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Water Rights, Water Quality & Water Solutions in the West

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ECOMARKET APPROACHES TO ADDRESSING WATER QUALITY OBLIGATIONS

LEGAL OVERVIEW & THE HELLS CANYON TEST CASE

by Richard M. Glick and Raven Nocar, Davis Wright Tremaine LLP (Portland, OR)

INTRODUCTION

Reliable water supply and water quality are two-sides of the same coin — both are essential to sustainable economies and ecosystems. Yet our laws do not function conjunctively to promote healthy streams and plentiful water for people. The Doctrine of Prior Appropriation, applicable everywhere in the American West, encourages aggressive use of water so as to preserve the water right, but not necessarily enhance efficient use. Exercise of water rights has a direct effect on water quality, particularly in the Pacific Northwest where our most serious water quality problems relate to flow conditions and water use. Water withdrawals and irrigation practices often result in degraded habitat conditions for aquatic species. Water quality standards to protect water-dependent species, such as temperature, dissolved oxygen, and suspended solids are often unmet. However, the water quality regulatory tools are designed to address a different problem, that is, end-of-the-pipe or "point source" discharges of industrial or municipal waste. The result is a ratcheting up of permit requirements on industrial and municipal dischargers without addressing the core problem of unregulated nonpoint discharges.

This is not to suggest that irrigated agriculture or other appropriators are to blame for the current poor water quality in many Northwest streams, or that a new regulatory program is needed. In most Western states, agricultural water rights are the oldest, with legally protected priority. Further, most family farms take pride in their stewardship of land and water, and margins are usually too thin to support aggressive runoff control. However, irrigated agriculture is an important part of the solution. Burgeoning water supply and water quality markets offer the potential for better environmental outcomes than enhanced regulation, and at lower cost.

The availability of water is under strain due to increased competition for the water — partially, the demand for instream uses competing against demand for consumptive use and receiving waters for waste discharge. Oregon laws do not currently lend themselves to optimal use and achieving best conservation practices when aimed at over-appropriated waters and nonpoint source pollution. Nevertheless, much can be done under existing law if the water-using community and regulatory agencies are creative and willing to accept some risk.

WATER QUALITY STRESSORS

According to the Oregon Department of Environmental Quality (ODEQ) the largest source of water pollution in Oregon's rivers, lakes and streams comes from nonpoint source pollution, in particular, surface runoff. The introduction of sediments, nutrients and toxins into streams, rivers and lakes from multi-source land-based activities alters water quality adversely. These changes are manifest by increased water temperature, increased

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Current Standards

Trading Encouraged

Reduction Trading

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suspended solids levels and decreases in dissolved oxygen. These changes to water quality in turn cause damage to fish, wildlife, habitats, and drinking water supplies, promote weed growth, and degrade the State's recreation sites and natural landscape. In effect, the adverse consequences are quite far-reaching.

Currently, Oregon's primary means for keeping water pollution at bay are contained in Oregon Revised Statute Chapter 468B. This chapter outlines Oregon's policy goals relating to water pollution abatement and control, enforcement mechanisms, and the water quality permitting process. Point source discharges are subject to permit, whereas diffuse sources of pollution, such as field runoff are not. When ODEQ finds that a particular stream is not attaining standards, it establishes Total Maximum Daily Loads (TMDLs), which allocate responsibility for various pollution loads on point and nonpoint sources alike, but are only enforceable against point sources. As a practical matter, the burden of correcting water quality problems falls immediately upon permit holders, while implementation of allocations to nonpoint sources can be deferred for decades.

WATER QUALITY TRADING

Oregon is moving in the direction of a multi-tiered approach that promises to bring optimal long-term water quality improvements. In 2001, ORS 468B.555, the Willamette Watershed Improvement Trading Act (the Act) was adopted. The Act charges ODEQ with developing a pollutant trading program as a means of achieving water quality objectives and standards in a manner that complies with state and federal water quality regulations. The Act strives to encourage trading as a means of promoting economic efficiency. The Act prioritizes trades that target the effects of nonpoint source pollution, e.g., phosphorus loading. It also emphasizes the need to adopt practical procedures for pollutant trading — procedures that can be implemented using reasonable engineering judgment. The Act encourages minimization of regulatory fees to facilitate and encourage pollutant trading.

The Act represents a form of pollution reduction trading, also known as water quality trading. This framework is a market driven means of addressing water quality problems. Typically, under this system, a regulated party confronting relatively high pollution control costs works cooperatively with a third party at a lower expense to achieve equivalent (or greater) pollution reduction. This system recognizes that the best opportunities for improving water quality and watershed health requires identifying nonpoint sources that have an economic interest in working with point sources. It allows ODEQ to consider watersheds holistically and encourages cost effective outcomes rather than capital-intensive and energy-intensive treatment technology fixes at particular sites. It is a framework that looks towards advancing solutions that will improve the Willamette River's water quality in the long run.

The Willamette Partnership, established to increase the pace, scope and effectiveness of conservation efforts in the Willamette Basin, is at the forefront of ecomarketing in Oregon. The goal of the organization is to optimize environmental benefits by developing a market-driven system that facilitates cooperation between agencies and industry while reducing the costs and conflicts associated with compliance under the traditional regulatory system. The US Environmental Protection Agency (EPA) allocated nearly $775,000 to promote the effort. The Partnership has been in the process of identifying and creating a Willamette Ecosystem Marketplace (WEM) in which buyers and sellers will trade conservation credits — a new form of currency created when action is taken to produce quantifiable improvements to watershed health. WEM focuses on public and private ecological investments which will serve the entire Willamette River Basin through improved water quality.

The Act and the efforts of the Willamette Partnership model the types of efforts which are needed to address Oregon's complex nonpoint source pollution water problems. At this time, ORS 468B.555 is aimed at protecting only the Willamette watershed and the system is still under development.

However, Clean Water Services (CWS), the second largest sewerage agency in Oregon, has developed an innovative ecomarket approach to regulatory compliance. Facing a temperature problem at its four outfalls to the Tualatin River, CWS proposed consolidating its four permits so that they could be managed in an integrated manner. Further, rather than installing a mechanical chiller to reduce discharge temperatures, CWS and ODEQ agreed to a large-scale riparian vegetation planting program to provide long-term shade. CWS avoided investing more than $60 million in technological upgrades by restoring 35 miles of 150-foot-wide stream buffers and paying farmers for use of their land for restoration. The anticipated outcome is lower long-term river temperatures. See Cordon, TWR #24.

Both federal and state agencies recognize the benefits to be obtained from pollution reduction trading and are actively supporting such efforts. EPA established a policy document on water quality trading on January 13, 2003 (www.epa.gov/owow/watershed/trading/finalpolicy2003.pdf), which states in part, "[t]he United States Environmental Protection Agency (EPA) believes that market-based approaches such as water quality trading provide greater flexibility and have potential to achieve water quality and environmental

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EPA Policy

benefits greater than would otherwise be achieved under more traditional regulatory approaches." EPA's water quality trading policy provides guidance to states and tribes on how to conduct trading under the Clean Water Act and its implementing regulations. It discusses Clean Water Act (CWA) requirements relevant to water quality trading such as the requirements to obtain permits, anti-backsliding provisions, development of water quality standards, National Pollutant Discharge Elimination System permit regulations, TMDLs, and water quality management plans. As a demonstration of EPA's commitment to the endeavor in Oregon, EPA granted Oregon a grant to identify a model pollution trade system in 2001.

Oregon Directive

Oregon created a project manager position for ODEQ's water quality trading projects and issued its own water quality trading document on January 13, 2005: *Water Quality Trading Internal Management Directive* (www.deq.state.or.us/wq/pubs/imds/wqtrading.pdf). Hopefully, the momentum growing behind this effort will establish pollution reduction trading as a preferred means of addressing water quality problems throughout the state. The absence of regulatory controls combined with limited resources for implementation indicates that nonpoint source pollution problems need multi-tiered solutions that improve the long-term health of Oregon's watersheds. Ecomarket approaches will be increasingly important.

WATER QUANTITY STRESSORS

Very little water remains available for new appropriation in Oregon. Many Oregon streams are over-appropriated. Part of the problem is that the water laws fail do not adequately promote optimal water use. In fact, Oregon's water code encourages in certain cases inefficient water use because water right holders may lose all or a portion of their water right if they fail to use it.

Prior Appropriation

In 1909, Oregon adopted a water code based on the Doctrine of Prior Appropriation, establishing state control over the right to use water. Prior to that time, water users relied on themselves and local courts to define the scope of their rights to Oregon water.

Prior appropriation means the first person to obtain a water right to any source of water (stream, lake, river, groundwater, etc.) is the last to be deprived during periods of low flow. The water right holder with the oldest date of priority can utilize water as specified under the terms of the water right without regard to the needs of junior users when water is in short supply. When water is bountiful, the needs of junior users are satisfied in turn, down the line by date of oldest priority, as long as the water is available.

Permit System

Water is owned by the people, but individuals may obtain the right to use the water from the Oregon Water Resources Department (OWRD) through the state's permit system. ORS 537.110, ORS 537.130 and ORS 537.140. The water permit must specify the details of the authorized use and set forth any terms, limitations and conditions OWRD considers appropriate. ORS 537.211. The permit creates an inchoate right, which allows construction of water works to put water to beneficial use. *Id.* Once beneficial use of the water is proved, the inchoate right ripens into a vested water right and a certificate is issued. ORS 537.250. The water right continues in perpetuity so long as water is applied to beneficial use in accordance with the terms and conditions of the certificate. *Id.* The right is appurtenant to the land and passes to successors by operation of law. The priority date of the right reverts back to the date of permit filing. ORS 537.097 and ORS 537.620.

Forfeiture and Cancellation

If a water right holder fails to make beneficial use of the water (without lapse) for five or more consecutive years under the certificate, the right is rebuttably presumed to be forfeited. ORS 540.610. Cancellation can also occur at the earlier permitting stage, if the holder fails to abide by permit conditions and complete construction within five years. *Id.*

Inefficiency Result

The "use it or lose it" element of prior appropriation law sometimes results in inefficiency and less than optimal water use. The fear of loss motivates the water right holder to use the water to the full amount under the permit or certificate, whether needed or not. The very regulations imposed to protect Oregon's water supply at times leads to water waste and unmet public policy goals — water is not adequately protected or efficiently applied.

Change of Use

Water Right Transfers and Other Options

Another concern is inflexibility in the law. Use is restricted to what is designated under the terms and conditions of the permit or certificate — place of use, point of diversion, and type of use. However, a water rights certificate holder may apply to change the place of use, point of diversion, or nature of use without losing priority. To do this a water right holder must seek leave to make changes to a water right through a transfer application process with OWRD. ORS 540.505 et seq. Transfers are not available to permit holders; to change a permit, it must be amended. ORS 537.211. Oregon allows for permanent transfers, temporary transfers and adopted special rules for transfers involving water districts, government interference and longstanding practices. *Id.* A temporary transfer may not exceed a period of five years. ORS 540.523.

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"No Injury Rule"

If a water right holder wishes to change the water right they will be confronted with a host of obstacles — the administrative process is time and information intensive and a "no injury rule" as to all impacted water users must be met. When a transfer would improve the overall health of a watershed the obstacles inherent in navigating the transfer process become clearly troubling. If Oregon facilitates a dynamic short-term transfers program and promotes regional water banking then the harms from the inefficiencies and inflexibility built into Oregon's law may be countered. Of course, junior appropriators must continue to be protected, but the process could be streamlined. One device for protecting water rights against forfeiture for non-use is the instream leasing program. ORS 537.332 through ORS 537.360 represents Oregon's current instream transfer, leasing and dedication program. It allows water right holders a way to protect water rights left unused while maintaining flows for aquatic habitat. Instream leases go through an expedited review process. These types of leases make it possible for growers to apply only water that is necessary and protect the unused water under their water rights. Split season leasing allows for both in-stream and existing uses to occur from the same water right. The term of an in-stream lease is limited to five years but can be renewed. The Freshwater Trust, formerly known as the Oregon Water Trust, is an efficient vehicle for bringing about such leases.

Instream Leases

Needed Changes

Oregon would benefit from a more expansive water transfer program. For example, growers still need a system that will make it possible for them to voluntarily temporarily take lands out of production, change to less water intensive crops and when feasible substitute irrigation water supply (e.g. groundwater for surface water) without fear of losing their water rights. Water right holders need to be able to make water use decisions based on supply and demand incentives, while protecting their property rights. This would maximize water conservation by giving water right holders increased benefits for making changes to their business practices that promote temporary and permanent instream dedications.

Water Banks

Water banks could facilitate flexible use of water. In general, a water bank is an institutional arrangement wherein water rights are "deposited" and may be withdrawn by the owner or leased to someone else for a specified period, for a specified price. Transaction costs are reduced through an expedited process. Depositors are protected against forfeiture. Both California and Idaho have state-wide water bank systems.

In Oregon, which lacks the infrastructure for a statewide system, regional water banks are forming. The state is encouraging such efforts. OWRD awarded grants to 16 communities in 2008 for use in their water supply planning efforts, some of which involved water banking. The Deschutes River Conservancy (DRC) on behalf of the Deschutes Water Alliance (DWA) was one such recipient in the amount of $10,000. The funds go towards the DWA Water Bank Outreach and Marketing Project which aims to create and implement a well-defined marketing and outreach plan for the DWA Water Bank.

Deschutes Bank

The DWA Water Bank came into being in 2004 through the efforts of the Deschutes Basin Board of Control (DBBC), The Confederated Tribes of Warm Springs, the DRC, and the Central Oregon Cities Organization (COCO). It was created to help guarantee adequate water supplies for Central Oregon cities, agriculture, and the Deschutes River. This water bank is market and volunteer based and uses existing Oregon water law regulations and cooperative agreements to further its mission. Current members of the DWA Water Bank are the Deschutes River Conservancy, Central Oregon Irrigation District, Swalley Irrigation District, City of Bend, City of Redmond, and Avion Water Company.

Groundwater Mitigation

The DRC administers and staffs the DWA Water Bank and a separate Groundwater Mitigation Bank (GMB) in which buyers can obtain temporary mitigation credits through an in-stream leasing program. The program aims to protect existing water rights, allow for new groundwater uses and create new opportunities for meeting instream flow targets throughout the Deschutes Basin.

The rules in OAR 690-521-0100 through 690-521-0600 set the process for recognizing and establishing mitigation banks in the Deschutes Basin and the process to establish, obtain and assign mitigation credits pursuant to Chapter 659, 2001 Oregon Laws (HB 2184). Oregon's OWRD rules promote cooperation between the agencies to further such mitigation efforts. As per OAR 690-521-0300 (7), "[t]he Department shall work in cooperation with a representative of the Oregon Department of Fish and Wildlife, Oregon State Parks and Recreation Department, Oregon Department of Environmental Quality and Division of State Lands to enhance the resource benefits and make the most effective use of mitigation projects and mitigation water."

Temporary Rotations

Regional water banks in Oregon facilitate temporary reduction in land cultivation through rotations and avoid permanent changes in land use. This keeps water in-stream which improves watershed water quantity health. Thus, water banks are a means for promoting and funding efficiency improvements in the use and distribution of water where it is needed most.

