AWRA newsletter
Washington Section
AMERICAN WATER RESOURCES ASSOCIATION
September-October 2008

# PRESIDENT'S NOTES

**Jacque Klug, WA-AWRA Section President**

It's been a few months since you've received your last AWRA newsletter, but we haven't been on summer vacation. Our committees and board of directors have been hard at work planning WA-AWRA events, awards and publications. This fall we have an exciting series of events planned. We are soliciting applications for our two student scholarships starting in October. These scholarships provide funding for two students in Washington pursing degrees in water related fields. Supporting education and connecting students with professionals working the field is a hallmark of our section. We are making plans to enhance our funding for scholarships through a new fundraising initiative. Members and firms will be able to donate directly towards the scholarship fund to help us reach of our goal of self-sustaining the scholarship fund. Look for more details on our website and at the annual conference.

We are also wrapping up a great series of dinner meetings in 2008 with our last dinner meeting to be held in Seattle on September 18th. Our last dinner meeting of the series will feature Professor Steve Burges discussing water storage. This dinner meeting will be an excellent precursor to our exciting annual conference, "The Present and Future of Water Storage in Washington State," to be held at the Bell Harbor Conference Center in Seattle on October 23rd, 2008.

The conference planning committee has put together a strong program on water storage with many excellent speakers. This will be a thought-provoking exploration of the technical, political and environmental issues surrounding ground and surface water storage projects. We are excited to have added a couple of new features for the conference this year. We will be having a student poster session at the conference and a networking reception following the end of the conference. I am looking forward to seeing the breadth and quality of research work occurring in our universities and meeting students. The reception will be a great way to extend the dialogue on water storage and allow for members to connect with one another. Additionally, we will be continuing the WA-AWRA photo contest that we initiated last year. I was surprised to see what amazing photographers we have in our members. I look forward to seeing the entries this year. For more details on the conference, including registration and the photo contest, is contained in this newsletter edition.

**INSIDE:**



**We are happy to report that Steve Hughes, our section secretary, is working 10-15 hours per week, has rejoined the board, and is looking forward to being back full time. Despite intense brain swelling, his memory appears unaffected by the accident, and he lost only taste and smell. We wish Steve full recovery.**

The annual conference is also our annual meeting of the state section, where we elect new board members and kick off the 2009 year. In preparation of the yearly transition, we are seeking new board members. What exactly are the responsibilities of the Board of Directors, might you ask? Well, board members chair section committees and oversee the business of the section. If you are interested in becoming a board member, please contact Pete Sturtevant, Nominating Committee Chair, or myself. Our contact information can be found inside the back of this newsletter.

Enjoy the final days of summer and I look forward to seeing you at the annual conference in Seattle in October!

*Annual State Conference – October 23, 2008 – Bell Harbor*

**PRESENT & FUTURE OF WATER STORAGE IN WASHINGTON STATE**

**A color version of the newsletter is available at:**

**www.wa-awra.org**

## WA-AWRA Section 2008 Annual Conference:

# *"Present and Future of Water Storage in Washington State"*

### *October 23, 2008*

Bell Harbor International Conference Center

Join us as invited speakers from the Pacific Northwest examine questions surrounding the role water storage plays in the 21st century management of this state's freshwater resources.

- What are the trends in demand and our region's water balance: agricultural use outlook, urban growth, fisheries preservation, changing climate?
- Where are the appropriate roles in this State of large-scale surface reservoirs and more distributed small scale options?
- Can our regulatory and institutional infrastructure support innovative, sustainable, and efficient storage options?

This year's event will be a one-day event structured around four sessions. In session 1, speakers will set the stage by describing the trends in water use from both agricultural and urban sectors, as well as climate projections. In session 2, practitioners will discuss recent experiences with surface water storage development in the State, both in the water-abundant western portion, and in the arid eastern region. In session 3, parties involved in developing and exploring groundwater storage solutions will describe their experiences and insights. Finally, in session 4, regulatory and stakeholder representatives will discuss the policy environment for present and future storage solutions.

The conference kicks off with a keynote address, and wrap up with an evening social mixer. Detailed conference logistics and the full agenda with speakers and presentation titles will be provided in an upcoming newsletter.

**More information on pages 12 & 13.**

## State Chapter Seeking New Members for the Board of Directors

The Washington State Chapter Board is seeking new board members to serve for the 2009 term which runs for 12 months starting in October, 2008. This is your chance to work with a diverse group of dynamic, influential members of the water resource community. The Board meets monthly and directs the activities of the chapter. You will work with committees that direct such interesting activities as publishing a bi-monthly newsletter, organizing an annual state conference, organizing a series of dinner meetings and student chapter activities or running an awards program. If you are interested, please e-mail the Nominations Committee Chair, Pete Sturtevant, by October 7, 2008 at psturtev@ch2m.com. Include a brief summary of your background in water resources and any AWRA-related activity (if any) you have participated in within the past year.

