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Water Rights, Water Quality & Water Solutions in the West

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WASTEWATER TREATMENT

BENEFITS OF MOVING BEYOND MINIMUM REQUIREMENTS
KING COUNTY WASHINGTON'S BRIGHTWATER PROJECT

by Stan Hummel, King County Wastewater Treatment Division (Woodinville, Washington)

Introduction
CHOOSING MEMBRANE BIOREACTOR TECHNOLOGY

In Washington state, King County's Wastewater Treatment Division is building the Brightwater project, which includes one of the largest **m**embrane **b**io**r**eactor (MBR) wastewater treatment plants in the world. When it comes on line in 2011, the plant will initially treat 36 **m**illion **g**allons per **d**ay (mgd) average wet weather flow and serve the rapidly growing population of the Seattle metropolitan area. The plant is located about 25 miles northeast of Seattle.

Like many other communities around the country, King County (County) is dealing with the problem of addressing growth and replacing aging infrastructure. Since government funding for clean water infrastructure has become more limited in the last two decades, few agencies are building entirely new wastewater treatment and conveyance systems. Brightwater, which includes a 14-mile conveyance system and deep water marine outfall in Puget Sound, is unique in this regard, being King County's largest regional wastewater project since its two other regional treatment plants were built in the 1960s.

Building an entirely new wastewater system in today's world brings new challenges. Siting and building the plant in a developed area required the County to consider not just cost, but site footprint, odor control, local community input, technological innovations, reliability, and environmental issues. In 2000, the County began the design, siting and environmental review processes for Brightwater — which included extensive public input and peer review.

In this article we look at the decision making process in more detail, and in particular how different factors — public input, design, procurement, permitting, environmental issues — were considered as part of the decision to use MBR technology instead of a more traditional wastewater treatment process.

Public Input During Siting Process Shapes Decision for MBR

The decision to use MBR technology at Brightwater was influenced by the site selection process for the new treatment plant. Site selection involved an extensive public process over a four year period that included: identifying sites; developing siting criteria and design guidelines; reviewing environmental impacts; and providing opportunities for input into the plant design. As part of this process, a policy-level advisory committee was formed with representatives from tribal governments, the 11 cities in the siting area (including mayors and other elected officials), and environmental and business organizations.

Wastewater

Public Input

Sustainability

Odor Control

Smaller Footprint

Evaluation Criteria

The County held dozens of public meetings and workshops, published a project newsletter and website, and provided detailed responses to questions and concerns raised by the public. The County also held hearings and hosted technical seminars where members of the public could speak with experts about the project. Topics addressed at these meetings included: treatment technologies; odor control; geotechnical, groundwater and seismic studies; and marine outfall issues.

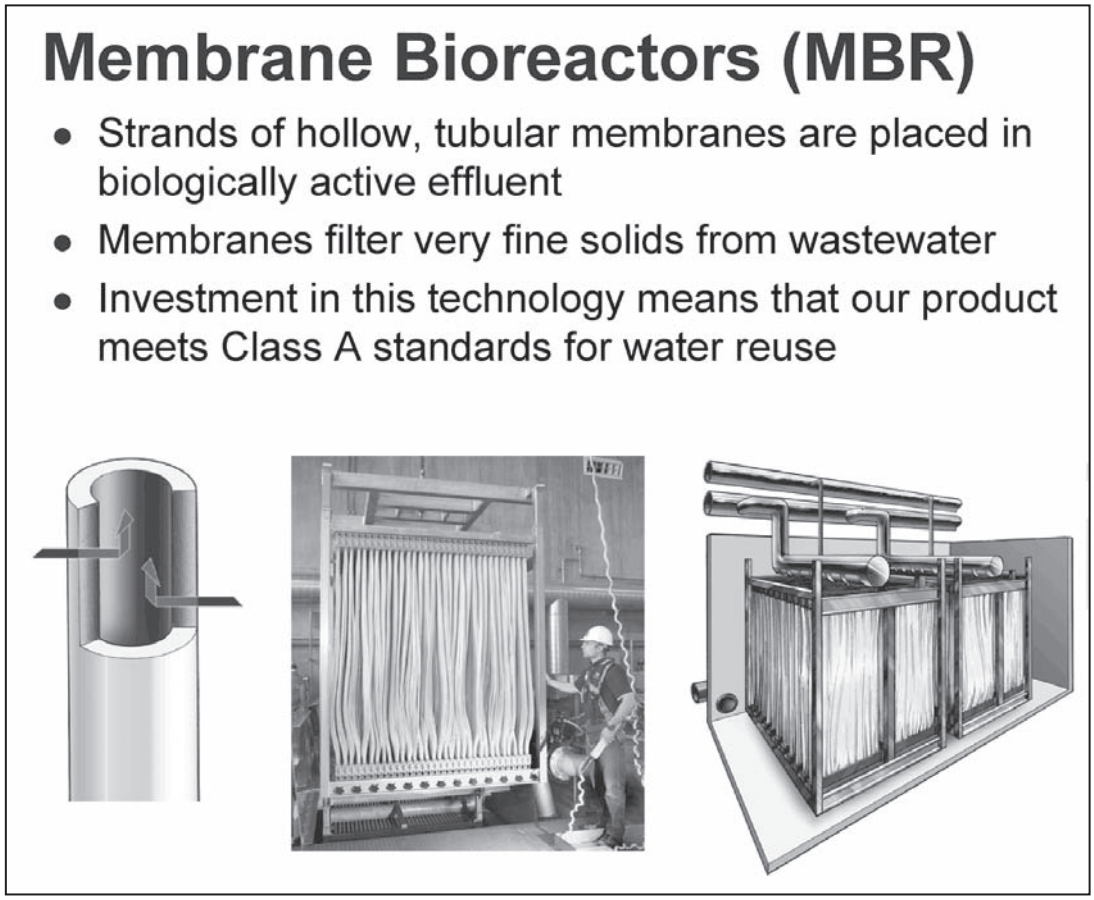
A culture of sustainability in the Northwest has created a region that supports innovation and environmentally-friendly practices as a vital part of the region's lifestyle and economy. This was evident in the feedback received by the County through its public process. People said that protecting the environment is important, and that they expected King County to create high-quality water as a result of treatment. People also said they wanted the County to reuse the treated water. These comments led to siting criteria that included providing opportunities for water reclamation and reuse, and design guidelines that encouraged the use of innovative engineering solutions.

Odor control was a major concern for the public, who wanted assurances the plant would not smell. The County made a commitment that the treatment facilities would operate without odors. Meeting this commitment requires a substantial investment in treatment technology. All processes at the new plant will be under cover and multiple stage odor control systems will be employed.

In the end, MBR became part of the solution for addressing many of these concerns. MBR creates cleaner effluent, thereby reducing impacts to the waters of Puget Sound. With additional disinfection, the effluent from MBR treatment will meet the state's strict reclaimed water standards. MBR's smaller footprint also makes it easier for all process units to be enclosed, thereby making odor control more compact and helping to meet the County's commitment to operate without odors.

Technology Selection Process – Comparing MBR to Traditional Treatment

Along with the siting process and environmental review, the County undertook a predesign evaluation to select the preferred liquids treatment technology. Over 40 technologies were evaluated against criteria that included: the facility size or footprint; process reliability; the potential to produce (or help control) objectionable odors; effluent quality; and capital and operating costs. The evaluation resulted in two technologies — each with its own unique characteristics — being considered for further evaluation: **c**onventional **a**ctivated **s**ludge (CAS) and MBR.



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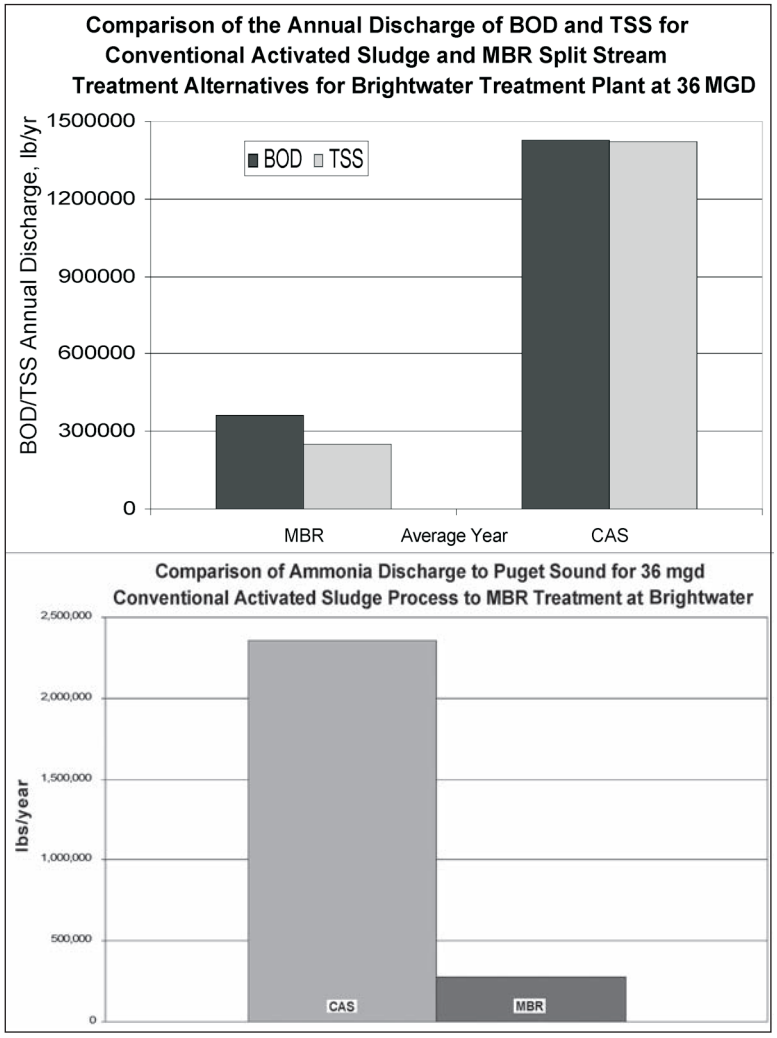


CAS is a biological process widely used in municipal wastewater treatment. It is used at King County's two existing regional treatment plants. The process is reliable, cost-effective, and efficient in terms of operations and maintenance. However, CAS requires a large area for process tanks. For the County to meet its stringent odor control commitments for Brightwater, all of the CAS process tanks would need to be covered — which would entail substantial cost.

Though MBR has been used for decades in drinking water treatment, its use in wastewater treatment is relatively new. MBR works through a biological treatment process that separates-out solids using filtration rather than settling, thus eliminating the need for secondary clarifiers and in many cases, primary clarifiers. When compared to CAS, MBR effluent has much lower concentrations of constituents which generate biochemical oxygen demand, lower amounts of total suspended solids, and less ammonia. This superior performance results in a substantially cleaner effluent for discharge to Puget Sound.

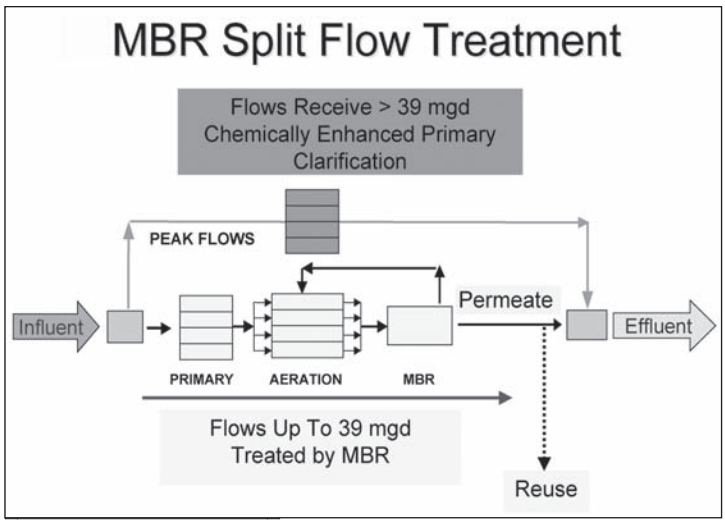
MBR has the potential to produce reclaimed water quality effluent, where CAS requires additional treatment to create reclaimed water. MBR can produce higher quality effluent all the time, even with differing influent quality or changes in solids and settling conditions.

In consideration of the positives mentioned, the County ended-up selecting MBR treatment for the new Brightwater facility. However, this decision also created the need to address the design and cost challenges of this technology.

MBR Split Flow Design: Smaller Footprint, Lower Cost, Cleaner Effluent

One of the challenges identified for MBR was cost. Based on the volume of treatment at Brightwater, building an MBR treatment plant with the capacity to provide full MBR treatment to peak flows (which are infrequent but much higher than the plant's average flows) would be substantially more expensive to build and operate than a CAS system. Designers addressed this with a split flow MBR system to optimize the benefits of MBR and reduce the cost when compared to full MBR treatment.

With a split flow design, flows up to 39 mgd receive MBR treatment. Flows exceeding 39 mgd (usually occurring only during wet weather) are treated with a chemically enhanced primary clarification treatment, routed around secondary treatment, and blended with MBR effluent prior to leaving the plant. This means that about 98 percent of the annual total volume projected from the plant will receive full MBR treatment.



The chemically enhanced primary clarification process creates effluent of lesser quality than CAS. But when used in combination with MBR, the average flows from Brightwater will be much cleaner than if using CAS alone. In a typical rainfall year, the MBR split flow design is expected to provide a net environmental benefit to Puget Sound, with a one million pound per year reduction, each, in biological oxygen demand and total suspended solids when compared to CAS. The process will also achieve significantly higher reductions of heavy metals and endocrine disrupting compounds.

Brightwater's split flow MBR system brought capital costs in line with full CAS treatment. Though operating and maintenance costs for MBR are still more expensive, the MBR split flow system has the added benefits of substantially improved effluent and a much smaller facility footprint. At Brightwater, this means more land for a visual buffer and landscaping.

Wastewater

Treatment Capacity

O & M

MBR Options

Vendor Selection

"Scale-Up" and Operational Challenges

Another challenge faced by the County was the size of this facility. No other MBR municipal treatment plant of this size has ever been built in the US. A majority of the existing MBR plants in the United States and throughout the world treat less than 2 mgd. There are a handful of MBR plants in the 5 to 12 mgd range, but only a few worldwide with capacity equal to or greater than Brightwater.

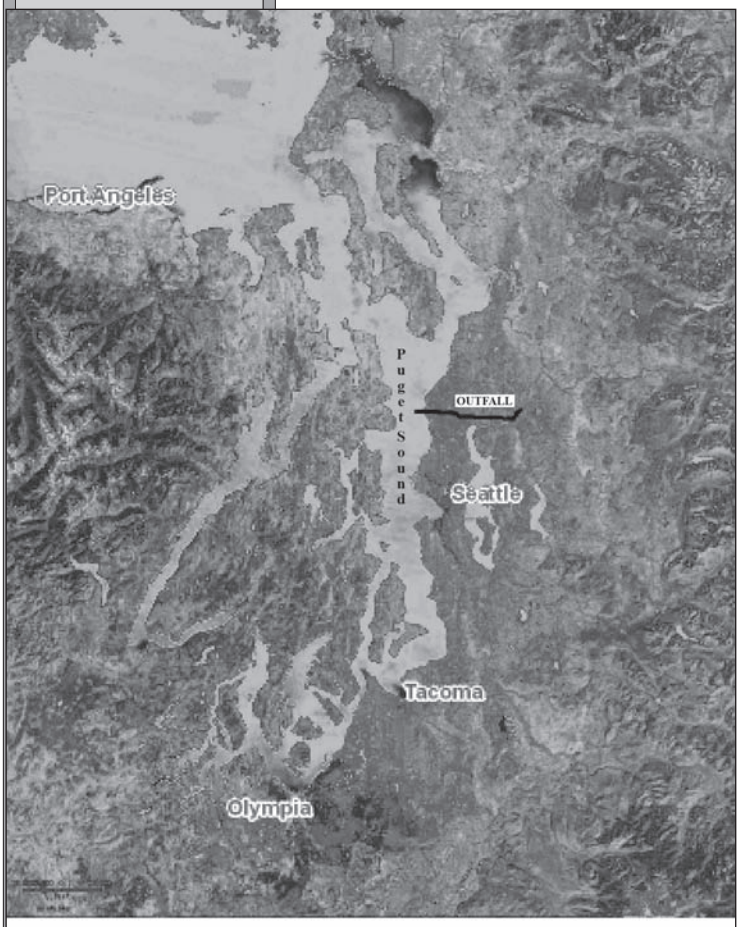
Designing an MBR facility of this scale was not simply a matter of adding more membranes. Many of the supporting systems such as backwash and air flow devices had to be designed to work with a plant of this scale. To meet this challenge the County worked extensively with designers and with an MBR vendor to achieve a workable system.

