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# OREGON WATER RESEARCH NEWS

Water Resources  
Research Institute  
Oregon State University

## From the Director:

The Oregon Water Resources Research Institute is an interface between the water research and teaching programs in Oregon's Universities and the water users in the State. One of WRRI's activities is to coordinate multi-disciplinary research studies that address Oregon's water problems. Let me describe one of these.

A joint Portland State University-Oregon State University research project is evaluating information available on quality of water in the Tualatin River Basin. The Tualatin River is a water quality limited stream with problems of excess algae growth and low dissolved oxygen. Investments over the past five years have made significant progress in reducing summer point source phosphorus loads. The major focus now is on controlling nonpoint sources. The project will develop and test different scenarios for enhancing water quality in the Basin.

The components of the study include evaluating the overall health of the River, applying water models to predict water quality in the Tualatin River under different management options, analyzing the environmental, economic and social impacts of various pollution control alternatives that would improve water quality, and assessing how the analytical approach used on the Tualatin River can be applied to other river basins in the State. Portland State scientists are using two nationally recognized models as analytical tools to evaluate alternative pollution reduction strategies. One model describes the inputs to the river from land uses and the second one describes processes in the stream. Oregon State University investigators are studying the interaction of rainfall, temperature, cropping practices and soils to define phosphorus movement in the basin. The study, funded by the Department of Environmental Quality builds on research work, past and present, at the Oregon Graduate Institute and the U.S. Geological Survey. A number of other organizations are contributing information to the study, including the Washington County Soil and Water Conservation District, the Oregon Department of Agriculture, the Unified Sewerage Agency in Washington County, the Oregon Department of Forestry, the Tualatin Valley Irrigation District and the Oregon Department of Water Resources.

An important component of this study is to incorporate ideas from the community into choosing and evaluating scenarios for water quality management. This is a very important aspect of the study and we ask anyone with an interest in the river to get in touch with us. Not only is this an important water quality management project which will be costly to implement, but it could develop procedures to evaluate water quality improvement in other water quality limited streams in Oregon.

The information developed in this project is being published in a series of working papers, published as Special Reports by the Oregon State University Extension Service and WRRI. The first of these reports is available and others are in preparation. See details on page 8.

## **REPORT ON WATER MARKETING SYMPOSIUM**

*Willamette University  
May 27 & 28, 1992  
By Joe Bowersox  
Oregon State University*

Calling the United States a nation of "over-consumers" of water, U.S. Senator Mark Hatfield delivered the keynote address to a water marketing symposium held May 27th and 28th at Willamette University in Salem. The symposium, co-sponsored by Willamette University's College of Law, the Oregon Water Resources Congress, the Oregon Water Resources Commission, and the Oregon Water Utilities Council, provided an opportunity for Oregon policy makers and other interested parties to learn more about the potential economic, legal, technical and environmental advantages and constraints of water marketing in Oregon.

### **Hatfield Calls for Conservation, Other Options**

Hatfield set the tone for the symposium by noting that increasing competition over water resources for instream and out-of-stream uses requires policy makers to consider new alternatives for meeting legitimate water needs. Environmental, economic, and political costs of new dam construction make this option increasingly prohibitive. While calling for passage of his Western Water Policy Review Act and increased conservation, Hatfield stressed the importance of water marketing as an option that may equitably redistribute water without invasive private takings or major disruptions of the prior appropriation doctrine.

### **Other Highlights**

The two day symposium included presentations and panels conducted by well-known experts on water marketing in the western states. The following is a brief glimpse of some of these presentations.

### **Howitt on Economic Constraints of Markets**

Using the 1991 California emergency water bank as an illustration, University of California-Davis professor Richard Howitt noted three economic constraints preventing potential water markets from becoming more freely competitive. These obstacles included prohibitions on water districts making profits, preventing marginal cost pricing; federal subsidies providing low cost water which, if sold, would create competing public and private claims to profits; and third party effects on impacted economies and environmental values.

Howitt proposed several solutions to these problems, including developing tiered pricing systems, splitting profits between private sellers and federal project developers to reclaim construction costs, providing "in-kind" payments to public agencies to insure instream releases, and establishing funds to offset third party claims of adverse economic impact.

### **Shupe on the Marketable Quantity of Water**

Other panels focused on the technical and engineering aspects of water marketing. Steven Shupe discussed the problematic determination of the marketable quantity of water. May the seller market the amount of the filed water right, or merely the portion which is beneficially used without waste? The first alternative maximizes economic incentives for the seller, while the latter more effectively protects third-party and public values. Many states make such determinations on a case by case basis, insuring long and expensive litigation.