## Correction

The May-June newsletter incorrectly identified the affiliation of Jeremy Lieb, author of "Climate Variability, Water Resource Development, and Socioeconomic Development in Kittitas County." Mr. Lieb is a graduate student in resource management at Central Washington University.

# Spokane Sustainability Task Force Takes Action

**Stan Miller, Inland Northwest Water Resources**

The City of Spokane's Sustainability Initiative is off and running. This spring, the Mayor's Sustainability Task Force kicked off its work toward developing a strategic plan to identify how city government can respond to the impacts of rising energy prices and climate change, including reducing our greenhouse gas emissions and preparing for the climate of the future. The thirteen-member Task Force includes representatives of the local and regional utility, transportation, planning, design and higher education communities.

The City of Spokane Sustainability Initiative is limited to what city government can accomplish: leading by example, and helping the community "go green." They are tasked with identifying actions that the city can take unilaterally. Adopting a "solar access" ordinance would be an example.

Four work groups began meeting in late May to identify actions the city can take to achieve its goal. The actions will be prioritized based on feasibility and cost-effectiveness. These groups are examining the city's Built/Unbuilt Environment, Procurement practices, Transportation and Mobility issues and Water (including wastewater and stormwater) management.

Spokane has a unique situation regarding the reduction of fossil fuel use in the area of its water utility. The City's Department of Water and Hydro Services is a net producer of energy. The City's Upriver Dam Hydro Project generates about 70 million KWH of electrical energy annually. Of that only about 30 million KWH is needed to pump and treat the City's water supply. The 40 million KWH of excess power is sold to Avista, the local electrical utility.

This situation leads to two potential problems. First, because water from the Spokane Valley Rathdrum Prairie Aquifer requires only minimal disinfection prior to distribution, and power for pumping is nearly free, the cost of water in Spokane is artificially low. This is in part responsible for the Spokane regions per capita water use of 215 gallons per day (gpd) – nearly double the average of 110 gpd for Washington State. Second, as no fossil fuel is consumed in the pumping, piping and treatment of Spokane's water, the only opportunity for petroleum use reduction by this sector lies in fleet services and replacement and construction of water lines.

Under the current conditions, increasing water rates to encourage conservation will likely lead to the public utility creating profits that will need to be returned to ratepayers. One suggestion by the Water Work Group to deal with this is to decouple the water and hydro functions. Forcing the water utility to buy power, even from a city-owned provider would allow better valuation of water and thus a more equitable rate base.

There are potential problems with such a move. As Spokane River flows drop in the summer, generating capacity at the city hydroelectric facility drops as well. Summer power production drops far below the demand for power to pump water. Using an arrangement with Avista Utilities, the local gas and electric utility, the city "trades" power produced during the winter and spring when river flow is high and power demand is low for power from Avista to meet summer pumping demands. It remains to be seen how decoupling water and hydro might affect rates the water utility must pay for summertime power. Beyond this, some city policies, mostly unwritten, must be changed before a change of the magnitude envisioned can occur.

The mayor also proposed the city adopt an outdoor irrigation ordinance restricting watering from noon to six pm, and homeowners would be required to water on alternate days. But it is proposed that the Spokane Parks Department be exempt from this rule because they rely on hand set sprinklers to water most of its parks. This is a complaint of citizens opposing the ordinance – "Why can't we water in the middle of the day when City Parks does." Citizens don't understand that mid-day watering not only wastes water but costs them money for the 20% -50% of water that evaporates before it ever gets to their lawn. The Water Work Group sees this debate as being outside the scope of its mission but is pushing two actions to deal with the issue. First, major education campaign is needed to improve the public's understanding of plant water needs and how best to meet them. Second, City Parks needs to undertake a capital improvement program to automate their irrigation systems to comply with such rules.

The Water Work Group has put forward a number of recommendations ranging from rainwater capture to reduce stormwater management problems, to the use of methane from wastewater treatment to power wastewater processes. Over 50 specific actions will be forwarded to the Task Force so they can meld the recommendation of all four groups into a package for city action.

The Task Force is scheduled to report to the city council in September 2008 and deliver its Draft Sustainability Strategic Action Plan by the end of February 2009. To accomplish this, the work groups will need to report out their recommendations for action by late July or early August 2008 so the Task Force can meet this goal.

The key to success will be participation by a wide range of citizens interested in Spokane's future. 〰

*More information on the program and how to share your ideas can be found at the websites listed below. Or you may contact the city's Sustainability Coordinator, Susanne Croft, at:* scroft@spokanecity.org.