Because MBR is a relatively new wastewater treatment technology, another challenge was winning acceptance from the people who would have to operate the system. Activities that helped ease concerns of the County's operations and maintenance staff included making site visits to existing MBR installations locally and in Atlanta, Georgia and conducting pilot tests of skid mounted MBR units to generate operator familiarity with the system.

Procuring MBR – "Its All In The Parts"

The procurement of such a large MBR system was a major effort. There are two different MBR designs (with different vendors) — hollow fiber and flat plate — and the plant would have to be designed differently depending on which design was chosen. If the plant was designed in advance of selecting an MBR system, the County ran the risk of having to do significant redesign.

To address this issue, the County selected the MBR vendor early in the design process, selecting GE Water & Process Technologies (formerly Zenon Environmental Corp). Wastewater treatment plants in California, Colorado, Michigan, Georgia, Florida, Ontario and other locations around the world use GE's membranes, which are also used worldwide to produce drinking water. GE's membrane systems have performed well and provide consistently high water quality. King County felt this would fit the needs for the Brightwater plant. The procurement of the approximately $23 million system took about a year, from planning to negotiation of the final contract.



Outfall Location in Puget Sound

Regulatory Challenges: Federal Clean Water Act and Endangered Species Act Permitting

As a large regional project, located across two counties and five local jurisdictions, permits and approvals from federal, state, and local jurisdictions were required. At the federal level, the County recognized that securing permits under the Clean Water Act (CWA) and Endangered Species Act (ESA) was a major area of uncertainty and risk that could affect construction schedules, change project requirements, or add delay-related costs. To address this, the County initiated discussions with the affected federal agencies well in advance of submitting permits so the designers could understand agency concerns and address regulatory issues in the project design.

King County submitted a CWA Section 404 application to the US Army Corps of Engineers (Corps) in December 2003. This initiated an Endangered Species Act (ESA) compliance review. The Corps administers the ESA consultation process with NOAA Fisheries and the US Fish and Wildlife Service, which prepared biological opinions on the project. These biological opinions contained the agencies' conclusions and recommended mitigation measures for the project's potential impacts to federally-protected species.

The primary concern for the federal agencies was the ESA listing of Chinook salmon in 1999. (Later more species were listed, including bull trout, and Puget Sound steelhead and Orca.) They were also concerned about the potential for toxins in the effluent, including **e**ndocrine **d**isruptive **c**ompounds (EDCs), whose cumulative effects in the marine environment are not well-understood and which can not be ruled out as a potential "factor of decline" for protected species.

Wastewater

Biological Opinion

Ecology Regulation

MBR Justification

Split Flow Benefits

Reclaimed Water

By engaging the federal agencies early on and choosing the MBR process, federal permitting was greatly facilitated and concerns addressed proactively. Cleaner effluent, reclaimed water production, and reduction of heavy metals and other compounds of concern (including EDCs), resulted in a biological opinion that was completed on schedule and favorable to the project. Federal permits and approvals were obtained on schedule to allow the project to move into construction beginning in 2006.

Regulatory Challenges: Facility Plan and NPDES Approval

The Washington State Department of Ecology (Ecology) regulates municipal discharges to Puget Sound through the CWA National Pollutant Discharge Elimination System (NPDES) permit system. Ecology is also the lead agency for review and approval of a project's Facility Plan, which includes the plant design and processes. Typically, Ecology expects that submittals for treatment plant design include a preferred alternative where all projected sewage flows are conveyed to a treatment plant with full secondary treatment. Peak wet weather flows are expected to be stored until sufficient capacity exists to treat them.

The County submitted a Facility Plan with two treatment alternatives. One was a **c**onventional **a**ctivated **s**ludge (CAS) plant where all projected flows would receive secondary treatment, and the second alternative was the MBR split flow process.

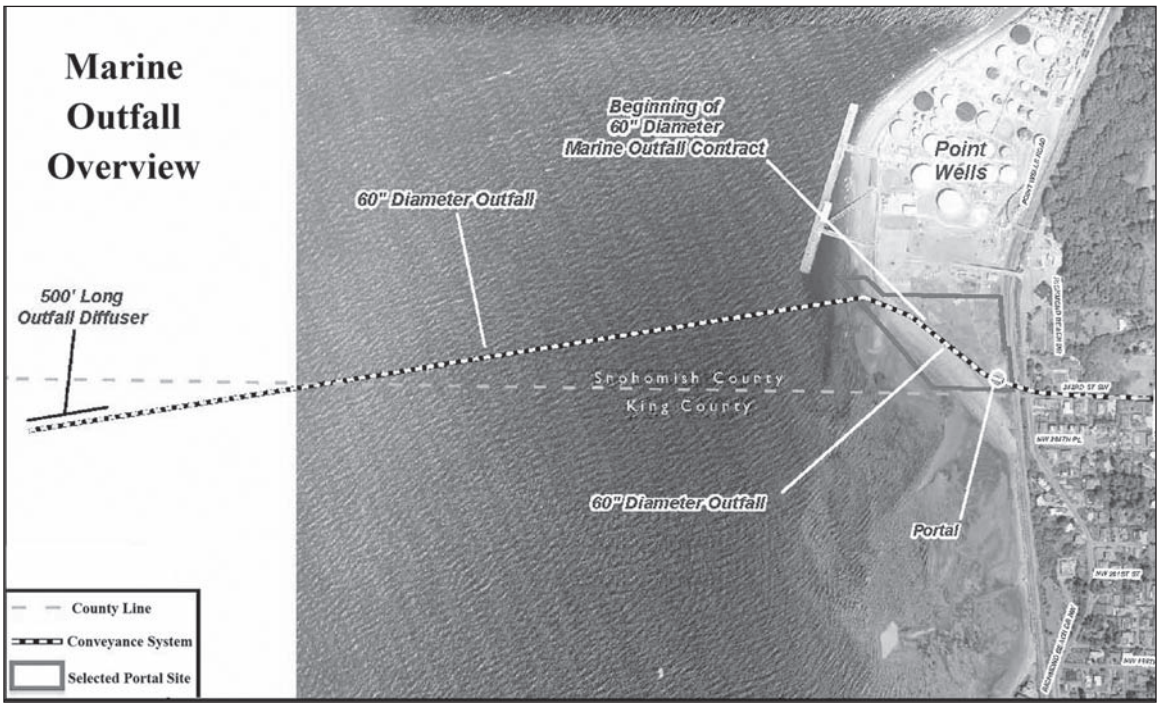
Initially, Ecology was hesitant to consider the MBR approach because it is a new technology and because a portion of the wastewater stream would not receive full secondary treatment. In its review, Ecology said that in order to justify approval of the process, the MBR split flow alternative must have significant environmental benefit when compared to a non-split flow CAS option.

After reviewing the County's submittals, Ecology concluded that the split flow alternative easily met this requirement. On an annual basis, MBR split flow would reduce the biochemical oxygen demand and total suspended solids discharges an average of 73 percent and 79 percent, respectively. Ecology also saw that the split flow alternative offered a decrease in pollutants discharged to Puget Sound (ammonia, heavy metals, EDCs) when compared to the full-flow CAS alternative under all of the modeled scenarios on an annual and monthly basis.

Another factor that allowed Ecology to view the split flow concept favorably was that this system also offered the option, if needed, to expand the chemically enhanced primary clarification to cover all the flows (not just those diverted from MBR), which would allow additional nutrient removal.

An additional important benefit was the fact that MBR treatment could produce water that meets the state Class A reclaimed water standards without requiring additional treatment. By incorporating a major reclaimed water component into to the project, the County could reduce the pollutant loads that are discharged to Puget Sound.

For these reasons, Ecology approved the Brightwater Facility Plan with the MBR split flow alternative. This approval set the stage for NPDES permit review and issuance.



Wastewater

Dissolved Oxygen

Municipal NPDES permits for discharge to the central basin of Puget Sound typically do not contain discharge limits for ammonia primarily because of the central basin's excellent mixing characteristics and lack of observed dissolved oxygen deficiencies. However, other areas of Puget Sound experience seasonal dissolved oxygen deficiencies, including southern Puget Sound and Saratoga Passage just northeast of the Brightwater outfall. One of these areas, Southern Hood Canal, has experienced serious seasonal dissolved oxygen deficiencies, which have resulted in well documented and publicized fish mortality. The problem is that excess nitrogen in marine waters can speed up and multiply the growth of phytoplankton (microscopic algae). As the phytoplankton die and decompose, oxygen is consumed in the decomposition process. The resulting lack of dissolved oxygen can be harmful to fish, crabs, shrimp and other marine organisms

Nitrification

With MBR, solids in the process tanks are retained at a higher concentration and aerated for a longer period than with conventional processes. This process, called nitrification, does not remove ammonia in the effluent, but oxidizes it and converts it to the nitrate form, thereby eliminating problems of toxicity to fish. The net result is a substantially reduced oxygen demand on Puget Sound compared to a conventional process. Investing in MBR now, while Brightwater is being built, prepares the County in the event that future regulations require additional nutrient removal.

NPDES Requirements

An NPDES permit is usually issued just prior to the time a project comes online, which for Brightwater is 2011. The County assumes that the project's NPDES permit will contain a number of requirements for the MBR split flow process.

Anticipated NPDES requirements include:

- Diverting around aeration basins and MBR will not be allowed until MBR capacity has been fully used
- Date, duration, and volume of each secondary bypass event as well as influent flow rate at the time of bypass must be reported
- To comply with the State's anti-degradation rule, the net environmental benefit must maintained
- Sampling will be required for the blended effluent and include metals and toxicity testing

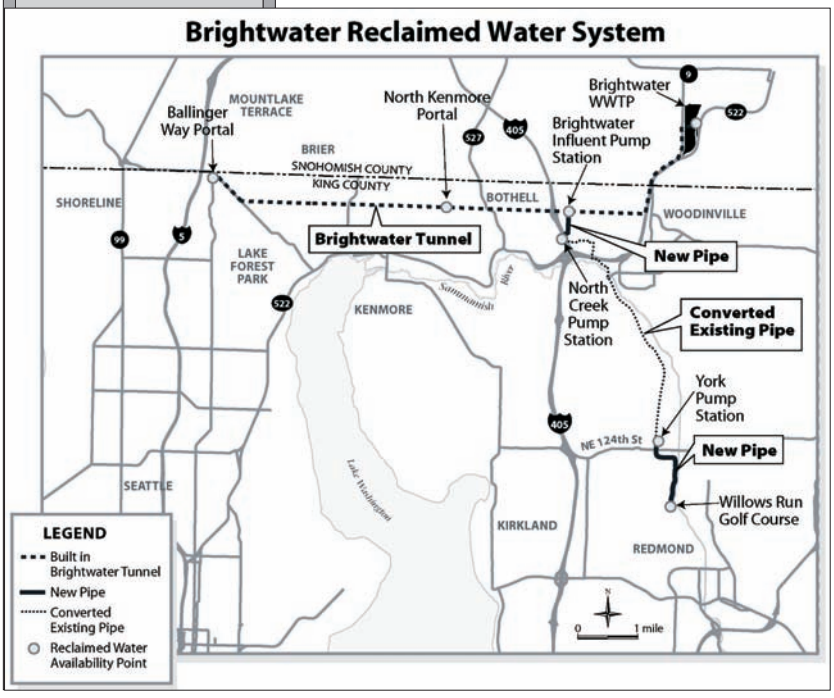
Reclaimed Water System

Brightwater Reclaimed Water Pipeline

Since almost all of the water treated at Brightwater will meet reclaimed water standards, the additional cost of making this water available to customers is from disinfection and distribution, not treatment. Because of periodic blending of the effluent during high flows, the water in the main effluent pipeline will not always meet reclaimed water standards. To address this, the County is building a separate two-part reclaimed water distribution system that only carries MBR-treated water.

Piping

One part of the reclaimed water distribution system includes a separate reclaimed water pipe within a portion of Brightwater's 14-mile conveyance tunnel. This pipe will travel west from the treatment plant to a point in the City of Shoreline. At plant start-up, there will be no reclaimed water conveyed in this pipe. It will be available for future use, when demand is found along this part of the system and additional pumping is installed at the treatment plant. A second part of this distribution system will take reclaimed water south from the plant, using an existing 4.5-mile wastewater line running through the Sammamish Valley. This pipe is being modified and disinfected for use as a dedicated reclaimed water line. This modified pipe will carry reclaimed water south to the Sammamish Valley — an area where farms, sports fields, and golf courses can take advantage of reclaimed water for irrigation. Willows Run Golf Course will be the first customer tied into this system. Reclaimed water will replace irrigation water that the golf course currently draws from groundwater wells along the Sammamish River — a waterway that supports many wildlife species and which will benefit from increased flow.



The reclaimed water system will pass through a major business park in the City of Bothell. The County is talking with the City, business park owners, and a large nearby newspaper printing facility about providing reclaimed water to them. The business park would use reclaimed water for landscape irrigation. The printing facility would use reclaimed water for heating, cooling and landscape irrigation.

Wastewater

Reclaimed Water Capacity

The County is actively pursuing other reclaimed water customers. In the Sammamish Valley, there are opportunities for agricultural customers who currently have no access to irrigation water or are self-supplied from wells or directly from the river.

The Brightwater reclaimed water distribution system will initially convey seven mgd of reclaimed water from the treatment plant using gravity alone. In the future, as more customers ask for reclaimed water, the capacity in the separate pipeline system could be increased (up to 21 mgd) with pumping.

Putting this project in motion now will reduce the amount of treated effluent sent to Puget Sound and allow industries and irrigators to make use of this valuable resource. By including a new pipe in the Brightwater conveyance tunnel and using an existing pipeline, the County is able to keep costs down, saving several million dollars in new pipeline construction.

Reclaimed Water Offers Environmental Benefits

Water Supply Benefits

For more than a decade, King County has been using reclaimed water for irrigating athletic fields, nurseries, and landscaping, and for wastewater treatment plant processes. Increasing the availability of this valuable resource for irrigation and industry will mean sending less treated wastewater to Puget Sound, conserving more of our municipal water supplies, and leaving more water in rivers and streams. It also provides flexibility for the future, as water supplies and infrastructure face the impacts of climate change and growth.

Instream Flow Benefits

Using reclaimed water from Brightwater for irrigation in the Sammamish Valley can replace some water now being drawn from local waterways, such as the Sammamish River. This can keep water in rivers where it will benefit salmon and other wildlife, even during hot weather and low flows.

The Washington State Departments of Ecology, Health, and Natural Resources have encouraged the County to look for opportunities to use reclaimed water, rather than sending all of it to Puget Sound. King County is currently working to form partnerships with local water utilities. Wherever possible, the County intends to wholesale reclaimed water to local water purveyors for distribution to their customers.

MEMBRANE BIOREACTOR (MBR) TECHNOLOGY FOR SMALL SYSTEMS: CITY OF CARNATION

In 2002, King County was contracted by the City of Carnation, Washington to build a 400,000 gallon a day capacity wastewater treatment plant. The city built the collection system for the project. Carnation is a rural western Washington community of 1,905 residents that is approximately 1.2 square miles in size. The Snoqualmie River, a recreational and ecological treasure of the region, runs past Carnation. It provides ideal spawning habitat for several salmon species, some of which are protected under the Endangered Species Act. Because of the importance of the river to the local community, very clean effluent for a river discharge was essential. A small footprint to fit the scale of the city was also desirable.

MBR's high-quality effluent and small footprint were perfect for this application. Once online, the facility will provide Class A reclaimed water for hydrologic and aquatic habitat enhancement of a nearby wetland. The wetland enhancement was done in partnership with Ducks Unlimited, a non-profit organization dedicated to creating wildlife habitat. Ducks Unlimited designed and constructed the project and received three grants to pay for scientific studies, design, construction, and interpretive signage for the enhancement project. King County will maintain the site, continue to plant native plants and control invasive plants on the site.

Because of the small population base in Carnation, both the city and the County were aggressive about securing grants and low interest loans to make this $31.1 million dollar project a reality. Carnation was able to secure several grants and low-interest loans to help finance the wastewater collection system. King County was able to get two State Revolving Fund loans to help finance the plant, conveyance and discharge facilities. King County was also able to reduce costs by combining the MBR procurement process with the larger one for the Brightwater project.