### **Legal Constraints on Water Markets: Tarlock and MacDonnell**

Other panels stressed legal aspects of water transfers gleaned from the experiences of other western states. A. Dan Tarlock (Chicago-Kent College of Law) cited examples from Colorado, Arizona and New Mexico where traditional third

party rights (like junior water rights holders) and non-water right stake holders (like rural and indigenous communities) successfully challenged rural-to-urban transfers as injurious to their interests. Tarlock also noted the chilling effect of Indian water rights and area of origin legislation on potential water markets.

Lawrence MacDonnell (University of Colorado Natural Resources Law Center) reported on a 30 month study of water transfers and marketing in Arizona, California, Colorado, New Mexico, Utah and Wyoming. Of the over 16,000 transfers studied, most involved changes in purpose and place of use, predominantly from agricultural/rural to non-agricultural/urban uses.

The study concluded that reallocation of rights to water resources is well underway in the West, yet Western water law and procedures must be amended to strike down remaining barriers to transfers and to explicitly protect third party and public interests. MacDonnell cited New Mexico's legislation as a model that facilitates transfers by specifying exact criteria for consumptive use determinations, public interest determinations, and market boundaries. Such legislative comprehensiveness prevents each transfer from becoming a unique "work of art" through extensive litigation and appeal.

#### Market Worries: Lazarus

Not all participants looked wholly favorably upon water marketing, as demonstrated by the panel on protecting public values. Richard Lazarus (Washington University-St. Louis) urged the audience not to place public values in the "footnotes" but in the "text" of our water policies. Economic efficiency should not be our primary goal in water transfers. Legislatures must demust deal candidly with the values they are trying to promote with water marketing and the public trust doctrine, rather than pretending that marketing will achieve these through the "privatization of public values." Private property concepts should not be grafted fully onto water, thereby inhibiting inevitable future regulation of a scarce and valuable resource.

#### Future Legislative Guidelines

Generally the symposium was a success, considering the level of analysis presented by the panelists and the frank discussions they generated among the diverse interests in attendance. A more direct result will be seen in the forthcoming recommendations from the Oregon Water Marketing Study Task Force (formed by the Oregon Water Resources Commission), which held its ninth meeting in conjunction with the symposium. The Task Force hopes to utilize the information gained from this symposium to draft conceptual guidelines for future action by the Oregon State Legislature.

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*Joe Bowersox is a Javits Fellow and Ph.D candidate in political science at the University of Wisconsin-Madison. An OSU alumnus, Joe is an adjunct in the Department of Political Science while completing his research in Oregon on natural resources policy and water policy in particular.*

#### WATER CONSERVATION ACTIVITIES IN OREGON

*Randy Selig  
Oregon Water Resources Department*

This article is a brief overview of current water supply conditions in Oregon and of a few of the conservation activities of the Water Resources Commission. There are many individual, commercial, and agency water conservation efforts which cannot be described in one short article.

The water supply picture for Oregon looks bleak in this sixth consecutive drought year. Snowpack was very low at most sites. For example, snowpack at Crater Lake had disappeared by May 9; normally snowpack at the end of May would be 61 inches. Although most stations reported greater than average April precipitation, May and June have set records in most areas for high temperatures and low rainfall. Reservoir storage is 10% of normal in Lake County and 24% of normal in the Owyhee Basin. Lost Creek Reservoir, the largest storage facility in the Rogue River Basin, did not fill this year for the first time since its construction in 1977. Although most of the 13 reservoirs operated by the Army Corp of Engineers in the Willamette Basin did fill, inflows to the reservoirs are at record low levels.

Statewide, stream flow during May was 33% of average. Many streams are at levels normally experienced during July or August of a dry year. In the Willamette Basin, stream flow forecasts are for 40% to 63% of normal. Many of the streams surveyed are at record low levels. Water supply indices indicate that the Owyhee and Klamath basins are the driest in the state. Stream flow forecasts for the Owyhee basin are 4% of normal; in the Klamath basin forecasts are 2% to 30% of normal.

The Water Resources Department has received many requests for emergency water uses and 22 counties have federal status as Drought Emergency Areas. The Department may be able to lend some assistance to those looking for ways to stretch their meager water supplies.