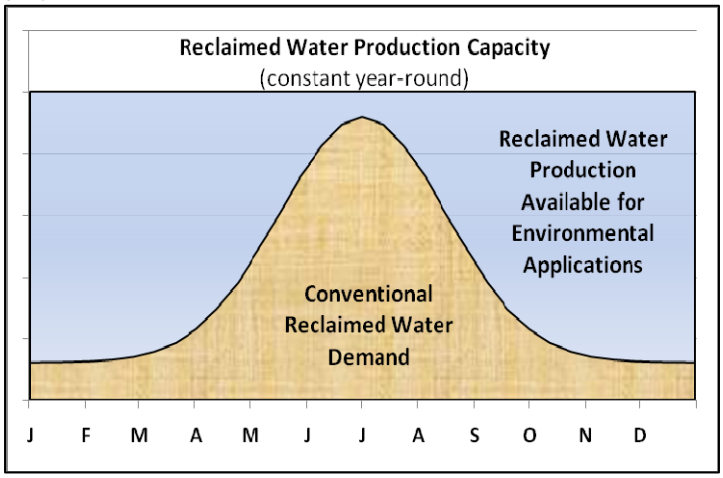
www.GreenSpokane.org

www.sustainablespokane.blogspot.com

# Environmental Applications of Reclaimed Water

**Adrianne Yang and Chris Pitre, Golder Associates**

The potential market demand for reclaimed water, primarily for irrigation use, is limited particularly in Western Washington, as a result of short and mild summers. As a result, there may be minimal demand conventional reuse for a significant portion of the annual reclaimed water production capacity (*e.g.*, on the order of 80% in Western Washington, without considering indoor reuse such as for toilets, or industrial applications). The unused portion of reclaimed water production capacity may be applied to environmental applications such as groundwater recharge, wetland restoration and/or streamflow augmentation. This article considers various environmental applications and other considerations of recognizing and realizing project value.




**Groundwater recharge** of reclaimed water during the winter season offers several possible benefits. Publicly Owned Treatment Works may have a primary water right associated with the reclaimed water. Therefore, groundwater recharge of reclaimed water may be used in an Aquifer Storage and Recovery project in which a portion the reclaimed water recharged during the winter may be recovered during the summer. Potable water would be recovered from another portion of the same aquifer so that it could be used for potable purposes. Recovery of the actual recharged reclaimed water would be avoided to avoid concerns over the direct use of reclaimed water for potable purposes. Alternatively, the seepage of recharged groundwater to streams may mitigate impacts from other, new, groundwater withdrawals (*e.g.*, from other aquifers). The potential of developing potable water supplies with new water rights is attractive to project proponents.

Two regulatory issues that must be addressed in groundwater recharge of reclaimed water are: 1) meeting antidegradation of groundwater quality regulations; and, 2) defining the recoverable quantity of the recharged water.

Current groundwater antidegradation regulations only allow the concentration of 5 micrograms per liter (μg/L) of chloroform. Chloroform is a disinfection product present in reclaimed water that has been chlorinated, and even in chlorinated potable water that is often used on conventional ASR projects (drinking water standards allow up to 80 μg/L of trihalomethanes, including chloroform). Also, concentrations of nitrate must be less than 10 milligrams per liter as nitrate. The definition of Class A reclaimed water (Washington State definition) does not address nitrate concentrations, and so better-than-Class A reclaimed water must be produced for groundwater recharge of reclaimed water.

ASR regulations define the allowable recoverable water based on the residual water remaining in aquifer storage after a given time (not as the same molecule of recharged water). Groundwater recharge may be achieved by direct injection through wells, or from surface infiltration. Surface infiltration offers more flexibility in meeting water quality criteria. But finding a good infiltration site that provides appropriate control of the resulting residence time of recharged water in the aquifer system for recovery under an ASR permit or optimizing the timing of seepage to most benefit streamflows may be difficult. Direct injection of reclaimed water into aquifers faces the reverse of these pros and cons, relative to surface infiltration.

**Wetlands** can be created or restored using reclaimed water. This provides an opportunity for banking of wetland credits that can be sold on the open market and generate project revenue. Restoration of degraded wetlands is more likely to be successful because the soil and hydrogeologic conditions needed for the successful establishment of a wetland already exist. Delivery of reclaimed water through wetlands is an environmentally attractive mechanism to deliver water to streams for flow augmentation to avoid in-channel structures and provide additional water quality improvements.

**Streamflows** can be augmented with reclaimed water delivered either through direct discharge with the use of a diffuser or another method to prevent bank and stream erosion, or indirectly through subsurface infiltration or wetlands. Water quality criteria have to be specifically developed for each receiving surface water body. This environmental benefit is particularly attractive in areas where streams do not meet minimum instream flow requirements. Streamflow augmentation with reclaimed water could open up a stream that was previously closed to new withdrawals, particularly in areas where the impacts of exempt wells are receiving closer scrutiny.

**Example Projects:**

All NPDES-permitted wastewater treatment plants (WWTP) in the Kitsap Watershed were screened in a watershed planning study. Advanced reclaimed water

projects are now in various stages of development at three facilities (West Sound Utilities, and Kitsap County's Kingston and Central Kitsap WWTPs). An additional environmental benefit of all of these projects is that they will reduce loadings, and in some cases completely eliminate discharge points, to Puget Sound, consistent with Governor Gregoire's Puget Sound Recovery Plan.