Local sewer rates will still cover a large portion of the cost of the new facility. However, without these grants and loans, the monthly sewer rate would have been about $155, while the grants and loans have lowered it to about $88 per month.

The new Carnation plant will come on-line in 2008. During startup, treated wastewater will be discharged via the river outfall. After that, the wetland enhancement will become the primary discharge location for the reclaimed water, reserving the river outfall as a backup.

For Additional Information:

City of Carnation website: www.ci.carnation.wa.us/

King County website: http://dnr.metrokc.gov/wtd/carnation/.

Wastewater

2011 Start-Up

Conclusion: Creating Resources from Wastewater

The Brightwater project is now under construction. Tunneling has begun on the 14-mile conveyance system, and construction of the treatment plant is underway. Start-up is scheduled for 2011.

The Brightwater design team is lead by CH2M Hill and Brown and Caldwell, who developed the design for the MBR split flow process. Mithun, a local Seattle architecture firm and international leader in environmentally sustainable architecture, is providing architectural design. Hargreaves Associates is leading the site landscape design.

Brightwater has already won multiple awards and garnered international interest. In 2005, the project's siting process earned an Award of Honor in analysis and planning from the American Society of Landscape Architects. In 2003, the project was named Project of the Year for the Core Values Award from the International Association for Public Participation for the County's efforts to inform and engage the public in a meaningful process. In 2007, the site was toured by a United Nations team of South Korean professors, graduate students, and landscape architecture and land management professionals who were in the United States to learn about sustainable development and habitat restoration.

In designing the split flow MBR system, the County was able to add the benefits of MBR while controlling project costs.

MBR Benefits

The benefits of MBR include:

- substantially improved effluent quality
- reliable means of producing high-quality reclaimed water
- facility footprint that is much smaller than conventional processes
- more area for landscaping or visual buffers
- more effective odor control
- acceptance from federal and state regulatory agencies that see the "net environmental benefit" of this system

The MBR treatment process is an important part of the success of the Brightwater project. Selecting the MBR treatment process met the Wastewater Treatment Division's vision of "creating resources from wastewater," helped facilitate the permitting process for the facilities, and met the needs and requests of the public. Faced with the challenge of using this relatively new treatment process, King County found innovative ways to contain costs and gain acceptance from federal and state permitting agencies.

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Irrigation

IRRIGATION SYSTEM EFFICIENCY

EMERGING TECHNOLOGIES

by Mac McKee, Director, Utah Water Research Laboratory, and Professor, Civil and Environmental Engineering, Utah State University, Logan, Utah

INTRODUCTION

Water Scarcity

Many water management problems in American river basins, especially in the more arid western states, revolve around the need to deal with increasing water scarcity relative to available water supplies. Concurrently, there is a growing expectation on the part of many water users to have a more active role in management decisions.

Factors that contribute to the escalating problem of water scarcity include:

- Economic expansion and population growth in many areas of the country that cause an increase in the demand for water to serve municipal and industrial needs
- Pollution of some water resources that makes them at least temporarily unsuitable for meeting some high quality needs
- Constraints on some of the more traditional types of uses resulting from a growing social and legal emphasis on recovery of endangered species and maintenance of other water-related environmental values

Basin-Scale Management

These and other related factors are changing the information requirements of basin-scale water resources management in subtle but significant ways. In particular, mechanisms are sought that will improve water use efficiency — especially in the agricultural sector — through water conservation and improved, more intensive system-wide water management.

Information Technology

The demand for increased water management efficiency puts a substantial new data collection and analysis burden on water management agencies. The diversity of these information requirements and their geographic and temporal dispersion have created new challenges for the application of information technology in the water sector. To be effective, affordable information must be supplied in a manner pertinent to water managers operating at very different levels (federal/state/local/private) and for different purposes (e.g., planning versus operations; long-term versus short-term).

The data-needs burden is compounded by the growing informational requirements of vocal stakeholder and interest groups. To support informed decision making, interested stakeholders now require information about the current and future state of basin-wide water resources systems. However, these stakeholders represent a diversity of backgrounds and viewpoints. Many lack the necessary technical training to be able to acquire, analyze, understand, and fully utilize the water resources data that are available.

Changing Approaches

In addition to these emerging information needs, the approaches that have been developed and used for acquiring water resources data are changing. Support for traditional mechanisms for gathering water-related data (e.g., maintenance of our nation's streamflow gauging network and SNOTEL (snowpack data) sites) waxes and wanes. Support for remote sensing is on the rise, but few practical tools are available to make sense of some of these data and to deliver affordable, decision-relevant information into the hands of managers of real systems.

Problem Areas

Water resources information problem areas include:

- Data Gathering Affordability: The cost of data acquisition associated with emerging remote sensing technologies must be affordable.
- Data Analysis Affordability: the processes whereby data are transformed into decision-relevant information — must be cheap, reliable, and practical.
- Data Assimilation: Data analysis techniques must also be capable of using all data — of "assimilating" data — of differing types, geographic resolutions, and temporal scales.
- Data Distribution: The provision of useful, understandable versions of the information that results from data acquisition and analysis must be timely and inexpensive.

Emerging Technologies

Many of these issues are currently being addressed through development of advanced techniques in remote sensing and application of Internet-based technologies. The purpose of this article is to describe some of the emerging technologies that are becoming available for data acquisition, information generation and distribution, and to demonstrate how they are being used to support the needs of irrigation water managers. This will be primarily illustrated by experiences gained over the past several years in the Sevier River Basin of south central Utah.

Irrigation

Sevier River Basin

Water Delivery Time

EXISTING TECHNOLOGIES USED IN THE SEVIER RIVER BASIN

Basin Overview

The Sevier River Basin (Figure 1) is one of Utah's major drainages. It occupies about 12.5 percent of the state's total land area, but only produces an average annual surface runoff of about 823,000 acre-feet. The river flows to Sevier Lake, which is normally a dry, terminal lake. In many years, little or no water reaches Sevier Lake. As in many places throughout the western US, irrigated agriculture dominates water use in the basin, diverting approximately 95 percent of the surface flows for use in irrigation. Approximately 354,000 acres are irrigated in the basin. The only significant non-agricultural water user is the Intermountain Power Project, which operates a coal-fired power plant near the city of Delta, Utah. The river is managed by a single entity, the Sevier River Water Users Association (SRWUA). All surface water rights holders are members of SRWUA, including all of the numerous irrigation companies that manage canals along the river.

In addition to the natural scarcity of water in the Sevier Basin, water managers must deal with other characteristics of the basin that make water management difficult or constrained. One critical factor is the long travel times required to deliver water from storage reservoirs to end users. Water released from Piute Reservoir in the upper basin must travel in the river for about two days before it reaches the diversion point into the first canal served by the reservoir. The travel time from the reservoir to the last canal served is around three days. Of course, travel times change as flows in the river change. There are canals served by Piute Reservoir that themselves have significant travel times. For example, the Sevier Valley-Piute Canal near Richfield, Utah, is 65 miles long. Water diverted from the river into this canal will usually require about three days to reach the end of the canal. Irrigators on the Sevier Valley-Piute Canal receive their water nearly in an "on demand" basis: in general, they place an order with the canal manager 24 hours in advance of when they receive water from the canal. This means that the canal operator must divert water into the canal to satisfy the demand of an irrigator at the end of the canal two days before the irrigator places the order for water. Further, it means that the reservoir operator must release that water from Piute Reservoir two days prior to that. As a result, the long and uncertain travel times in river and canal flows, together with uncertainties in future irrigation water demand, make it very difficult for canal and reservoir operators to deliver with precision (in both time and location) the quantity of water that irrigators request. If too much water is released and/or diverted, some is spilled or used inefficiently; if too little is released and/or diverted, then some irrigators might be shorted. Neither of these conditions — both resulting from an erroneous estimate on the part of a system operator — is desirable. Similar difficulties associated with long travel times and uncertain short-term irrigation water demand exist in the lower portion of the basin, where farms in the area of Delta, Utah, are served by water released from three other reservoirs (Sevier Bridge, DMAD, and Gunnison).

Figure 1: Sevier River Basin

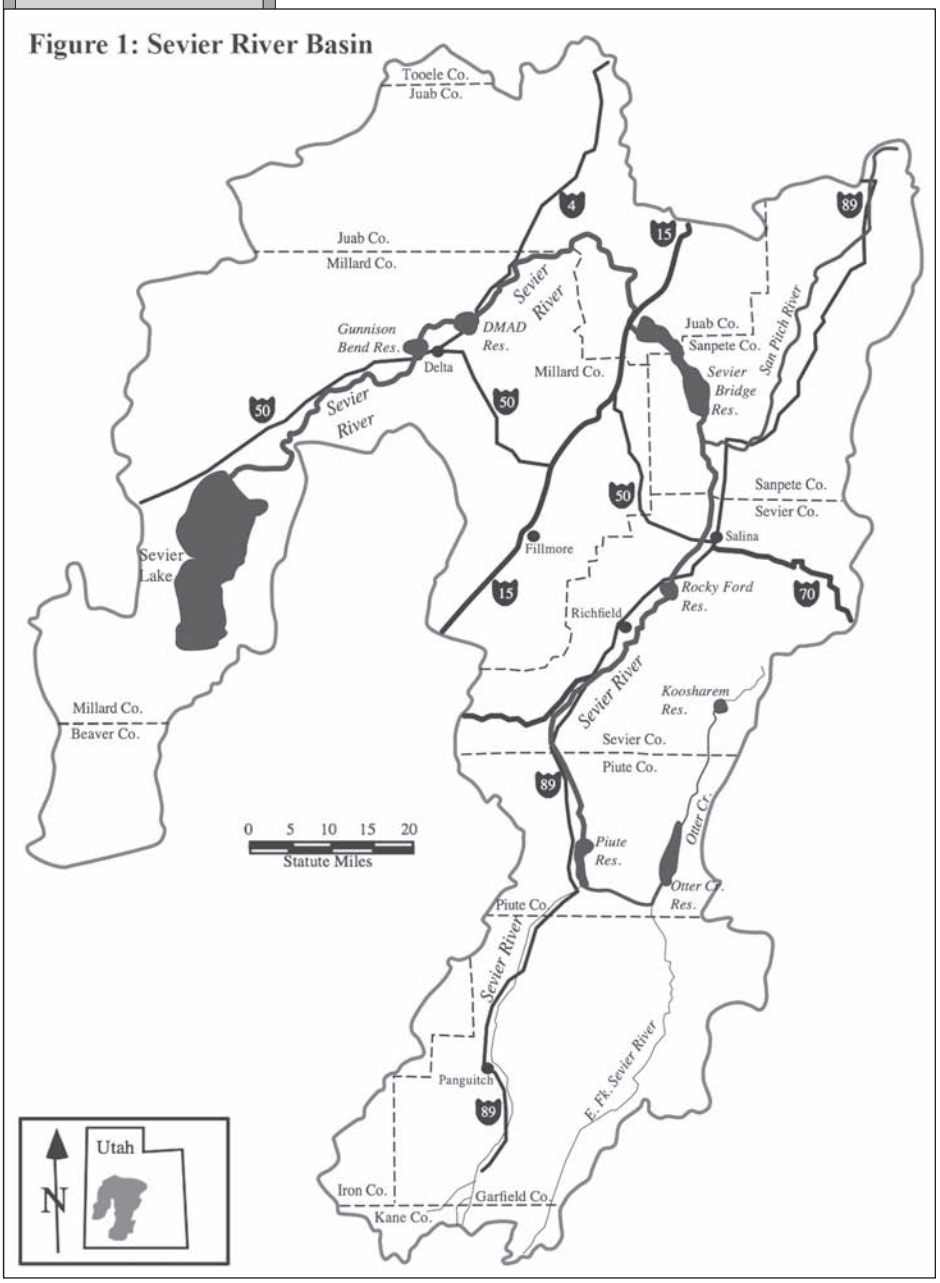



Figure 2: Flow Monitoring Equipment


Figure 3: Weather Station


Figure 4: Soil Moisture Probe

Improved Monitoring

In 1997, SRWUA entered into partnership with the US Bureau of Reclamation and StoneFly Technology, Inc., to establish real-time monitoring capabilities for flows on the Sevier River and its significant tributaries, canal flows, reservoir levels and releases, and weather. Remote control capabilities for all major canal diversions and reservoir releases were also established via radio and the Internet. The data that were produced through these monitoring activities were to be posted to a website that is funded by SRWUA. These investments created the ability to acquire better information about the near real-time state of the Sevier River water system (e.g., flows throughout the basin, quantities of water in reservoir, groundwater, and soil moisture storage, weather conditions, canal operations, etc.). This improved ability enables reservoir operators to access better information in order to achieve greater system-wide efficiency in water use. In 1997, when they began these modifications in data collection and system control, SRWUA also hoped that improvements in the efficiency of water management would boost the economic gains to be derived from water use. Additionally, there was an expectation that the availability of better information about the state of the river system, together with potential conservation gains made possible by such information, would provide improved environmental benefits associated with non-irrigation uses of the river. (The vision and experience of SRWUA and its partners in establishing a modern, Internet-based network for water resources monitoring and control are documented by various publications available from SRWUA's website: www.sevierriver.org).

In the past decade, the information technology installed in the Sevier River Basin by SRWUA has met these expectations. In addition, the data that this technology provides opens up opportunities for the development of additional information to further improve system management. The following sections present an overview of some of the information-based technologies that SRWUA currently uses to support more intensive water management.

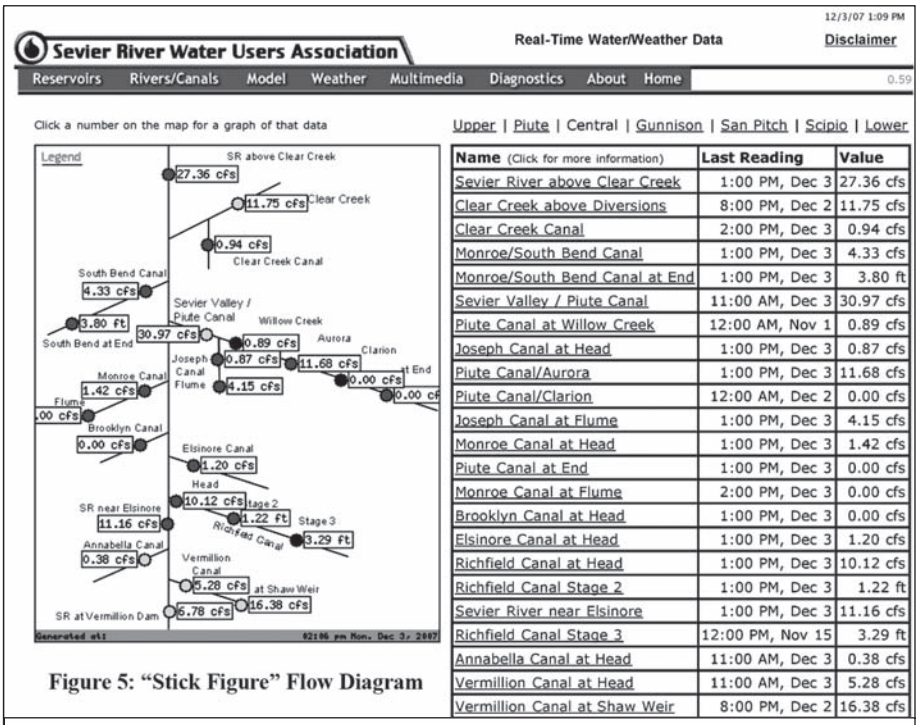
Internet Information Access

THE INTERNET COMES TO THE FARM…AND CANAL…AND RESERVOIR

From the beginning, SRWUA chose to use only technology that was commercially available in implementing its data collection and control system. Emphasis was placed on the use of open-source software for database and web server capabilities. They also found it economically efficient to make maximum use of existing monitoring equipment and control systems rather than investing anew in equipment with which the personnel responsible for operations and maintenance would be unfamiliar. They installed an impressive array of data collection devices, including: stream and canal flow monitoring equipment (e.g., Figure 2); weather stations (Figure 3); and, more recently, soil moisture probes (Figure 4). (The latter has been done in partnership with the Utah Water Research Laboratory and the Utah Center for Water Resources Research at Utah State University.)

The data collection system captures hourly measurements of numerous variables of interest to water managers. These measurements are posted immediately to SRWUA's website (www.sevierriver.org) and thereby made available to any potential user. For example, streamflow and canal discharge data are collected at scores of locations throughout the Sevier Basin and presented in both tabular and graphical formats. Access to these data are facilitated through simple graphical interfaces, such as the "stick figure" diagram shown in Figure 5 that is used to provide access to canal, river, and tributary flows in the central portion of the river basin. Upon selecting one of the monitoring sites illustrated in the figure, a graphical depiction of discharge at that point is presented for time periods that are selectable by the user (Figure 6). Tabular output of the same data can also be obtained.

