construction and runoff can create ditches, i.e. streams that previously did not exist. Ditch discharges can create or aggravate problems. Even though design improvements have been made, rural and urban road construction still leads to slope failures and gully erosion. Poorly-designed road crossings can prevent mobility for fish and other aquatic organisms, threaten migration and reduce population numbers. Many undersized culverts, dangerously old bridge, and drainage problems have gone ignored. The 2009 American Recovery and Reinvestment Act provided $9 million, a drop in the bucket, to Washington and Oregon towards structure and culvert replacement, and improved drainage to increase the long-term integrity of roads and to address on-going NPS impacts to aquatic resources. Most of these adverse effects cannot be reversed without very costly human intervention. A variety of agencies, including the Oregon Watershed Enhancement Board (OWEB), fund road improvement such as culvert replacements.

Construction practices have often contributed significant sediment pollution. Runoff from cleared land often flows directly to water bodies and adds heavy loads of sediment that both cloud the water and change the streambed. Now all construction sites disturbing over one acre must have a NPDES stormwater permit and develop best management practices such as the use of silt fences. In the next few years, monitoring will be required on sites over 10 acres. The success of these efforts is dependent on enforcement and on the erosion control methods employed.

Urban areas are a significant source of NPS pollution. The increased number of roofs, sidewalks and streets, as well as the concentration of people and vehicles, results in more pollution that is carried away in runoff. Many cities and counties are now required to have NPDES permits for stormwater. These permits require: public education and outreach, removal of any illicit connections to stormwater systems, control of construction site practices, post construction stormwater facilities and the development of municipal best management practices. As part of NPDES permits, local and regional governments are adopting regulations and working with commercial enterprises and developers to control runoff.

As our interviewees observed repeatedly, the challenge is to convince the public that they are part of this problem. The individual who washes her car in the street, the resident who does not clean up after his pet and the gardeners who liberally fertilize and treat their lawns with pesticides all contribute significantly to NPS pollution.

Communities across the state have developed comprehensive manuals with information on how the city and residents can reduce stormwater pollution.[30, 31 32] Through stormwater fee incentives, cities have been able to create buy-in for on-site stormwater

treatment for industries, commercial entities and residential units. Large complexes are installing on-site treatment such as bioswales, roof gardens and rain gardens.

Addressing Total Maximum Daily Loads (TMDLs)

TMDLs are standards (or a pollution diet) that are set for the maximum level of specific pollutants that can be discharged in a given water body without interfering with the beneficial uses of that water body. The TMDL process is part of federal CWA regulations and implemented by DEQ. The DEQ must develop programs that comply with federal requirements and the process must be completed on a defined timeline.

The state must first identify impaired waters that do not meet the water quality standards for their beneficial uses, such as fishing, swimming, wildlife habitat and recreation. The list must be regularly updated. Once impaired waters are identified, the state must review levels and contributing sources of pollution and prioritize the corrections. Then a TMDL is developed for the impaired water. Those holding NPDES pollutant discharge permits are assigned a maximum level of the specific pollutant that can be discharged. Plans must be developed by the NPDES permit holders to reduce their pollutant discharge to below the established maximum; the process is hugely complex.

Those interviewed for this paper gave the TMDL process mixed reviews. Comments included concerns that TMDLs still allow pollution and are bureaucratic. A repeated concern was that the public does not understand what TMDL means. Others stressed that TMDLs do not have the flexibility to address problems on a watershed basis. Ken Bierly of OWEB explained that the real problems are many, yet TMDLs deal with isolated sources and are not an integrated approach. He observed that we do not have the mechanisms in place to look at water quality holistically/ecologically. According to Bierly, the good news is the high quality analysis of the problem, and the bad news is the narrow and anemic management plans.

The TMDL process has brought together diverse organizations and agencies to solve problems with TMDLs on waterways, and improvements have resulted. As mentioned previously, the temperature TMDL on the Tualatin River brought together a cooperative group using a watershed approach to improve river quality. Through October 2009, there were 998 TMDLs on water bodies throughout the state completed and approved by the EPA. However, over 1800 impaired waters were identified on the 2004/2006 303(d) Impaired Waters list. The actual number varies as new impaired waters are added and others are removed, either through completion of a TMDL or as the result of additional data.[33]

Some interviewees also have questioned the source of certain impairments listed in TMDLs, such magnesium and iron in the Umatilla River and temperature and phosphorus in the Tualatin River. For example during TMDL development for the Tualatin River, investigators learned that groundwater that feeds into the river had naturally high phosphorus levels. Although current data are available for river quality, historical information is lacking to determine whether current levels are natural or increased.

The number of TMDLs that require completion on a timeline challenges the DEQ. Environmental groups are carefully watching and have successfully sued to keep the process on schedule. Wastewater treatment facilities and industry are important participants in the process. Although some federal funding is supplied for TMDL projects, inadequate staffing, insufficient money and time spent in developing cooperation with local citizenry and organizations exacerbate the challenges.

Several interviewees felt that the TMDL concept was good but can be used and misused as a weapon to prove a point. Others felt that the process was

cumbersome and inflexible and that the standards used by the EPA are often not updated. Some suggested that allowing a level of pollution actually conflicts with the CWA, while others pointed out successful cleanups had occurred as a result.

An important concern expressed by interviewees was that the TMDL program does not address contamination of groundwater. Additionally, others suggested that TMDLs are not an effective tool for nonpoint source pollution and should only be used for point source pollution. Because runoff is variable by season and weather, samples for turbidity and temperature constantly change, which complicates setting standards and sampling.

In a written response to interview questions, Ani Kame'enui, Healthy Rivers Campaign Coordinator for Oregon Wild commented:

> Oregon Wild's recent experience with TMDLs has been mixed. The TMDL process is a means to achieving regulation and control over toxic water quality conditions, often bringing relief to rivers plagued by pollution. Unfortunately, for Oregon Wild, our work in the Klamath Basin provides unfortunate evidence of a TMDL process largely hijacked due to larger basin negotiations or powerful, special interest stakeholders. While the TMDL process may identify rivers in need of state or federal support and Section 303(d) listings, it is imperative that we also identify means and resources to support improvements.

Addressing Trace Pollutants

The initial target of water clean-up was the visible sources of pollutants. Significant improvements have occurred. Now, attention has shifted to the many chemicals entering the water in smaller amounts, called trace pollutants. Interviewees noted that because of the increasing ability to test and to identify substances at very low levels, more materials can be detected in water, and that increases public concern. Wastewater treatment systems may need to develop methods to remove these minute quantities of chemicals. In addition, many of the current toxics are "legacy toxics" that are in the sediments and the water leftover from historical activities. For example, some pesticides and PCBs are now banned but are still present in water. Others are found in many household products that we use daily.

Water is a universal solvent that has the ability to dissolve and carry many substances. Even very small amounts of toxic substances that enter water may stay for a long time. Residuals of commonly used products such as hand creams, cleaning products, disinfectants and medicines, as well as many pesticides, paints, lubricants and fertilizers, reach our waterways. Many common practices such as dumping unused medications down the toilet or the residuals of these medications that are found in urine may be contributing to the problem.