In December of 1990, the Water Resources Commission adopted a new statewide policy on Conservation and Efficient Use of Water. A Conservation Advisory Committee was established by the Water Resources Commission last summer. Committee members were nominated by a broad spectrum of water interest groups. The first project tackled by the committee is the development of rules describing the water management planning process.

### Rules for Water Management Plans

The Water Resources Department, with the assistance of the Conservation Advisory Committee, has been developing rules for water management plans to be prepared by municipal water suppliers and agricultural water suppliers and users. These rules are intended to guide long-range conservation efforts by cities and agriculture. After many meetings, the draft rules are nearly ready for formal hearings. The water management plans have three main components: a water conservation plan, a long-range water supply plan, and an allocation or curtailment plan.

The draft rules for municipalities would require all suppliers serving 300 or more people to prepare plans. Plans of the largest suppliers would be due first and all plans would be completed within five years. Each water supplier would be expected to evaluate a variety of water conserva-

tion measures and to implement all cost-effective measures. Some of the required measures to be implemented include water audits, metering, and public education and information programs.

Draft rules for irrigation water users would require all districts and private diverters with more than 500 acres of irrigated land to complete the planning process. The planning requirements would be phased in over the next 8 years. The draft rules require users and suppliers to quantify losses in canals and pipelines. The rules require the development of goals to improve water management and to decrease water losses, an evaluation of alternatives to meet goals, and a program for data acquisition, monitoring and evaluation of conservation projects after implementation.

Public hearings on the draft rules are planned for late August or September. The rules will be presented to the Water Resources Commission for adoption in October 1992.

### Deschutes Basin Water Conservation Study

The Bureau of Reclamation is involved with local irrigation districts, the Soil Conservation Service, and the Water Resources Department in a conservation program in Deschutes, Jefferson, and Crook Counties called the Upper Deschutes River Basin Water Conservation Project. The study has three major goals: reduce the seasonal flow fluctuations in the Deschutes River above the City of Bend, increase the irrigation season flows in the Deschutes River below the City of Bend, and ensure adequate irrigation water to those areas that incur periodic shortages.

The first phase of the project is a demonstration of experimental canal-lining technologies. Traditional methods of lining canals are not suitable for many of the local canals which are cut through basalt rocks. Fifteen different lining technologies are being applied in two miles of canal in the Arnold Irrigation District and one mile of canal in the North Unit Irrigation District. Many of these materials have never been used for canal lining. Decreasing seepage from the canals of the region could make more water available for other uses, both instream and out-of-stream. The costs, effec-

tiveness, and durability of the lining technologies will be evaluated to determine if any provide a cost-effective method for reducing seepage losses.

Phase two of the Project has just begun with the selection of five different lateral canals which are suitable for conversion to gravity pressure pipelines. Converting open ditches to pressure-pipe saves both water and energy. Further engineering analysis of these five sites is underway and funding sources are being sought.

### **Water-saving Fixtures**

The 1991 legislative session passed Senate Bill 203, the "toilet bill". The bill mandates the use of low water using fixtures in new building construction and major remodeling by July 1993. Standards include 1.6 gallons per flush toilets, 1.0 gallon per flush urinals, and showers and interior faucets of less than 2.5 gallons per minute.

An estimated 4 billion gallons of water will be saved in the year 2000 because of the changes required by the bill. The simple payback on the difference in cost for a customer in a metered community is less than three years. The Building Codes Agency is now adopting rules to implement the standards.

For more information about any of these activities, call the Conservation Program staff at the Water Resources Department (378-8455).

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President Bush has proclaimed 1992 the "Year of Clean Water" to celebrate the 20th anniversary of the Clean Water Act, and October 1992 as "Clean Water Month." For more information contact America's Clean Water Foundation, Hall of the States, 444 N. Capitol Street NW, Washington, D.C. 2001

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## **HEAP-LEACH MINING AND WATER QUALITY**

*Allen Agnew, Courtesy Professor  
of Geology, Oregon State University*

We who travel through old mining districts are often shocked by the devastated landscape caused by mining operations of several decades to a century ago. Many of us do not realize that today, in response to society's insistence on environmental enhancement rather than degradation, mining operations are not only more efficient in extracting the minerals or gravel from the ground, but are often required to restore the land to its former value, or a higher value.

This greater attention to reclamation and restoration has caused increases in the cost of those minerals. We as consumers have been willing to pay those greater costs in order to acquire the goods that we can't seem to do without (e.g. autos, kitchenware, furniture, golf clubs, aluminum baseball bats, and TV sets.)