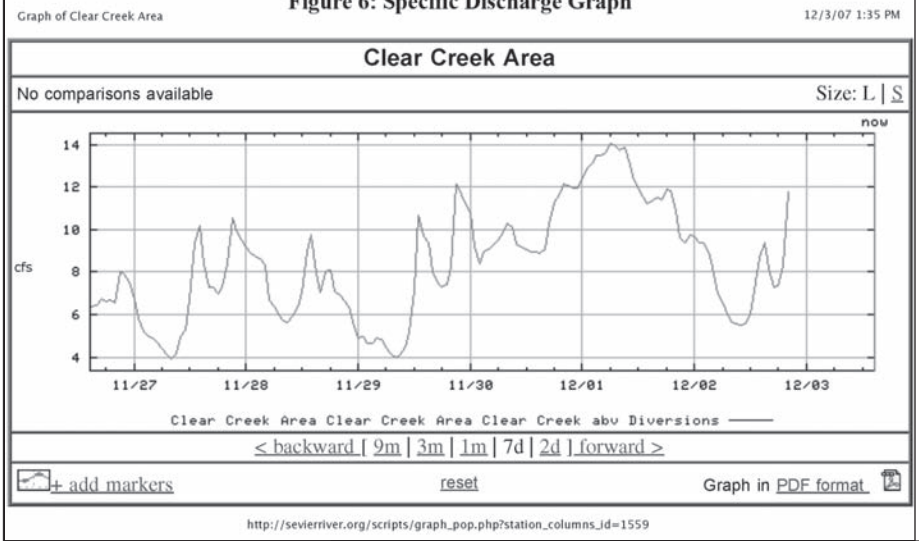
Using similar graphical "point-and-click" interface formats, meteorological data (e.g., temperature, wind speed and direction, relative humidity, solar radiation, and precipitation, as illustrated in Figure 7) are provided for ten locations in the basin. Real-time data on storage volumes and releases are made available for eight reservoirs in the basin. Data obtained from SNOTEL sites and US Geological



Name (Click for more information)	Last Reading	Value
Sevier River above Clear Creek	1:00 PM, Dec 3	27.36 cfs
Clear Creek above Diversions	8:00 PM, Dec 2	11.75 cfs
Clear Creek Canal	2:00 PM, Dec 3	0.94 cfs
Monroe/South Bend Canal	1:00 PM, Dec 3	4.33 cfs
Monroe/South Bend Canal at End	1:00 PM, Dec 3	3.80 ft
Sevier Valley / Piute Canal	11:00 AM, Dec 3	30.97 cfs
Piute Canal at Willow Creek	12:00 AM, Nov 1	0.89 cfs
Joseph Canal at Head	1:00 PM, Dec 3	0.87 cfs
Piute Canal/Aurora	1:00 PM, Dec 3	11.68 cfs
Piute Canal/Clarion	12:00 AM, Dec 2	0.00 cfs
Joseph Canal at Flume	1:00 PM, Dec 3	4.15 cfs
Monroe Canal at Head	1:00 PM, Dec 3	1.42 cfs
Piute Canal at End	1:00 PM, Dec 3	0.00 cfs
Monroe Canal at Flume	2:00 PM, Dec 3	0.00 cfs
Brooklyn Canal at Head	1:00 PM, Dec 3	0.00 cfs
Elsinore Canal at Head	1:00 PM, Dec 3	1.20 cfs
Richfield Canal at Head	1:00 PM, Dec 3	10.12 cfs
Richfield Canal Stage 2	1:00 PM, Dec 3	1.22 ft
Sevier River near Elsinore	1:00 PM, Dec 3	11.16 cfs
Richfield Canal Stage 3	12:00 PM, Nov 15	3.29 ft
Annabella Canal at Head	11:00 AM, Dec 3	0.38 cfs
Vermillion Canal at Head	11:00 AM, Dec 3	5.28 cfs
Vermillion Canal at Shaw Weir	8:00 PM, Dec 2	16.38 cfs

Figure 5: "Stick Figure" Flow Diagram

Figure 6: Specific Discharge Graph



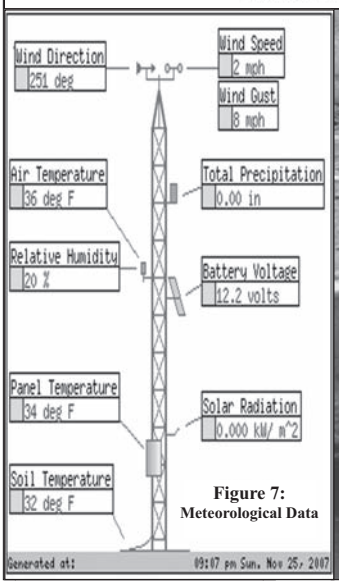


Figure 7: Meteorological Data

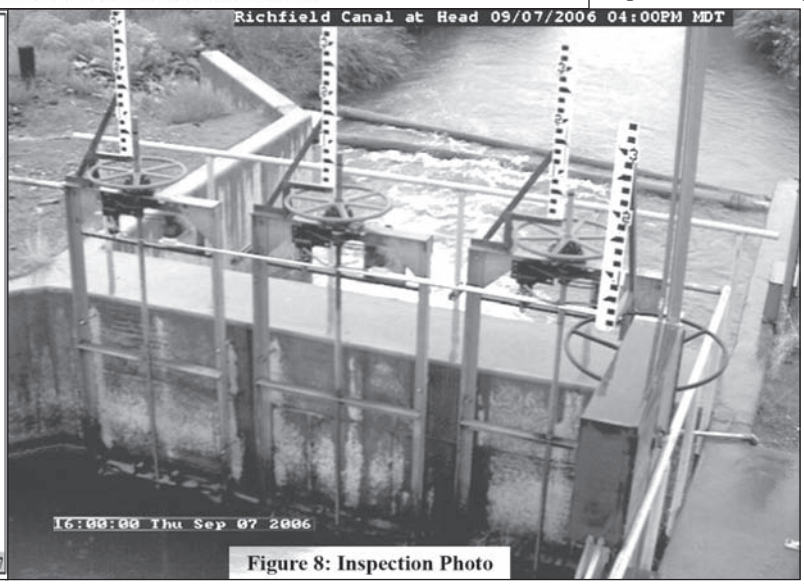


Figure 8: Inspection Photo

Service's real-time streamflow gauges are also captured and provided through SRWUA's website. The results of simple analyses that are done with these data are also accessible from the website. For example, daily estimates of evaporation losses at the major reservoirs and evapotranspiration rates at several locations throughout the basin are computed and posted, as are daily data about all water rights quantities.

The raw data provided by the real-time SRWUA system are posted without modification or filtering. As a result, users of the data must assume the burden of quality control and take care in evaluating the information content of the data before implementing a release or diversion decision on the basis of the data. Nonetheless, for a number of years the canal and reservoir operators in the Sevier River Basin have found the data provided by the real-time monitoring system to be invaluable in improving system operations. Canal operators are at liberty to adjust diversion levels at any time, and the real-time system provides a simple and powerful capability for monitoring flows into a canal. When coupled with the capability to remotely adjust diversion quantities, individual canal operators can now "fine tune" diversions on an hour-by-hour basis throughout the day during the irrigation season. Similarly, reservoir operators can monitor and remotely adjust release levels at any time. Monitoring information is not limited solely to graphical and numeric outputs. For example, many canal diversion points have been equipped with cameras that post near real-time images of the diversion facilities to SRWUA's website. As shown in Figure 8, the canal operator can easily determine whether the diversion gate is obstructed with trash, whether the gate settings are being properly maintained by the Internet-based control system, and so forth. This visual inspection capability results in a real cost-savings for the canal company; if the diversion gate is not obstructed by trash, the canal operator does not have to send a ditch rider 40 miles one-way to see if an obstruction must be removed. This savings in time and travel costs accumulates quickly.

Irrigation

Management Benefits

These capabilities have provided substantial new benefits to irrigators in the basin. For example, much of Utah has experienced frequent and severe drought conditions since 2000, and the agricultural sector in the state has often suffered from water shortages. For many canals in the Sevier River Basin, however, the economic costs of recent droughts have been significantly tempered through more intensive water management. Ivan Cowley, past president of SRWUA, estimates that the real-time monitoring and control system has provided users with "25 percent more water" than they have historically had, especially during drought conditions. This, of course, is accomplished by more intensive management of the water supply system made possible by the acquisition of better and timelier data and by the capability to more finely control the system. In addition to the benefits realized through improved real-time management, the data that are made available on reservoir volumes and releases have greatly reduced intra-basin conflicts over water. The system of water rights in the Sevier has resulted in a situation that, in the absence of good data on the status of the system, places upper basin water rights holders (generally in the vicinity of Richfield, Utah, and above) at odds with water rights holders in the lower basin (generally in the area of Delta, Utah). Accurate measurements of streamflow and reservoir volumes are critical to all aspects of this system. In the past, upper basin versus lower basin disputes were frequent. These disputes generally revolved around disagreement over where and when and how much water was available. Since installation of the real-time monitoring system, these disputes have effectively ceased. It is also notable that the implementation of the real-time monitoring and control technology has not resulted in the loss of a single job in the Sevier River Basin. Instead, workers employed by SRWUA and the various canal companies find themselves engaged in different and higher-valued job activities.

Intra-Basin Conflicts

Adaptive Forecasting

Adaptive Technology

MACHINES THAT "LEARN"

A common, frequently worsening, problem in the field of water resources management is the need to process and interpret huge and growing amounts of data. In recent years, with the database that SRWUA's real-time system has made available, it has become possible to apply analytic tools that have been developed for uses in other fields to address this problem. These tools allow for better analysis of water management conditions in the Sevier and improved forecasting of likely future system conditions. For example, researchers at the Utah Water Research Laboratory (UWRL) at Utah State University have applied techniques borrowed from the realm of statistical learning theory to the operation of canals and reservoirs currently managed by SRWUA. These methods are designed to search for and recognize patterns in large quantities of data. They can be adapted for providing forecasts of possible future conditions and, in the case of the information needs of SRWUA for helping inform short-term management decisions regarding canal and reservoir operations. These methods "let the data speak." They can deal with very large quantities of data and "learn" to recognize complex, nonlinear relationships in the data.

Reservoir Management

One example of utilizing statistical learning theory techniques in the Sevier is their application to reservoir management. As previously mentioned, Piute Reservoir provides water to nine downstream canals located in the Richfield, Utah area. Travel times from the reservoir to these canals range between two and three days. There are tributaries between the reservoir and canal diversion points whose flows are difficult to forecast (especially early in the irrigation season), and as a result it is difficult to know with confidence how much water to release in order to satisfy irrigation demands that will occur over a several-day period following release from the reservoir. A model based on a Bayesian learning algorithm, called a "**r**elevance **v**ector **m**achine" (RVM), was formulated at UWRL and used to provide hourly recommendations on releases from Piute Reservoir. For inputs, the model uses data on recent reservoir releases, downstream flow conditions on tributaries and the mainstem, recent canal diversions, and weather conditions. As its output, the model provides a recommendation for the release rate from Piute Reservoir for the next hour. The model, documented in the peer-reviewed literature, also quantifies the uncertainty in its recommendation and provides this information to the reservoir operator in the form of a 95 percent confidence interval on the recommendation. Figure 9 illustrates the model's behavior over one entire irrigation season and contrasts it against the actual decisions of the reservoir operator. The model is always

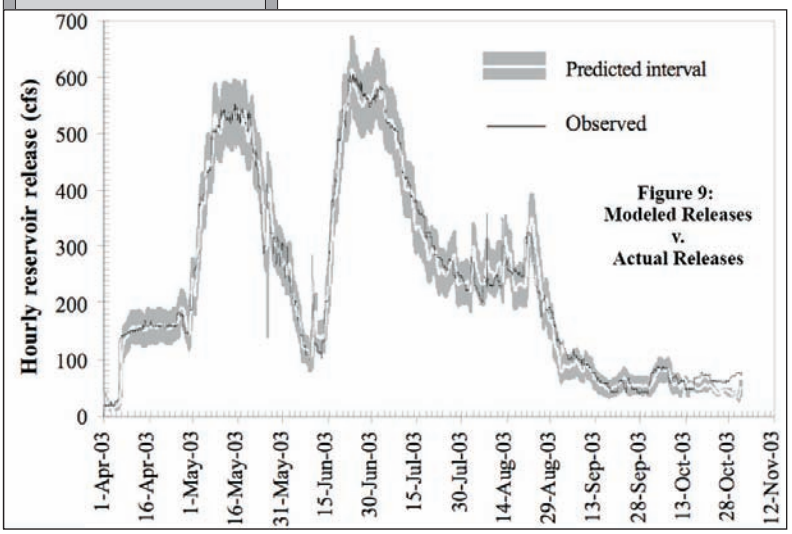


Figure 9: Modeled Releases v. Actual Releases

Irrigation

Model Control

"learning." It understands when it is presented with conditions that it has not previously seen in the data; when this happens, it "retrains" itself as new data become available hour-by-hour. Analyses of the model's recommendations and the observed reservoir releases over a period of several irrigation seasons indicate that the behavior of the model is statistically indistinguishable from the decisions of the reservoir operator. Plans are now being formulated to directly connect the model to the gate controllers of the reservoir, and use the reservoir operator to oversee its decisions. In this way, the model would provide continuous monitoring and decision-making actions, as opposed to a human operator who cannot be available to operate the system every minute of the day.

Technologies Testing

EMERGING TECHNOLOGIES

As noted, the above examples of advanced techniques for data acquisition and analysis in support of water management are in use in the Sevier River Basin today. Other techniques under development are not yet ready for deployment in an actual water management setting. However, several of these emerging techniques show great potential and are likely to become available to water managers in the relatively near future. The following sections introduce two such techniques that are being tested at present at UWRL.

Data Available

"Data Assimilation" for Irrigation Water Management

Managers of irrigation systems have extremely large amounts of potentially valuable data available. Imagery that could provide information about soil moisture and evapotranspiration rates is available from satellites on a fairly frequent basis, and it can be obtained for free. Forecasts of these same variables, as well as things such as temperature and precipitation, are also available as the product of meso-scale climate models (meso-scale pertains to atmospheric phenomena having horizontal scales (e.g. thunderstorms, squall lines, fronts, etc.) and topographically generated weather systems (e.g. mountain waves, sea and land breezes)). As a practical matter, however, these data sources present a number of problems.

Disparate Data

From the point of view of an irrigation system operator these data sources are extremely difficult to acquire and use. Further, they do not provide data at a time and a spatial resolution that is of benefit. Combining the remotely-sensed and meso-scale data with the data readily available from more traditional sources into a complete and consistent picture of the current and potential future state of the water system requires the application of appropriate analytic methods. There are techniques to address these shortcomings. Such techniques — which combine disparate data from an array of sources that operate on different time and spatial scales into a description of the water system that is self-consistent at all temporal and spatial scales — are referred to as "data assimilation" methods. If data assimilation methods were made easily available to irrigation water managers, they could be used to better forecast future water demands and thereby improve system operations.

Data Integration

Researchers at UWRL have recently developed techniques for integrating data from such diverse sources as on-ground soil moisture probes, photo imagery from conventional aircraft, satellites, and meso-scale models to provide estimates of soil moisture and evapotranspiration rates at high spatial and temporal resolution. Though not yet ready for immediate application, these techniques have been published in the professional literature, and work is underway to develop ways to implement them on a practical scale.