In 2008, Oregon Legislature passed SB 737, which directed DEQ to begin categorizing dangerous pollutants in our water and to develop a strategy for reducing them. DEQ started with about 2000 compounds and in October 2009 released a final priority list of 118 toxic chemicals, all with possible impact or harm to living organisms. DEQ will assess the toxicity, persistence and bioaccumulation characteristics of these substances. The list includes both well-studied and many newly identified pollutants, including pesticides and herbicides, pharmaceuticals, personal care products, industrial chemicals, and inorganic and organic metals.[34] In 2010, DEQ will report back to the Legislature on how to identify, control and establish standards to eliminate or reduce exposure to these pollutants. Many of the chemicals identified as persistent pollutants are not regulated by either state or federal environmental standards. The toxics reduction strategy of DEQ will include consulting with those working in water industries, the science community,

and interest groups and the media and will create a plan to reduce use of – and exposure to – these pollutants. Outreach and education of the public will be included in plan development. Funding for two staff members to collect and analyze the data for this program has been provided by a fee on the state's 52 largest wastewater treatment facilities.

At present, information on the toxicity of trace pollutants to humans is not conclusive. For example, a recent fact sheet provided by the Network for Oregon Watersheds explains:

> The research on ecological and human health risks due to trace amounts of pharmaceutical compounds and EDC (endocrine disrupting chemicals) in water is not conclusive. Some believe that low concentrations of these substances make a human health threat unlikely at this time. Others believe that adverse health effects on aquatic species, the existence of antibiotic-resistant bacteria in rivers, and mixtures of pharmaceutical compounds and EDCs suggest a threat to humans, including sensitive populations such as unborn fetuses.[35]

Several groups interviewed stressed that trace toxic pollutants are an important concern. However, some interviewees pointed out that public perception of available water treatments are beyond current technological capacity and expectations for pristine water quality are unrealistic. Some interviewees stressed that awareness of these trace toxins has only developed as testing methods have improved. Interviewees noted that testing methods can be expensive. Karl Morgenstern, Source Protection Coordinator with Eugene Water and Electric Board, cited an example of three chemicals commonly used in forestry that should be tested for, but no commercial analytical laboratories with the testing capacity are available in Oregon, so samples must be sent to the U.S. Geological Survey (USGS) laboratories in Denver, Colorado and Kansas for analysis at a cost of up to $1000 per test.

Removal of these toxic chemicals from point source discharges may be a significant challenge. The Portland Bureau of Environmental Services (BES) cited the example of mercury, for which a defined limit is listed in its discharge permits. A city rainfall study in 2004 showed that in most cases more than half of the mercury in stormwater comes from rainfall. The Portland BES would like to see more targeted removal of toxic chemicals at the source –such as crematoriums that are contributing lead and mercury, cement kilns that pollute air and runoff, and abandoned mines. BES stresses the need for educated consumers that demand removal of these toxic chemicals from household products at the source.

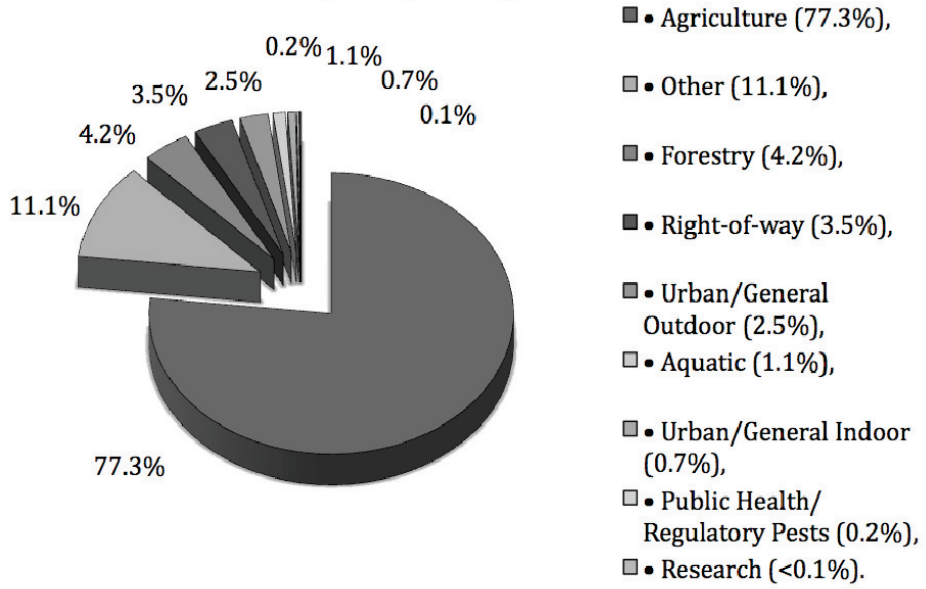
In Oregon in 2008, 343,565 reports of pesticide use were entered into ODA's Pesticide Use Reporting System (PURS). These reports identified 19,696,784 pounds of pesticides, including approximately 570 different active ingredients. The greatest poundage of pesticides was from agriculture. In 2009, pesticide use reporting did not occur due to a lack of funding in the ODA. See the Chart 1 for 2008 percentages.[36]

Addressing Land Use and Planning for Water

"*To make a long story short, Oregon's out of easy water,*" noted Rick Bastasch in the "Preface" to The Oregon Water Handbook. [37]

The conflicts surrounding the use of land and the use of water are very similar. Oregon's early recognition of the need to protect agricultural land from urban development engendered Oregon's Statewide Land Use Program – which includes not only a goal "to preserve and maintain agricultural lands," a goal "to provide for an orderly and efficient transition from rural to urban land use," but also a goal "to maintain and improve the quality of the air, water and land resources of the state." Without question, the agricultural goal provided the principal motivation for the program.[38]

Chart 1: Pesticides Use Reporting in Oregon , 2008 [36]



An interesting problem displaying the urban/rural differences is the fact that much of the surface water used by municipalities originates in rural upstream watersheds. Some interviewees noted that upstream rural pollution, both point and nonpoint source, can affect the quality and quantity of water for downstream users. Many municipalities are stuck with treating the problems downstream. Counties are the principal land use planning governmental body for rural areas, but they have limited authority and little expertise to deal with either water quantity or quality planning.

For both water quality and quantity, what happens on the land affects water; what happens to water affects the land. The nexus extends to the future and will require planning. One significant difference between water planning and land use planning at present is the role that the public plays. Oregon's Statewide Land Use Planning Program begins with the requirement that all land use action must be structured "to insure the opportunity for citizens to be involved in all phases of the planning process" and "to assure an adequate factual base for such decisions and actions." However, as Bastasch[39] notes, the definition of public interest "falls short of an operational instruction for the day-to-day decisions which shape how the public water is managed."