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Water Quality Impacts

THE HELLS CANYON COMPLEX

AN ECOMARKET TEST CASE

Relicensing of Idaho Power Company's Hells Canyon Complex (HCC) will be a test case for application of ecomarket solutions to environmental regulatory problems. HCC is a 1,166.9 MW hydroelectric facility comprised of three dams on the Snake River: Brownlee, Oxbow and Hells Canyon Dams. The total storage at full pool of those reservoirs is, respectively, 1,420,062 acre-feet; 58,385 acre-feet; and 167,720 acre-feet. As part of the Federal Energy Regulatory Commission (FERC) relicensing effort, Clean Water Act § 401 (CWA § 401) requires certification from the affected state that water quality standards will be maintained. Since the Snake is a border river between Idaho and Oregon, and since HCC discharges from both sides of the river, certification is required from both. The approach to addressing HCC water quality impacts includes a combination of water quality trading and water marketing. See FERC Project No. 1971.

The Snake River upstream of HCC is heavily used, both for withdrawals to serve irrigated agriculture and for municipal and industrial wastewater discharge. The two most significant water quality issues concerning HCC are dissolved oxygen and temperature. While HCC certainly has an independent effect, overall water quality is strongly influenced by upstream human activity. Low dissolved oxygen levels are present in the transition zone of Brownlee Reservoir, the largest and uppermost of HCC's facilities. Upstream nutrient loads reach the relatively slack and shallow waters of the transition zone, bake in the sun and sprout algae, which consumes oxygen. The Snake River-Hells Canyon Total Maximum Daily Load (TMDL) assigned HCC a 1,200 ton load allocation for dissolved oxygen as a result. One solution would be to install a mechanical aeration device in the reservoir to pump oxygen into the transition zone. Another would be to do a water quality trade in which an upstream discharger to the river would land apply its wastewater instead. Idaho Power is hopeful of finding an upstream trading partner to do a deal that would cover its load allocation. While both alternatives would likely solve the regulatory problem of meeting the load allocation, the trade would provide better results both in the reservoir and in upstream river water quality. It would also eliminate ongoing operation and maintenance expenses, including the energy to operate the aerator. Low levels of dissolved oxygen occurring below HCC can readily be addressed through installation of aerating runners on the Brownlee turbines, which is what Idaho Power proposes.

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Temperature Program

Temperature is a trickier problem, but amenable to an ecomarketing approach. In its CWA § 401 application, Idaho Power proposes a watershed approach to meet HCC's temperature responsibility. This paper provides a brief overview of the proposed Temperature Enhancement Management Program (TEMP) taken from the application, which can be found at www.idahopower.com/AboutUs/RatesRegulatory/Relicensing/hellscanyon/HCapplication.cfm.

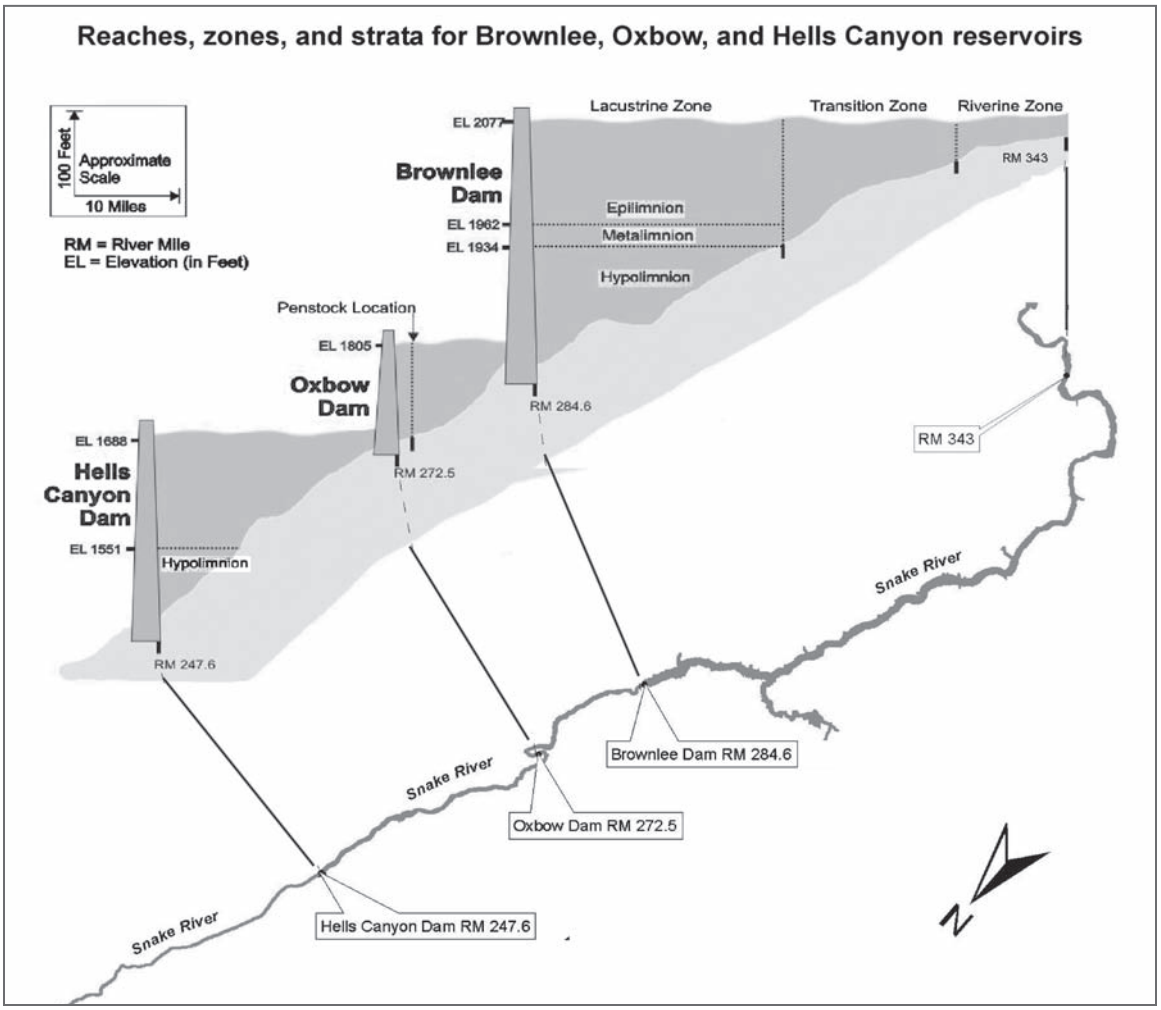
Multiple Benefits

As noted, upstream water quality conditions in the vast Snake River Basin have become degraded due to a complex interplay of natural and human forces. These sources affect inflow temperatures in Brownlee Reservoir, but also increase suspended solids, deplete dissolved oxygen and otherwise reduce water quality. To complicate matters, the delayed effects of upstream groundwater pumping, decreased surface water recharge caused by changes in irrigation practices, recent drought, and expected climate change likely will result in less flow in the Snake River above Brownlee Reservoir than historically experienced. By implementing projects that improve the upstream watershed and enhance declining river and tributary spring flows, TEMP seeks to meet HCC temperature responsibility and also to benefit Snake River water quality and aquatic habitat overall.

The Snake River-Hells Canyon (SR-HC) TMDL assessment of water quality conditions in the Snake River reach above Brownlee Reservoir identified substantial water quality concerns centered on excessive nutrient loading. Sediment, which is listed as a pollutant in the upstream Snake River segment, was identified as not only having an affect on aquatic life, but also was identified as a transport mechanism for mercury, pesticides and nutrients. The TMDL noted that the SR-HC TMDL reach is a highly complex system and that as implementation of overall TMDL measures proceed, additional assessment and re-visitation of the impacts and benefits to beneficial uses and system impairment will be necessary. TEMP would be an important step toward meeting this need.

Adaptive Management Approach

TEMP would constitute a collaborative and adaptive management approach to a range of water quality issues in the Snake River Basin. It would involve other stakeholders in an effort to address multiple watershed issues and also to leverage Idaho Power Company (IPC) funds against other funding sources to maximize the potential of the program. IPC would develop and vet potential projects in consultation



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Watershed Improvements

with key stakeholders comprising a Watershed Advisory Committee (WAC), and those projects would be subject to approval by the Oregon and Idaho DEQs. In other words, the TEMP approach would convert a local water temperature problem into a regional opportunity to address a basin-wide set of water quality issues. Watershed improvement projects would include, among other things, riparian revegetation, fencing of streams, corrections to stream bed morphology, flow augmentation through water rights acquisitions and cooperative operational arrangements.

In the process of developing and implementing watershed measures, IPC will maximize temperature amelioration through coordination with WAC and other stakeholders in the basin in an effort to identify and initiate projects that not only address a range of water quality or other habitat issues in the watershed, but also promote cost-sharing contributions from other stakeholders. Thus, TEMP will act as a catalyst for improving temperature conditions, overall water quality, and aquatic habitat in the Snake River above and below the HCC.

Extensive Scope

With TEMP's broad, regionally unprecedented ambitions come the need for managing expectations. Due to the complexity and extensive geographic scope of the watershed and the effort required to address its water quality issues, an extended time period for implementation and system response is inescapable. As stated in the TMDL, "this system, with its sequential tributary TMDL processes, wide diversity of land use and staggering size will no doubt require several decades to respond completely to implementation projects and changes in management" (SR-HC TMDL 2004).

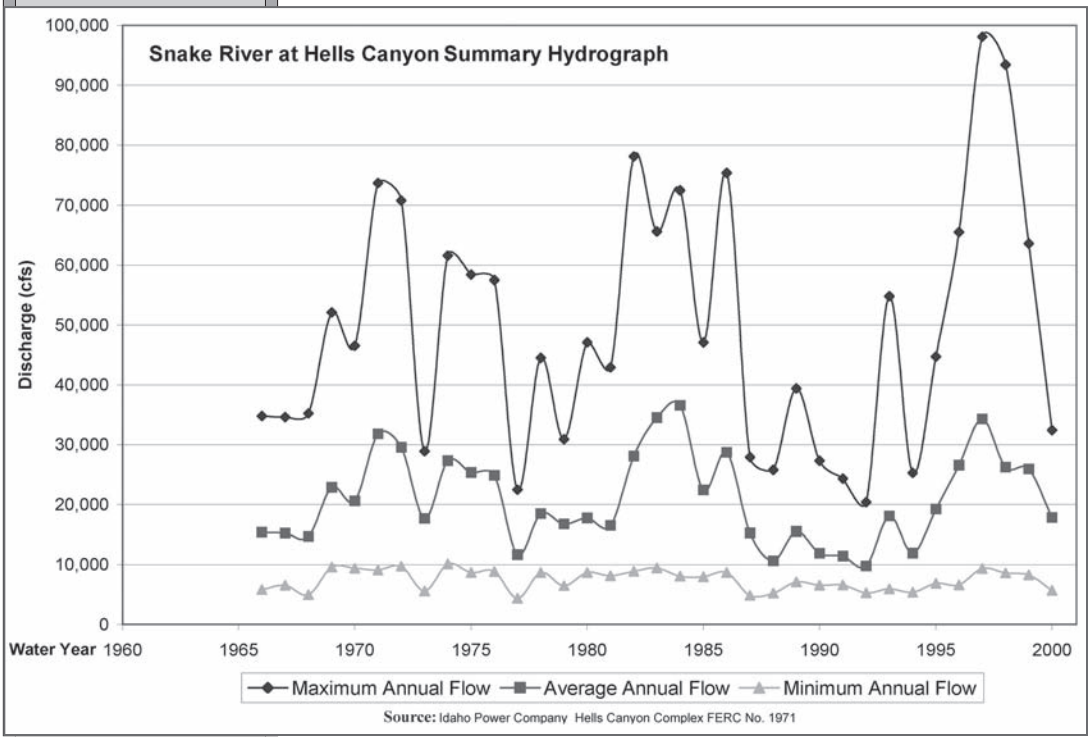
Temperature Control Structure

Through the extensive evaluation process associated with the FERC licensing process as well as the CWA § 401 certification process, IPC has determined that TEMP is the most effective and systemically beneficial means of addressing HCC's effect on water temperature while posing the least risk to aquatic resources. The other approaches IPC considered involve construction and operation of a **t**emperature **c**ontrol **s**tructure (TCS) at Brownlee Dam that would allow for the withdrawal of water from the thermally stratified water column of Brownlee Reservoir. The analysis IPC completed in connection with the FERC licensing effort indicates that a TCS could reduce downstream outflow temperatures during the period of salmonid spawning criteria exceedence, but that tells only a small part of the story. Although this approach may offer the opportunity to reduce temperatures immediately below Hells Canyon Dam for a relatively short period during the fall, it does not provide significant resource benefits downstream of Hells Canyon Dam. This is due to the fact that IPC analysis and data demonstrate that the temperature effects of the HCC are benign and in fact may be beneficial to species downstream of the HCC, particularly fall Chinook salmon. See: *White Paper: The Effects of Hells Canyon Complex Relative to Water Temperature and Fall Chinook Salmon*, (IPC 2007), filed with the FERC on July 30, 2007.

Drawbacks

In fact, the operation of a TCS poses significant risks for natural resources in the river and the three reservoirs within HCC. Brownlee Reservoir currently exhibits severely degraded water quality conditions in the cooler water contained within the hypolimnion (the hypolimnion is the deepest part of a reservoir).

Water Quality Concerns



Withdrawal of cool water from within the thermally stratified reservoir carries with it the inherent risk that the selected water will not meet water quality standards, and that the effect of releasing such pollutants on beneficial uses downstream will be adverse. The operation of a TCS will also change or influence the current stratification within Brownlee Reservoir, which may have adverse effects upon the in-reservoir aquatic community. The precise nature and extent of these adverse effects cannot be predetermined, as a complete evaluation cannot occur until a structure is constructed and operated. This necessarily increases the risk.

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Holistic Approach

Watershed Elements

IPC's choice to pursue TEMP rather than a TCS is an effort to capture the opportunity simultaneously to address its § 401 certification requirements and facilitate regional efforts to resolve broader Snake River water quality problems. TEMP is consistent with an ecologically holistic pursuit of water quality remediation, which improves overall ecosystem dynamics. Water quality approaches that recognize the complex interaction of watersheds and aquatic environments are widely recognized as preferable to artificial, engineered remedies, and are also consistent with EPA Region 10 temperature guidance, which recognizes the full range of anthropogenic influences (see: http://yosemite.epa.gov/R10/WATER.NSF >> "Water Quality" >> "Water Temperature Guidance").

IPC's proposed TEMP is based on EPA's approach for developing watershed plans (see: www.epa.gov/owow/nps/watershed_handbook/). EPA has identified six major elements for effective planning and implementation of a watershed approach: 1) building partnerships; 2) characterizing the watershed; 3) finalizing goals and identifying solutions; 4) designing an implementation program; 5) implementation of the program; and 6) measuring progress and making adjustments. IPC's proposed TEMP uses these criteria as an organizing principle.