The **West Sound Utilities** reclaimed water program evolved from the need to increase wastewater treatment capacity on a limited property footprint. The membrane bioreactor installed resulted in the production of Class A reclaimed water quality. At this time, West Sound Utilities is working on developing the distribution system to deliver water for high demand irrigation projects and to replenish streamflows in local streams.

The **Kingston** WWTP is relatively new (2005) and will require minimal upgrades to produce Class A reclaimed water. The County is now entering a design phase for expansion of existing wetlands through which reclaimed water will be delivered for streamflow augmentation, funded with grants from Ecology. The wetlands are all on County-owned lands adjacent to the WWTP, which reduces transmission costs. The increase in streamflows is planned to mitigate potential impacts from a new well for the North Kitsap County Heritage Park. Although this plant is located in an area of concentrated high irrigation demand (*e.g.*, golf course, parks, and other institutional public lands), initial delivery of reclaimed water will be 100% to wetlands and streamflow augmentation, resulting in the completion elimination of an existing point discharge to Puget Sound.

Planning is underway to use reclaimed water from the **Central Kitsap** WWTP to meet peaking non-potable summer demand in one of the fastest growing areas of the State. New developments are now required to install two connections to accommodate current supply of potable water and future reclaimed water for non-potable use, such as irrigation. This source of water supply for peaking irrigation demand will allow for future full build-out as planned under the Growth Management Act without new water rights. The project is being designed to be financially self-sustaining by using connection fees from initial phases pay for subsequent development phases. Planning for a diverse range of environmental applications is being underway to maximize the beneficial use of reclaimed water year-round, including wetlands restoration, streamflow augmentation and groundwater recharge.

The **Saltese Flats** in the Spokane area contains approximately two square miles of degraded wetlands. Spokane County is proceeding with further evaluation

of the restoration of wetlands using reclaimed water from a planned regional WWTP, as developed in the watershed planning process. Inflows on the order of 32 million gallons a day would receive water quality polishing in the wetlands and recharge to the Spokane Aquifer, which is in direct hydraulic continuity with the Spokane River.

The **LOTT** reclaimed water consortium of Lacey, Olympia, Tumwater and Thurston County developed reclaimed water facilities to improve water quality in South Puget Sound. Each member is developing reclaimed water applications within their jurisdictions. One option Tumwater is considering the delivery of reclaimed water approximately 10 miles up the Deschutes River to mitigate potential impacts from downstream new groundwater development. This would be a realization of the concept that has existed for many years of returning reclaimed water from low in the watersheds back to the middle of watersheds to better address a broader range of impacts on streams.

**Economic Considerations:** There are significant financial costs to starting a reclaimed water project. Initial financing is often off-set with Ecology grants. Revenue may be obtained in some projects that are able to secure users. However, reclaimed water capacity sized to meet irrigation demand may only generate immediate revenue on 20%-25% of its annual capacity. Accounting for all aspects of a reclaimed water project is necessary to understand the true value of the project, including concrete and intangible costs. An example of a concrete cost is reclaimed water that is used to recharge the groundwater can be used to offset the cost of acquiring new water rights. Alternatively the water can be stored in the aquifer over the winter months and withdrawn during the summer to meet peak demands, offsetting the need for a new water right. Another example is the cost of offsetting future treatment upgrades as water quality requirements become stricter.

Less tangible benefits may be and elimination of loadings to current receiving waters such as Puget Sound, improving stream flows, which could increase populations of endangered or threatened fish. Complexities arise when applying value to intangible costs. Often times, these costs are dependent on the perception of the community where the reclaimed water project is being implemented. However, local surveys or applying benefits-transfer studies from other parts of the country can reveal the true value of these benefits and the willingness of the community to pay for them.

*Golder Associates has been involved in all of the reclaimed water projects mentioned in this article. Feel free to contact Adrianne Yang (ayang@golder.com) or Chris Pitre (cpitre@golder.com) for more information.*

*Groundwater recharge of reclaimed water will be a topic at the WA-AWRA conference on October 23, 2008 – visit www.wa-awra.org to register and/or for sponsorship.* ≈

# Seattle Public Utilities (SPU) is designing a large City of Seattle South Park Water Quality Project

**Mark Ewbank, Herrera Environmental Consultants**

Seattle Public Utilities (SPU) is designing a large stormwater treatment facility with a flood control pump station in the South Park neighborhood to improve upon degraded water and sediment quality conditions in the lower Duwamish Waterway. This article presents a summary of the preliminary engineering work conducted to develop the design concept for the regional stormwater treatment facility, including evaluation of viable stormwater treatment technologies.