This observation is seconded by Tamra Mabbott in her paper *Water and Land Use Planning in Oregon: Bridging the Governance Gap*: "Quite often citizen concerns about water are raised formally in public for the first time at a land use hearing. But the local planning commission has no regulatory authority over water and therefore cannot directly address the citizen concern(s). Citizens leave the hearing feeling disenfranchised …"[40]

One challenge to be faced in developing a working partnership between water use and land use planning is providing the public with an ongoing important role.

Addressing Climate Change

How will Oregon adjust to climate change? Predictions of less snow pack and periods of less winter rainfall could challenge some areas' water use. With this changeable environment, Oregonians involved in the League's interviews illustrated a diversity of thought.

Many stated that no single answer appeared possible, given the unpredictability of outcomes; rather a variety of adjustments were suggested. "If you build resiliency into systems, we can handle changes,"

Ken Bierly, Deputy Director of OWEB noted. "We don't know what the changes in precipitation will be, but we know there will be changes."

Adaptation and modification were stressed, as was the need for long-term planning and using integrated approaches to restore and maintain adequate water quality and supply. Several interviewees called for changes in legislation to make water management more responsive to users. A number of state and local agencies are involved in planning efforts. Interviewees stressed that, in these efforts, it will be essential to look at ways to adapt current practices to address specific situations and to consider everything from managing invasive juniper growth to encouraging beaver dams to using nurseries as "carbon sinks." Although nearly all recognized climate change as occurring, many of those interviewed said they were not directly involved in planning for climate change.

Part 1 of the study noted that climate change affecting water management included higher overall temperatures, changes in historic rainfall and storms patterns, melting of snowpack and glaciers and increasing variation in stream flow, flooding and drought. Ocean levels may rise, inundating some coastal water and wastewater treatment facilities. Acidification of the oceans as well as variations in stream flow and temperatures may add to species extinction. Vegetation changes result with temperature and habitat disruption. This can lead to insect shifts, more destructive wild fires, invasive and refugee species, and different kinds of agricultural crop choices.

It is predicted that population may grow as more people come to live in Oregon as conditions elsewhere worsen. In addition, Oregonians may face health issues due to increasing respiratory ailments and the spread of diseases for which immunities and vaccines have yet to be developed.[41] Rethinking water use has begun, as well as planning to deal with changes in population numbers and health issues Oregonians may face.

Steps To Protect and Conserve Oregon's Waters

In light of the issues facing Oregon's water, conservation and protection are needed. Differing perspectives about what should be accomplished, and how, complicate the process of ensuring adequate, high quality water in Oregon's future. Those interviewed have provided examples of efforts to conserve and protect water. The major groups that utilize water include agriculture, by far the biggest user, municipal and domestic use, forestry and industry. Domestic users include those that are part of a public system and rural users that have private wells and septic systems.

Agriculture - Water Conservation and Protection

Despite Oregon's reputation for rain, nearly 45% of Oregon's farms and ranches use some form of irrigation. Indeed, approximately 70 to 87% of water from rivers, streams and ground sources in Oregon is used for agricultural irrigation.[42]

OSU Extension Station, Pendleton, Oregon

Many farmers and ranchers have senior water rights either granted under the 1909 law or vested if the water was used prior to 1909 and the rights have either been adjudicated or a surface water registration statement issued.[43] Many from the agriculture sector contend that maintaining these

water rights is essential for informed investment, long-term stability and profitability, all of which are considered essential to produce high value and unique Oregon products for the nation and world. They also cite their obligation to help feed the world and their role supporting the $4.9 billion agriculture industry in Oregon. Eighty percent of Oregon agricultural products leave the state.[44]

Growers need an adequate supply of water at the right time for successful agriculture production. In eastern Oregon, wheat was traditionally grown as a dry land crop. The use of pivot irrigation has greatly increased the productivity of the land. Kent Madison of Madison Farms explained that the yields are significantly better using pivot irrigation– for example wheat yields increasing from 15 bushels an acre to 100 bushels.

Agriculture is adjusting and changing due to the costs associated with irrigation, including water, equipment and energy. Responding to the market, many farmers now raise potatoes, melon, sweet corn, onions, grapes and poplar trees for pulp, all of which do require more water, but are more profitable than the traditional wheat crop. With modern irrigation farmers are able to reduce the amount of seed, fertilizer, energy, water and land required to produce a bushel of crop. Interviewees noted that this technology and the use of wells have allowed farming to expand to land farther away from streams and rivers. However, irrigation equipment is expensive; one pivot circle costs approximately $75,000. Also irrigation faces challenges because water levels in the deep wells are dropping. Small farms are particularly at risk because they are unable to take advantage of many modern irrigation techniques.

The Oregon Department of Agriculture (ODA) views the newly initiated statewide Integrated Water Resources Strategy (IWRS) as key to the future of Oregon agriculture. The agency is working to assure that "agriculture interests are represented, that other strategy participants carefully consider impacts on agriculture, and that the water strategies focus on mutually beneficial outcomes that expand the water 'pie'."[45]

ODA encourages Oregon Water Resources Department (WRD) to continue participation in Columbia River issues including plans to build 'off-stem' storage in Idaho and Washington, multistate compacts and plans for protecting state's rights. To increase water availability for agriculture other recommended strategies include: conservation, reuse, aquifer recharge and recovery systems, water transfer between willing parties, off-main stem multipurpose storage and use of groundwater wells that would not interfere with surface water and where a proven sustainable supply of water is available.[46]

Since agriculture is the largest user of water, that sector is often the focus of efforts to conserve water. A number of interviewees commented that agriculture could do a much better job of conserving water that could then be shifted to other areas of need, especially in growing population centers in Central and Eastern Oregon. While there has been incremental progress in making prior appropriation statutes more flexible, several interviewees expressed concern that the law still does not encourage conservation of water. Others contend that if everyone, including the agriculture sector, were to more nearly pay for the true cost of water delivery, greater conservation efforts would result. Asit Biswas, of the Third World Center for Water Management, Mexico City, echoes this view. He believes that the problem is not scarcity, but mismanagement. "Water must have a price. Anything that is free won't be used prudently."[47]

Many in the agriculture community are actively engaged in conserving water and improving water quality by reducing toxics and temperature. In the Hermiston area prior to the 1970's, standard farming practice used excessive water and fertilizer, and this contributed to groundwater contamination. Extension Agent Don Horneck in Hermiston stated, "If you manage nitrogen (fertilizer) well, you will manage water (quality) well." He feels that the farmers he works with are innovative and will try

anything to improve conservation of resources. However, he and others interviewed feel that many water laws are too rigid, don't allow for innovation and provide few incentives for change.