IPC's CWA § 401 application is undergoing review by the Oregon and Idaho DEQs. The watershed approach to addressing temperature concerns is very much a work in progress and has generated some controversy. The company is hopeful of using the § 401 process as an opportunity for wide scale water quality improvements in the Snake River that go beyond mechanical solutions. If successful, it will represent one of the most ambitious applications of ecomarket principles to address environmental regulatory problems.

CONCLUSION

The need to implement forward thinking solutions is pressing with scarce water supplies and water quality challenges. Ecomarket approaches offer a promising opportunity to find cooperative, cost-effective solutions to these problems that may also provide better protection for the resource. Ecomarkets do not supplant a vigorous regulatory scheme, either for water rights or water quality control. Rather, they should be seen as an important adjunct focused on delivering the best environmental outcomes at the lowest cost.

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National EcoMarkets Conference

June 18-19

Editor's Note: Next **June 18th & 19th**, a national conference addressing the use of markets to protect and restore ecosystems will be presented in Portland by the Northwest Environmental Business Council (NEBC) and the American Forest Foundation (AFF). The conference will feature a wide range of national experts, including Sally Collins, Director of the new federal Office of Ecosystem Services and Markets.
CONFERENCE INCLUDES: The State of Market Development; Business Opportunities; Policy Issues; Voluntary Markets; Regulatory Markets; Case Studies; and More (full agenda at websites).
FOR INFO: NEBC website: www.nebc.org — AFF website: www.affoundation.org

Climate & Water Rights

Shifting Hydrographs

CLIMATE CHANGE & WATER RIGHTS

IMPACT OF EARLIER SPRING SNOWMELT ON WATER RIGHTS & ADMINISTRATION

by Douglas Kenney, Roberta Klein, Chris Goemans, Christina Alvord, and Julie Shapiro
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INTRODUCTION

In many watersheds in the western US, global climate change is manifested as earlier snowmelt (i.e., earlier runoff), reduced late-summer streamflows, and longer growing seasons (Knowles et al., 2006; Stewart et al., 2005; and Regonda et al., 2005). These trends can be problematic for several facets of water supply management in ways which invalidate many of the design and operational assumptions underlying the West's water resources infrastructure (Milly et al., 2008), while modifying patterns and quantities of water demand. At this interface of supply and demand are systems of water rights and water rights administration. Many surface water rights in the western states are defined in part by seasonal characteristics, either generally through terms such as "irrigation season" rights, or more specifically in rights that use explicit calendar dates to describe the start and end of diversion (or storage) seasons. A similar phenomenon exists in the apportionment of rivers in interstate compacts.

Water managers have expressed concern to Western Water Assessment (WWA) researchers that this growing mismatch between dates found in water rights and the shifting of the hydrograph has the potential to impact the functioning of water rights, thereby modifying yields, demands, reliabilities, and other elements of water systems — with impacts resonating throughout the entire community of water users. To date, this issue generally has not been the subject of any major studies that examined it directly (although several acknowledge the issue without providing additional analysis) or real-world disputes. Given projected trends in snowmelt, it is reasonable to expect that this issue will grow in salience. This article provides a reconnaissance level review of this issue in the 11 westernmost continental states (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming). The complete study on which this article draws is available on WWA's website noted at the end of the article; it includes an overview of state statutes, administrative rules and applicable case law.

CHANGES IN THE TIMING OF SPRING SNOWMELT

Several recent studies have examined the relationship between climatic trends in the western US and the timing and magnitude of snow and snowmelt. Five of the most relevant studies (Hamlet et al., 2005; Knowles et al., 2006; Mote et al., 2005; Regonda et al., 2005; and Stewart et al., 2005) are summarized by Udall and Bates (2007). Of these, Stewart and Regonda most directly focus on changes in the timing of snowmelt in the West, using data from the USGS Hydro Climate Data Network (HCDN). Stewart used 241 US gauges from 1948 to 2002, while Regonda used data from 89 stations from 1950 to 1999. Both studies are consistent in showing earlier runoff over the study period at many stations — as great as four weeks earlier in the Pacific Northwest. This is shown below in Figure 1:

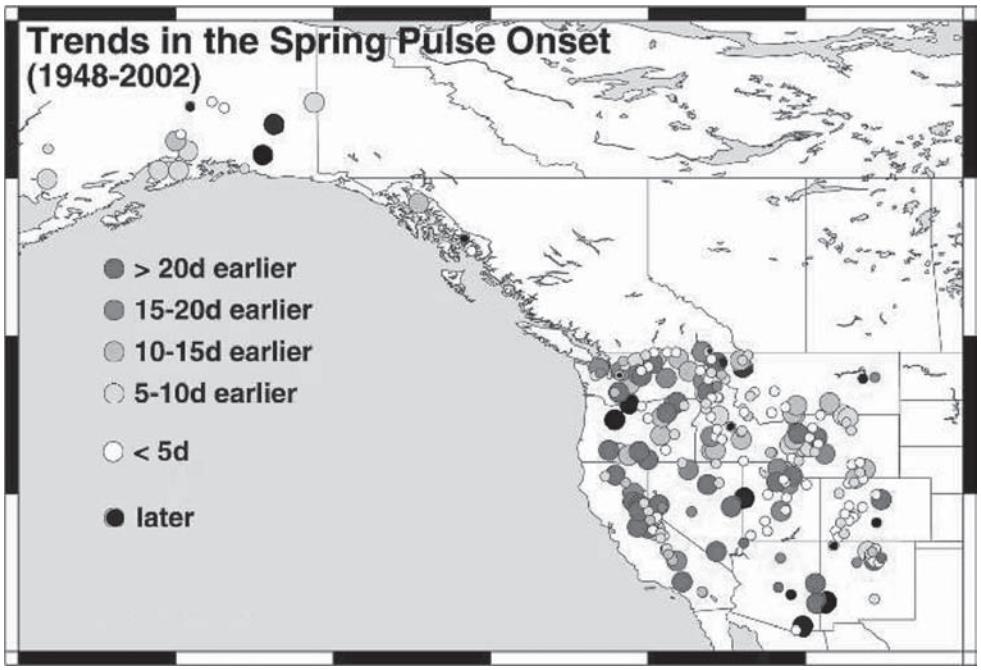

Figure 1. Trends in the Spring Pulse Onset. Adapted for greyscale from Figure 2 in Stewart et al. (2005). The figure shows trends in the spring pulse onset of snowmelt-dominated gauging stations from 1948-2000 expressed as timing change in days. Larger symbols indicate statistically significant trends (at 90% confidence level).

Climate & Water Rights

Elevation Correlation

In general, trends in earlier runoff are closely correlated with elevation: i.e., locations with the majority of basins below 2500 meters (8,200 feet) elevation — primarily the Cascade and Sierra Nevada Mountains — show the strongest trend toward earlier runoff. Conversely, areas of higher elevation (e.g., large parts of Colorado, Utah, Arizona, and northern New Mexico) often lack clear trends, or exhibit trends that are not statistically significant. Since higher elevation regions are generally colder than lower elevation areas, they are furthest from the temperature threshold at which snow turns to water; thus, snowmelt in many high elevation watersheds, to date, has been largely unaffected by global warming. The effect of decade-long phenomenon such as the Pacific Decadal Oscillation (PDO) and even shorter-term climatic events such as the El Nino Southern Oscillation (ENSO) may also partially influence the observed trends.

State Law

TREATMENT OF TIMING IN WATER RIGHTS SYSTEMS

Variations in State Water Law

Water allocation under the Doctrine of Prior Appropriation predominates throughout the American West. Rules requiring that time of year limitations be specified for Prior Appropriation water rights can be found in statutes, administrative rules, and/or case law. Since water allocation in the West is a product of state law, it is not surprising that requirements vary from state to state, sometimes in significant ways. All of the western states included in this study except Colorado administer water rights through a permit system administered by a state agency. Water right permits, licenses and certificates are issued by administrative agencies. A permit authorizes the permittee to develop a water project, but is not a water right itself. If all conditions are met the agency will issue a license or certificate, which constitutes a "vested" water right. Alternatively, determinations of water rights by courts are issued as "decrees." In Colorado, water rights are established exclusively through the courts. The remaining western states also provide for judicial adjudication of water rights under some circumstances.

Several states are explicit in requiring time of year limitations in those documents establishing water rights, while a smaller number are silent (or nearly silent) on the issue. In the middle are several states that address the issue partially, in multiple and often highly nuanced ways, and/or in ways that provide for multiple interpretations. For example, in several states, questions arise regarding whether a requirement for calendar dates in water right applications is carried forward into the document establishing a water right. Additionally, in some states, not all categories of water rights (e.g., irrigation/municipal, direct flow/storage) are treated equally with regard to specifying calendar dates. Perhaps most importantly, the on-the-ground interpretation and application of these rules by water administrators can vary significantly from state to state and even within states, often following local ad hoc customs that have evolved over decades of local administration.

Water Rights & Time Limitations: State Differences

Arizona: Claimants must state time of year in their application forms or claims statements, but the statutes are silent on whether that information must be included in final documents establishing water rights.

California: All permits/decrees for post-1914 water rights and in stream adjudications must include the dates or seasons when the water right will be used. Pre-1914 water rights are not subject to the permit system and often dates and seasons of use are not specified. However, actual beneficial use determines both the amount and season of diversion that can be used under these rights.

Colorado: There is no general requirement that water rights decrees (with certain specific exceptions such as recreational rights) contain time of year limits. Courts have discretion to include time of year limitations in transfer decrees, and often do, to assure there is not an expansion of use of the amount that occurred historically, to the detriment of other water rights.

Idaho: Since at least May 1967, water rights must include a period of use with a specific beginning and ending date.

Montana: Time of year limitations must be included in final decrees under the statewide adjudication procedure. While period of use is a required element of a permit application form, and administrative rules even define standard periods of diversion and use, the statutes are silent as to whether this element must be included in post-1973 water rights permits or certificates of water rights.

Nevada: Statutes describing the appropriation process do not require that permits include time of year limits; however, this information is required in the permit application forms. Statutes on contents of stream adjudication claims forms and decrees are silent on the issue, although time of year or season of use limits are routinely included in those decrees.

New Mexico: State law requires period of use to be stated in both applications for water permits and in stream adjudication decrees.

Oregon: Defining a period of use is required in several facets of Oregon water law administration: applications for a permit, registration of pre-1909 rights, and adjudication processes. Additionally, case law is clear that courts may impose time of year limits, particularly with respect to irrigation rights. However, it is unclear whether or not the requirement that water right certificates describe the "extent of the right" must do so using actual calendar dates.

Utah: Utah law is clear that the period of use must be specified in judgments in adjudications as well as certificates of appropriation for permit cases.

Washington: Applications for water permits ask for time of year limits, but the statutes don't explicitly require this information in permits or certificates. However, an online "Proof of Appropriation of Water" form asks for time of year of use, and may (after approval) function as a certificate of water right. Certificates in general adjudications must include time of year limitations.

Wyoming: Wyoming's statutes do not require time of year limits for water rights, though administrative rules require that changes of use be limited to historic use. Local water commissioners determine the irrigation season based on whether beneficial use can be achieved.

Climate & Water Rights

Compact Formulas

Timing Elements

Interstate Compacts

The focus of this study is primarily on the definition and administration of state water rights featuring specific timing elements. However, it is worthwhile to appreciate that timing elements also exist at the interstate level. This subject is explored in more depth in the WWA working paper: "*The Effect of Changing Hydrographs on Compact Apportionments in the Western United States: A Preliminary Analysis of Potential Trouble-Spots*" (Kenney et al., 2007). As shown in Table 1, of the sixteen interstate water apportionment compacts found in the eleven western states, at least six compacts (affecting eight states) feature formulas that rely, to various degrees, on key spring calendar dates. Note that in Table 1, the five categories used under the heading "Dates Used for Apportionment & Accounting Periods" are ordered, left to right, with respect to their general likelihood of being problematic given current and growing shifts in snowmelt patterns. As a practical matter, determining which compacts will prove problematic is much more complex and subject to case-specific conditions. Nonetheless, all else being equal, compacts that rely heavily on specific spring dates, especially if they are associated with low-elevation watersheds, perhaps are most deserving of concern and further investigation. These six compacts were negotiated, literally, in a different climate, well before global warming was a concern in the water management community (or elsewhere): the most recent was negotiated in 1962; and the average negotiation date of the others is 1941.

Table 1. Timing Elements in Western Water Allocation Compacts

Compact			Dates Used for Apportionment & Accounting Periods					
Basin	Signatory States	Year	Key Spring Dates	Key Fall Dates	Calendar Year Accounting	Multi-Year Accounting	No Time Element Needed	Comments & Notes
Arkansas	CO, KS	1948	X	X				Defines winter storage season dates (Nov 1 to March 31) and summer storage season dates (April 1 to Oct 31)
Bear	ID, UT, WY	1955 1978		X				Measures depletions over a water year from Oct 1 to Sept 30
Belle Fourche	WY, SD	1943			X			Apportionments defined over a calendar year
Canadian	NM, TX, OK	1950					X	Apportionment based on limiting storage capacity
Colorado	WY, CO, UT, NM, NV, AZ, CA	1922				X		Apportionment based on 10-year moving averages
Costilla Creek	CO, NM	1944 1963	X	X				Defines irrigation season from May 16 to September 30; storage season from October 1 to May 15
Klamath	OR, CA	1957			X			A few calendar year references; otherwise, no timing elements
La Plata	CO, NM	1922		X				Defines a period of unrestricted use (Dec 1 to Feb 15) and an apportionment period (Feb 15 to Dec 1).
Pecos	NM, TX	1948			X	X		Primarily 3-year apportionment; measured over calendar years
Republican	CO, NE, KS	1942			X			Apportionments in annual volumes.
Rio Grande	CO, NM, TX	1938	X	X	X			Some delivery obligations tied to flows from April 1 to Oct 31 or Oct 1 to June 30
Snake	WY, ID	1949		X				Apportionment based on annual water-year basis from Oct 1 through Sept 30
South Platte	CO, NE	1923	X	X				An irrigation season apportionment is defined from April 1 through Oct 15
Upper Colorado	WY, CO, UT, NM	1948		X				Measurements based on a water year extending from to Oct 1 to Sept 30
Upper Niobrara	WY, NE	1962	X	X				Multiple storage seasons defined, beginning on Oct 1, and ending on either May 1, June 1, or Sept 30 depending upon the project and direct flow rights
Yellowstone	WY, MT, ND	1950	X	X				Apportionment between MT and WY is based on annual water-year basis measured from Oct 1 through Sept 30, while the MT-ND apportionment runs from May 1 to Sept 30

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Modifications Limited

Compact Issues

Administrative Regimes

Theory v. Reality

To date, there is no evidence to suggest that these timing elements have been problematic, an observation that is perhaps linked to the fact that high-altitude Colorado watersheds are the upstream component in four of the six basins. Nonetheless, the potential for eventual timing-related controversies seems very real, in part since no compact features a commission expressly empowered to modify apportionments or administration based on climate change considerations. Additionally, WWA's limited effort to identify potentially problematic compacts by merely focusing on the presence/absence of calendar dates likely understates the issues associated with a growing mismatch between interstate water rights and hydrology. For example, even though the La Plata Compact does not feature spring calendar dates, it does require the maintenance of minimum summer flows — a challenge that is likely to grow in areas with earlier runoff and longer growing seasons.