One of the great concerns in mine-wastewater today is cyanide, which is widely used in leaching operations both at the surface and below ground. The process of heap leaching for gold has been proposed by the Atlas Precious Metals Company for its Grassy Mountain Prospect in Malheur County. The operation plans to recover 100,000 troy oz of gold per year and a similar amount of silver for at least eight years, and is expected to have a 6 million annual payroll that will support 190 jobs.

### **Chemical Heap-Leaching Legislation in Oregon.**

In July, 1991, Governor Roberts signed into law HB 2244, which provides for chemical heap-leaching in gold mining in Oregon. That bill had been worked out by a group of industry and environment representatives, asked by the Governor to hammer out a compromise that would be acceptable to both groups. The objective is "to solve tough environmental problems while allowing responsible development of our natural resources." (Anon, 1991)

That mining bill does several things (Anon, 1991):

It creates a comprehensive application process for heap-leaching companies, under the direction of Oregon's Department of Geology and Mineral Industries (DOGAMI).

It provides that any chemical-process mining operation use the "best available, practicable, and necessary technology" to meet environmental requirements.

There must be no net loss of fish and wildlife habitat values.

It requires that the site be reclaimed so as to protect human health and safety as well as wildlife.

It requires a complete environmental assessment, as well as a thorough socioeconomic assessment, of the proposed operation.

There are opportunities for public input and public information in the application process.

When the mining operation ceases in eight years or so for the Atlas/Grassy Mountain project, the leach-heap pads are to be rinsed down until their cyanide level and alkalinity are acceptable to DOGAMI.

### What is Heap-Leaching?

It is a relatively simple process that replaces many steps required for conventional milling of a mineral deposit. (Trexler et al, 1990, p. 1; Throop, 1989; Wiley, 1991, p. 66). Crushed ore is placed on an impervious pad on the surface of the ground. A dilute solution of sodium cyanide is then delivered to the heap of crushed ore, either by sprinkling or by drip irrigation. As the cyanide solution trickles through the ore pile, it dissolves the gold and silver, and that liquid drains from the heap to be collected in a large plastic-lined pond. This gold and silver bearing solution is then pumped through tanks containing activated charcoal, which absorbs the gold and silver. The "barren" cyanide solution is then pumped to a holding pond, where lime and cyanide are added to restore the alkalinity and bring the leach solution up to the required cyanide content so it can be re-used on the ore heap. The gold/silver-bearing charcoal is treated with a stronger cyanide solution to recover the

gold/silver, and the charcoal is reactivated for reuse; the cyanide waste solution is recovered.

### Potential Heap-Leach Problems.

Ten years of cyanide heap-leach gold-ore mining and treatment in Nevada have taught us a lot about it (Ross, 1991). Because the mines were in remote desert areas having little precipitation, wildlife, or human population, potential problems that might arise from the use of this technology were ignored. A leak in a leach pad or pond liner or a conveyance system could have occurred, but because the depth to ground water in such desert areas is commonly several hundred feet below the land surface, leaks might not be detected. Cyanide usually breaks down quickly in well-oxygenated soils, so that a water sample 10 feet down may show no cyanide. Leaks can be detected by monitor wells installed in and around the mine facility, as is required by Oregon regulations. At one Nevada mine operation, a pump-back system is required to catch the leaked cyanide product; mining companies recognize the economic advantages of such recovery systems because makeup of lost cyanide is expensive as well as environmentally deleterious.

Small quantities of cyanide that may get into animals or humans break down quickly and thus do not accumulate in the body. However, larger quantities of cyanide are very toxic to humans as well as to fish and other animals (Throop, 1989, p.11, 20)

Heap-leach mining experience in Nevada has shown that migratory birds saw the waste-solution ponds as attractive sources of water, even at night and flying 7,000 feet above the ponds. Many bird deaths resulted. Thus, ponds from current mining operations are covered with netting, and the inactive ponds are neutralized to 50 ppm or less cyanide.

### Summing Up.

Although we are learning as we go along, and even though Nevada's regulatory mechanisms are in their infancy, Nevada has not documented any severe groundwater contamination from heap-leach cyanide mining operation (Ross, 1991,

p. 90). Nevertheless, because cyanide processing is a wave of the future in Oregon gold mining, all participants in this major new mining and processing technology are remaining alert for possible problems that may not show up for many years.