In 1987 the Legislature approved the Allocation of Conserved Water Program that allows water users who conserve water to use a portion, about 75%, after mitigating effects on other water rights of the conserved water, on additional lands, or to lease or sell the water. Water Resources Commission allocates the remaining 25% of the conserved water for in-steam water rights.[48] By 2009 the department had approved 44 applications resulting in over 95 cubic feet per second (cfs) of water permanently protected in-stream. "Oregon leads the country in flow restoration...This is more than triple the amount for Washington, Idaho and Montana combined."[49]

Rick Craiger of the Oregon Watershed Enhancement Board (OWEB) said his agency is helping irrigation districts improve their delivery systems to reduce water loss so some or all of the conserved water can be left in-stream to improve water quality. OWEB is also helping ranchers manage livestock away from rivers and streams by providing funds to develop off-stream water sources and fencing riparian areas to allow plants to come back to stabilize streambanks and shade streams.

Water contamination from agricultural pesticides is another concern. In Oregon, pesticide sellers and applicators must comply with the state's pesticide control law[50] that requires state product registration and applicator licensing, and prohibits faulty, careless or negligent applications. We heard from interviewees in the agricultural community that agriculture is steadily reducing its pesticide use with targeted applications that increase effectiveness, reduce cost and limit runoff.

The nursery/greenhouse industry produces the highest valued crop in Oregon. Jeff Stone of the Oregon Association of Nurseries (OAN) explains that "you can't dry land our product." Nurseries need an adequate supply of high quality water. He, along with other agriculture representatives, contends that increasing the cost of water would force some farmers to quit. Growers believe that increased storage, water conservation and water quality are essential for the future of the industry. Some growers now use sensors with drip systems to individual plants, and some place pots on gravel to reclaim, treat and reuse the water overflow. OAN has launched a Climate Friendly Nurseries pilot project with a few nurseries that will measure greenhouse gas emissions and identify ways to reduce energy use and increase efficiencies.

For over 75 years water has been withdrawn from the lower Umatilla River, which resulted in very low summer flows, higher water temperatures, concentration of toxins and a drastic reduction of salmon runs. About 25 years ago, the Confederated Tribes of the Umatilla, the Bureau of Reclamation, irrigation districts, Representatives Les AuCoin and Bob Smith and Senator Mark Hatfield started work to restore water to the streams while protecting agricultural interests. Their goals were to protect the agricultural economy and to restore stream flows and salmon runs. Interested parties came together to resolve the issues of water temperature and toxics and they completed the TMDL for the Umatilla 10 years ago. Salmon have returned to the river, but these accomplishments and compromises were not without conflict.

Water conservation can have unexpected results. To conserve water from evaporation and run-off and to reduce energy costs, many irrigation districts began replacing open canals with pipes. Smaller farmers soon reported that their shallow wells were running dry and in some cases, groundwater levels dropped. The importance of water seeping out of the canals and recharging the groundwater is now recognized and is considered in conservation planning.

Many innovative approaches to water conservation, sharing of water resources, improving water quality and increasing groundwater and in-stream flows

have emerged when landowners, "on the ground" agency staff, local government and citizens come together to solve a common problem. The Deschutes River Basin project and its water bank are one of the most frequently cited examples of compromise and positive problem solving to achieve adequate clean water for agriculture, fish and the City of Bend.

Junipers near Paisley, Oregon

Recently collaborations have begun to develop methods of conserving water in the rangelands. The U. S. Forest Service publication *Western Juniper in Eastern Oregon* states that the acreage of fast spreading western juniper in eastern Oregon rangeland has increased from 420,000 acres in 1934 to 2,200,000 acres in 1999. It estimates that 9 to 35 mature juniper trees on one acre can utilize all available moisture on the site.[51]

To test the assumption that the spread of western juniper is a main cause of desertification of rangeland, a paired watershed study of Mays and Jensen Creeks near Brothers, Oregon began in 1993. Oregon State University Extension Service in Crook County, EPA, BLM, Oregon Watershed Enhancement Board, Crook County Grazing Board and landowner Doc Hatfield collaborated for over 16 years to determine new ways to conserve and increase the availability of water in an area that gets 13-16 inches of moisture a year.

Data were collected on both watersheds. Temperature, rain/snow fall, spring flow, channel flow, and soil moisture and soil temperature were measured by satellite uplinks along with on-the-site observation. Six wells were drilled in the bottom of each watershed to measure groundwater. In 2006 the juniper was cut on the Mays Creek watershed but not on the Jensen watershed. In the next two years, tests on Mays Creek showed that spring flow, groundwater and soil moisture all increased when compared to precutting levels and the non-cut watershed. An increase in native grasses and other vegetation were observed in the cut area. The landowner was able to store and release water in a controlled manner that allowed him to pasture cattle for a longer period.[52]

> "A healthy, functioning watershed is one that captures, stores and safely releases the precipitation that is delivered to the site."[52]

Industry and Commerce - Water Conservation and Protection

Like agriculture, industries such as Intel are dependent on a consistent high quality water supply for production. Industrial site selection is to a great extent dependent on available abundant and high quality water.

Using Oregon's waterways as a disposal site for wastewater was common practice during early economic development in Oregon. Cleaning up these problems can be challenging and very expensive. The problem is further exacerbated as pollution continues to enter waters. Today, all point source water discharges of pollutants are regulated by NPDES or WPCF permits. Regulation does not mean that all pollutants are removed from the water. Depending on the type of industry, different standards are set for discharges. Industrial permits require tracking and controlling these discharges if they do not meet water standards or are identified as toxins of concern. Since many trace pollutants do not have standards, they may not be controlled.

Past industrial and commercial business practices included storage of materials in exposed areas where they may pollute stormwater that flows over them. Today identified industries that may be pollution risks are required to obtain NPDES stormwater permits. These permits require developing Best Management Practices (BMPs), such as retention areas and covered storage to prevent runoff of pollutants. Detailed NPDES requirements have also been established for construction sites that disturb more than one acre of land. Construction sites must include BMPs, such as silt fencing, protection of storm drains, covering raw materials and temporary retention ponds.

Being a good environmental citizen often has economic rewards for industry, and there are many examples of industrial progress. Reduced water use saves on both energy and water bills. Cleaner discharge water can reduce permit costs and sewage treatment bills. In Eastern Oregon the food processing industry is recycling its process discharge water for irrigation. Residual nutrients in the water reduce the need for fertilizer, and the process conserves water.

Intel, located in the Portland Metro area, has been recognized as one of the best environmental industries in the country. It selected its Oregon site in part because of an inexpensive high quality water supply and has repeatedly partnered with other stakeholders in the area to protect the water. Within its facilities, managers have set a goal to reduce water use per chip below 2007 levels by 2012.