Climate change is also likely to force attention on many other topics currently omitted from compacts. Of the 22 western compacts (including the 16 in Table 1) reviewed by Kenney in other research, none mention climate or climate change, only one mentions drought, only four mention fish or wildlife, only six mention water quality or pollution, only three mention groundwater, and only eight mention Native American water claims. At some point, all of these issues will require examination, and climate change may be the stimulus.

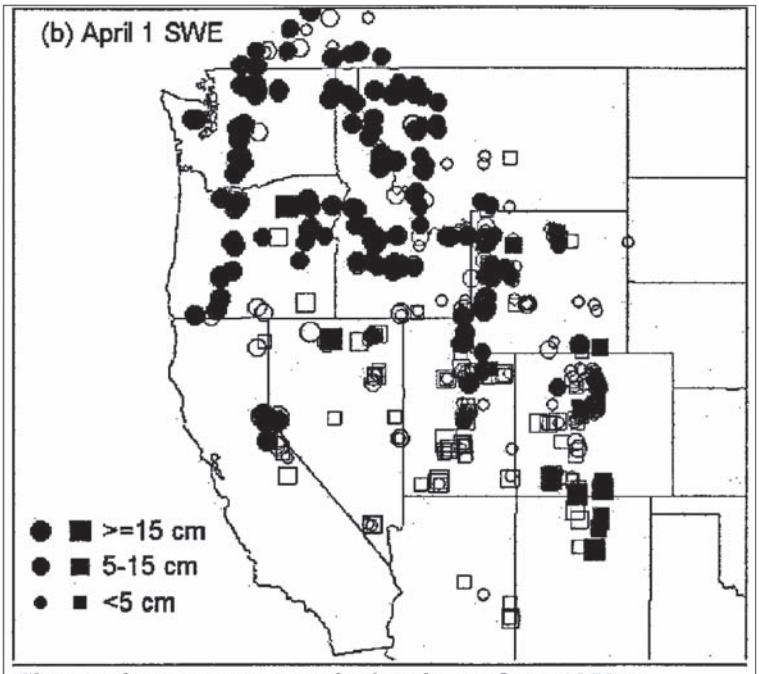
INTERPLAY OF EARLIER SNOWMELT AND WATER RIGHTS

Table 2 features a rough categorization of the eleven western states based on the two criteria relevant to this analysis: first, an assessment of whether or not the state (or sub-state region) is experiencing clear trends in the earlier onset of spring snowmelt, based on the findings of Stewart et al. (2005) and Regonda et al. (2005); and second, a review of the language used in the statutes, administrative rules and case law in each of the eleven states concerning timing of water rights under the prior appropriation system. This is an imprecise exercise in many respects. For example, since many basins within a state have widely varying altitudes, it is difficult and inherently imprecise to categorize entire states as having a uniform signal regarding earlier snowmelt. Yet, since legal regimes referring to the timing of water rights are generally uniform throughout a state regardless of any elevation changes, it was necessary to use the state as the standard unit of analysis. Additionally, the summary of legal requirements suggests an administrative regime that may be more theory than reality; interviews of many state officials have confirmed that patterns of water rights administration often vary significantly within the state depending on local conditions and traditions. With these caveats, Table 2 is offered here as a way to organize the variety of different circumstances seen throughout the West, and as a tool for selecting case studies that may offer transferable lessons.

Table 2. Hydrologic and Legal Trends in Streamflow Timing in the 11 Western States

Inclusion of Timing Elements in Water Rights	Trend Toward Significantly Earlier Spring Snowmelt	
	Strong	Weak / Inconclusive
(A) Explicit Timing Requirement: Statutes, rules and/or case law explicitly require time of year limitations in documents establishing water rights	Washington California (post-1914) Idaho (post-May 1967) Northern Utah NW Montana (stream adjudications)	New Mexico Utah (except northern) Montana stream adjudications (except northwest)
(B) Some Attention to Timing: Statutes, rules and/or state-prescribed application forms require that time of year be stated in the application for a right, but are silent as to whether time of year must be included in documents establishing water rights	Eastern Oregon Eastern Arizona Northwestern Montana (permits) Nevada (permits) Western Wyoming (transfers)	Oregon (except eastern) Arizona (except eastern) Montana permits (except northwest) Eastern Wyoming (transfers)
(C) Silent on Timing Issues: Neither statutes, application forms, nor case law generally require time of year limitations as an element of water rights (though exceptions exist such as transfers and recreational rights)	Western Wyoming (except transfers) Nevada (stream adjudications) California (pre-1914)	Eastern Wyoming (except transfers) Colorado

To better understand how timing issues are addressed in practice, data were gathered from water decrees and interviews with water administrators in four states: Idaho, Utah, Wyoming, and Colorado. These states, chosen because they fall at the four corners of the typology in Table 2, provide an overview of the range of circumstances that characterize the water rights timing issue in the West. Specifically, Idaho is showing a strong earlier snowmelt signal, and state law explicitly requires time of year limitations for water rights. Most of Utah is showing a weak or inconclusive earlier snowmelt signal, and state law explicitly



Changes in snow water equivalent in cm from 1950 to 1999 for April 1 (501 stations). Circles indicate decreasing trends, squares increasing trends. Solid shapes are statistically significant and the size of the shape is proportional to the change. (From Regonda et al. Figure 4)

requires time of year limitations for water rights. Western Wyoming is showing a stronger earlier snowmelt signal, and state law is silent on time limitations in water rights, except for transfers. Colorado is showing a weak or inconclusive earlier snowmelt signal, and state law, for the most part, is silent about time of year limitations in water rights, except for transfers. The case studies themselves are presented in Appendix D in the full WWA report, which includes additional details about each states' snowmelt data. The major trends and findings from these case studies — as supplemented with insights from other states and interviews — are summarized below.

THEMES & FINDINGS

Although there is significant variation from state to state, it is generally fair to say that collecting statistical information about water rights — and in particular, the timing elements in those water rights — is difficult and time-consuming. Collecting evidence of how those rights are actually exercised and administered on an annual basis is dramatically more difficult; in lieu of the documentation which accompanies a "call" for water by a senior user or a lawsuit, almost no data is available to track patterns and changes over time. In fact, many water rights are not even adjudicated. Given this reality, much of what we have learned about issues in water administration has come from interviews with administrators, water users, and attorneys. Those interviews, combined with our review of legal regimes, case studies, and the relevant literatures, support the following tentative findings:

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Growing Rights v. Enforcement

Many Irrigation Water Rights Appear to Be Lengthening (and Growing)

The earlier onset of spring snowmelt has increased the length of the irrigation season in many locations. As expected, in states that do not feature calendar dates on these rights (but rather are silent or simply define rights as corresponding to the irrigation season), it is generally accepted (although poorly documented) that these rights are being exercised earlier and longer. Perhaps more surprising, however, is the observation that in states that do feature actual calendar dates on water rights, we have not found examples where a serious effort has been made to enforce these dates. As long as the water is being used beneficially (and in a similar way and location as historically done) — and in lieu of any protests from other water users — earlier diversions are generally seen as appropriate and are not deterred. In fact, the distinction made in this report between the four states that do and do not require time of year limitations in water rights seems to have very little significance in current practice.

Increasing "Calls"

Administrative Flexibility is Being Exhausted

Systems of water administration generally have sufficient flexibility built into them to accommodate annual hydrologic variability. This same flexibility is being drawn upon to accommodate more fundamental shifts in climate and hydrology, although this reality may not be readily obvious — after all, on-the-ground, climate change can be indistinguishable from climate variability. However, it appears that, at least in the four case study states, the extent of available flexibility may be near an end. Colorado water administrators, for example, report that "gentleman's agreements" regarding diversion schedules among water users are eroding, and in Wyoming, the growing frequency of late-season calls is focusing more attention on early season water-use practices.

Discretionary Limits

Legal Disputes Associated with Water Rights Timing are Not Yet Apparent

Despite repeated inquiries to water rights attorneys and ongoing literature searches, we did not find any evidence of a lawsuit in any western state that can be directly attributed to a controversy over the mismatch between timing elements in water rights and the shifting hydrograph associated with climate change. This lack of litigation is perhaps explained by the apparent legality in many contexts of modifying diversion schedules to meet shifting hydrologic conditions, and in those situations where such actions are presumably

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barred, the failure of injured parties to appreciate the role of this behavior in creating observed problems. We did not encounter any groups of water rights holders arguing for more scrutiny or enforcement of water rights terms. Nonetheless, some interviewed parties suggested that this period of calm is expected to erode in coming years, with the first wave of lawsuits perhaps focusing on better defining the discretionary limits (and obligations) of water administrators.

Winners and Losers Are Tough To Predict

Seniors v. Juniors

Beyond the simple observation that senior water right holders (seniors) are almost always better off than junior water right holders (juniors), it is difficult to predict the distribution of winners and losers to emerging problems (and responses) associated with the growing mismatch between hydrology and timing elements in water rights. To the extent that water rights feature no timing restrictions (or feature timing restrictions that are not enforced), then seniors are in a position to increase water diversions often at the expense of juniors — an advantage perhaps most evident during late-season low-flow periods. Similarly, a strict enforcement of timing elements in water rights may prevent an expansion of senior rights that benefits some juniors, although these same users are likely to also feature demand patterns that are increasingly out of synch with their rights. The salience of case specific factors precludes further generalizations.

Storage v. Flow

For example, one wildcard in any situation is the interplay between direct-flow rights and storage rights. Minimizing interference among the exercise of these two types of rights is a familiar administrative challenge that can become more complicated by changes in the hydrograph. Additionally, changes in the timing of water diversion and use can have huge consequences, either positive or negative, for water users reliant on return flows. This is particularly true for trans-basin diversions. Other complications can arise from management needs for environmental protection, water quality, and even power generation, and in all situations, the availability (and use of) storage can be of great importance.

Volume Limits

[**Editor's Note:** Water right systems in the western states often, though not always, place volume limitations on the exercise of water rights (usually expressed in terms of "acre-feet" allowed). Where such a limitation does exist a water user could be prevented from diverting additional water once the volume amount is reached. Some water rights require meters that measure the total volume of water used during the course of an irrigation season.]

CONCLUDING THOUGHTS & RECOMMENDATIONS

Emerging Problems

Our review of the relationship between climate change and the functioning of water rights has led us to two overriding conclusions: first, significant on-the-ground problems associated with the growing mismatch of rights and hydrographs have yet to emerge, even though snowmelt in many locations has advanced several weeks; and second, that this period of calm may not last much longer. It remains unclear exactly where and how intensely these problems may be manifest, and whether they will present as legal or water management problems. In a state that explicitly requires that water rights be exercised within specific calendar dates, it is reasonable to expect lawsuits to emerge, likely initiated by juniors harmed by increased consumption from seniors that have expanded their season of use. In a state without such timing requirements, the issue perhaps is better characterized as a management problem. This is because water rights holders — especially juniors — search for means to manage reduced yields and higher vulnerabilities from their water rights portfolios.

Interstate Compacts

Problems at the interstate level may be particularly difficult to resolve, as the zero-sum nature of compact apportionments can be a formidable barrier to resolving disputes through compromise and negotiation. In those settings, litigation may be unavoidable. Further speculation is difficult to support and may be largely irrelevant, as the other impacts and challenges on water resources associated with climate change may subsume or overwhelm the specific issue of water rights timing. So in lieu of a better vision of what the future entails, we conclude with only two simple recommendations. First, if they are not already doing so, we encourage water managers to design and operate their models and modeled scenarios in a way that considers how shifts in the hydrograph may influence the yield and vulnerability of their water rights portfolios. And second, states should expect the demands on water administrators to increase, and should make appropriate investments in personnel, budgets and training.

Recommended Actions

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Western water assessment report website:
http://wwa.colorado.edu/current_projects/Adapt_Mit.html

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Water & Energy

Low Impact Development + Water Reuse + Pre-Cooling Air

WATER & ENERGY NEXUS

SITE SCALE CONSERVATION OPPORTUNITIES

by Steve Moddemeyer, CollinsWoerman (Seattle, WA)

Introduction

There is tremendous latent capability in our urban water systems to deliver energy conservation. This article is focused on energy and water synergies that can be developed and implemented at the site or building scale. With conscious forethought and existing technologies, water and energy practices in commercial areas can be configured to save more than two-thirds of potable water use, reduce stormwater flows, and create valuable energy conservation. This site-scaled energy/water nexus is the story of three concepts working together: low impact development (sustainable urban drainage systems); onsite water reuse irrigation and rainwater collection; and a combination design to pre-cool air for HVAC (**h**eating, **v**entilating, and **a**ir **c**onditioning) systems. When this configuration makes economic sense, the math alone provides ample reason for action. It is certainly noteworthy, however, that such actions also result in: net gains in property values; better human health and healing; improvements to water quality; increased learning ability in children; additional pedestrian activity on urban streets; and greater urban beauty. The key to these deliverables is the living vegetation that links all these systems (see sidebar).

Living Coolers

In addition to being living, growing, and beautiful, plants are evaporation pumps. During photosynthesis moisture is released to leaf surfaces. This moisture then evaporates from the stomata in the pores of the leaf surface. The act of evaporation creates two beneficial impacts: negative pressure and cooling. This negative pressure pulls on the sap within the plant. When sufficient evaporation occurs across the leaf area, the plant is able to pull in water and nutrients through the roots from the surrounding soil. The plant needs water and these nutrients in order to grow and thrive. One way to think of it is that plants take wet water from the soil and turn it into water vapor (the process of transpiration) in order to get the food they need. As liquid water evaporates into a gas, it transfers energy from the surrounding air and causes cooling.

The rate of evaporation at any given moment depends upon ambient air temperature, humidity, air movement, plant species, availability of water in the soil, and solar radiation intensity. If a plant isn't evaporating, it isn't getting any new food or water. Some succulents are excellent at controlling how much water they evaporate. However, research has shown that even succulents will evaporate rapidly if water is readily available in surrounding soils.

Urban Heat Island Effect

Removal of vegetation, which has been typical of urban development, is a big contributor to the urban "heat island" effect — whereby urban areas exhibit much higher temperatures than their surrounding landscape. Plants that once provided cooling through shade and evaporation are gone. Wetlands and soils that held rainwater are capped with pavement. The less evaporation and cooling from plants and soils, the hotter it gets. Radiation from the sun, instead of being the driver for photosynthesis and evaporation, now causes urban roofs, streets, and building walls to radiate heat. Thus it is that traditional development practices continue to raise the ambient temperature of cities (Kravik et al. (2008)).

Higher ambient temperatures raise the demand for electricity because most commercial buildings require cooling year-round. This is not just because the sun warms the sunny side of the building, but because the base load of lighting, people, and air movement systems creates heat that must be removed by mechanical air conditioning.

If you lower the ambient air temperature you lower the demand for energy to cool a building. Researcher Marco Schmidt conducted a study where he pre-cooled intake air into the Berlin Technical University Physics Building using a rainwater misting system that cooled exhaust air from 26º Centigrade (C) to 16ºC through evaporation. This exhaust air traveled over a heat exchanger that caused pre-cooling of the intake air. His research showed a reduction in electrical use of 70% while this method was employed (see Figure 1).