#### References:

- Anonymous, Sept. 1991, "Governor Signs Landmark Mining Bill": Oregon Geology, v. 53, no. 5, p. 117
- Ross, Christopher, Spring 1991, "Leach Heap Operations and Ground water": Groundwater Monitoring Review, p. 88, 90.
- Throop, Allen H., January 1989, "Cyanide in Mining": Oregon Geology, v. 51, no. 1, p. 9-11, 20.
- Trexler, Dennis T., Tomas Flynn and James L. Hendrix, Summer 1990, "Heap Leaching": Geo-Heat Center Quart.
- Wiley, Thomas J., May 1991, "Mining and Exploration in Oregon During 1990": Oregon Geology, v. 53, no. 3, p. 66-70

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## Announcements

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### Meetings

The 1992 Annual Meeting of the American Institute of Hydrology will be held at the Red Lion/Columbia River Hotel in Portland, Oregon on October 16-22, 1992. The conference will discuss interdisciplinary approaches in hydrology and hydrogeology. For more information call (503) 231-2025.

The 7th Northwest On-Site Wastewater Treatment Short Course and Equipment Exhibition will be held September 14 and 15, 1992 at the University of Washington in Seattle. For more information call (206) 543-6744.

On November 5 and 6, the Fifth James A. Vomocil Water Quality Conference "Water Quality and Allocation Policy Issues" will be held at the LaSells Stewart Center, Oregon State University. For more information call (503) 737-6295.

The program includes:

*Determining stream flows for fish habitat protection under conditions of over-allocated water* - Hiram W. Li, Dept. of Fisheries and Wildlife, OSU.

*Bioassessment as an alternative to conventional physical and chemical measurements to describe the health of natural waters* - Stanley V. Gregory, Dept. of Fisheries and Wildlife, OSU.

*The tradeoffs involved in protecting the salmon of the Columbia River* - Ludwig Eisgruber, Dept. of Agricultural and Resource Economics, OSU.

*The clean-up of toxic wastes associated with the former United Chrome facility in south Corvallis* - Scott McKinley, CH2M-Hill Engineers and Planners, Corvallis

*The development of the current Malheur County groundwater quality dilemma and what we can expect over the next several years* - Jonathan D. Istok, Dept. of Civil Engineering, OSU.

*The Total Maximum Daily Load (TMDL) process as applied to the Tualatin River* - Fred Hansen, Director, Oregon DEQ, Portland.

*The prior appropriations doctrine for the allocation of water to beneficial uses as applied in Oregon* - Stephen Sanders, State Attorney General's Office, Salem

*If it ain't broke, don't fix it* - Kip Lombard, Attorney, Oregon Water Resources Congress, Klamath Falls.

*Modernizing the Prior Appropriations Doctrine for equitable streamflow* - Rep. Chuck Norris, Chairman, House Interim Committee on Water Policy, Salem.

*The Prior Appropriations Doctrine is not very appropriate* - Karen Russell, Waterwatch, Portland

### WRI Seminar Series at OSU

The fall Seminar Series, beginning October 1, will include 9 presentations on "Drinking Water - How Safe and at What Cost?" Call WRI at (503) 737-4022 for information and to be placed on a mailing list for seminar notices.

Our spring Seminar Series on "Oregon Water Policy Issues" is available in several ways - A publication with a write-up on each seminar is being published by the OSU Extension Service and will be available late August. Videotapes and audio tapes of each lecture are available at the Institute Office. Call (503) 737-4022.

### Publications

The WRRI has published two new research reports. WRI-111, **Current Use and Potential Impacts of Whitewater Recreation in Oregon**, by Mark Brunson, Bo Shelby and Rebecca L. Johnson, and WRI-112, **Impact of Estuarine Benthic Algal Production on Dissolved Nutrients and Water Quality in the Yaquina River Estuary, Oregon**, by Jonathan H. Garber, John L. Collins, Jr., and Michael W. Davis are available by sending a check or money order for \$5.00 each (to cover printing and mailing costs) to: Water Resources Research Institute, Oregon State University, 210 Strand Agriculture Hall, Corvallis, OR 97331-2208, or call (503) 737-4022.

The Oregon State University Extension Service and the Oregon Water Resources Research Institute has published a Special Report 898, **Land Use and Nonpoint Phosphorus Pollution in the Tualatin Basin, Oregon, A Literature Review**. This is the first report on a joint Portland State/Oregon State University project assembling information on water quality in the Tualatin River basin. Other reports on interpretation of monitoring data and on models for water quality are in preparation.



#### Water Resources Research Institute

Director: B. P. Warkentin

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