**Background:** The project focuses on the 7th Ave. S. drainage basin (Figure 1). Land use in this basin is primarily residential in the middle and upper basin (approximately 160 acres) and industrial in the lower basin (approximately 70 acres). The industrial land use (Figure 2) is suspected of contributing significant contamination to riverbed sediments via stormwater pollutant loadings that drain into the river at a City-owned outfall. The City is currently engaged in a cleanup of the contaminated riverbed sediments in response to the U.S. EPA Superfund listing of the waterway. The pollutants of concern near the 7th Ave. S. basin outfall include arsenic, mercury, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and phthalates, as well as other conventional urban runoff pollutants. SPU is seeking to enact substantial pollutant loading reductions in areas that drain to the lower Duwamish Waterway via City-owned outfalls through a combination of aggressive pollutant source control efforts and selected stormwater treatment retrofits. For reasons unrelated to the river cleanup, SPU is planning to install a stormwater pump station at the downstream end of the 7th Ave. S. basin. This capital project affords the opportunity to "piggyback" a regional stormwater treatment facility onto the flood control improvements.

**A Lot of Water to be Treated:** Because the drainage basin is mostly built out, and the City needs to implement a stormwater treatment solution relatively quickly. "End of pipe" treatment options that can handle large volumes of flow were evaluated. SPU deemed that construction of numerous smaller treatment facilities, or phasing in of stormwater quality improvements over time as private properties redevelop and City streets are improved, is not a preferable alternative. A centralized stormwater treatment facility would focus the City's long-term operations and maintenance activities in one location.

Consideration was given to separating runoff from the lower industrial area of the basin from the upper and middle subbasins that generate lesser stormwater pollutant loadings per acre, to reduce the size of the treatment facility. However, preliminary engineering analysis indicated that separation of lower basin runoff is not viable for feasibility and cost reasons. The goal of this project then became to treat as much of the runoff from the total 232-acre basin as possible given space constraints at the treatment facility site and available project funding.

Because the treatment facility will be sited near a flood control pump station, pumping of water into the treatment facility is a realistic option. This opens up additional possibilities for the configuration of the treatment system and the type of treatment technology that could be used, particularly filters that require several feet of elevation drop in what is a very flat lower basin area.

**Treatment Technology Evaluation:** Treatment technologies were evaluated based on the following criteria:

- Applicability to urban runoff treatment.
- Pollutant removal effectiveness.
- Design flow capacity.
- Land area requirements.
- Capital, and operations and maintenance costs.
- Adaptability to meet future changes in design flow and/or targeted pollutants.

The stormwater treatment technologies that were evaluated according to these criteria included:

- Wet pond.
- Wet vault.
- Hydrodynamic separator.
- Electrocoagulation.
- Chemical precipitation.
- Ballasted sedimentation.
- Porous concrete reactor (the ecoStorm plus® proprietary product).
- Media filtration (StormFilter® and other proprietary products).


Figure 1: South park neighborhood of Seattle, including 7th Ave. S. Basin Area (lower, north extents only).

Sand filters were not considered in this study because other filtration systems can provide comparable or better pollutant removal with a smaller facility footprint and less propensity for clogging.

A challenge for this study related to evaluating technology effectiveness is removing organic pollutants that are a major concern in the Duwamish Waterway. Most of the published and unpublished treatment system performance data reviewed for the various technologies do not include organic pollutants. Further, typical sediment particle size in runoff and dissolved

versus particulate pollutant partitioning were also driving factors in the technology evaluation. Given the general lack of organic pollutant removal data and runoff sediment particle size data, SPU and Herrera jointly conducted a comprehensive literature and data search for available information with which organic pollutant removal can be inferred based upon total suspended solids removal, the sediment sorption characteristics of the pollutants of concern, and the particle size distribution of these pollutants in runoff.

Several technologies were eliminated on the basis of an initial screening due to considerations such as large land area requirements, excessive capital cost, insufficient pollutant removal performance, or requirements for consistent and predictable flow or water quality conditions. The following technologies were advanced to a detailed evaluation:

- Ballasted sedimentation.
- Media filtration using a CONTECH StormFilter® vault with ZPG (zeolite, perlite, and granular activated carbon) medium.
- Media filtration using CONTECH MFS or the aqua-filter™, each of which uses perlite as the filter medium.
- ecoStorm plus® porous concrete reactor.

Ballasted sedimentation has been used on a large scale for treatment of combined sewer overflows, such as a facility in Bremerton, but not for treatment of only stormwater flows. As with chemical precipitation not aided by fine sediment as a ballasting agent, this technology requires an operator to manage the system components when it is in operation. To reduce the demand for the operator, a large storage tank could be included in the facility design for batching of runoff treatment on a convenient basis. However, the targeted flows for treatment in the 7th Ave S basin, the storage tank add considerable cost and site area. Because of the need for an onsite operator and the uncertainties in using ballasted sedimentation for stormwater treatment applications, this technology was ultimately removed from consideration. That left the proprietary filtration systems as the final options from which to select a preferred technology.