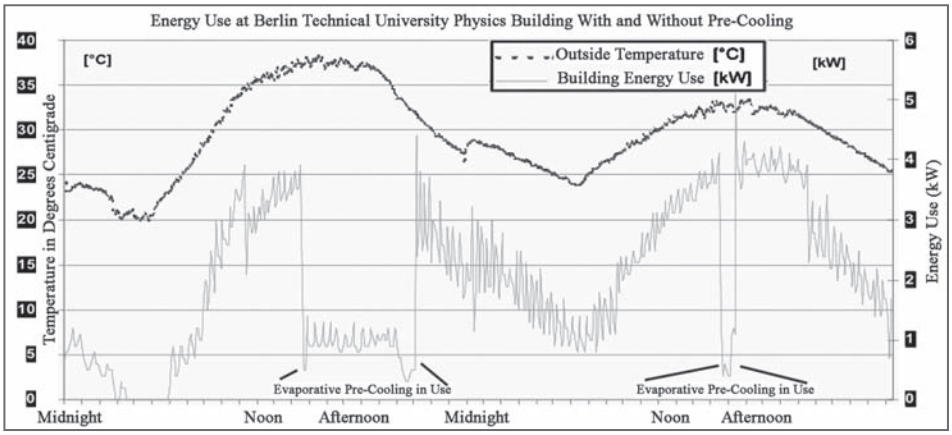


Figure 1

Water & Energy

Ambient Temperature

Achieving a reduction of ambient air temperature in a city with a year-round "cooling load" is possible through the intelligent management of vegetation. Researchers in Japan and the United States (and elsewhere) have already documented the value of vegetation in park lands in lowering ambient air temperature. Daniel Roehr of the Design Centre for Sustainability quotes a study that measured a 2ºC reduction in ambient temperature occurring up to 90 meters from Shinjuku Park in Japan (Honjo et al. (2002). A 2006 study also cited by Roehr measured a reduction of up to 2-5ºC in the area surrounding New York's Central Park. (Rosenzweig et al. (2006)).

Building a new Central Park to achieve energy savings is probably out of reach for most built cities. However, lowering the ambient temperature at the site scale — building by building — by linking landscapes to a building's cooling systems is very achievable. Indeed, given the considerable economic and environmental advantages involved, one has to ask: why not?

Stormwater Techniques

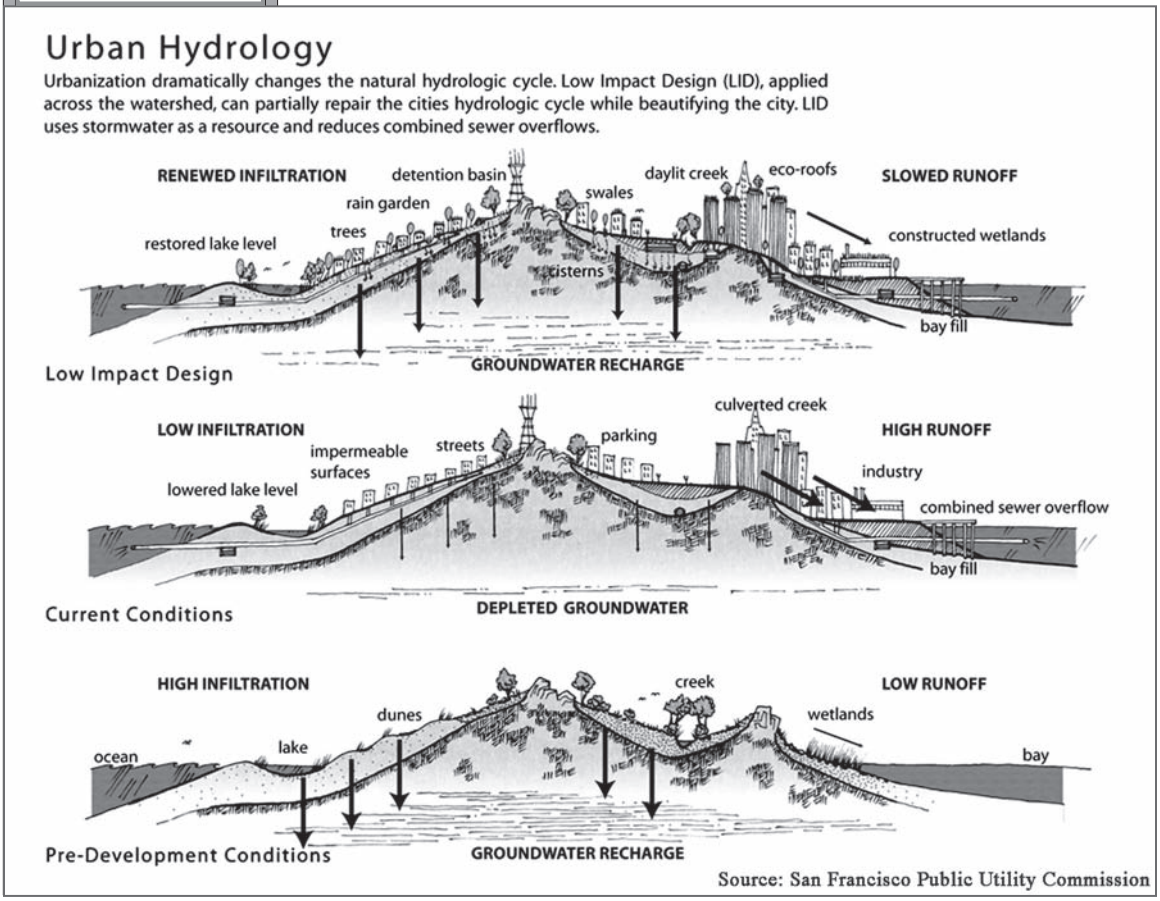
Stormwater Control

To a certain extent, vegetation is already creeping back into our cities. A number of cities have started to use plantings at the site scale in dense urban areas to help control stormwater flows — both to delay the arrival of peak flows that cause combined sewer overflows, and to slow down the peak rainfall events that can overwhelm the storm drainage systems (see MacDonald et al., TWR#53). Whether it is through the use of green roofs, vegetated walls, stormwater planters, or vegetated swales, these techniques are proving to be cost-effective tools for controlling stormwater flows. Portland, Oregon has an impressive "Gray to Green" program that uses vegetation and soils to control stormwater flows (see Vizzini, TWR #55). In Seattle's creek watershed areas (as defined in the City's 2009 National Pollution Discharge Elimination Permit for Stormwater), new development must use these techniques whenever possible or demonstrate why it is not practicable. (see "Website References" — below). Indianapolis has recently adopted a green infrastructure approach that encourages vegetation use for this purpose (see References).

Combined Sewer Overflow

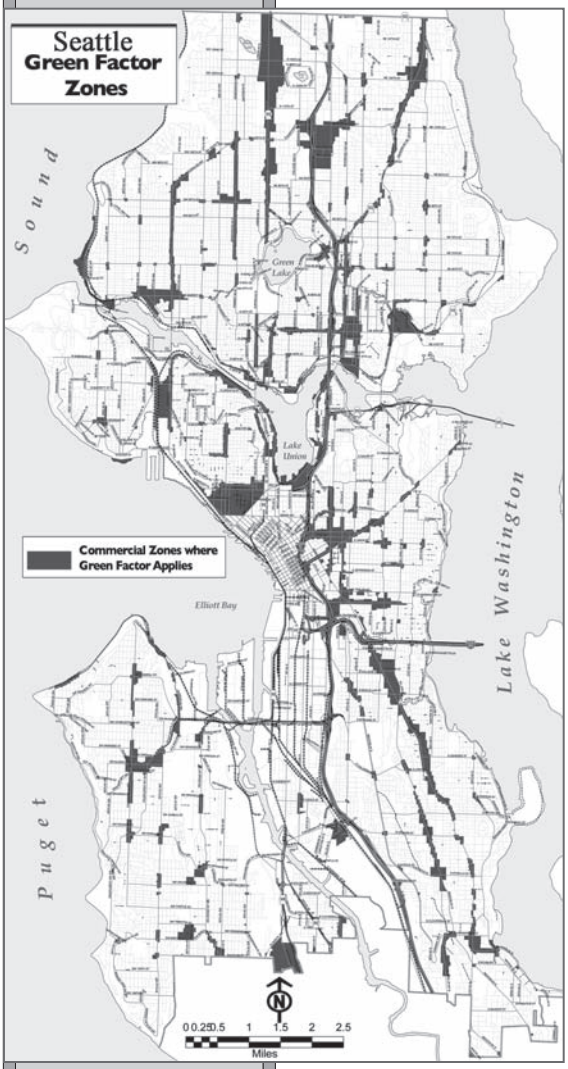
These vegetation and soil techniques are proving their worth in "combined sewer overflow" areas where runoff from large urban storm events has routinely combined with wastewater from toilets as a result of outmoded sewer design features. Both the San Francisco Public Utilities Commission and Seattle Public Utilities have included low-impact development strategies in their toolkit as a "demand management" or "Green Stormwater Infrastructure" strategy to help control combined sewer overflows (see References). Seattle bases engineering estimates to control peak flows on costs calculated to be about six dollars per gallon. Note, this is not just any gallon of water entering a combined sewer. Rather, this is the calculated cost of controlling those "peak" gallons generated by large storm events that result in overflow. So, while lowering every gallon of water that enters the sewer is a good thing during a storm, any strategy that shaves down peak flows is particularly valuable. Both cities have determined that certain low impact development strategies — including green roofs, vegetated swales, and rainwater planters — can cost effectively help prevent those particularly problematic and expensive to manage peak flow gallons from entering their systems.

Figure 2



Water & Energy

Figure 3



Stormwater Control - Energy Conservation Link

Low impact development strategies for water quality also have direct links with energy conservation strategies for individual buildings. The evidence for utilizing these links is compelling. Stuart Gaffin and a Penn State team found that the peak temperatures on green roofs they planted with sedum were 30ºC (54º Fahrenheit (F)) lower than the temperatures on standard roofs (see References). This impressive cooling power provides a strong argument for optimizing stormwater control systems to also provide energy conservation savings. As Gaffin has stated, he prefers green roofs because — not only do they cool the ambient air significantly — they are also fundamental to countering what he calls the "urban runoff island" effect.

"Seattle Green Factor" Tool

The "Seattle Green Factor" is one type of tool to help further the site level energy/water nexus (see References). The Green Factor took a moribund landscaping ordinance used for screening parking lots and loading docks and turned it into a powerful tool for urban sustainability. The Seattle Green Factor requires that all new commercial buildings achieve the equivalent of 30% of their site in vegetation. The developer can select from a menu of strategies to accomplish this requirement, including green roofs, vegetated walls, layers of vegetation, deeper soils, and other specified options. Seattle's Green Factor has lead to more than half of the city's new commercial buildings having green roofs, half having vegetated walls, and about two-thirds using porous paving. It has proven so popular that the Seattle City Council is considering extending this approach to all multi-family zones in the city (see Figure 3).

The Green Factor integrates vegetation directly back on site, instead of only in parks. In doing so it opens up another important opportunity. Vegetating the site itself supports the option of harvesting energy conservation benefits from the cooling power of that vegetation at the site level.

Onsite Water Reuse

Some water suppliers, however, correctly note that adding additional landscaping in urban areas creates a net increase in water demand. This result may be especially problematic if we insist on using precious potable water for irrigating landscapes. Even using reclaimed water for irrigation can prove expensive — especially when the water is treated in centralized reclamation plants that require expensive new distribution systems. Onsite water reuse, however, is turning this issue on its head.

In Battery Park, New York, the Solaire Building rises gracefully above the Hudson River (see References). An exemplar of green building, the Solaire and adjoining buildings use an onsite membrane bioreactor that treats the wastewater generated by the building residents. The quality of this treated wastewater is so high that it is appropriate for non-potable uses including toilet flushing, irrigation, and cooling tower makeup water.

Other developers are also beginning to install onsite membrane bioreactors to treat and reclaim water. For example, Dockside Green, a residential and commercial development in Victoria, Canada, uses an onsite membrane bioreactor coupled with rainwater harvesting to create a valuable water feature that was so attractive, the increased sales value of the units paid for the system (see References).

In both of these examples, the technology is not particularly new — two decades of use have already demonstrated the possibilities. However, the reliability of these onsite systems continues to improve as does the energy efficiency of the processes. Dozens of buildings in New York City use this technology and thousands of buildings in Japan do the same. What is truly new is that this technology is finally being adopted in North America.

Reclaimed Water

Intake Pre-Cooling

The highly treated water from buildings can be used to create lush gardens associated with the building to pre-cool the intake air. This is a particularly reasonable option if the developer is already putting in water treatment technology. This course of action merely requires the conscious intent to make that connection. One can collect rainwater for the same reasons. In fact, as discussed below, estimates valuing the attendant energy savings suggest that providing as much onsite wastewater treatment and rainwater storage as we can handle is very cost effective — both monetarily and environmentally.

Water & Energy

Many still believe that treating wastewater at the site or building level is too expensive, but as the technology continues to be refined even the initial cost continues to drop. Moreover, the number of locations where onsite treatment makes sense can expand dramatically if we add in the value of energy savings gained by irrigating landscaped areas for cooling.

Energy Savings

Daniel Roehr in Vancouver, Canada, calculated a 10% reduction in energy use by applying the Seattle Green Factor to nine city blocks of downtown Vancouver, Canada (Roehr et al. (2008)). Roehr assumed only the passive ambient temperature reduction that 30% vegetation cover would provide. However, if the vegetation were consciously optimized for energy conservation, particularly for pre-cooling, the economics improve dramatically.

Combination of Tools

To accomplish this, a green factor-like tool could be used to:

- Re-vegetate dense urban areas in order to reduce stormwater and combined sewer flows
- Combine that with onsite wastewater treatment to further reduce wastewater flows
- Use that highly-treated water to irrigate lush Green Factor landscapes where the intake air from HVAC systems is pre-cooled by these active evaporation zones

Energy Use Reduction Value

The worth of a 10% reduction in energy use worth is readily calculable. Many electric utilities already provide a range of monetary incentives to promote energy conservation. Seattle City Light published their Integrated Resource Management Plan in 2008, which included conservation values (see References). Extrapolating from their numbers, one can calculate that one annual average megawatt of energy conservation is worth $3.3 million. Seattle City Light provides this level of conservation incentives for developers able to demonstrate a project's level of energy conservation using advanced modeling of proposed mechanical systems and special energy saving techniques. The energy saving techniques covered under this program do not include using managed vegetation, however.

Currently, a 31-acre redevelopment is being considered in Seattle. This site has a potential density of 3,500 residential units and from 800,000 to 1.2 million square feet of office space. The site will place about 10 average annual megawatts of demand onto the Seattle system. Normally, a developer that was able to conserve 10% of the energy use for a project this big would be able to collect a check for $3.3 million to help pay for energy conservation improvements. What if they demonstrated that they had reduced electrical demand through their vegetation? Can an electric utility write a check for landscaping if shown that it would reliably reduce energy demand by 10, 20, or 70%?