In response to League questions Intel spokesman Bill MacKenzie outlined the following steps Intel is currently taking:

> Water conservation efforts taken by Intel Oregon include:
> • Improved efficiency in operations of our campus cooling plants…
> • Installing efficient equipment in our new facilities and retrofitting our existing facilities with updated plumbing fixtures…
> • Buying and installing wafer processing tools that use less Ultra-pure water for the production of chips…
> • Increasing Reverse Osmosis (RO) Performance from the standard 75% efficiency to as much as 87% depending on the city water quality. RO is a major part of the process used to purify city water into ultrapure water used to make integrated circuits (chips).
> • Reusing plant waste water in air scrubbers, and re-using those same scrubber wastes again through chemical re-treatment…
> • Modifying wafer production tool 'recipes' to minimize internal water usage…

Business and industrial involvement in conserving and protecting water may be driven by economics. In a letter to the editor in the *Portland Tribune,* representatives of the Working Water Coalition, North Portland, expressed concern over the burden placed on industry in the North Portland River Plan and pointed out that one business had already cancelled expansion plans. The letter cited the burdens that industries have taken on:

> What is missing from the River Front Plan discussion is that waterfront industrial businesses will likely pay millions in their respective obligations under the Superfund. What is also missing is the recognition that most businesses have already changed their practices by investing in on-site stormwater treatment facilities and reducing or eliminating stormwater discharges altogether – a crucial investment toward river cleanup and habitat improvement. [53]

Countering the economic concerns of business are the viewpoints of groups that prioritize the river and see business as a logical funder of improvement. The stakeholder group Willamette Riverkeepers sees the issue from this perspective:

> When properties are being redeveloped, the

> Plan requires that companies and other property owners conduct some restoration of the riverbank, or pay into a fund that can acquire and restore land in the same area. This is to mitigate for their impact to water quality and habitat. The Plan provides some baseline regulatory requirements to make improvements over time for an area that is highly impacted by industry… By approving this plan, a modest charge is assessed to businesses seeking to expand their operations along the river, and these funds will assist restoration efforts.[54]

Balancing environmental and economic concerns as well as repairing legacy damage remains a challenge. Recognizing the challenge the Oregon Business Plan Water Initiative has proposed endorsing "a long term vision of Oregon water managed as a valuable and critical asset by all Oregonians for all Oregonians, providing safe and sustainable water for all beneficial uses." The initiative includes steps for achieving the vision by 2050.[55] Many of those interviewed stressed the need for the public to take responsibility for insuring that everyone does his/her share. Interviewees suggest that the public should support businesses that make changes and demand products that do minimum damage during production and contain materials that are environmentally friendly, thus making good practices economically feasible.

Municipal – Water Conservation and Protection

If you are visiting Oregon for the first time and the plane sets down at the Portland airport, one of the first locations you visit may be the rest room and that is where you discover one of Portland's significant efforts to conserve water – the two-flush toilet system, one for liquid/two for solids. In a busy airport, you can quickly see how this plan conserves water.

Water tank above Klamath Falls

Most Oregonians live in urban areas. Population forecasts suggest these areas will grow. Water is a limited resource, and these population increases can place a strain on our limited water supply. Cities and their utilities are required to take steps to plan for this growth.

In 2002, the WRD updated its rules[56] to better address the quantity of water required by municipal suppliers as service populations expand. Prior to this update, water right permit extensions were issued every five years. The newer regulations allow longer extensions with the requirement that the municipal water supplier develop a Water Management and Conservation Plan (WMCP). The plan documents the supplier's use, management and conservation of water resources. "The approved WMCP provides the basis for WRD to authorize increased diversion of water under existing permits that have been extended or that include conditions limiting the use of water pending a more complete justification of the water supplier's need for additional water." [57] Many of these plans and education programs are available at municipal water system websites.

Communities have incorporated a variety of approaches to promote conservation, such as encouraging landscaping with native plants, watering restrictions during dry months and developing codes that include the use of low-flow toilets, faucets and showerheads. The Tualatin Valley Water District held a "commode corral" to recycle old commodes

and provided $40 rebates toward the purchase of water conserving models. The district estimates a saving of one million gallons of water a year through the program.[58]

All those interviewed recognized the need for conservation of water. Lon Welsh of Lenart Acres Water System, a small water system in Marmot, noted, "The nature of our system which supplies limited quantities of water at all times, and especially during dry months, requires disciplined water conservation."

Agricultural and nursery water users were sensitive to the criticism of their water use in light of perceived water waste in urban environments, for example, the use of water for golf courses and green lawns. Interviewees suggested that getting the conservation message to the individual user was challenging when the user had a good supply of readily available water.

Within municipal systems, conservation is emphasized. For example, the Eugene Water and Electric Board has five staff members working on energy and water conservation issues. Beyond public education, municipal water suppliers are taking steps to sensitize customers to water costs, including charging higher rates as water use rises. Municipal suppliers have performed audits of water use and worked with industry to develop methods for reducing water use.

Communities are looking at alternate uses for "graywater" (water used for laundry, dish washing, and bathing). Graywater could be used for lawn and garden watering and even toilet flushing. In 2009, House Bill 2080A was signed into law legalizing the use of graywater for beneficial uses. According to the legislation a person may not construct, install, or operate a graywater reuse and disposal system without a permit from the DEQ. The bill further directs the Environmental Quality Commission to adopt rules for graywater permitting.[59] Interviewees noted that care must be taken to prevent contamination of drinking water.

Native plants

Capturing and using rainwater for gardens is another option. For much of Oregon, the dry summer/wet winter climate does not support this activity. In some specific locations this alternative can be very effective. For example, the Tillamook Forestry Center has a 65,000 gallon forest wetland pond near the building entry that "performs several key tasks: harvesting and storing rain water for use in the fire sprinkler system; providing non-potable water for other building systems; as a heat exchange for the cooling system. In addition, the pond serves as a reservoir for structural and wildland fire fighters who may need water to fight fires in the surrounding region."[60]

One important issue in conservation in municipal systems is maintaining infrastructure. Pipe leakage or breakage can release millions of gallons of water. A 2006 article on Albany's infrastructure includes the following discussion:

> The largest threat to water quality in the Albany system is the deterioration of the distribution networks. While the cast iron and concrete/ asbestos pipes from the turn of the 20th century remain intact, steel pipes from the Works Progress Administration projects of the 1930s have broken all over town. This includes storm and municipal sewage as well as drinking water lines. Thirty of the 190 mains carrying treated

drinking water leak severely and about 25% of water entering the system seeps back into the ground.

The city has funded replacement of the worst leaks of both systems with nearly $17 million through 2006. However, this does not address all the steel pipes, the current un-funded cost of which is nearly $16 million.[61]

The Portland Water Bureau has developed a strategic plan for 2008-2011 that prioritizes maintaining and improving infrastructure. Similar priorities have been developed throughout the state. Smaller systems face additional challenges because of the lack of funding for replacement of aging infrastructure. Lon Welsh, Lenart Acres Water System, said that work to upgrade its smaller system, including improving reservoirs, adding treatment, and improving piping is expensive and would result in additional development fees on top of the annual water bill.

Pendleton has developed a newer approach to managing its water supply. Recognizing the limited water supply in the region and the seasonal availability of water, it is using an aquifer injection system to store high-quality drinking water produced in its membrane filtration water treatment plant. During the winter wet months, water from the Umatilla River is treated and stored in the basalt aquifer system beneath the city and is recovered during the summer dry months. The process is referred to as Aquifer Storage and Recovery (ASR). During 2008, Pendleton recharged and stored 474 million gallons in the underground aquifer.[62]

All those interviewed spoke of the need both to conserve water and to reduce pollution. There is no agreement on how to do this and how effective current efforts are. Of particular concern was the prevention of nonpoint source pollution.