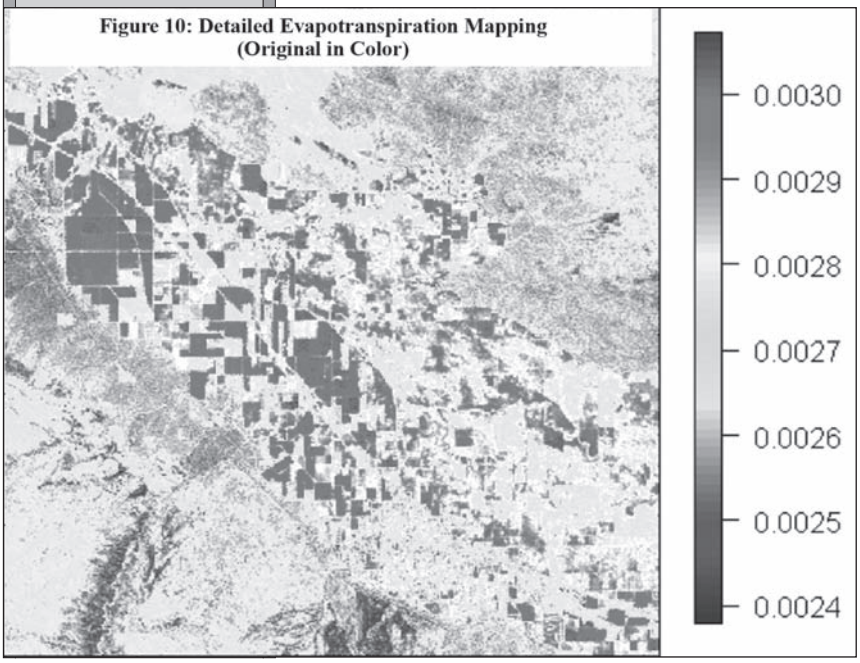


Figure 10: Detailed Evapotranspiration Mapping (Original in Color)

One data-integrating technique is a downscaling algorithm that reconciles coarse satellite images that contain data on evapotranspiration. Individual pixels from a satellite might contain several farms and, as a result, be much too coarse to be of value to a water manager. The downscaling algorithm reconciles coarse satellite data with fine-scale imagery and on-ground measurements to produce high-resolution images of evapotranspiration over irrigated areas. Figure 10 shows estimates of evapotranspiration rates at a resolution of 15 meters — developed from available satellite data that had a resolution of 250 meters — for an area around Richfield, Utah. If produced on a frequent and regular basis, this type of information could be aggregated by canal command area and used to estimate short-term irrigation water demand. Research is currently underway at UWRL to provide the capability to do exactly that.


Figure 11: Unmanned Autonomous Vehicles

Irrigation

High Resolution

Soil Moisture & Water Demand Forecasting

Remote Sensing for Estimation of Irrigation Demand

SMART AIRCRAFT AND WATER MANAGEMENT

As mentioned previously, the use of remotely-sensed satellite data to provide useful information about the state of an irrigation system is severely hindered by the infrequent availability of data and the relatively coarse quality of satellite images. This problem is exacerbated by the near total lack of usable tools for extracting decision-relevant information from satellite data for water management at the local scale. Inexpensive and easy-to-use tools, providing more spatially-detailed remotely-sensed data than is available from satellite images, are needed to produce higher quality information at a frequency appropriate for local decision-making. These tools should readily integrate other data sources to produce useful water management information.

To address these issues, researchers at the UWRL are engaged in developing inexpensive, special-purpose aircraft that function as **u**nmanned **a**utonomous **v**ehicles (UAVs) for acquiring remotely-sensed data about irrigation systems. Illustrated in Figure 11, these UAVs are capable of acquiring high-resolution imagery (on the order of 5 cm) of several square miles in a flight time of less than an hour. Each aircraft is equipped with an on-board computer, a GPS system, and avionics for sensing pitch, yaw, roll, and air speed. To use one of these aircraft, one manipulates a simple point-and-click interface on a computer to create a flight plan in GPS coordinates and then, through a USB connection, uploads the flight plan to the aircraft. At present, cameras are available to provide data in the visual, near-infrared, and infrared wavelengths. Several algorithms are available to translate such data into soil moisture and evapotranspiration estimates. Software is under development to automatically "georeference" the images and overlay them into a composite image. Figure 12 shows such a composite photograph (in the visual spectrum, only) obtained from a flight over a farm owned by Utah State University. Figure 13 (see next page) compares the resolution that is obtained from this technology against commercially available systems flown on normal aircraft.

At present, this UAV technology is not ready for use in water management. It is anticipated that the technology embodied in the UAV aircraft, cameras, and the image processing ability that is under development, will be combined with data assimilation capabilities (as discussed above). This will result in tools that will be capable of providing both affordable and timely data on the current state of soil moisture on large irrigated areas and short-term forecasts of how soil moisture will change. It will then be possible to aggregate this information into irrigation water demand forecasts at the canal level. For systems such as the Sevier River Basin, the information these demand forecasts provide would be of great value in improving overall system efficiency.

It is anticipated that when commercially available, this new technique will be very cost-effective. The UAV aircraft, software for flying them, visual band and NIR cameras and software for controlling them during flight, and software for retrieving and analyzing the data they produce, will cost less than $1,000. Several patents on this technology, as well as copyrights on the related software, are in preparation.

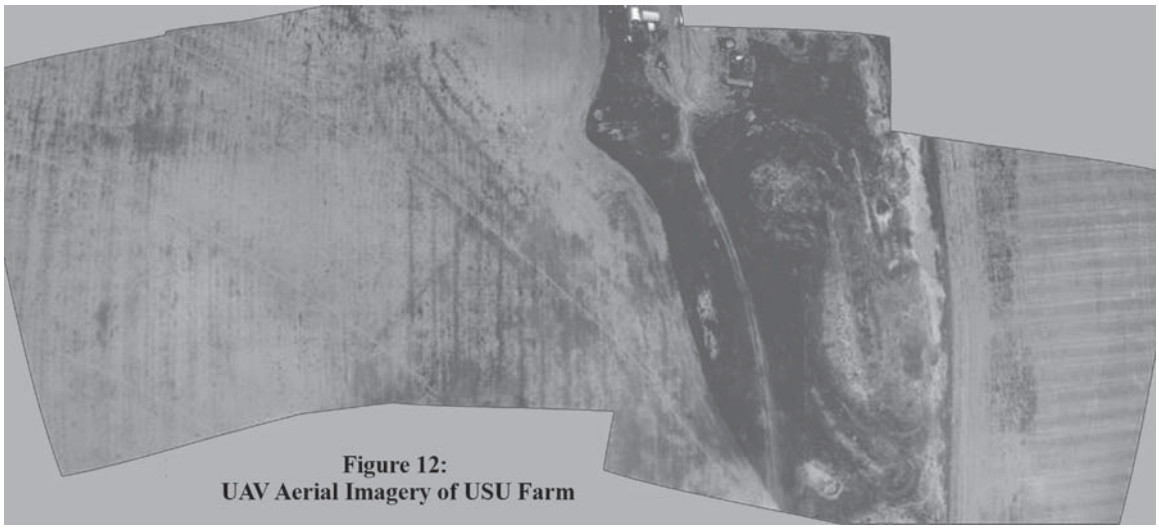


Figure 12:
UAV Aerial Imagery of USU Farm

Irrigation

Better Management Enabled

SUMMARY

Investments made by the Sevier River Water Users Association over the past decade have lead to the development of sophisticated means for acquiring data in support of more intensive management of a large, basin-wide irrigation system. The data acquisition system is affordable, and successfully substitutes better management information to address the needs of water users in the place of costly investments in more water storage and conveyance facilities. The data that are collected enable managers (e.g., canal and reservoir operators, farmers, and other stakeholders) to more intensively utilize the scarce water of the Sevier River Basin. With the addition of existing and emerging data acquisition and analysis techniques that incorporate available satellite data, meso-scale model forecasts, and remotely-sensed data from UAV platforms, the real-time data acquisition and control system in the Sevier River Basin will provide operators with affordable, state-of-the-art technology that maximizes the value of the decision-relevant information it provides.

For Additional Information: Mac McKee, Utah Water Research Laboratory, Utah State University, 435/797-3188 or email: Mac.McKee@usu.edu

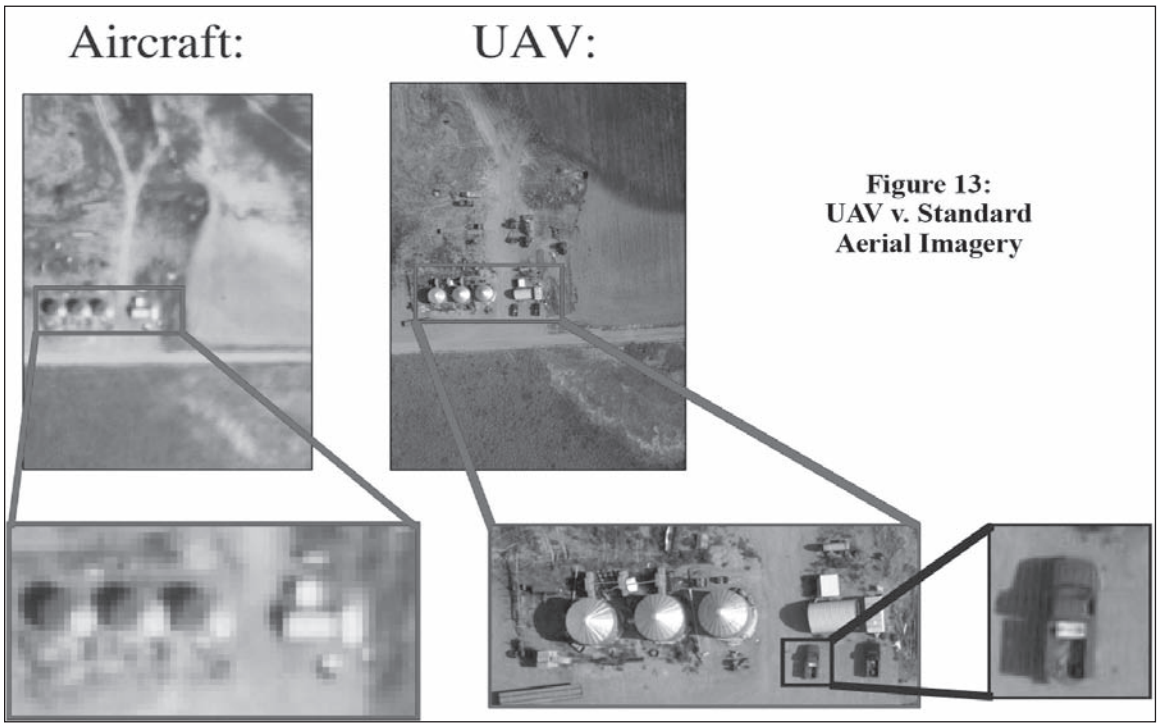


Figure 13: UAV v. Standard Aerial Imagery

Dr. Mac McKee is the Director of the Utah Water Research Laboratory at Utah State University (USU). He teaches graduate and undergraduate courses in the Department of Civil & Environmental Engineering at USU in water resources systems analysis, water resources engineering, and water resources planning and management. He holds a Ph.D. in Civil & Environmental Engineering from Utah State University, in addition to an MS in Systems Ecology and a BS in Philosophy. Prior to beginning his academic career in 1984, he was the Senior Water Resources Engineer with Harza Engineering Company in Chicago, Illinois, and a Resident Manager with Harza in India. Dr. McKee has been active in domestic and international water resources planning and management projects for the past 33 years. His diverse experience has included assignments in flood control planning and design in the Philippines, development of an environmental baseline document for Uzbekistan, water quality management in Samoa, integrated river basin planning and management in India, and development of a comprehensive water resources master plan and integrated water management plans for the West Bank and Gaza Strip. His current research is focused on the improvement of irrigation canal and reservoir operation efficiency through the use of statistical learning theory and remote sensing.

Acknowledgements

The author wishes to acknowledge the Sevier River Water Users Association, the US Bureau of Reclamation, the Utah Water Research Laboratory, the Utah Center for Water Resources Research, and the Utah State University Research Foundation for financial support of much of the research discussed in this article. The author must also recognize the long-standing collaboration and support of Dr. Roger Hansen, of the Provo, Utah office of the US Bureau of Reclamation. Without his vision and guidance, the web-based data acquisition and control system that is today in place in the Sevier River Basin would not exist.

Pinto Creek

IMPAIRED WATERS & PERMITTING

IMPLICATIONS OF *PINTO CREEK* DECISION

by Jeremy N. Jungreis, Nossaman Guthner Knox & Elliott, LLP (Orange County, CA)

Ninth Circuit Decision

Uncertainty

CWA Structure

"Point Source"

Water Quality Report

Nonpoint Challenge

303(d) Lists

Introduction

On the surface, the Ninth Circuit Court of Appeals' (Ninth Circuit) recent opinion in *Friends of Pinto Creek v. U.S. Envtl. Protection Agency* (*Pinto Creek*) does not appear to represent much of significance. The decision is relatively short, and spends much of its analysis on the interpretation of one federal regulation — 40 C.F.R. § 122.4(i). Nor does the opinion go to great lengths to address public policy balancing, Congressional intent or conflicting precedent. Yet, the holding of *Pinto Creek* is significant, and despite legitimate questions about the soundness of its legal reasoning, the decision will likely have widespread ramifications throughout the western United States.

This article will identify where uncertainty now lies in the NPDES permitting process after *Pinto Creek*, and, where applicable, suggest mechanisms that potential permittees (or policymakers) can utilize to distinguish or minimize the restrictive effect of the *Pinto Creek* decision.

Regulatory Context

Understanding the *Pinto* Creek decision and its implications requires a basic familiarity with the federal Clean Water Act (CWA) and its structure. The stated purpose of CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). In many ways, the CWA has been a great success story. The CWA's National Pollutant Discharge Elimination System (NPDES) permit program has removed the most concentrated sources of pollutant loading by requiring municipal and industrial "point sources" of water pollution to treat their waste streams with specified pollutant removal technologies prior to discharge. See 40 C.F.R. § 122.44(a)(1).

Section 402 of the federal Clean Water Act (CWA) precludes discharge of pollutants from a "point source" to jurisdictional waters of the US unless an NPDES permit is first obtained. 40 C.F.R. § 122.1(b). CWA defines a point source as "any discernable, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." 33 U.S.C. § 1362.

Water quality in many watersheds improved substantially with the implementation of the NPDES program. Yet, in its 2002 CWA Section 305(b) report to Congress detailing the condition of the Nation's waters, the US Environmental Protection Agency (EPA) reported that approximately 45 percent of rivers/streams and 47 percent of lakes/reservoirs do not support their designated beneficial uses (such as fishing and swimming). See EPA, *National Water Quality Inventory: Report to Congress*, 2002 Reporting Cycle, at ES-2 (October 2007) (hereinafter 2002 Section 305(b) Report).

The statistics in the 2002 Section 305(b) Report reveal what is perhaps CWA's greatest continuing challenge — controlling **n**on**p**oint **s**ources (NPS) of water pollution. NPS is "pollution that does not result from the 'discharge' or 'addition' of a pollutant" from a "point source." *Or. Natural Res. Council v. U.S. Forest Serv.*, 834 F.2d 842, 849 n.9 (9th Cir. 1987). NPS is typically associated with runoff from agricultural or silvicultural operations, but can encompass other activities that degrade water quality including water withdrawals and hydromodification of stream channels. See generally *Id.* at 849. NPS water pollution alone is often sufficient to prevent attainment of designated beneficial uses in many watersheds. See for example*, Pronsolino v. Nastri*, 291 F.3d 1123 (9th Cir. 2002), which noted that impairment of the Garcia River was entirely attributable to NPS pollution.

Where beneficial uses are not supported by existing water conditions (even after the implementation of technology based effluent limitations in NPDES permits), the CWA outlines mandatory steps to address remaining problems. CWA Section 303(d), 33 U.S.C. § 1313(d), requires each state — every two years — to compile a list of all waters within its boundaries that are not anticipated to attain water quality standards. 40 C.F.R. § 130.7(d)(1). This "303(d) list" is submitted to EPA. The next step in the process is for the state, upon consultation with EPA and internal prioritization of efforts, to develop a **t**otal **d**aily **m**aximum **l**oads (TMDLs) for the impaired waterbodies. 33 U.S.C. § 1313(d)(1)(C). A TMDL is a regulatory determination regarding the sum of pollutants (the "load") a body of water can absorb from all point and nonpoint sources, plus a margin of safety, while still meeting water quality standards. 40 C.F.R. § 130.2 (i). In other words, TMDLs are "the best possible estimates of the assimilative capacity of [a] water body for a pollutant

Pinto Creek

"New" Discharge Preclusion

Intermittent Flow

Copper Loading

Mine Proposed

NPDES Permit

Mitigation Commitment

Discharge Allocation

under consideration." *City of Waco v. Tex. Natural Res. Conservation Comm'n*, 83 S.W.3d 169 (Tex. Ct. App. 2002). TMDLs set up an "allocation" framework to limit an impaired waterbody's total pollutant load to within its assimilative capacity.