If electric utilities can justifiably write a check for landscaping which results in reliable energy savings, they will be receiving important additional benefits for free. Stormwater benefits were mentioned above, but managed vegetation is also a powerful tool for increasing urban livability — and increased livability also delivers a range of significant, measurable, community benefits.

Dr. Kathleen L Wolf runs the website Human Dimension of Urban Forestry and Urban Greening for the University of Washington's Center for Urban Horticulture (see References). Wolf publishes an array of research on the measured benefits to human health and well-being offered by plants in the urban environment.

Additional Landscaping Benefits

Research by Wolf and others consistently shows that:

- Land values increase with good landscaping
- People heal faster when they have a view from their hospital bed towards vegetation
- School children who live and learn in proximity to vegetation have demonstrated a higher ability to learn

It is also true that a beautiful urban environment with trees and shrubs encourages pedestrian activity — which not only activates the street, but increases the health of the walkers by encouraging them to get out of their cars and away from the television to enjoy the beauty of their neighborhood.

Other Options

Sewer Heat Recovery

This article has focused on just a few techniques for optimizing energy and water at the site scale. There are other strong contenders. Sewer heat recovery is another well-tested concept in Europe and Canada that is still in its infancy in the United States. Heat exchangers in sanitary and combined sewer lines can be used to cool and warm buildings. Harvard University is considering the Rabtherm sewer heat recovery system for their new campus development (see References).

Even potable water distribution lines can be deployed for heating and cooling purposes when appropriate. If you lived in a warm climate, would you mind it if your drinking water was cooled 7°F before it arrived at the tap? The heat removed from drinking water could be used to heat homes or preheat hot water.

Water & Energy

Heat Pumps

Solar Chimneys

Energy/Water Synergy

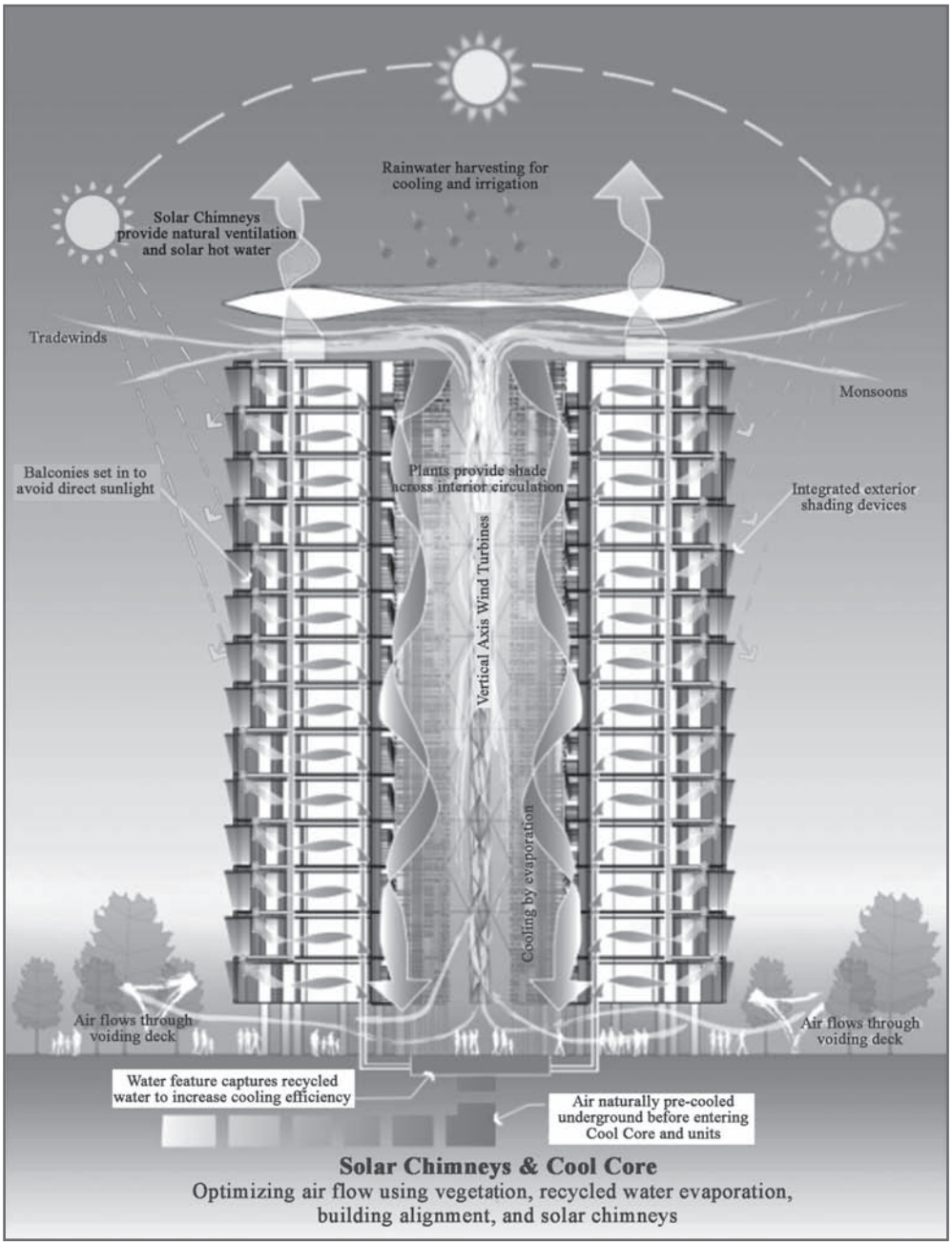
Ground source heat pumps are being implemented in dense urban areas to provide thermal "batteries" for buildings. A network of wells can be drilled beneath the sub-basement floor as a building is being constructed. This network can use the moderating temperatures of the soils and groundwaters beneath the building to balance out the heating and cooling loads of the building. Such a system can provide most of the thermal energy needed for the facility.

Other concepts being explored include solar chimneys that reduce fan loads and preheat hot water at the same time (see Figure 4). Students of "bioclimatic architecture" can now demonstrate how buildings related to each other can be optimized to increase natural ventilation and cooling at the site scale.

Conclusion

This article has dealt with strategies of proven worth. Most of these strategies are already in use — albeit all too rarely. As energy prices rebound and as energy independence increases in cultural importance, it will be important to expand upon these energy/water synergies at the site scale. They have the definite potential to become established best practices. Towards that end, the larger utilities and research consortiums may choose to direct energy and water dollars towards further quantifying the values of these integrated strategies. Who knows, maybe mechanical engineers, civil engineers, and architects will learn to collaborate more on behalf of an integrated outcome. Energy utilities and water utilities may begin to explore formal partnerships to augment these types of opportunities.

Figure 4



Water & Energy

Look Around

There's an old question, "If you saw a dollar on the ground, would you pick it up?" As concerns 20th Century buildings and infrastructure development thus far, the answer has most assuredly been no. Untold planetary wealth has been squandered because it wasn't "cost effective" to pick up that dollar. As the planet reels from the impacts of climate change and as energy prices confound our economic recovery, it may be time to start looking for all that value that is just lying around. A good place to start is right where we are. Look around. There are opportunities for energy efficiency and water conservation in every direction and these strategies are likely to play an ever increasing role in 21st Century infrastructure.

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www.seattle.gov/util/stellent/groups/public/@spu/@ssw/documents/webcontent/spu01_003933.pdf).

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www.thesolaire.com
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WATER BRIEFS

COALBED METHANE DECISION: "BENEFICIAL USE" AND WELL PERMIT REQUIRED — COLORADO

RANCHERS' SENIOR WATER RIGHTS PROTECTED

by David Moon, Editor

In an important decision by the Colorado Supreme Court (Court) on April 20, Justice Eid upheld the water court ruling that coalbed methane (CBM) production constitutes an appropriation of water for a "beneficial use." Consequently, out-of-priority diversions cannot be allowed without a well permit and, where necessary, a decree adjudicating an augmentation plan. *Vance v. Wolfe,* Case No. 07SA293, Supreme Court of Colorado (April 20, 2009).

A petition for a declaratory judgment was filed by "the Ranchers" — four individuals who "possess water rights" used "for irrigation, stock watering, domestic uses, farming, and piscatorial uses." *Advance Sheets* at 7. The "Ranchers' central concern is the protection of their vested senior water rights." *Id.* at 18. The Ranchers sought a declaration that withdrawal of ground water during the CBM process constitutes a "beneficial use" giving rise to appropriative water rights subject to administration and permitting by the State Engineer under the Water Right Determination and Administration Act of 1969, §§ 37-92-101 through –602, C.R.S. (2008) (1969 Act), and the Colorado Ground Water Management Act, §§ 37-90-101 through -143, C.R.S. (2008) (Ground Water Act).

The Engineers (Colorado State Engineer and Engineer for Water Division 7) and BP America Production Company, an intervenor in the action, asserted that CBM wells are not "wells," as defined by the Ground Water Act, because they do not put water to a "beneficial use." Instead, they claimed that the extracted water (i.e. "produced water") is merely a nuisance, which is exempt from the Prior Appropriation Doctrine and, instead, regulated exclusively by the Colorado Oil and Gas Commission (COGCC). *Id.* at 7-8.

The Court held that under the language of the 1969 Act, § 37-92-103(4), C.R.S. (2008), the coalbed methane process "uses" water — by extracting it from the ground and storing it in tanks — to accomplish a particular purpose — the release of methane gas. Consequently, the extraction of water to facilitate coalbed methane production is a "beneficial use" as defined in the Act and a "well" as defined in the Colorado Ground Water Management Act. Coalbed Methane production is therefore subject to regulation under both acts. The Court rejected the argument that water used in coalbed methane production is merely a nuisance rather than a "beneficial use." On the contrary, the use of water in coalbed methane production is an integral part of the process itself. The presence and subsequent controlled extraction of the water makes the capture of methane gas possible. *Headnote*. at 2.

The Court referred to an earlier decision concerning water use in a gravel mining operation. "As our precedent in the gravel cases makes clear, the fact that the water used during the CBM process may become a nuisance after it has been extracted from the ground and stored in above-ground tanks (that is, after it has been beneficially used) does not prevent a finding that the water is put to a beneficial use. See *Three Bells Ranch Assocs. v. Cache La Poudre Water Users Ass'n*, 758 P.2d 164 (Colo. 1988), and *Zigan Sand & Gravel, Inc. v. Cache La Poudre Water Users Ass'n*, 758 P.2d 175 (Colo. 1988)." *Advance Sheets*. at 4-5.

Conjunctive use of ground water and surface water was also addressed in the decision. It is important to note that the water court began with the assumption — unchallenged before the water court or the Supreme Court of Colorado (Court) — that the case involved "tributary water," i.e. ground water that is tributary to surface water. See *Safranek v. Limon*, 123 Colo. 330, 334, 228 P.2d 975, 977 (1951), which held that all ground water is presumed to be tributary until proven otherwise. The water court found that the extraction of water during the CBM process was a "beneficial use" constituting both a "well" and an "appropriation," because "the removal of water...is not incidental" but rather "occurs as the result of the active and intentional pumping of water to accomplish the intended purpose." *Advance Sheets* at 8. The Court also emphasized that the water court supported its conclusion by noting "the overall intent of the water law scheme. By passing the 1969 Act, the General Assembly intended to integrate the appropriation, use, and administration of underground water...[because under Colorado law] adjudication and administration are essential to protection of water rights." *Id.* Under Colorado law, "nontributary" ground water is defined as "ground water, located outside the boundaries of any designated ground water basins in existence on January 1, 1985, the withdrawal of which will not, within one hundred years, deplete the flow of a natural stream...at an annual rate greater than one-tenth of one percent of the annual rate of withdrawal." § 37-90-103(10.5), C.R.S. (2008). See Footnote 4, *Id.* at 16.

The Court also decided not to defer to the State Engineer's decision. "The Engineers and BP argue that because 'beneficial use' is an ambiguous term, we should defer to the Engineers' interpretation and hold that the extraction of water to facilitate CBM production is not a beneficial use of water. While we may take into account agency interpretations, we are not bound by them. See *Colo. Mining Ass'n v. Bd. of County Comm'rs*, 199 P.3d 718, 731–32 (Colo. 2009). Here, the Engineers' interpretation of the term 'beneficial use' is contrary to the 1969 Act's definition of that term. Their interpretation also conflicts with our case law interpreting the term. We therefore decline to defer to the Engineers' interpretation." *Id*. at 20-21. Finally, the Court held that "COGCC does not have exclusive regulatory authority over the extraction of water in CBM production" *Id.* at 21.

Other states in the West, notably Wyoming, are also struggling with coalbed methane production and the byproduct of "produced" water. This Colorado Supreme Court decision may end up being cited in other legal proceedings where the parties face similar issues.

For info: Complete case available on the Colorado Bar Association's website: www.cobar.org.

WATER BRIEFS

SUPERFUND LIABILITY US
"ARRANGED FOR DISPOSAL" & PRP(S)

Shell Oil Company (Shell) won a major victory before the US Supreme Court (Court) on May 4, when the Court held that Shell is not liable for groundwater contamination under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as a party that "arranged for disposal...of hazardous substances." The Court reversed the Ninth Circuit, which had found Shell and the "Railroads" (Burlington Northern, Santa Fe Railway Company and Union Pacific Railroad Company) to be responsible for nearly all of the cleanup costs. The Court also ruled that the US District Court (trial court) reasonably apportioned the Railroads' share of the site remediation costs at 9%. *Burlington N. & S.F.R. Co. v. United States*, Case No. 07-1601 and 07-1607 (May 4, 2009).

The issue in the cases was whether and to what extent a party associated with a contaminated site may be held responsible for the full costs of remediation. Shell Oil Company sold pesticides to a chemical distribution business in Arvin, California, where many of these chemicals spilled during transfers and deliveries, and as a result of equipment failures. "During each of these transfers leaks and spills could — and often did — occur." *Slip Op*. at 3. The trial court held that both the Railroads and Shell were potentially responsible parties (PRPs) under CERCLA — the Railroads because they were owners of a portion of the facility (see 42 U. S. C. §§9607(a)(1)–(2)), and Shell because it had "arranged for" the disposal of hazardous substances through its sale and delivery of one of the chemicals involved (see §9607(a)(3)).

In discussing the "arranger" issue, the Court stated that, "Although we agree that the question whether §9607(a)(3) liability attaches is fact intensive and case specific, such liability may not extend beyond the limits of the statute itself. Because CERCLA does not specifically define what it means to 'arrang[e] for' disposal of a hazardous substance...we give the phrase its ordinary meaning." *Id*. at 10. The US argued that "Although the delivery of a useful product was the ultimate purpose of the arrangement, Shell's continued participation in the delivery, with knowledge that spills and leaks would result, was sufficient to establish Shell's intent to dispose of hazardous substances" (Brief for United States 24). The Court, however, found "While it is true that in some instances an entity's knowledge that its product will be leaked, spilled, dumped, or otherwise discarded may provide evidence of the entity's intent to dispose of its hazardous wastes, knowledge alone is insufficient to prove that an entity 'planned for' the disposal, particularly when the disposal occurs as a peripheral result of the legitimate sale of an unused, useful product. In order to qualify as an arranger, Shell must have entered into the sale of D–D with the intention that at least a portion of the product be disposed of during the transfer process by one or more of the methods described in §6903(3). *Id*. at 12.