Municipalities are taking steps to protect water quality. Many municipalities are now required to have NPDES stormwater permits that require plans for preventing pollution of stormwater prior to it entering rivers and streams. Portland has an underground stormwater injection control system for municipal stormwater in many areas of Portland. Sedimentation manholes in the street collect stormwater to separate oil and sediment prior to transfer to a perforated vertical sump that allows the water to trickle into the ground. Care is taken to insure the system is not used where groundwater levels are near the bottom of the sump. All approximately 9,000 Portland injection systems are covered by a system-wide state permit.[63]

Many public water systems have developed drinking water source protection plans.

In Oregon, developing a drinking water protection plan is voluntary. Although it is important for both surface and groundwater water systems to protect their water sources, only groundwater drinking water protection plans can be "certified." The management plan's sections address potential contaminant sources identified for these water systems, and provide concrete examples that communities can use as guidance in developing drinking water protection strategies. In addition to a management plan, a Drinking Water Protection Plan has other required elements, including information on public participation during the plan development, a contingency plan, and a plan for future water system needs. [64]

To protect water quality, municipalities are also using green roofs, bioswales, gardens along the street and reduction of stormwater fees for the construction of stormwater features such as pervious pavers, rain gardens and other techniques that clean water and return it to the ground. For all municipal systems the biggest challenges remain the general education of their residents in conserving and protecting the water and the funding needed to upgrade or replace old infrastructure.

Forestry - Water Conservation and Protection

> "The cleanest water comes from a well-managed forest," stated Jake Gibbs of Lone Rock Timber

According to the Associated Oregon Loggers, "Water is indeed a forest product. Most municipal water originates in forests, and in the West, almost 70% of useable water comes from managed forests -- many such forests where harvest occurs."[65] In contrast, in Oregon, 80% of the water supply source is forest land.[66] This is where water quality and quantity issues begin.

North Umpqua River

Oregon is truly a forest state. Historic rainfall levels and suitable soils have provided a landscape where acres upon acres of Douglas Firs have made Oregon rich in trees. Oregon's forests cover about 30.5 million of the state's 61 million-acre landmass, or about one half of the state's total lands. Oregon is a leading producer of lumber in the nation. Its forest sector is the second largest contributor to its economy, behind the high tech industry, and accounts for 6.9% of Oregon's total industrial output. [67]

Forestry management is essential to protect water as was demonstrated in the Bull Run Watershed. A major summer storm in 1996 washed sediment and debris into Portland's Bull Run drinking water reservoirs making the water unusable and ultimately resulting in banning of logging in the watershed.[68] Oregonians need to consider forestry's role in the water cycle, in light of current water shortages, climate change predictions, pollution levels and population projections,

The Bureau of Land Management (BLM) and the US Forest Service (USFS) manage 59% of all forestland in Oregon. About 3% of Oregon's forests actually belongs to the state, and approximately 35% is in private ownership. Oregon recognizes the need for the state, federal and private management groups to work together to protect Oregon forests. The Forestry Board created the Federal Forestry Advisory Committee to create a vision for how the state and federal agencies can work together to protect Oregon's forest and the resources dependent on them. Oregon has taken a first step to more uniform management of the forests, the source of most of our water.[69]

Oregon's Forest Practice Act (FPA), enacted in 1971, and forest practice rules apply to the 11.7 million acres of non-federal forest land in Oregon. By agreement with the state, the federal lands meet or exceed the requirements of the FPA. The aspects of commercial growing and harvesting of trees on state or private land that are regulated under the FPA include: riparian buffer zones (new stream rules added in 1995), timber harvesting, road construction and maintenance, slash treatment, reforestation, and pesticide and fertilizer use. [70]

The FPA has been revised and updated many times since the 1970s. An important component of the update has been expanding the rules for the protection of streams. Current rules require Riparian Management Areas. Within a specified distance from a stream bank (depending upon the type and size of stream) no harvesting and only minimal disturbances can occur. Moving farther from the edge of the water, other controls limit harvest and retain canopy and conifers. Rules have flexibility to address slope and differing forest conditions. Federal forest lands have similar requirements. [71]

FPA also has requirements to prevent landslides and erosion from the construction of logging roads. Reforestation is required. Before harvesting can occur, a management plan must be prepared to address the FPA rules. The Oregon Department of Forestry (ODF) works with landowners, loggers and pesticide applicators to help them comply voluntarily with forest practice rules.

To protect forest crops, forestry practices include the use of pesticides for control of insects, diseases and undesirable plants that are regulated by the ODA. In Oregon, according to the Pesticide Use Reporting System (PURS), forestry used 4.2% of the pesticides reported. Streamside protection rules for non-federal forest lands in Oregon were adopted in 1994. All private, state and local government forest landowners or managers conducting pesticide operations near streams, lakes or wetlands must comply with the rules.

> The rules require operators to protect soil, air, fish, wildlife, and water quality through measures that include avoiding aerial herbicide applications within 60 feet of streams that contain fish or drinking water streams, and avoiding ground-based applications using backpack or pressurized sprayers within 10 feet of those streams. [72]

The contribution of forestland to pollution was measured in a study done in the 1990s of runoff from land activities (agricultural, urban and forest land) on the Willamette River. The researchers found that forest land use was the smallest contributor of nutrient and pesticide pollutants to the river. "Nutrient concentrations at forested sites were among the smallest observed at any of the sites sampled. In addition, only one pesticide and one pesticide degradation product were detected at forested sites, at concentrations near the method detection limits." [73]

Additional pesticide buffer zone requirements have been introduced as the result of court rulings. In January 2004, the U.S. District Court for the Western District of Washington ordered protective measures as the result of rulings in the case of Washington Toxics Coalition v. EPA. Buffer zones around specific water bodies in California, Oregon and Washington were established. Within the buffer zones, 37 active ingredient pesticides identified by the EPA as having deleterious effects to one or more of the listed Pacific salmon or steelhead cannot be used. The court order establishes a 20-yard buffer zone for ground applications of these specific pesticides. For aerial pesticide applications, the court order established a 100-yard buffer zone adjacent to "salmon-supporting" waters.[74]

Several other recent activities are addressing pesticide and chemical use in the forest. A lawsuit filed in October 2008 alleges problems with fire retardants used in the forest. However, the U.S. Forest Service claims they use approved chemicals saying, "In general, all eight fire retardants approved for use are ammonium phosphate compounds and a gum thickener and bactericide."[75] Additional pesticide review is currently underway by the EPA to examine the possible human and animal effects of the pesticide atrazine, and future use of this pesticide may be affected. Atrazine, the second most widely used pesticide in Oregon forests, is used to control plants and brush that compete with young trees.[76]