Of the media filter technologies currently approved by the Department of Ecology, the StormFilter® is considered to be the best option for use in the 7th Ave. S. basin because it has a longer track record of performance compared to competitors in the market, and it could be adaptable in the future. If designed to accommodate future flows, a StormFilter® system can be modified to accommodate increased hydraulic loading by adjusting the filter cartridge flow-through rate (this may reduce treatment effectiveness) or installing additional cartridges. As more performance data become available for the StormFilter®, MFS, Aqua-Filter™, and ecoStorm plus® technologies, and other proprietary products that are sure to come onto the market in the years ahead, these technologies should be considered for other projects.

**Treatment Facility Site Selection and Sizing:** The factors influencing selection of a treatment facility site included flat terrain, tidal influence, property ownership, maintenance accessibility, utility conflicts, and facility footprint. Two sites near the basin outfall were evaluated in detail for a large StormFilter® installation.


**Figure 2. Typical industrial street area in the lower 7th Ave S basin**

The tradeoffs included the extent of utility relocations needed, untreated inflow pumping configuration with respect to flood control pumping plans, maximum facility size that could be accommodated, and anticipated permitting requirements. Based on careful consideration of these siting issues, the preferred site is on two parcels adjacent to the 7th Ave. S. street end. SPU is pursuing acquisition of these parcels.

A cost-benefit analysis tailored to the selected facility site was performed to balance pollutant removal performance, capital cost, long-term operations and maintenance costs, and system adaptability. The result of that evaluation was a decision to proceed with a treatment system design flow of 11 cubic feet per second. This peak flow rate requires a StormFilter vault containing hundreds of filter cartridges connected to an underdrain manifold system. This will be one of the largest StormFilter installations in the region, comparable to a similar system that the Port of Seattle recently installed at Sea-Tac International Airport.

**Next Steps:** SPU is proceeding with project design, aiming for construction of the pump station and treatment facility by end of summer 2011. The end-of-pipe treatment facility in the 7th Ave. S. basin in the South Park neighborhood will provide valuable information on cost-effectiveness of large-scale pollutant removal, including organic pollutant removal, for application to other stormwater treatment retrofits in the region that are looming in relation to municipal NPDES stormwater permit compliance and cleanup of Puget Sound.

*For more information, contact Mark Ewbank at (206) 441-9080 or* mewbank@herrerainc.com.

# Lummi Indian Nation, et al. v. State

## The Municipal Water Law Case – July 31, 2008

**Prepared by Washington State Department of Ecology**

**Summary**

Lummi Indian Nation, et al. v. State, the facial challenge to the constitutionality of the 2003 Municipal Water Law (MWL) brought by several Indian tribes, environmental organizations and others, was decided in King County Superior Court in June. This case is also known as the Muni Case.

The Court struck down three provisions of the MWL for violating the constitutional separation of powers doctrine under the state constitution: the definitions of "municipal water supplier" and "municipal water supply purposes" and the language establishing that "pumps and pipes" water right certificates issued before September9, 2003 are rights in good standing. The Court declined to rule on whether these provisions violated substantive due process, and held that the remaining challenged provisions of the act were constitutional.

**Extended Overview**

In 2003, the Legislature passed the MWL, which, in part, specifically defined "municipal water supplier" and "municipal water supply purposes." These definitions included water systems, whether owned by a municipality (public) or privately, that provide water for residential purposes to 15 or more residences, and to water systems supplying water for a range of specified purposes "generally associated with the use of water within a municipality." In addition, the Act contained a statutory provision declaring "pumps and pipes" certificates issued before September 9, 2003 to be rights in good standing.

Initially, in the so-called Burlingame case, the Washington Environmental Council, Center for Environmental Law and Policy, Sierra Club, Puget Sound Harvesters, and several individuals filed suit against Ecology and the Department of Health to challenge the validity of several sections the MWL of 2003. Subsequently, in the so-called Lummi case, six Indian Tribes (the Lummi, Makah, Quinault, Squaxin Island, Suquamish, and Tulalip Tribes) filed suit against the Governor, Ecology, and Health to challenge the validity of several sections MWL. These cases were consolidated.

The Plaintiffs complaints alleged that eight subsections of the MWL violate the Due Process Clauses of the U.S. and Washington Constitutions and the constitutional principle of separation of powers. The Plaintiffs complaints alleged that the MWL violates separation of powers based on their contention that it retroactively overrules the Supreme Court's decision in Department of Ecology v. Theodoratus (discussed below). They further alleged that certain sections of the MWL violate substantive due process because, among other reasons, the law revives relinquished water rights, and allows expanded water use under municipal water rights, to the detriment of other right holders. Moreover, they alleged that the MWL violates procedural due process because the MWL provides that the place of use of a water right for municipal purposes is based on a municipal supplier's service areas based upon an approved water plan, rather than what is described in that purveyor's water right documents. This provision precluded the need to file applications to change place of use under RCW 90.03.380 and 90.44.100, which include non-impairment requirements. Intervention was granted to the Washington Water Utilities Council (WWUC), Cascade Water Alliance (CWA), and Washington State University.