Pinto Creek holds that EPA rules for NPDES permit issuance at 40 C.F.R. § 122.4(i) preclude issuance of a "new" discharge permit for any waterbody listed as "impaired" on a 303(d) list until: 1) all existing "discharges" from "point sources" in the watershed are identified and made subject to compliance schedules; and 2) the compliance schedules can demonstrate future attainment of all pertinent water quality standards. By vacating EPA's Appeals Board decision in *In re Carlota Copper Co*., 11 Envtl. Admin. Decisions 692 (Sept. 30, 2004), the Ninth Circuit has injected uncertainty into virtually any project or development that will require issuance of a "new" NPDES permit in the western US.

Although *Pinto Creek* is a case about an NPDES permit issued by EPA in Arizona (Arizona had not yet received EPA delegation to administer a state NPDES program at the time of permit issuance), most of EPA's rules implementing the NPDES program in 40 C.F.R. Part 122 — including those implicated in *Pinto Creek* (e.g., 40 C.F.R. § 122.4 and 40 C.F.R. § 122.44(d)) — apply with equal force to state-administered NPDES programs. See 40 C.F.R. § 123.25; compare 33 U.S.C. 1342(a)(3) (EPA's permit program is subject to the "same terms, conditions, and requirements" as a state permit program).

***Pinto Creek* Background**

Pinto Creek is a desert river in Central Arizona about 60 miles east of Phoenix. It is dry for much of the year, but there are stretches that flow perennially in small volumes as the result of groundwater contributions. Pinto Creek is currently listed as impaired for copper and in 2001 EPA developed a TMDL for the water quality limited segment in the vicinity of the proposed Carlota Copper Mine (Carlota). Subsequent investigation and sampling by the state of Arizona Department of Environmental Quality (ADEQ) revealed that Pinto Creek and its tributaries, in their natural state, contain high levels of naturally occurring copper (approximately four times greater than the default levels established in the TMDL). ADEQ's investigations also revealed that approximately 90% of the copper loading in the upper portion of the watershed could be attributed to leaching and runoff in and around the abandoned Gibson Mine. See ADEQ, *Pinto Creek Site Specific Water Quality Standard for Dissolved Copper* (Draft) 31 (March 12, 2007) (available at www.azdeq.gov/environ/water/assessment/download/pinto_final.pdf). As a result of the findings regarding natural background conditions, and the desire to clean up the watershed while allowing ecologically responsible mining activities to continue, the State of Arizona is currently completing development of a site-specific water quality standard for copper in Pinto Creek. *Id.* at 1-4.

In the late 1990s, Carlota proposed to construct and operate a 3000-acre open-pit copper mine and processing facility on Pinto Creek with the intention of extracting approximately 100 million tons of ore over the life of the mine. The proposed project consisted of: four open pits; a sulfuric acid heap leach pad; process solution ponds; an on-site processing plant; waste rock disposal areas; and other facilities. The mine pits were designed to drain internally, thereby preventing discharges during active mining operations. Pinto Creek was to be diverted around the mine through two diversion channels. However, stormwater channelized within the mine and exposed to materials containing high concentrations of copper would be "discharged" to Pinto Creek via outlet structures during large storm events — thereby triggering the need to obtain a NPDES permit.

EPA, the permitting authority at the time, granted Carlota's permit application in July 2000 after receiving certification from the State of Arizona, in accordance with Section 401 of CWA (33 U.S.C. 1341), that the discharge would not violate state water quality standards. As a condition of the permit, Carlota was required to conduct mitigation in and around the Gibson Mine to "offset" any additional loadings of copper to Pinto Creek that might result from construction and operation of the Carlota Mine. As a result of the mitigation, Pinto Creek would be cleaner after implementation of the new permit than before. Nevertheless, Friends of Pinto Creek, and other non-governmental organizations, (hereinafter "Plaintiffs") filed a petition challenging the issuance of the permit with the EPA Environmental Appeals Board (EAB) shortly thereafter. As a result of the challenge, and in response to public comments, EPA developed and approved a TMDL for Pinto Creek in 2001.

The TMDL included an allocation for Carlota's proposed stormwater outfalls — notwithstanding the fact that the creek remained in violation of state water quality standards for copper. Plaintiffs amended their challenge to include an argument that no new discharges could be undertaken until all state water quality standards for Pinto Creek were met or exceeded (an impossibility because of naturally high background levels of copper in the watershed). Plaintiffs argued their petition before EAB in October of 2002. In September of 2004, EAB denied relief, and EPA Region IX issued a final NPDES permit to Carlota. Plaintiffs then appealed EAB's decision to the Ninth Circuit. In October of 2007, the Ninth

Pinto Creek

Circuit ruled in Plaintiffs' favor holding that no "new" permits could be issued until all point sources in water quality impaired segments of Pinto Creek were made subject to compliance schedules that would demonstrate compliance with all water quality standards. *Pinto Creek*, 2007 U.S. App. LEXIS 23251 at *12-18.

Analysis of the *Pinto Creek* Decision

Application of the CWA in *Pinto Creek*

CWA Prohibition

The Ninth Circuit in *Pinto Creek* correctly notes that new discharges that "cause or contribute" to a "violation of water quality standards" are prohibited under the CWA. 40 C.F.R. § 122.4(i). Likewise, NPDES permits issued in an impaired watershed must be consistent with any load allocations established in a TMDL (see 40 C.F.R. § 122.44(d)(1)(vii)(B), which provides that effluent limits developed to protect water quality criteria must be consistent with the assumptions and requirements of TMDL wasteload allocation). However, neither CWA nor EPA's regulations interpreting it, contemplate an outright ban on permitting of new point sources discharges where the overall impact of the new discharge will be a net benefit to water quality (the scenario in *Pinto Creek*).

Net Environmental Benefit

Ban Rejected

For example, the court in *Arkansas v. Oklahoma*, 503 U.S. 91 (1992) rejected a ban on new discharges that would result in technical violation of the downstream state's water quality standards. The court noted that new discharges that improve overall water quality — through increased water volume or enhanced technology implementation — should be encouraged where EPA deems the discharge to be beneficial. This decision approved an administrative law judge's finding that downstream water quality standards were not violated — notwithstanding their 303(d) listing — where evidence suggested no "measurable" adverse impact on water quality. Similarly, the court in *Matter of the Cities of Annandale and Maple Lake NPDES/SDS Permit Issuance*, 731 N.W.2d 502 (Minn. 2007) ("*Cities of Annandale"*) construed 40 C.F.R. § 122.4(i) to authorize a "new" discharge permit where mandatory offsets would result in an overall reduction in loading to an impaired watershed.

Rule Ambiguity

Admittedly, the meaning of 40 C.F.R. § 122.4 (i) is ambiguous. See *City of Waco,* 83 S.W.3d at 176-77 (noting two divergent meanings attributed by the parties to the language of 40 C.F.R. § 122.4 (i)); and *Cities of Annandale*, 731 N.W.2d at 522 (concluding that 40 C.F.R. 122.4(i) is "unclear and susceptible to different reasonable interpretations.").

Per Se Violation?

The Ninth Circuit in *Pinto Creek* appears to equate a new discharge in 303(d) listed waters with a per se violation of water quality standards. There is no support for this position in CWA. *Pinto Creek* only avoids a direct conflict with the Supreme Court's decision in *Arkansas v. Oklahoma* — which disapproved a comprehensive ban on new permits in impaired watersheds — by providing a narrow exception that could, under limited circumstances authorize EPA (or a state) to issue a NPDES permit to a "new source" or "new discharger" in an impaired water quality segment. *See Pinto Creek*, 2007 U.S. App. LEXIS 23251 at *13-16. According to the Ninth Circuit, 40 C.F.R. § 122.4(i) does allow for a "new discharge" where load allocations are available, provided there is a compliance schedule in place for *existing point source dischargers* (whether formally permitted, exempt or illegal) in the impaired water quality segment, and the compliance schedule projects attainment of applicable water quality standards over time. *Id.* at *12-17.

Exception

TMDL Inclusions

The court indicated on pages *12-13 that EPA must include "any" point sources in a compliance schedule prior to permit issuance. Later in the decision, however, the court seems to imply that less than the total number of existing dischargers could be included in an EPA compliance schedule provided permit requirements for the subset will result in achievement of water quality standards. "If point sources, other than the permitted point source, are necessary to be scheduled in order to achieve the water quality standard, then the EPA must locate any such point sources and establish compliance schedules to meet the water quality standard before issuing a permit." *Id.* at *18. Thus, the degree to which *all* dischargers must be subject to compliance schedules remains an open question after *Pinto Creek.*

If sufficient load reductions cannot be obtained via compliance schedules for point sources, then EPA can only issue a new permit if it can convince a state to mandate reductions in nonpoint source loading via a compliance schedule. *Id.* at 18. This position is contrasted with an earlier Ninth Circuit decision in *Or. Natural Res. Council v. U.S. Forest Serv*., 834 F.2d 842, 849 (9th Cir. 1987), which held, "We do not agree with plaintiffs that Congress intended [Section 301] to apply to nonpoint sources."

Implications of *Pinto Creek*

Unanswered Questions

Pinto Creek leaves a host of unanswered questions in its wake. It is unclear from the decision what types of discharges are to be restricted by the Ninth Circuit's broad reading of 40 C.F.R. § 122.4(i). The *Pinto Creek* decision involves an industrial discharge from a mining operation. Does the Ninth Circuit's

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MS4s

Development Preclusion?

TMDL Inclusion Questions

Innovations Discouraged?

New Rules?

prohibition on new sources extend only to traditional point sources such as industrial and municipal wastewater discharges, or did the court intend that its decision would extend to stormwater discharges from **m**unicipal **s**eparate **s**torm **s**ewer **s**ystems (MS4s) and construction sites (which are also subject to NPDES general permits in most states)? The NDPES regulations do not preclude such a result. 40 C.F.R § 122.4 applies to either a "new source" or a "new discharger" and the pertinent definitions in 40 C.F.R § 122.2 could be construed to include "new" stormwater "discharges."

If the court did intend to extend the prohibitive effect of 40 C.F.R. § 122.4(i) to stormwater discharges, then *Pinto Creek,* taken to its logical extreme, could be interpreted to preclude *all development* in excess of one acre (the threshold for filing of a notice of intent under EPA's NPDES Phase II Stormwater Program) in impaired watersheds. The 2002 Section 305(b) Report, *supra,* indicated that nearly 50% of watersheds in the US are impaired by some pollutant. Could Congress have actually intended in passing Section 303(d) of the CWA to impose what amounts to a de facto building moratorium on up to one half of the watersheds in the country? Such a result would wreak havoc on local economies and potentially expose the states and EPA to limitless inverse condemnation claims from property owners precluded from developing their properties by 40 C.F.R. § 122.4(i).

Additionally, the *Pinto Creek* decision is ambiguous vis-à-vis whether *all* "point source" dischargers in the watershed, or only a number sufficient to demonstrate compliance with water quality standards, must be subject to compliance schedules before issuance of new permits (as discussed above). Nor does the court explain how EPA (or a state permitting entity) might establish a compliance schedule for an ownerless point source (such as the abandoned Gibson Mine). A compliance schedule is meaningless without an owner/operator that can execute its requirements. In this vein, the decision ignores the fact that many watersheds in the country exceed pertinent water quality standards by virtue of NPS loading alone (to include situations where natural background levels exceed water quality standards). For NPS loadings (which include atmospheric deposition and diffuse runoff from any number of different land uses) there often will not be an owner or operator that can be made subject to a compliance schedule (assuming that a state even has the regulatory authority to impose such conditions on landowners who are not point sources of discharge). In addition, the owner/operator may not have the financial means to comply even if otherwise willing. Thus, although the Ninth Circuit denied that it was applying a categorical ban on all point source discharges to impaired watersheds (*Pinto Creek* at *19), the difficulty, and in many cases impossibility, of complying with the pre-conditions established by the court will in many circumstances result in a de facto prohibition on the issuance of new NPDES permits in 303(d) listed watersheds.

Under such circumstances, the value of recent innovations in water quality policy and management could be greatly diminished. EPA's water quality trading program, a useful and emerging tool in the fight against water quality impairment, would be particularly susceptible to a devaluation of offsets. See *Envtl. Prot. Agency, Final Water Quality Trading Policy*, 68 Fed. Reg. 1609 (Jan. 13, 2003): "Finding solutions to...complex water quality problems requires innovative approaches that are aligned with core water programs. Water quality trading...offers greater efficiency in achieving water quality goals on a watershed basis. It allows one source to meet its regulatory obligations by using pollutant reductions created by another source that has lower pollution control costs."

Prudent Actions in Light of the *Pinto Creek* Decision

Pinto Creek unquestionably poses a compliance challenge for those seeking to discharge (and develop) in and around a 303(d) listed watershed in the western US. However, there a number of actions stakeholders (and EPA) can take to help minimize the impact of the decision.

Change the Regulations for NPDES Issuance in Impaired Watersheds

The Ninth Circuit based its *Pinto* Creek decision almost entirely upon its interpretation of the meaning of 40 CFR § 122.4(i) and not upon a specific prohibition in the CWA. The court gave EPA's interpretation of its own regulations no deference in the process (see note 14, *supra).* Such a position is seemingly in stark contrast to the Supreme Court's decision in *Arkansas v. Oklahoma*, 503 U.S. 91, 108: "Although the Act [CWA] contains several provisions directing compliance with state water quality standards... the parties have pointed to nothing that mandates a complete ban on discharges into a waterway that is in violation of those standards." Accordingly, nothing in *Pinto Creek* would appear to prevent EPA from promulgating new rules along the lines suggested by the Supreme Court in *Arkansas v. Oklahoma*, 503 U.S. at 111-12, which approved an administrative law judge's determination that a discharge to 303(d) listed waters required *detectable or measurable* degradation of water quality before running afoul of

Pinto Creek

Offset Clarification

CWA's antidegradation prohibition. At a minimum, the EPA should clarify by regulation, that where a new discharge to 303(d) listed waters will be consistent with load allocations in a TMDL (if applicable), and will otherwise be offset by pollution reductions elsewhere within the watershed, then a permitting agency has the discretion to authorize such a discharge. Revising 40 CFR § 122.4(i) in such a manner would comport with the Supreme Court's guidance that new and environmentally beneficial projects not be stifled by a categorical ban that does nothing to improve the status quo. EPA should also use the rulemaking as an opportunity to clarify that 40 CFR § 122.4(i) does not apply to stormwater discharges.

***Pinto Creek* Application to Stormwater Discharges from an MS4**

Limited Application

While a clarifying statement from the EPA would be helpful, given the ambiguity in 40 CFR § 122.2 on what constitutes a "new discharge" for purposes of 40 CFR § 122.4(i), local governments have a very strong argument that the *Pinto Creek* decision has limited (if any) application to discharges from MS4s. There is a distinction between industrial and wastewater permits administered under the NPDES program on the one hand, and the MS4 program (which implements Section 402(p)(3)(B) of the CWA) on the other. Stormwater will flow, permit or not, whenever it rains. It makes no sense (and is physically impossible) to *prohibit* all municipal stormwater discharges into waterbodies that are currently listed as "impaired" under Section 303(d) — particularly during high flow rain events. The Ninth Circuit recognized the Congressionally sanctioned distinction between MS4 Permits and other types of NPDES permits in *Defenders of Wildlife v. Browner*, 191 F.3d 1159, 1165 (9th Cir. 1999). *Defenders of Wildlife* held that MS4 dischargers are not required to achieve strict compliance with state water quality standards. Rather, MS4 dischargers must treat stormwater to the **m**aximum **e**xtent **p**racticable (MEP). They are not precluded from discharge if MEP does not result in the attainment of all pertinent water quality standards. *Id.* Moreover, most MS4 discharge points have been in place for many years and are accordingly outside the ambit of 40 CFR § 122.4(i). See *City of Waco v. Tex. Natural Res. Conservation Comm'n*, 83 S.W.3d at 176 n.6, where the court observed that "[s]ection 122.4(i) applies only to a permit for a new source or discharger," and does not apply to "additional or expanded uses" by the same source.