Three ten-year paired watershed studies, Hinkle Creek, Trask River and Alsea River, monitoring harvested and un-harvested forest basins are underway to measure the effects of forest practices on water quality, temperature and biological effects. The same scientists are using the same techniques in different geographic locations to investigate fish, water quality, stream flow and aquatic habitat. Such studies will provide additional scientific information which may guide future forest practices.[77]

Climate change may also impact future forestry practices. "The Oregon Department of Forestry is committed to assisting Oregon with the reduction of atmospheric carbon and reducing the impact of greenhouse gases on global climate change."[78] Suggested modifications to forest management

practices to enhance carbon sequestration are lengthening harvest regeneration cycles and adopting low-impact logging. Other suggestions to help store carbon in the forests include thinning, as opposed to clearcutting, reducing forest road systems and preventing soil erosion.[79]

A concern expressed by many interviewees was that currently, many state agencies face budget cuts. These budget cuts to the ODF will make successful implementation of better forest practices more challenging and may eliminate enforcement of rules in the private forests program, which provides landowner assistance services and enforcement of resource protection rules on 10.7 million acres of privately-owned forest in Oregon.[80]

Putting the Public Into the Water Discussion

When and how does the public become involved in the water discussion? Many of the interviewees felt the public was often not involved or knowledgeable about water issues or how to influence decisions regarding its use. For example:

> "I believe that the public needs to better understand the link between water quantity and water quality. We all have a personal responsibility to understand our impact on the environment." Keith Andersen, Interim Western Regional Administrator DEQ.

> "If people don't see a problem, they don't see a reason to show up (at meetings)." Linda Modrell, Benton County Commissioner.

Most interviewees felt that the public isn't always well informed about water issues. If individuals sense that they can be directly affected, some may show up at public meetings and provide testimony. Others don't become involved until after decisions are made; then they may complain by writing angry letters to the editor or venting to neighbors. Some interviewees stressed that public involvement and interest only occur when individuals are directly affected by an issue. Recently, positive tests for E. coli in a Portland reservoir increased public awareness and intensified the call for covering the reservoirs. The virtual disappearance of the Deschutes River through Bend was the driving force to unite stakeholders to address water issues. The threat of law suits and loss of irrigation water brought together the Tribes and the farmers to seek out answers on the Umatilla River. Issues such as wells running dry, exempt wells, private property rights or pollution in the water may generate public involvement. However, when the tap is running and the drinking water is clean, the public is seldom concerned. Getting the public involved before problems occur is challenging.

Lorna Stickel of the Portland Water Bureau spoke of past public events where considerable time, expense and effort had been put into developing and marketing informational programs only to have minimal attendance. In general, interviewees felt that novel approaches must be developed that bring issues home to the public, whether it is increased charges for water or waste treatment or placing limits on watering, mandating purchase of water conserving appliances, legislating the ban of products containing identified toxics, or developing collection sites for toxics and mandating controlled disposal. Once again all the approaches require community buy in, political leadership and funding.

Terry Morton, mediator & facilitator in Klamath Falls, has worked with diverse groups to reach consensus on difficult water related issues. She feels that unstructured meetings, like town hall gatherings, allow extreme viewpoints to influence the middle views. Morton believes that in volatile cases it may be best at first to conduct meetings that are closed to the public to allow interested parties to find common ground.

Interviewees frequently indicated that the public failed to understand the unique water priorities of the

different stakeholders. For example, they cited concerns that the urban public did not understand rural needs, did not recognize the costs and stresses on industries, agriculture and forestry, and were not cognizant of the urgency of the risks to the environment. Also interviewees cited the need for understanding of the concepts of watersheds, hydrological cycles, the impacts of individual actions on water, the natural characteristics of water and the food chain.

How can public participation and understanding of water issues be encouraged? Several interviewees suggested the need to attach a cash value to water; i.e. when cost is involved, individuals are more likely to act. Programs that provide funding for detaching roof drains from the sewer system or for installing stormwater treatment, rebates for low flush toilets and give-aways of low-flow showerheads encourage public conservation action.

Social marketing or advertising may change public behavior. If everyone is doing it – others do it. This approach rewards appropriate practices and encourages the public to act similarly - for example, prompting the drinking of tap water and using recyclable bottles.

Although this method can be successful in changing habits, it does not educate.[81,82]

Other interviewees emphasized the need for providing more education and involvement about water issues from earlier ages, beginning with programs in schools. When asked what she would do if she had unlimited funds, Sandra Coveny (former Council Coordinator, Marys River Watershed Council) stated, "I would start education with kindergarteners, teaching them from day two … give them a chance to settle into school first on day one … how to be good stewards of our land, good community members and good participants in our democracy. I would like to see all learn the value of our air and water and land."

Integrated Water Resources Strategy

"A statewide integrated water resources strategic plan will bring various sectors and interests together to work toward the common purpose of maintaining healthy water resources to meet the needs of Oregonians and Oregon's environment for generations to come."[83]

Repeatedly, during the interviews for this report, the League heard comments about the complexity of addressing water issues with many agencies and groups involved and often limited joint communication. In 2008, the Oregon State University Institute for Water and Watersheds, Oregon Sea Grant Extension, OSU Institute for Natural Resources, and the Oregon House Committee on Energy and the Environment organized a series of Statewide Water Roundtables to take feedback on Oregonians' concerns and vision for Oregon water. An extensive report issued in December 2008 is now available online.[84] The feedback stressed the public interest in future planning for water.

In Oregon, quality and quantity of water have remained clearly separated. However this siloed approach may soon change. In 2009 the Legislature passed HB 3369 directing the development of an Integrated Water Resources Strategy (IWRS). The legislation directs the WRD along with the DEQ, the ODFW, ODA and other Oregon agencies to "develop an integrated water resources strategy to implement the state water resources policy." The legislation directs the agencies to design the strategy to meet Oregon's in-stream and out-of-stream water needs, and the quality, quantity, and ecosystem needs for today and in the future.

The IWRS process began by agency staff setting the stage. Identifying our water resource needs is a part of the next effort; open houses and presentations around the state will solicit Oregonians' information

and opinions. A second series of open houses and presentations will occur after preliminary recommendations are developed, ending with a progress report to the 2011 Legislature. A final strategy will be developed and taken to agency boards and commissions with final adoption by the Water Resources Commission by the end of 2012. The justification is put very well in the issue paper from the WRC.

> Oregon is currently one of two western states without a formal water management strategy. And, it is one of many without an integrated strategy that takes into account water quantity, water quality, and ecosystem needs. An integrated water resources strategy is needed, as we develop a vision of what Oregon's livability and economic viability will look like for future generations based upon adequate high quality water supplies.[85]

The team led by the WRD and the WRC has already produced seven draft issue papers that discuss: introduction, water quality, water quantity, ecology, economy, social issues and the impacts of climate change.[86] At every stage a critical component of this work will be involving all Oregonians in the important recommendations that may go forward. Those interviewed for this study support the need for maximizing public feedback. Interviewees also expressed the importance of developing both long term technical and strategic plans and for developing a data bank that allows sharing of information.