In Theodoratus, the Washington State Supreme Court upheld Ecology's requirement of actual beneficial use in an extension of a permit to build a residential water supply system by a private limited partnership. The Court determined that Ecology had acted unlawfully in using a system capacity measure of a water right in the original permit because the partnership was not a municipality. The Court expressly declined to address issues concerning municipal water suppliers in the context of the case, but noted that the water right statutes allowed for differences between municipal and other water uses. However, the decision created a great deal of uncertainty for municipalities holding pumps and pipes certificates.

Turning to the separation of powers doctrine, if the Washington Supreme Court has interpreted a law and decided its meaning, the Legislature cannot retroactively overrule or change that interpretation as applied to past events. The Legislature may only change the law as applied prospectively - to future events. Additionally, the Legislature may not make legislative determinations of adjudicative facts.

On June 11, 2008, in its order on cross motions for summary judgment, the superior court ruled that three sections of the MWL, RCW 90.03.015(3) and (4) [the definitions] and 90.03.330(3) ['good standing'], are unconstitutional because they violate the separation of powers. The basis of the court's ruling was that these provisions are retroactive in effect and attempt to overrule an interpretation of the Water Code in the Theodoratus case.

However, the court rejected the Plaintiffs' substantive and procedural due process claims and ruled that the other five challenged sections of the MWL are constitutionally sound. The State, the WWUC, WSU, and CWA all filed appeals to challenge the portion of the order that invalidates three sections of the MWL. The Plaintiff Tribes and Burlingame Plaintiffs filed cross-appeals to challenge the portion of the order that denies their other constitutional claims. All parties are seeking direct review

in the Supreme Court in order to bypass the Court of Appeals.

An important component of the decision is that since the definitions have been declared unconstitutional, private water suppliers cannot be considered municipal water suppliers with all the benefits inherent thereto, including exemption from relinquishment, flexibility with place of use equaling service area, and service connections and population figures not providing a limit on the exercise of the rights. However, under the court's ruling, private purveyors do not have to meet the conservation standards prescribed in the MWL, since they no longer meet the definition.

Finally, the Court upheld a provision prohibiting Ecology from revoking or diminishing previously issued water right certificates of water rights for municipal water supply purposes except to correct ministerial errors or in the case of a certificate obtained through misrepresentation. However, the viability of RCW 90.03.330(2) is questionable because the court declared the definitions and 90.03.330(3) unconstitutional.

**Current Issues**

Ecology and Health have not yet decided (as of 7/29/08) whether to ask for a stay of the King County Superior Court's decision. Ecology does not plan to revisit any decisions made under the existing language of the statutes. The decision from the Superior Court has been cross appealed directly to the Washington Supreme Court. The Washington Supreme Court may decide to hear the case or send the case to the Court of Appeals. Additionally, there may be legislation to amend these definitions to make them constitutional.

# Rod Sakrison Student Fellowship 2008-09 Announcement

The Student Fellowship Awards was established in respect to long time Association member and two-time past president of the State Association Rod Sakrison. Rod was instrumental in establishing the University of Washington AWRA Student Chapter.

The Washington State Section of the American Water Resources Association (WA-AWRA) is seeking nominations for two 2008–09 **Fellowship Award of $2,000 each**. One award will be to a member of a Washington Section affiliated Student Chapter. The other award will go to a student enrolled in a graduate program at a college or university in Washington State. Institutions of higher learning are encouraged to establish student sections and obtain a preferred status for the awarding of fellowships along with extended support from the state chapter.

Both fellowships are for a full-time graduate student completing an advanced degree in an interdisciplinary water resources subject. In addition to cash, the award includes a one-year membership in both the State and National AWRA, a one-year subscription to the Journal of the American Water Resources Association, and admission to the Washington State Section Annual Conference. The application form is available on the state section website: www.wa-awra.org.

Nominations will be accepted until **October 30, 2008**. Students are encouraged to submit application early. In early November the Fellowship Committee will evaluate all applications received and will recommend recipients for the Open and Student Section winners to the Washington Section Board of Directors. The Board will approve the selections no later than the December 2008 Board meeting. The winners will be notified as soon as the board approves the award. Special recognition will be given to the fellowship recipients at a Washington Student Section function following announcement of the award.

**From: http://wdfw.wa.gov/do/weekendr/weekendr.htm**

The Puyallup River system is a popular fishing spot right now for chinook and coho, said Hal Michael, WDFW fish biologist. "There are quite a few fish and lots of effort," he said. Anglers fishing the Carbon River, which opened Sept. 1, are finding chinook while, the mainstem of the Puyallup is producing coho, Michael said. The Puyallup opened Aug. 16. Michael reminded anglers to check the *Fishing in Washington* pamphlet (http://wdfw.wa.gov/fish/regs/fishregs.htm) for fishing and retention rules.