"MEP"

***Pinto Creek* Application to Discharges from Construction Sites**

Construction Permits

Construction activities on sites in excess of one acre are characterized as a type of "industrial" activity under EPA's Phase II Stormwater Program. 64 Fed.Reg. 68722 (Dec. 8, 1999); 40 C.F.R. § 122.26(b)(15). They are accordingly administered in most states (and by EPA in states where EPA is the permitting agency) through a general NPDES permit program (40 C.F.R. § 122.28). Industrial stormwater permits have their genesis in Section 402(p)(3)(A) of the CWA — and, unlike MS4 permits, *are tied to attainment of water quality based effluent standards*. Thus, environmental groups may try to assert that *new* construction in excess of one acre constitutes a "new" point source discharge that is subject to the restrictions of *Pinto Creek.*

Defining "Discharge"

Other than identifying for the regulators the public policy nightmare that would occur if every construction project had to first ensure the existence of basin-wide compliance schedules for every point source in the watershed prior to turning a spade, there are other reasonable ways to distinguish *Pinto Creek* in the construction context. First, there is arguably no *new* "discharge" in the context of stormwater associated with construction, where pollutants — if any — are transported offsite during rain via diffused "runoff," a nonpoint source. Note that 40 C.F.R. § 122.2 states that surface runoff must be "collected or channeled by man" before it will be deemed a "discharge." Instead, the "point source" is the conveyance that receives the runoff pollution from the construction site, an *existing* storm sewer system conveyance that then "discharges" to waters of the US. Thus, with a construction site, there is often no "new" discharge of pollutants at all — merely diffused flow into an existing stormwater conveyance that does not become "new" by virtue of increased stormwater volume or pollutant concentrations (compare *City of Waco, supra* at 176 n.6).

General Permits

Second, control of construction project-related runoff is typically administered through *existing* general permits issued (and re-issued) every five years by a permitting agency to an entire category of stormwater sources. See generally 40 C.F.R. § 122.28(a)(2)(i), which provides that water quality based effluent limits should be the same for all sources within the same category or sub-category. The developer submits a notice of intent to obtain coverage under the *existing* general permit, not a new permit application, and is then subject to the same water quality based standards, if any, as others within the same category. 40 C.F.R. § 122.28(a)(3). If faced with the question, developers and their counsel could argue that there is no indication that EPA in 40 C.F.R. § 122.4(i) nor the Ninth Circuit in *Pinto Creek* intended to apply a "new" discharge prohibition to *existing* general permits which typically regulate large classes of dischargers throughout an entire state.

Pinto Creek

Compliance Schedule

All Dischargers?

Nonpoint Issues

Changing Water Quality Determinations

Difficulties Remain

Plan to Attain Water Quality Standards in Accordance With Compliance Schedules

Though this option will not be feasible in many water quality impaired segments, some watershed stakeholders will be able to avail themselves of the new permit approval process described in *Pinto Creek*. This option may be particularly viable in watersheds where impairment is linked to loading from actively managed point sources, and the increment of improvement needed to meet water quality standards is reasonably achievable with the implementation of new technology and best management practices.

Stakeholders seeking to obtain a "new" permit after *Pinto Creek* should first advocate that the Ninth Circuit's decision does not mandate the participation of *all* point source dischargers in the watershed (as some, like the Gibson Mine in *Pinto Creek*, may be hard to get to the table). Second, to the extent feasible, the permit applicant and permitting agency should attempt to bring in nonpoint sources of pollutant loadings (via state regulation or voluntary agreement), and require them (via a compliance schedule) to implement best management practices that will reduce NPS pollutant loadings over time. In many watersheds, NPS loading is the primary source of impairment, and it may be difficult to demonstrate future attainment of all pertinent water quality standards in the absence of meaningful NPS controls. If a TMDL is already in place, then sources of NPS pollution will have already received a "load allocation" indicating how much pollutant the waterbody can assimilate from NPS pollution and still meet water quality standards. However, because EPA does not typically have regulatory jurisdiction over sources of NPS pollution, participation of state and local governments — with the power to enforce land use controls — is imperative.

Create "New" Assimilative Capacity

DEVELOP A SITE SPECIFIC STANDARD OR CONDUCT A USE ATTAINABILITY ANALYSIS

Attainment of *existing* water quality standards — even over time — may not be a technically feasible alternative in many watersheds. This may be the reality for a variety of reasons ranging from improper beneficial use designations to high natural background levels of an "impairing" pollutant. After *Pinto Creek*, failure to demonstrate attainment of water quality standards over time is fatal to a "new" permit application. However, there remain at least two potential avenues of relief. Development of a **s**ite **s**pecific standard (SSS) or a successful **u**se **a**ttainability **a**nalysis (UAA) will result in changes to the pertinent water quality standards such that they can potentially be met over time.

40 C.F.R. Part 131 provides procedures for the establishment and review of state water quality standards and uses. Development of an SSS requires a demonstration that existing beneficial uses are still protected at higher pollutant concentrations on a site specific (or seasonal) basis, while a UAA requires demonstration that the most sensitive beneficial uses do not currently exist in the watershed — thereby eliminating the need for more stringent water quality standards to protect them. (See generally California State Water Resources Control Board, State of California S.B. 469 TMDL Guidance, A Process For Addressing Impaired Waters in California § 6.3.(June 2005)).

As previously referenced, development of an SSS is the approach that the State of Arizona is currently pursuing on Pinto Creek in light of the litigation surrounding the Carlota Mine application and continued copper loading from naturally occurring sources (see *Background* above). With successful implementation of an SSS or UAA, additional loading can be freed up — allowing attainment of revised water quality standards via compliance schedules. If the UAA or SSS is particularly successful an impaired water quality segment may be delisted outright.

Conclusion

The Ninth Circuit's decision in *Pinto Creek* does not make water quality compliance decisions any easier. With many watersheds across the western US listed as "impaired" under Section 303(d), and because the Ninth Circuit now mandates the implementation of compliance schedules for all (or most) point sources prior to the issuance of any new NPDES permit in and around impaired water quality segments, the decision is likely to impact a significant amount of people (and greatly enhance watershed stakeholder efforts to develop SSSs and UAAs). The court's holding also puts regulators in a difficult position vis-à-vis meritorious NPDES applications where compliance schedules are not a feasible option. A new permit applicant, as in *Pinto Creek,* often has the incentive to undertake significant mitigation in order to get its project approved and implemented. After *Pinto Creek*, however, EPA no longer has the discretion to weigh a project's overall benefits and determine that, on the whole, issuance of a new NPDES permit is a net win for the environment. The Ninth Circuit's "all or nothing" approach to addressing 303(d) impairment may result in less clean-ups occurring because many dischargers may conclude that the path to permit approval is now just too steep. Hopefully EPA will revise 40 C.F.R § 122.4(i) to clarify that projects with a net benefit on water quality may proceed without initiating a watershed wide clean up.

Pinto Creek

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Case website: *Friends of Pinto Creek c*omplete case available at: http://caselaw.lp.findlaw.com/scripts/getcase.pl?court=9th&navby=year&year=2007-10
Lexis website: *Friends of Pinto Creek v. U.S. Envtl. Protection Agency,* No. 05-70785, 2007 U.S. App. LEXIS 23251 (9th Cir. Oct. 4, 2007)

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Quotes from *Pinto Creek* (Case No. 05-7078; October 4, 2007)

Pinto Creek Listing

Due to excessive copper contamination from historical mining activities in the region, Pinto Creek is included on Arizona's list of impaired waters under § 303(d) of the Clean Water Act, 33 U.S.C. § 1313(d), as a water quality limited stream due to non-attainment of water quality standards for dissolved copper. Slip Op. at 13509

Applicable Rule

The Petitioners contend that as a "new discharger" Carlota's discharge of dissolved copper into a waterway that is already impaired by an excess of the copper pollutant violates the intent and purpose of the Clean Water Act. Under the NPDES permitting program, 40 C.F.R. § 122.4(i) addresses the situation where a new source seeks to permit a discharge of pollutants into a stream already exceeding its water quality standards for that pollutant**.** Section 122.4 states in relevant part:
No permit may be issued: . . . .

> (i) To a new source or a new discharger if the discharge from its construction or operation will cause EPA or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards . . . and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the public comment period, that: (1) There are sufficient remaining pollutant load allocations to allow for the discharge; and (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. 40 C.F.R. § 122.4 (2000).

Id. at 13514-13515

CWA & Offsets

The EPA contends that the partial remediation of the discharge from the Gibson Mine will offset the pollution. However, there is nothing in the Clean Water Act or the regulation that provides an exception for an offset when the waters remain impaired and the new source is discharging pollution into that impaired water. The regulation does provide for an exception where a TMDL has been performed and the owner or operator demonstrates that *before the close of the comment period* two conditions are met, which will assure that the impaired waters will be brought into compliance with the applicable water quality standards. The plain language of this exception to the prohibited discharge by a new source provides that the exception does not apply unless the new source can demonstrate that, under the TMDL, the plan is designed to bring the waters into compliance with applicable water quality standards. *Id.* at 13515-13516 (court emphasis)

"Lessening" Not Enough

In Carlota's case, there are no plans or compliance schedules to bring the Pinto Creek segment "into compliance with applicable water quality standards," as required by § 122.4(i)(2), which Carlota and the EPA both acknowledge is the applicable section with which Carlota must comply. The error of both the EPA and Carlota is that the objective of that section is not simply to show a lessening of pollution, but to show how the water quality standard will be met if Carlota is allowed to discharge pollutants into the impaired waters. *Id.* at 13519

WATER BRIEFS

ERRATA/ADDITION

HYDROPOWER & WATER QUALITY

One of our readers, Don Essig of the Idaho Department of Environmental Quality (IDEQ) contacted The Water Report and the authors of "Water Quality Standards & Hydropower Dams" (TWR #45), about additional information that our readers may find to be of interest.

On March 29, 2006, the US Environmental Protection Agency (EPA) approved the redesignation of the beneficial use of the Snake River from Brownlee, Oxbow, and Hells Canyon Reservoirs in Idaho, as part of Idaho's revision to its water quality standards. The purpose of the change was to remove the salmonid spawning use designation for that portion of the Snake River, as salmonid spawning has not occurred in this stretch of river since the construction of the Hells Canyon dams between 1958 and 1967. This redesignation was approved pursuant to 40 C.F.R. 13 1.10(g)(5), which addresses physical conditions related to the natural features of the water body, such as lack of proper substrate, cover, flow, depth, pools, riffles, and the like, that preclude the attainment of aquatic life uses. EPA's approval was not based upon the dam-related section of the UAA regulation and water quality discussed in The Water Report article (40 C.F.R. 13 1.10(g)(4)). The TWR article dealt with the implementation of 40 C.F.R. 13 1.10(g)(4) (relating to dams) and the potential for a hydropower operator to utilize this section, particularly in the face of a 401 water quality certification occurring as part of a FERC relicensing effort.

Mr. Essig also pointed out that a site-specific criterion (SSC) for fall Chinook spawning in the Snake River below Hells Canyon dam was previously adopted by the State of Idaho and approved by EPA on July 20, 2004. As discussed in the TWR article, Idaho Power Company is proposing another SSC for fall Chinook spawning temperatures, that has yet to be acted on.

For info: UAA and SSC approval letters can be obtained by contacting Don Essig, IDEQ, 208/ 373-0119 or email: Don.Essig@deq.idaho.gov

TRIBAL GROUNDWATER WA

LUMMI NATION SETTLEMENT

Washington's first-ever tribal-state-federal water rights settlement received federal court approval in Seattle on November 20. US District Court Judge Thomas Zilly signed a judgment and order approving the settlement, negotiated by the Washington Department of Ecology (Ecology), the Lummi Nation, the US Government, and non-tribal water users (including water associations and Winning Is Necessary (WIN)) to resolve a long-standing water conflict on the Lummi Reservation. (See Markham, TWR #17).

The dispute centered on how groundwater should be allocated on the Lummi Peninsula portion of the Lummi Reservation, northwest of Bellingham, Washington. The peninsula, which relies on a freshwater aquifer for its water supply, is bounded by the Strait of Georgia and Bellingham Bay. Over-pumping of the aquifer poses a risk of saltwater intrusion into the aquifer.

The agreement recognizes that approximately 900 acre-feet (AF) of water can be used each year without risking saltwater intrusion. This makes water available to all existing users and some future uses without risking saltwater intrusion. The Lummi Nation will allocate and monitor the use of this water by tribal members and by non-members who receive water service from the Lummi Nation. Ecology will administer about 120 AF/year of the available water for use primarily by non-tribal property owners.

Other provisions of the agreement include: a court-appointed Water Master will resolve any water conflicts that may arise in the future; wells on the Ecology allocation will have set withdrawal limits based on the amount of water allotted for the state to administer (standards to protect against saltwater intrusion will determine limits for wells on the Lummi allocation); residents with a well will be required to meter their wells and provide water quality sampling data; well drilling will require approval from the Lummi Nation or Ecology (whichever is the applicant's water-use authority); the settlement agreement went into effect immediately and authorizes the tribe and state to begin the coordinated management program.

The court also retained jurisdiction of the case "to modify this Order and Judgment upon motion of the parties, to appoint a Water Master and to replace the same as might be necessary from time to time, to decide appeals from decisions of the Water Master, and to resolve disputes regarding the annual budget of the Water Master." Order at 6.

The Water Report contacted Assistant Attorney General Barbara Markham, who worked on the case for the State of Washington, concerning her view of the settlement. "We succeeded in fashioning an historic first in Washington state — a settlement on Indian water rights among the US, the Tribe, and the State, by dividing the water and the regulatory authority."

For info: Larry Altose, Ecology, 425/ 649-7009Evelyn Jefferson, Chairwoman Lummi Nation, 360/ 384-7140; J. Timothy Slater, counsel for water associations, 360/ 734-5980; Gene Knapp, counsel for WIN, 360/ 376-4579; Settlement and Order available on Ecology's website**:** www.ecy.wa.gov/programs/wr/rights/us_lummi_ecy.html

STATE WATER MARKET CA

MWDSC PURCHASE PLANS

On November 21, the Board of Directors of the Metropolitan Water District of Southern California (Metro) authorized entering the water market to pursue back-up supplies to meet the region's needs next year and beyond. The move was designed to shore up the reliability of Southern California's imported water deliveries under continuing dry conditions. The proposed transfers would help make up for the anticipated reductions in Northern California supplies because of critically dry conditions and a court-imposed cutback in State Water Project (SWP) deliveries from the Sacramento-San Joaquin Delta.

Metro's board authorized the purchase of 13,750 acre-feet (AF) to 35,000 AF in dry years over the next 18 years from the Yuba County Water Agency. The board also authorized Metro, in conjunction with the State Water Project Contractors Authority, to pursue up to 200,000 AF of water for 2008 from the Central Valley through one-year option transfer agreements.

Metropolitan General Manager Jeff Kightlinger noted the pending supply impacts from a federal court decision that may reduce the availability of Delta supplies to Metropolitan by up to 30 percent to address declining

WATER BRIEFS

populations of Delta smelt. In addition, with the Colorado River having endured its eighth year of drought, Colorado River surplus supplies will not be made available to Metropolitan in 2008.

The actions today mark the third time since 2003 that Metropolitan has tapped the statewide water market to secure options. In 2005, Metropolitan worked with the State Water Project Contractors Authority to secure one-year transfer options on 125,000 acre-feet of Central Valley supplies, which the district did not exercise. Two years earlier, the district bought about 150,000 acre-feet of water from Sacramento Valley water users.

For info: Bob Muir, Metropolitan, 213/217-6930 or website: www.mwdh2o.com/

EXEMPT WELLS — WA

INTERIM AGREEMENT

The Washington Department of Ecology (Ecology) and Kittitas County have developed an interim water management agreement after local citizens petitioned Ecology seeking a temporary moratorium on new exempt wells in Kittitas County. Ecology signed the agreement as an alternative to a moratorium requested by the group Aqua Permanente. The November 9, 2007, "Agreement in Principle" provides a framework for protecting senior water rights and reducing the impact of the exempt wells on future water supplies in the Yakima Basin.

As part of the agreement, Ecology acknowledged that there is sufficient reason to believe that groundwater in the Yakima River Basin is in hydraulic continuity with surface water and that increased use of exempt wells may impair senior water rights. The Agreement at page two essentially states Ecology's chosen "alternative approach that implements interim measures to better understand water resource availability and generates data to support long-term decision making is preferable to withdrawal of all unappropriated ground water or rejection of the petition."

Aqua Permanente was concerned that rapid rural residential growth will impair senior water rights and stream flows in the Kittitas and Yakima valleys. Of particular concern is the proliferation of so-called "exempt wells" which do not require a water right permit from Ecology (RCW 90.44.050). The petitioners wanted the moratorium to stop the practice of some developers who are drilling multiple exempt wells to serve multi-home subdivisions.

Ecology received the Kittitas County water petition on September 13, 2007 and consulted with local governments, Indian tribes, legislators and land owners before making a decision by November 9, 2007. Even before receiving the petition, Ecology had cautioned county officials about the large number of wells being drilled and the rate at which new subdivisions were being approved in Kittitas County that rely on the exempt well provision.