In absolving Shell, the Court placed great weight on their attempts to prevent spills. "Although the evidence adduced at trial showed that Shell was aware that minor, accidental spills occurred during the transfer of D–D from the common carrier to B&B's bulk storage tanks...the evidence does not support an inference that Shell intended such spills to occur. To the contrary, the evidence revealed that Shell took numerous steps to encourage its distributors to reduce the likelihood of such spills, providing them with detailed safety manuals, requiring them to maintain adequate storage facilities, and providing discounts for those that took safety precautions. Although Shell's efforts were less than wholly successful, given these facts, Shell's mere knowledge that spills and leaks continued to occur is insufficient grounds for concluding that Shell 'arranged for' the disposal of D–D within the meaning of §9607(a)(3)." *Id.* at 12-13.

The issue for the Railroads was "whether the record provided a reasonable basis for the District Court's conclusion that the Railroads were liable for only 9% of the harm caused by contamination at the Arvin facility." *Id*. at 15. "Despite these criticisms [by the Ninth Circuit regarding the trial court's basis for its division of liability], we conclude that the facts contained in the record reasonably supported the apportionment of liability." *Id.* at 17.
For info: Complete case available at Court's website: www.supremecourtus.gov/

NEW WATER LAWS NM
WATER MANAGEMENT

The New Mexico Legislature has been active recently, passing laws impacting water management and giving the State Engineer new authority. House Bill (HB) 19 gives the State Engineer authority over drilling into deep saline aquifers and fixed a loophole in the law that allowed an exception for wells that tapped into aquifers that start at least 2,500 feet below the land's surface, contain brackish water, and were disconnected from upper aquifers. "Already more than 50 Notices of Intent have been filed in the past year to drill deep wells to pump more than 1 million acre-feet of water a year," said State Engineer John D'Antonio.

HB 63 amended the Dam Construction Statute to ensure that the State Engineer is regulating the safe design, construction and operation of dams of significant size and capacity in New Mexico. It also clarified that owners of a flood or erosion control dam do not have to apply for or have water rights if the dam drains in 96 hours. HB 63 recognizes the State Engineer's authority to determine height, storage, and storage duration time. It raised the minimum size limit for dams subject to mandatory inspection from 10 feet high and 10 acre-feet of capacity, to 25 feet high and 50 acre-feet of capacity.

On April 9, Governor Bill Richardson signed HB 40, limiting the power of municipalities to condemn water rights. In a press release, Governor Richardson pointed out that municipalities already enjoy extraordinary preferential powers under New Mexico water law. Most significant is the power to hold

WATER BRIEFS

water rights unexercised for up to 40 years without fear of forfeiture. With new limitations on the power of condemnation as a backstop, municipalities will be pushed more strongly to be proactive in securing capacity in the marketplace to cover future water needs. The bill puts water used by an acequia, community ditch, irrigation district, conservancy district or political subdivision of the state beyond the reach of condemnation. In cases where condemnation goes forward, the municipality must meet certain conditions for it to proceed, and mediation is encouraged.
For info: Karin Stangl, OSE, 505/ 699-4923; Alarie Ray-Garcia, Governor's Office, 505/ 476-2248

COALBED AMMONIA WY/MT

POWDER RIVER POLLUTION

New US Geological Survey (USGS) research released April 28 indicates that ammonia from water used in the production of natural gas from underground coal beds in Wyoming is entering the Powder River. "High concentrations of ammonia are toxic, particularly at some of the higher pH values found in these discharged waters," USGS scientist Richard Smith said. "Even low concentrations of ammonia can fertilize pristine rivers as added nitrogen, causing unwanted plant and algal growth." Natural gas can be brought to the surface by pumping groundwater from gas-containing coal beds, an economically viable method of energy production. In addition to natural gas, this groundwater drawn from wells contains ammonia, which is often subsequently released back into the natural drainage.

While the USGS research showed that relatively high concentrations of ammonia are draining into some areas of the Powder River as a result of this process, the research also determined that the concentrations vary according to disposal methods and natural processes occurring within the stream channel. "The ultimate fate of the coal bed ammonia depends upon the action of plants and microorganisms living within the drainage channels receiving the discharged water," Smith said. Ammonia concentrations in water flowing through plant-rich channels were found to be lower than in less vegetated channels. This variation is due in part to ammonia absorption by the plants and the chemical conversion of ammonia to harmless nitrogen gas by microorganisms. According to USGS, such findings provide refined scientific insight into the effects of energy production on federal lands and Western US watersheds.
For info: Marisa Lubeck, USGS, 303/ 202-4765 or website: www.usgs.gov/newsroom/article.asp?ID=2207

SACRAMENTO SALMON CA

FALL CHINOOK POPULATION DECLINE

A multi-agency scientific review panel chaired by NOAA Fisheries Service released a report on March 18 outlining the potential causes for the recent severe decline in the number of Sacramento River fall Chinook salmon. As noted in the Executive Summary of the report at page 4, "...all of the evidence that we could find points to ocean conditions as being the proximate cause of the poor performance of the 2004 and 2005 broods of SRFC. We recognize, however, that the rapid and likely temporary deterioration in ocean conditions is acting on top of a long-term, steady degradation of the freshwater and estuarine environment." The report also states that "The long-standing and ongoing degradation of freshwater and estuarine habitats and the subsequent heavy reliance on hatchery production were also likely contributors to the collapse of the stock." *Id.* at 5.
For info: Report available at NMFS website: http://swr.nmfs.noaa.gov/media/SalmonDeclineReport.pdf

FIFRA VIOLATIONS ID

HERBICIDE APPLICATIONS

Asplundh Tree Expert Company (Asplundh) has agreed to pay $4,200 to settle eight alleged violations of the Federal Insecticide, Fungicide and Rodenticide Act for operations in Sweetwater and Orofino, Idaho, located on the Nez Perce Reservation. An inspector working on behalf of EPA from the Tribal Pesticide Circuit Rider Program found evidence that Asplundh may have improperly applied an herbicide, Dow AgroSciences Garlon 4, to control right-of-ways on at least eight occasions in 2006. In some instances, the herbicide was applied at more than eleven times the maximum rate allowed by the label. The case was referred to EPA for further investigation and enforcement.
For info: EPA website: www.epa.gov/pesticides/

METHYLMERCURY STUDY US

SEAFOOD CONTAMINATION

A new landmark study published May 1 documents for the first time the process in which increased mercury emissions from human sources across the globe, and in particular from Asia, make their way into the North Pacific Ocean and as a result contaminate seafood. Because much of the mercury that enters the North Pacific comes from the atmosphere, scientists have predicted an additional 50% increase in mercury in the Pacific by 2050 if mercury emission rates continue as projected. Methylmercury is a highly toxic form of mercury that rapidly accumulates in the food chain to levels that can cause serious health concerns for those who consume the seafood.

"This unprecedented USGS study is critically important to the health and safety of the American people and our wildlife because it helps us understand the relationship between atmospheric emissions of mercury and concentrations of mercury in marine fish," said Secretary of the Interior Ken Salazar. "We have always known that mercury can pose a risk, now we need to reduce the mercury emissions so that we can reduce the ocean mercury levels."

Water sampling cited in the study shows that mercury levels in 2006 were approximately 30% higher than those measured in the mid-1990s. This study documents for the first

time the formation of methylmercury in the North Pacific Ocean. It shows that methylmercury is produced in mid-depth ocean waters by processes linked to the "ocean rain." Algae, which are produced in sunlit waters near the surface, die quickly and "rain" downward to greater water depths. At depth, the settling algae are decomposed by bacteria and the interaction of this decomposition process in the presence of mercury results in the formation of methylmercury. Many steps up the food chain later, predators like tuna receive methylmercury from the fish they consume.

One unexpected finding from this study is the significance of long-range transport of mercury within the ocean that originates in the western Pacific Ocean, off the coast of Asia. "Mercury researchers typically look skyward to find a mercury source from the atmosphere due to emissions from land-based combustion facilities. In this study, however, the pathway of the mercury was a little different. Instead, it appears the recent mercury enrichment of the sampled Pacific Ocean waters is caused by emissions originating from fallout near the Asian coasts. The mercury-enriched waters then enter a long-range eastward transport by large ocean circulation currents," said USGS scientist and coauthor David Krabbenhoft.

For info: Joan Moody, Interior, 202/208-6416 or email: Joan_Moody@ios.doi.gov; Study is available at USGS' website: http://toxics.usgs.gov/highlights/pacific_mercury.html

MERCURY ADVISORY AZ

FISH CONSUMPTION LIMITS

The Arizona Department of Environmental Quality (ADEQ) announced on April 24 that ADEQ, in association with the Arizona Game and Fish Department and the Arizona Department of Health Services, has issued a fish consumption advisory recommending that people limit consumption of certain fish caught from Lake Pleasant and Roosevelt Lake. The inclusion of Lake Pleasant, north of Phoenix in Maricopa County, and Roosevelt Lake, northwest of Globe in Gila County, brings the total number of lakes in Arizona affected by fish consumption advisories for mercury to 13.

"Consuming fish contaminated with mercury is the most common method of human exposure to mercury," said ADEQ Acting Director Patrick Cunningham. "While we continue to work to reduce mercury pollution in Arizona's water bodies, these fish consumption advisories are an important part of our effort to protect public health." Mercury in the environment can come from various sources and can cause numerous health problems when ingested, most notably its toxicity to the central nervous system.

For info: ADEQ's Fact Sheet at: www.azdeq.gov/environ/water/assessment/ongoing.html#mer

COLUMBIA BASIN PROJECT WA

"ARTIFICIALLY-STORED" GROUNDWATER

The Washington Department of Ecology (Ecology) issued 16 new water use permits on May 1 for the Quincy Basin near Moses Lake, Washington. The permits issued went to people who applied for Quincy Basin "artificially-stored" groundwater (ASGW) several years ago and have been waiting for water to become available. The water permits are for irrigation uses, except one permit for dairy use. The 15 permits for irrigation purposes range from two acre domestic lawns to 1,000 acre full-scale agricultural fields. In the coming months, Ecology plans to issue dozens more permits to applicants who have been waiting in line for Quincy Basin water. Permits will be issued until 177,000 acre-feet (AF) of ASGW has been fully allocated, a limit set by state regulation.

The artificially-stored groundwater is water that has accumulated underground over many years as a result of the federal government's Columbia Basin Project. The Columbia Basin Project provides irrigation water from Lake Roosevelt for more than 670,000 acres of agricultural land in the Columbia Basin. The ASGW permits are jointly administered by Ecology and the US Bureau of Reclamation (Reclamation). Ecology approves the permits, but permittees also must agree to enter into a federal contract and pay an annual water use fee to Reclamation. The permits are issued with a requirement that the water must be put to full use within three years.

The market value of the roughly 30,000 AF of water that will be issued is estimated to be about $60 million. According to an economic analysis conducted by Ecology, the water is expected to add $12.7 million to the value of agricultural land in Grant County, $3.1 million a year in agricultural production and $60 million to the value of commercial land in the county.

For info: Ecology website: www.ecy.wa.gov/biblio/0911013.html

WETLANDS PROJECT US/MEX

JOINT TREATMENT PROJECT

On April 22 in Tecate, Mexico, representatives from the US Environmental Protection Agency (EPA), SEMARNAT, Mexico's Ministry of Environment and Natural Resources, along with the Border Environmental Cooperation (BECC), the Baja State Water Commission for Tecate (CESPTE), and the city of Tecate, celebrated the completion of the first phase of a wetlands project funded by the US and Mexico. Once completed, the newly constructed wetlands will cleanse treated municipal and brewery wastewater that are discharged into the river, create areas for groundwater recharge, help reduce floods, and provide refuge and food for resident and migratory birds.

While only the first cell covering one acre has been completed, sampling by CESPTE has shown a 60% reduction in suspended solids in the portion of wastewater directed through the wetland. In addition, 600 recycled tires were used in the membrane, and 80 abandoned cars were removed from the floodplain to make room for the wetland. Once construction of the

WATER BRIEFS

second and third cells is completed later this year, the wetlands will cover nearly four acres and improve the quality of flows from the brewery, as well as the wastewater treatment plant. Since the Tecate River flows across the international border, the wetlands project will improve water quality in both Tecate and California.

EPA's Border 2012 program helped finance the wetlands project with a $50,000 grant. The North American Development Bank partially funded the project, as well as Fundacion La Puerta, a Mexican NGO, which contributed $41,000. CESPTE provided the remaining $57,000. In addition, the firm Huffman and Carpenter, Inc. provided nearly $60,000 in technical services.
For info: Margot Perez-Sullivan, EPA, 415/ 947-4149, email: Perezsullivan.margot@epa.gov or EPA's Border 2012 Program website: www.epa.gov/usmexicoborder/

PESTICIDES BIOP ISSUED WEST

IMPACTS ON SALMON

NOAA Fisheries Service has issued a final Biological Opinion that evaluates EPA's proposed registration of three types of pesticides and the expected impacts on threatened and endangered populations of Pacific salmon. NOAA has concluded that pesticides products containing carbaryl and carbofuran are likely to jeopardize the continued existence of 22 listed salmon populations, while the use of methomyl is likely to jeopardize 18 populations of listed salmon. The agency also determined that these pesticides are likely to destroy or adversely modify the designated critical habitat of some populations. This biological opinion is part of a series of opinions that NOAA will issue between now and February 29, 2012, to the EPA concerning a total of 37 active chemical ingredients in pesticides.
For info: BiOp available on NMFS' website: www.nmfs.noaa.gov/pr/

TRIBE & UTILITY SETTLE WA

KALISPEL TRIBE/BOX CANYON DAM

After years of negotiation, a final settlement has been reached on the appealed conditions of the Pend Oreille PUD's Box Canyon Dam license renewal before the Federal Energy Regulatory Commission (FERC). The settlement between the Pend Oreille PUD (PUD) and the Kalispel Tribe of Indians is the latest example of tribes using the FERC relicensing process to address long-standing environmental issues. PUD applied to FERC for a new license in January 2000.

Box Canyon Dam was built in the 1950's on the Pend Oreille River near Ione in northeastern Washington, creating a 55-mile-long reservoir that flooded 493 acres of the small Kalispel Indian Reservation, including several tribal cultural sites. The dam was built without fish ladders and caused a sharp decline in the bull trout that the Kalispel Tribe seeks to restore.

New conditions agreed upon include: improved downstream fish passage (non-turbine route); a Habitat Restoration Program that requires 164 miles of tributary habitat to be restored within the first 25 years of the license and maintained perpetually, through the term of the license (total PUD contribution of $9.25 million over 25 years); and PUD will make $300,000 available for the Kalispel Tribe to use for construction of recreation facilities at the Pow Wow Grounds, Kalispel Boat Launch and Manresa Grotto Beach.