The IWRS plan will look at the current issues discussed in this report and will address future concerns including:

- Population growth that includes the addition of an expected one million people in Oregon before 2030
- Climate change that may alter the timing and form of precipitation in Oregon
- Surface water that is almost completely allocated across Oregon during summer months
- Groundwater
- The hydrological connection between surface water and groundwater
- Future in-stream and out-of stream demands on Oregon's water supply
- Increased knowledge of toxins and trace pollutants in waters

Interviewees have repeatedly stressed the need for a holistic approach to water issues, protecting water quality, insuring adequate water for all uses, land use planning, economic growth and addressing a changing future.

Summary

With the initiation of a statewide Integrated Water Resources Strategy, Oregon is looking in detail at water issues. As discussed in this document, the challenges are a complex jigsaw puzzle that needs to be assembled correctly to ensure sufficient high quality water supplies for Oregon. To meet these challenges, policy must be developed that maximizes the best future for Oregon. These policies will require Oregonians to eliminate the "siloed" approach and work together. In addition, all Oregonians have a role in conservation and water protection and need to recognize the cost, the sacrifices and responsibilities that are required to ensure enough high quality water for Oregon's future.

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Appendix A

Interview Questions

The League of Women Voters of Oregon is studying water in Oregon. In the first year of the study the League learned about the laws and regulation that govern water in Oregon. In the second part of the study the League is interested in learning about current and future issues facing our water resource. We are interested in your viewpoint.

1. What is the major water problem(s) that you see at this time?
    a. Problems with individual water need (wells, septic, water usage)
    b. Problems (shifts) in group needs?

2. What are the positive points and problems with current water regulations? How are you addressing or would you address these problems?
    a. Does Prior Appropriation work? Can it be changed? How?
    b. Do TMDLs work? How could they be better?

3. Describe your relationship with other agencies and levels of government and how it promotes or hinders your goals?

4. What is needed to best address water issues now and in the future (i.e. data, usage, etc)?

5. Within your sphere of involvement what steps could or are being taken that result in conservation of the waters of the state?

6. Within your sphere of involvement what steps could or are being taken that result in protecting water quality.

7. How are you planning for climate change?

8. Can you provide some current examples of water conflicts and resolution going on at the present time in your sphere of influence?
    a. Success stories
    b. Failures

9. Is there one thing about current water issues that you would really like the general public to understand?
    a. Do you feel that there is adequate public participation?
    b. Do you feel that the mechanisms for public participation are well understood?

10. If you had unlimited funding what issue(s) would you address first?

11. Is there anything you would like to add?

Acknowledgments

The League of Women Voters of Oregon Education Fund would like to thank the following individuals who provided interviews or technical assistance for this project. Without their cooperation this paper would not be possible.

Written and Oral Interviews and Communications

Gail Achterman, Director, Institute for Natural Resources, Oregon State University

Greg Addington, Executive Director, Klamath Water Users Association, Klamath, OR

Belinda Stewart, Program/Outreach Coordinator, Klamath Water Users Association, Klamath Falls, OR

Keith Andersen, Western Region Administrator, Oregon Department of Environmental Quality

Ken Bierly, Deputy Director of the Oregon Watershed Enhancement Board (OWEB)

John Buckhouse, Extension Range Management Specialist, Emeritus, Oregon State University

Megan Callahan, Public Information Manager,
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Rick Craiger, Regional Program Representative, Oregon Watershed Enhancement Board

Sandra Coveny, Former Council Coordinator, Marys River Watershed Council, Corvallis, OR

Tim Deboodt, Extension Agent, Oregon State University

Jeff Dose, Head Fisheries Biologist, Umpqua National Forest

Bill Gaffi, General Manager, Clean Water Services, Hillsboro, OR

Jake Gibbs, Stand Management Forester,
Lone Rock Timber Management Company, Roseburg, OR

Rick George, Public Affairs Manager, Confederated Tribes of the Umatilla Indian Reservation

Rick Hallmark, Supervising Environmental Health Specialist,
Coos County Public Health Department

Connie and Doc Hatfield, Ranchers, Brothers, OR

Don Horneck, Extension Agent, Oregon State University, Hermiston, OR

Paul Heberling, Umpqua Basin Coordinator, Oregon Department of Environmental Quality

Ani Kame'enui, Healthy Rivers Campaign Coordinator, Oregon Wild, Portland, OR

David Kliewer, P.E. Principal Engineer,
Portland Bureau of Environmental Services, Portland, OR

Jeanne LeJeune, Water Resources Commission, Water Marketing Manager, HRD, Portland, OR

Dwight Long, Environmental Activist, Klamath, OR

Bill MacKenzie, Communications Manager, Intel Corporation, Hillsboro, OR

Kent Madison, Madison Farms, Echo, OR

Tamra Mabbott, Umatilla County Planning Director, Umatilla County, OR

Patrice Mango, R.P.G., Stormwater Program Manager,
Portland Bureau of Environmental Services, Portland, OR

Linc Mann, Public Information Officer,
Portland Bureau of Environmental Services, Portland, OR

Linda Modrell, Benton County Commissioner, President of AOC, Benton County, OR

Karl Morgenstern, Source Protection Coordinator,
Eugene Water and Energy Board, Eugene, OR

Terry Morton, Oregon Independent Mediator, Cascade Quality Solutions, Klamath Falls, OR

Stanley Petrowski, President, South Umpqua Rural Community Partnership, Umpqua, OR

Bruce Roll, Watershed Management, Clean Water Services, Hillsboro, OR

Adam Stebbins, Water Project Coordinator, Benton County, OR

Jeff Stone, Director of Government Relations, Oregon Association of Nurseries.

Lorna Stickel, Water Planning Consortium Project Manager,
Bureau of Water Works, City of Portland, OR

Mike Wick, General Manager, Westland Irrigation District, Pendleton, OR

Lon Welsh, Lenart Acres Water System, area of Marmot, OR

Fred Ziari, CEO, IRZ Engineering, Hermiston, OR

Published by the League of Women Voters of Oregon Education Fund – 2010

Chair: Jane Gigler

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Roger A. Bachman, Water Policy Advocate, Oregon Trout, Portland, OR

Todd Jarvis, PhD, Associate Director, Institute for Water & Watersheds, Oregon State University

Photo Acknowledgments

Paul Sanford, Horticulturist and Natural Garden, Toxic Reduction Educator, Metro, Portland, OR, Janet Calvert, Jane Gigler, Marnie Lonsdale,
Sally McKain (in greenhouse photo), Pat Russell, and Robin Wisdom

Design

Don Atwell, Community Newspapers

Printing

Community Newspapers

Donors

The LWOREF is grateful to the following donors for providing funding to make this publication possible.

Eugene Water and Electric Board

**A Grant from the Mountaineers Foundation,
http://www.mountaineersfoundation.org**

Contributions from members and friends of the League of Women Voters