Ecology Director Jay Manning noted that the Yakima River basin is one of the state's most water-short areas. Twice in the past seven years, surface water rights with priority dates as old as 1905 have been shut off during droughts because senior water right holders were not able to divert water they are entitled to. Homes and subdivisions extracting groundwater that flows into the Yakima or its tributaries could pose a risk to these senior water rights. Similarly, new groundwater withdrawals may interfere with river flows necessary to protect endangered or threatened salmon species. Ecology is concerned that buyers of homes in new subdivisions that rely on so-called exempt wells may be at risk of having their domestic water cut off in future droughts.

The Agreement (available at the Ecology website noted below) sets forth "Interim Management Measures." The interim measures put in place exempt well residential development standards that limit exemptions to 5,000 gallons per day for each 40 acres of land, for domestic use and irrigation of non-commercial lawn and garden. For development of less than 40 acres, the limits are to be prorated (e.g. for 20 acres, 2,500 gpd). The Measures also include a study to help determine the impact of exempt wells on the water resource; technical assistance by Ecology to Kittitas County, prospective water users and other stakeholders; and public notice by Kittitas County to prospective buyers and existing well owners of the risks concerning the reliability of the water supply.

Other provisions of the Agreement include a Ground Water Study; a Long-Term Water Management Program (to be based on the study); development of a Mitigation program, which would allow mitigation to be purchased to offset water resource impacts associated with exempt well use; and a Memorandum of Agreement (MOA) to finalize the commitments of the "Agreement in Principle" to be developed within 60 days (or as extended). The MOA is set to expire in three years from its effective date unless extended by the parties.

For info: Judy Beitel, Ecology, 360/407-6878 or email: jbei461@ecy.wa.gov; Ecology website: www.ecy.wa.gov/programs/wr/cro/kittitas_wp.html

CLIMATE CHANGE — US

IPCC REPORT RELEASED

The Summary for Policymakers - Intergovernmental Panel on Climate Change Report (Fourth Assessment Report) was released on November 16. The "Synthesis Report" is based on the assessment carried out by the three Working Groups of the IPCC and provides an integrated view of climate change as the final part of the IPCC's Fourth Assessment Report.

For info: Report available at: http://195.70.10.65/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

WATER CABINET — NM

GOVERNOR'S EXECUTIVE ORDER

On November 2, Governor Bill Richardson signed an executive order creating a Water Cabinet to unify the direction of all executive agencies with responsibilities for New Mexico's water. The Water Cabinet will align the State Water Plan with water and wastewater infrastructure development, environmental regulations, and existing planning documents.

"Creation of the Water Cabinet will help coordinate water policy at the highest level," Governor Richardson said. "Water is our most precious resource and the looming spectre of global climate change will only make protecting our limited water resources all the more important. Having cabinet level policy makers working together will ensure money is more efficiently funneled to water and wastewater projects that make a difference for New Mexicans."

The Cabinet will also be responsible for promoting interagency coordination of water and wastewater infrastructure funding, expanding the management capacity of local water and

WATER BRIEFS

wastewater systems, and developing policy recommendations for addressing drinking water emergencies. The Executive Order directs the Secretary of the New Mexico Environment Department to reorganize and create a new Division of Water and Wastewater Infrastructure Development. This Division will lead an interagency effort to bring consistency and coordination to the funding of water and wastewater infrastructure and create a "uniform application" that will streamline the process for local communities seeking state or federal funding.

The Water Cabinet will include the Interstate Stream Commission, the State Engineer, the New Mexico Environment Department, the Agriculture Department, the New Mexico Department of Game and Fish, the Energy, Minerals, and Natural Resources Department, the Department of Finance and Administration, the New Mexico Finance Authority, and a representative of the Governor's Office.

The Governor's office noted that the Executive Order is an important step in carrying through on the Year of Water. The 2007 legislature appropriated more than $60 million dollars for statewide water projects, including $10 million for Indian Water Rights settlements, $2.5 million for river ecosystem restoration, $12 million for the Eastern Navajo pipeline project, and more than $20 million for water and wastewater projects funded through the Water Trust Fund and Water Project Fund.
For info: Stephanie Lenhart, DFA, 505/ 827-3881; Order available at: www.governor.state.nm.us/press/2007/nov/110207_02.pdf

EFFLUENT AUCTION AZ

$67 MILLION SALE

The Town of Prescott Valley sold 2,724 acre-feet (AF) of effluent water for more than $67 million during an innovative two-day auction on Oct. 29-30. The town awarded the effluent water to the highest bidder — Water Property Investors LLC, a New York-based water resource investment firm — for $24,650 per AF. Water Property Investors can re-sell or use the water to meet state water supply requirements for new subdivision developments.

The auction attracted local and national bidders through the use of a unique price-floor bid process that the town's consultants, WestWater Research LLC, developed and arranged. The town set a minimum-bid price by negotiating a $53 million agreement with Aqua Capital Management LP, a Nebraska-based water resource company. The company worked cooperatively with Prescott Valley for more than nine months to develop a price-floor agreement that provided financial security for the unprecedented effluent water auction. The agreement provided the town a guaranteed price of $19,500 per AF and would have awarded the effluent water to Aqua Capital if no qualified bids were received during the two-day auction.

Water Property Investors, LLC, will have until November 30, 2007 to close its bid with the Town. As noted above, the purchaser may either use or re-sell the effluent interests. However, when the effluent interests are put to use, they must be put to a beneficial use within the Town of Prescott.
For info: Clay Landry, WestWater Research LLC, 360/ 695-5233 or website: www.waterexchange.com

INTERSTATE WQ OR/AR

SURFACE/GROUNDWATER CONTAMINATION

Citing an "imminent and substantial endangerment" to public health, the State of Oklahoma on November 14 asked a federal judge to prohibit any further land application of poultry waste in the Illinois River Watershed. Showing a "direct path from the place of poultry waste disposal to the locations... where contamination is found," the state presented evidence that the poultry companies' reckless waste dumping is contributing to high levels of bacteria in Oklahoma.

Oklahoma, through Attorney General W.A. Drew Edmondson and Secretary of the Environment Miles Tolbert in 2005, sued several out-of-state poultry companies in Arkansas for the pollution caused by the improper land application and storage of hundreds of thousands of tons of poultry waste. The state accuses the companies of knowingly violating numerous state and federal environmental laws with their careless waste-dumping methods. Oklahoma officials have estimated that about 347,000 tons of bacteria-laden poultry waste is generated in the watershed every year, and the majority of that waste dumped in the watershed.

Oklahoma is seeking the injunction now so the court will have time to rule before the winter and spring waste disposal seasons expose even more of these harmful bacteria to the surface water and groundwater. An Oklahoma expert found around 70 percent of poultry waste land application in the watershed occurs during the first six months of the year, with almost half of the total application occurring from March to June.

According to a press release by Edmondson's office, scientific sampling has discovered a "unique chemical and bacterial signature" that indicates contamination by poultry waste. This signature has been found in the soil at the waste disposal fields and in runoff water from those fields.
For info: Oklahoma AG's website: www.oag.state.ok.us/oagweb.nsf/

NRC REPORT OR/CA

KLAMATH RIVER BASIN

The National Research Council Committee's report, *Hydrology, Ecology, and Fishes of the Klamath River Basin,* was released on November 28. The report from the National Research Council says for the studies to prove more useful for decision makers, a comprehensive analysis of the basin should be completed to identify all research and management needs. "Science is being done in bits and pieces, and there is no conceptual model that gives a big picture perspective of the entire Klamath River basin and its many components," said William L. Graf, professor of geography at the University of South Carolina, Columbia, and chair of the committee that wrote the report. "As a result, the integration of individual studies -- such as the two examined by the committee -- into a coherent whole has not taken place, and it is unlikely to take place under the present scientific and political arrangements."

The studies included models that were intended to help reconstruct pre-development flows (without dams or irrigation) and to help understand the relationship between flows in the Klamath River and the amount of river habitat available for use by anadromous fishes. The report also evaluated the US Bureau of Reclamation's Natural Flow of the Upper Klamath Basin study and Utah State University's Instream Flow Phase II study.
For info: Report available at: www.nap.edu/catalog.php?record_id=12072

CALENDAR

December 18-20 WV
Understanding and Applying Environmental Flows Training, Shepherdstown. USFWS National Conservation Training Center. RE: Development of Environmental Flows & Use of Indicators of Hydrological Alteration Software; sponsored by The Nature Conservancy. For info: Diedre A. Paterno Pai, TNC, 303/ 541-0344, email: dpaterno-pai@tnc.org, or website: www.nature.org/initiatives/freshwater/conservationtools/art21768.html; or NCTC website: http://training.fws.gov

January 1-10 LA
Optimizing Decision-Making and Remediation at Complex Sediment Sites, New Orleans. Wyndham at Canal Place. For info: Sediment Management Workgroup website: www.smwg.org/

January 10 WA
Joint Afternoon Meeting of the Fish and Wildlife Commissions for Oregon and Washington, Vancouver. Red Lion Inn at the Quay. Joint Reception from 6 to 8pm. For info: Director's Office ODFW, 503/ 947-6044, email: odfw.commission@state.or.us, or website: www.dfw.state.or.us/agency/commission/minutes/

January 11 CA
California State Water Board Funding Fair 2008, Sacramento. Cal/EPA Bldg. RE: Water & Related Environmental Funding Opportunities Available Through the State. For info: Erin Ragazzi, SWB, 916/ 341-5733, email: enragazzi@waterboards.ca.gov or website: www.waterboards.ca.gov/funding/fundingfair2008.html

January 11 WA
Conservation Easements, Seattle. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=952&page=Conservation_Easements

January 11 CO
Conservation Easements SuperSeminar, Denver. Grand Hyatt. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=950&page=Conservation_Easements_SuperSeminar

January 14-15 WA
Buying & Selling Electric Power in the West, Seattle. Crowne Plaza Hotel. RE: FERC Update, State Regulatory Challenges, Renewables & More. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

January 14-15 CA
California Wetlands, Sacramento. Hyatt Regency. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=953&page=California_Wetlands

January 14-15 NV
Nevada Water Law Conference, Reno. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=917&page=Nevada_Water_Law

January 15-16 MT
Montana Water Policy Interim Committee Meeting, Hamilton. For info: Krista Lee Evans, Lead Staff, 406/ 444-1640; Committee website: http://leg.mt.gov/css/lepo/2007_2008/water_policy/default.asp

January 16 CA
Implementing Sustainable Development Programs, Irvine. RE: How Companies Can Achieve Competitive Business Advantage Through Sustainable Business Approaches; Successful Programs Presented & Discussed. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

January 16 WA
SEPA & NEPA, Seattle. Red Lion Hotel. For info: Law Seminars Int'l, 800/854-8009, email: registrar@lawseminars.com or website: www.lawseminars.com/detail.php?SeminarCode=08SEPAWA

January 17 CA
Landform Grading and Soil Ecology: Preserving Natural Hydrologic Functions in Watersheds Impacted by Development, Sacramento. California EPA Bldg.. Sponsored by the California State Water Resources Board. For info: Mary Tappel, SWRCB, 916/ 341-5491, email: mtappel@waterboards.ca.gov or website: www.waterboards.ca.gov/nps/index.html

January 21 AK
Permitting Strategies in Alaska, Anchorage. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 22-23 CO
Colorado Water Conservation Board Meeting, Denver. For info: www.cwcb.state.co.us/

January 24-25 NM
Law of the Rio Grande SuperConference, Albuquerque. For info: CLE International, 800/ 873-7130 or website: www.cle.com

January 24-25 WA
15th Annual Endangered Species Act Seminar, Seattle. State Convention & Trade Center. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 24-25 CA
Criminal Enforcement of Environmental Laws, Los Angeles. Biltmore. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=957&page=Criminal_Enforcement_of_Environmental_Laws

January 28-29 FL
Growth and Water Supply Conference, West Palm Beach. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=962&page=Growth_%26_Water_Supply

January 30-February 2 IL
Water Environment Federation Midyear Meeting, Chicago. Sheraton Chicago Hotel & Towers. RE: Knowledge and Technology Exchange within the Water and Wastewater Fields. For info: WEF website: www.weftec.org

January 31-February 1 WA
Introduction to Aquatic Toxicology: Understanding Impacts of Organic Chemicals and Metals on Aquatic Ecosystems, Lacey. Lacey Community Center, 6729 Pacific Avenue SE. Course ID: ETOX - 410 (2 days); instructor: Ruth M. Harper, PhD. For info: Northwest Environmental Training Center: www.nwetc.org or register online: https://nwetc.websitesource.net/reg_etox-410_01-08_lacey/registration.htm

February 1-2 OR
Pacific Northwest Groundwater Exposition, Portland. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

February 5-7 WA
Stream Restoration Symposium, Stevenson. Skamania Lodge. For info: http://rrnw.org/symposium.htm

February 7-8 ID
Water Rights Transfers, Boise. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net/seminar-request.lasso?seminar=08.WAMID

February 9 CO
An Evening About Colorado's Water Resources, Fort Collins. Morgan Library (CSU). For info: CSU website: http://lib.colostate.edu/archives/water/

(continued from previous page)

February 11 CA
Long Range Planning & Water Policy in California, Ontario. Ontario Convention Center. For info: American Ground Water Trust, 800/ 423-7748 or website: www.agwt.org/workshops.htm

February 11-12 TX
Texas Wetlands, Austin. Omni Downtown. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=965&page=Texas_Wetlands

February 13 OR
Fishing the Past to Feed the Future: Archaeology, Historical Ecology, and Restoration of Marine Ecosystems, Eugene. University of Oregon, Many Nations Longhouse. For info: Christina Davis, ENR, 541/ 346-1395, email: cdavis6@uoregonl.edu, or website: www.law.uoregon.edu/org/jell/climate.php

February 19-20 MT
Montana Water Policy Interim Committee Meeting, TBA. For info: Krista Lee Evans, Lead Staff, 406/ 444-1640; Committee website: http://leg.mt.gov/css/lepo/2007_2008/water_policy/default.asp

February 19-21 OR
Northwest Hydroelectric Association Conference, Portland. Marriott Hotel. For info: NWHA, 541/ 610-3311 or website: www.nwhydro.org

February 20-22 CA
2008 Environmental Industry Summit, San Diego. Coronado Island Marriott Resort. For info: Summit website: www.ebiusa.com/Summit2007/

February 20-22 NM
Western Coalition of Arid States Winter Conference, Albuquerque. Embassy Suites. RE: Water Resrouces Planning for Climate Change in the Arid West. For info: WESTCAS, 202/ 966-2190 or website: www.westcas.org

February 21 CO
Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) Workshop, Denver. RE: Clean Water Act, Scope of the NPDES Program, other water regulations (e.g., SPCC, Wetlands), case studies and more. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

February 21-22 CA
26th Annual Water Law Conference (American Bar Association), San Diego. For info: ABA website: www.abanet.org/environ/waterresources/home.html

February 21-22 GA
Southeast & Georgia Wetlands & Water Law Update, Atlanta. Hyatt Regency. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net/seminar.lasso?seminar=08.WETGA

February 21-24 NM
13th Water Conservation/ Xeriscape Conference and Expo, Albuquerque. Marriott Pyramid Hotel. For info: Scott Varner, Xeriscape Council of New Mexico, 505/ 468-1021, email: scott@xeriscapenm.com or website: www.xeriscapenm.com

February 25-26 DC
Ground Water Industry Legislative Conference, Washington D.C.. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

February 26-28 DC
2008 Association of California Water Agencies Washington DC Conference, Washington DC. Washington Court Hotel. For info: ACWA website: www.acwa.com//events/acwa_events.asp

February 27 OR
Environmental Entrepreneurship, Eugene. University of Oregon, Many Nations Longhouse. For info: Christina Davis, ENR, 541/ 346-1395, email: cdavis6@uoregonl.edu, or website: www.law.uoregon.edu/org/jell/climate.php

February 28 OR
Aquifer Storage & Recovery and Artificial Recharge, Corvallis. SU (LaSells Stewart Center). For info: Michael Campana, Institute for Water & Watersheds, 541/ 737-2413 or email: aquadoc@oregonstate.edu

February 28-29 NV
Family Farm Alliance 20th Annual Meeting & Conference, Las Vegas. Monte Carlo Resort & Casino. For info: Dan Keppen, FFA, 541/ 850-9007, email: DanKeppen@clearwire.net or website: www.familyfarmalliance.org

The Water Report
Water Rights, Water Quality & Water Solutions in the West
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