The signed agreement must still be approved by FERC. The new license will be valid from 2005 to 2055. "This was a team effort and we are glad that we were able to reach an agreement," said Bob Geddes, PUD General Manager. "We feel like we have fairly addressed all concerns and now look forward to implementing the license conditions."
For info: Settlement Agreement available on PUD website: www.popud.com/news.htm

FALSIFYING REPORTS OK

TREATMENT SUPERVISOR PLEADS GUILTY

Christopher Neil Gauntt, the former supervisor of the Fort Gibson Water Treatment Plant in Fort Gibson, Oklahoma, pleaded guilty on April 30 in US District Court in Muskogee, Oklahoma, to falsifying a monthly operating report that certified the safety of drinking water from the facility, the US Department of Justice (DOJ) announced. Gauntt pled guilty to a one-count information charging him with a felony count of making a false statement. He admitted that on or about June 12, 2008, he submitted a monthly operating report containing false data for drinking water that is provided to residents of Fort Gibson as well as residents of Muskogee Rural Water Districts 4 and 7, Cherokee Water drinking water systems, and the water systems for Corral Creek Subdivision and Ozark Water Inc.

Gauntt admitted that he recorded levels in the monthly operating report submitted to Oklahoma DEQ that indicated the turbidity and chlorine levels were in compliance with required standards when he knew in fact they were not. In August 2008, Fort Gibson had sent a notice concerning this to residents who receive their drinking water from the Fort Gibson water treatment plant. Fort Gibson did not receive any information that anyone experienced any ill effects from the drinking water during that time period.

"Accurate information is essential for the federal government and the State of Oklahoma to assure good drinking water for the public," said Warren Amburn, Special Agent in Charge of EPA's criminal enforcement program in Dallas. "Individuals who submit false reports or bogus data undermine those efforts and they will be vigorously pursued." As a result of the felony conviction, Gauntt could be sentenced up to five years in prison and fined up to $250,000. The case was prosecuted by DOJ's Environmental Crimes Section and was investigated by EPA's Criminal Investigation and the Oklahoma Attorney General's Office.
For info: DOJ, 202/ 514-2007; EPA, 214/ 665-2200 or email: r6press@epa.gov

CALENDAR

May 14-15 CA
California Water Law Seminar, Monterey. Hyatt Regency. For info: CLE International, 800/ 873-7130 or website: www.cle.com

May 15 WA
Water Rights Transfers: Participating in the Water Market in Washington State, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

May 17-19 CA
Waste-to-Fuels Conference & Trade Show, San Diego. Hyatt Regency Mission Bay. For info: Gene Jones, 800-441-7949 or website: www.waste-to-fuels.org/

May 17-21 KS
World Environmental & Water Resources Congress Conference, Kansas City. For info: Conference website: http://content.asce.org/conferences

May 18 WA
Environmental Reporting & Disclosure Seminar, Seattle. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

May 18-19 CA
Endangered Species Act Seminar: Hot Environmental Issues in Southern California, Palm Springs. La Quinta. For info: CLE International, 800/ 873-7130 or website: www.cle.com

May 18-19 CA
13th Annual Water Reuse & Desalinization Research Conference, Huntington Beach. Hilton Waterfront Beach Resort. For info: Water ReUse website: www.WateReuse.org

May 18-21 CO
National Hydrologic Warning Council 2009 Conference & Exposition, Vail. For info: Conference website: www.hydrologicwarning.org/

May 19-22 CA
2009 Assn of California Water Agencies Spring Conference & Exhibition, Sacramento. Sacramento Convention Center. For info: ACWA, 916/ 441-4545 or website: www.acwa.com

May 19-22 WA
Creating Thriving Rural & Urban Communities through Ecological Restoration - Society for Ecological Restoration International Conference, Lynwood. Lynwood Convention Center. For info: Conference website: www.ser.org/

May 20 CA
Mitigation Measure Development & Monitoring, Sacramento. Sutter Square Galleria, 2901 K Street. Sponsored by UC Davis Extension. For info: UC Davis Extension, 800/ 752-0881 or website: http://extension.ucdavis.edu

May 20 OR
Advanced Water Rights Bootcamp, Burns. Harvey Co. Community Center. Sponsored by Water for Life and Schroeder Law. For info: Helen Moore, WFL, 375-6003, email: helen.moore@waterforlife.net or website: www.waterforlife.net

May 20-21 WA
Construction Site Erosion & Pollution Control (CESCL), Bellevue. For info: UW Engineering website: www.engr.washington.edu/epp/cee/cec.html

May 20-22 TX
Water Quality Conference, San Antonio. Hilton Hill Country Hotel & Spa. For info: NWETC website: http://nwetc.org/training_or.htm

May 21 OR
Sustainability Using The Natural Step Framework, Portland. DoubleTree Hotel, 1000 NE Multnomah. For info: April Knudsen, Natural Step Network, 503-241-1140 x1, email: april@ortns.org or website: www.thenaturalstep.org/usa

May 22 OR
Native American Eco-Educational Symposium, Ashland. Southern Oregon State University. Sponsored by Native American Student Union, ECOS & Native American Studies Dept.. For info: ECOS, 541/ 552-8512 or Red Earth Descendants website: www.redearthdescendants.org

May 27 OR
Aligning Sustainability Goals with Indictors to Measure Success Discussion, Portland. DoubleTree Hotel. For info: April Knudsen, Natural Step Network, 503-241-1140 x1, email: april@ortns.org or website: www.thenaturalstep.org/usa

May 27 WA
Making Sustainability Stick: Tools for Change Agents Course, Seattle. NWETC Hdqtrs. Sponsored by Northwest Environmental Training Center. For info: NWETC website: http://nwetc.org/sust-502_05-09_seattle.htm

May 27-29 MT
14th Institute for Natural Resource Law Teachers, Chico Hot Springs. Sponsored by Rocky Mt. Mineral Law Foundation. For info: Mark Holland, RMMLF, 303/ 321-8100 x106, mholland@rmmlf.org or website: www.rmmlf.org

May 28 WA
Rain Garden Workshop, Puyallup. Puyallup City Hall. For info: Becky Abbey, Stewardship Partners, 206/ 292-9875 or email: ba@stewardshippartners.org or website: www.stewardshippartners.org

May 28-29 WA
Quality Assurance/Control: Management of Environmental Analytical Data, Seattle. NWETC Hdqtrs. For info: NWETC website: http://nwetc.org/chem-404_05-09_seattle.htm

May 28-29 WA
Three Degrees: The Law of Climate Change & Human Rights Conference, Seattle. UW Law School. For info: Conference website: www.threedegreesconference.org

May 28-29 OR
Eminent Domain: Current Developments in Condemnation, Valuation & Challenges Seminar, Portland. World Trade Center. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

May 29 WA
Permitting Strategies Seminar, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

May 29-30 ID
Northwest Energy Coalition Spring Conference, Boise. Red Lion Hotel Downtowner. For info: NWEC, 206/ 621-0094, email: nwec@nwenergy.org or website: www.nwenergy.org/conference

May 29-June 1 MD
National River Rally, Baltimore. Hyatt Regency. Sponsored by the River Network. For info: River Network's website: http://rivernetwork.org/

June 1 OR
2009 Toxics Conference, Portland. World Trade Center 2. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, email: hduncan@elecenter.com or website: www.elecenter.com

June 1-2 DC
River Action Day, Washington. Capitol Hill. Sponsored by River Network & American Rivers. For info: American Rivers website: www.americanrivers.org/take-action/river-action-day/

June 2-3 CA
Integrated Regional Water Management: An Interactive Symposium, Davis. UC Davis, AGR Hall. For info: UC Davis Extension, 800/ 752-0881 or website: http://extension.ucdavis.edu

June 2-4 MD
Federal Environmental Symposium East : Progress and Transition, Bethesda. Ntl Institute of Health, Natcher Conf Ctr, 9000 Rockville Pike. For info: Katie Miller, Office of Federal Environmental Executive, email: katie.miller@ofee.gov or www.fedcenter.gov/calendar/conferences/symposia2009/

June 3 CA
Draft Construction General Permit for Stormwater Public Hearing, Sacramento. Cal/EPA Hdqtrs, 1001 I Street. SWRCB Hearing. For info: SWRCB website: www.waterboards.ca.gov/public_notices/comments/index.shtml

June 3-4 CA
Successful CEQA Compliance Seminar, Sacramento. Sutter Square Galleria, 2901 K Street. Sponsored by UC Davis Extension. For info: UC Davis Extension, 800/ 752-0881 or website: http://extension.ucdavis.edu

June 3-5 CO
Western Water Law, Policy & Management: NRLC 30th Annual Conference, Boulder. University of Colorado School of Law. Sponsored by Natural Resources Law Center. For info: NRLC website: www.colorado.edu/law/nrlc/

June 4 CO
Colorado Water Trust First Annual Riverbank Event, Denver. EventGallery 910Arts, 910 Santa Fe Dr.. For info: Erica Payne, CWT. 303/ 623-3139, email: epayne@coloradowatertrust.org or website: www.coloradowatertrust.org

June 4-5 WA
Washington Water Law 2009, Seattle. Washington State Trade & Convention Center. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

June 5 CA
Habitat Conservation Planning Seminar, Sacramento. Sutter Square Galleria. Sponsored by UC Davis Extension. For info: UC Davis Extension, 800/ 752-0881 or website: http://extension.ucdavis.edu

June 8-10 CA
Micropol & Ecohazard 2009 Conference, San Francisco. Sponsored by Groundwater Resources Ass'n of California. For info: GRA website: www.grac.org/micropol.asp

June 8-9 FL
Florida Coastal Law, Tampa. For info: CLE International, 800/ 873-7130 or website: www.cle.com

June 9-11 MA
Environmental Implications & Applications of Nanotechnology Conference, Amherst. University of Massachusetts. Sponsored by The Environmental Institute & EPA Office of Superfund Remediation & Technology Innovation. For info: The Environmental Institute, 413/ 545-2842, email: conferences@tei.umass.edu or website: www.umass.edu/tei/conferences/nanoconference/

June 11-12 AK
Climate Change Litigation & Policies, Anchorage. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

June 14-16 UT
Western Governors' Association Annual Meeting, Park City. Water Issues on the Agenda. For info: WGA website: www.westgov.org

June 14-18 CA
ACE09 Annual Conference & Exhibition, San Diego. Sponsored by American Water Works Ass'n. For info: AWWA website: www.awwa.org/ace09

June 15-16 OR
Oregon Streamflow Duration Assessment Method Training Session, La Grande. USFS Ranger District Office, 3502 Hwy. 30. For info: Scott Clemans, Corps. 503/ 808-4510 or EPA website: http://yosemite.epa.gov/R10/ecocomm.nsf/wetlands/oregonstreamflow

June 15-19 OR
Water Governance & Conflict Management Course, Corvallis. Oregon State University. For info: Lynette de Silva, OSU, 541/ 737-7013, email: desilval@geo.oregonstate.edu or J203website: www.transboundarywaters.orst.edu/training/watergovernance/

The Water Report
Water Rights, Water Quality & Water Solutions in the West
260 N. Polk Street • Eugene, OR 97402

CALENDAR

(continued from previous page)

June 16-18 WA
Federal Environmental Symposium West: Progress and Transition, Grand Mound. Great Wolf Lodge, 20500 Old Highway 99 SW. Open to federal employees and contractors currently representing their Federal agencies; focus on federal sustainability initiatives over the past while expanding into new areas new presidential administration. For info: Katie Miller, Office of the Federal Environmental Executive, email: katie.miller@ofee.gov or www.fedcenter.gov/calendar/conferences/symposia2009/

June 16-18 WA
Introduction to ArcGIS 9 for Fisheries & Wildlife Biology Applications: NWETC Course, Olympia. Evergreen State College. For info: NWETC website: http://nwetc.org/gis-400_06-09_olympia.htm

June 17-20 OR
Sagebrush to Seaweed: Environmental Education Leadership Clinic, Eugene. McKenzie River Conf. Ctr.. Presidential Administration. For info: EEAO website: www.eeao.org/leadership.aspx

June 18-19 OR
Ecosystem Markets: Making Them Work, Portland. DoubleTree Hotel at Lloyd Ctr.. Presented by NW Environmental Business Council & American Forest Foundation. For info: Sue Moir, NEBC, 503/ 227-6361 or website: www.nebc.org

June 18-19 CO
Conservation Easements Seminar, Denver. Ritz-Carlton. For info: CLE International, 800/ 873-7130 or website: www.cle.com

June 18-19 AZ
Law of the Colorado River Seminar, Phoenix. Arizona Biltmore Hotel. For info: CLE International, 800/ 873-7130 or website: www.cle.com

June 18-19 NE
Nebraska Water Law Conference, Lincoln. Cornhusker Marriott. For info: CLE International, 800/ 873-7130 or website: www.cle.com

June 19 CO
Renewable Energy: Legal Challenges & Solutions for the Green Economy, Denver. Hyatt Regency. Sponsored by ABA Environmental Law Committee. For info: ABA website: www.abanet.org/environ/calendar/

June 20-21 CA
SalmonAid Festival, Oakland. Jack London Square. For info: SalmonAid website: http://salmonaid.org/

June 22-26 Czech Republic
Water Policy 2009: Water as a Vulnerable & Exhaustible Resource, Prague. For info: Conference website: www.fzp.czu.cz/waterpolicy2009/index.php

June 22-26 UT
7th North American Forest Ecology Workshop, Logan. For info: Conference website: www.nafew2009.org/

June 23 WA
Using the Interagency Mitigation Guidance to Review Mitigation Plans Program, Moses Lake. Big Bend Community College. Sponsored by Coastal Training Program (Ecology). For info: CTP website: www.coastaltraining-wa.org/

June 23-26 Iceland
International Hydropower Association 2009 Conference, Reykjavik. For info: IHA website: www.hydropower.org/

June 24-25 WA
Liquid Planet: Exploring Global Water Issues Conference, Seattle. UW Seattle Campus, Walker Ames Rm, Kane Hall. For info: Conference website: http://jsis.washington.edu/ellison/events.php#June%202009

June 24-25 OR
Engineering for Ecosystem Services - Design at the Interface of Human & Natural Systems: Ninth AEES Annual Meeting, Corvallis. OSU. For info: John Bolte, OSU, 541/ 737-6303 or email: boltej@engr.orst.edu

June 24-26 CA
WESTCAS Annual Meeting & Conference, San Diego. Kona Kai Resort. For info: Charlie Nylander email: cdnylander@comcast.net or WESTCAS website: www.westcas.org/

June 29-July 1 UT
Adaptive Management of Water Resources II Conference, Snowbird. Snowbird Resort. Sponsored by American Water Resources Assn. For info: AWRA, 540/ 687-8390 or website: www.awra.org

July 7-10 FL
Interdisciplinary Environmental Conference, Daytona Beach. For info: Dr. Kimberly Reiter, Conference Chair, email: kreiter@stetson.edu or IEA website: www.ieaonline.org

July 7-9 IL
2009 UCOWR/NIWR Conference: Urban Water Management - Issues & Opportunities, Chicago. For info: UCOWR website: www.ucowr.siu.edu/

July 9-10 OR
Sustainability and Green Building, Portland. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

July 9-10 NM
Natural Resources Damages Seminar, Santa Fe. La Fonda Hotel. For info: Law Seminars Int'l, 800/ 854-8009, website: www.lawseminars.com