Low and clear water have made it tough for anglers fishing the Quillayute system on the northern Olympic Peninsula, said David Low, WDFW fish biologist. "There are **summer steelhead** and coho in the rivers, but anglers need to be careful when they're fishing in these conditions because the fish get spooked easily," Low said.

# Atmospheric Rivers: AWRA May Dinner Meeting Review

**Terra Hegy, Instream Flow Biologist, WDFW**

The May AWRA dinner meeting was held Olympia at the Water Street Café and Bar in downtown Olympia. About 20 members and guests enjoyed a buffet of chicken marsala, cheese-filled tortellini, Caesar salad, and a brownie dessert.

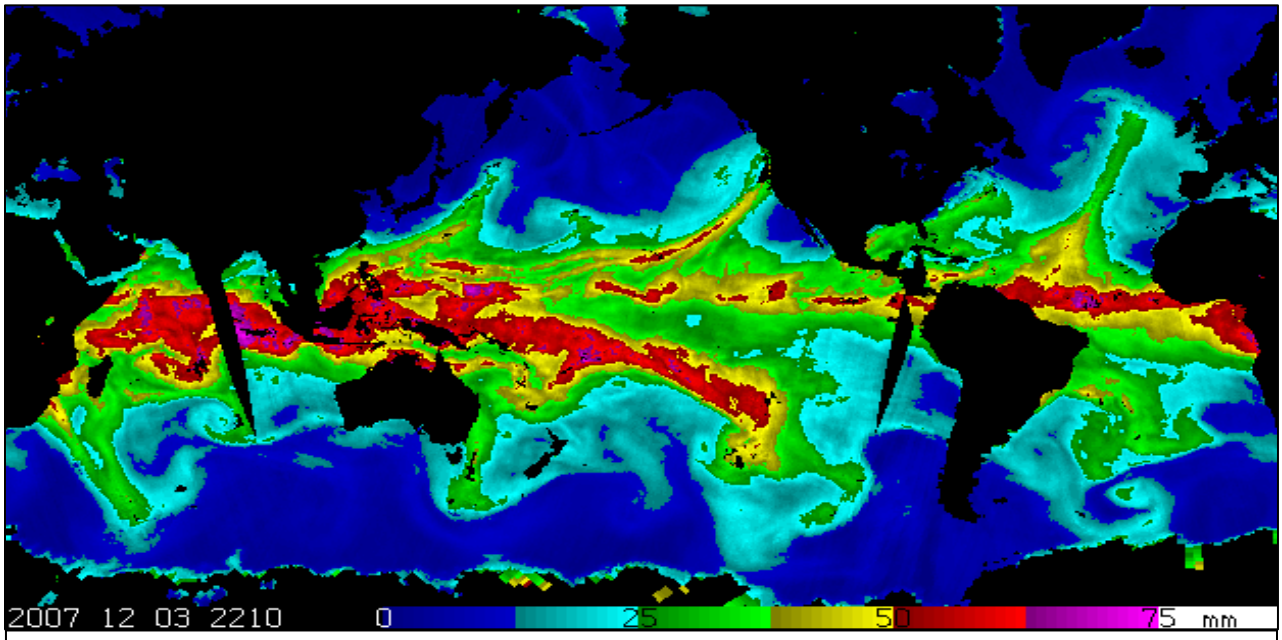
The talk, entitled "Atmospheric Rivers," was led by Robert Kimbrough, an expert in atmospheric processes at the US Geological Survey and Assistant Director of the USGS Washington Water Science Center. Kimbrough led a fascinating discussion on how atmospheric patterns create our most dramatic weather. High-altitude weather maps were used to illustrate cyclones that develop in the tropics of Indonesia and carry moisture-laden air across the Pacific Ocean. One of these "atmospheric rivers", commonly known as the Pineapple Express, often creates torrential rain in western Washington, as it did in 2006 and 2007, causing two of the most devastating wind storms and flooding in history. These two storm events were the subject of much of Mr. Kimbrough's talk.

The 2006 event hit Mt. Rainier National Park hard, with 24 inches of rain at Paradise. Mr. Kimbrough used precipitation and flood data from the USGS network of more than 150 stream gages in western Washington to demonstrate the strength of these atmospheric rivers. Measurements at many stream gages exceeded the 100-year recurrence interval. Thirty-three streams broke the previous historical flood record. The Queets River, in the Olympic Mountains, increased from 10,000 to 100,000 cfs in less than a day.

The second storm, in December 2007, caused havoc in the Chehalis River basin and on the coast. Winds of 127 mph broke records, not for speed, but for duration. For nine hours, one inch of rain per hour fell in the upper elevations of the Willapa Hills. Kimbrough showed pictures of the devastating flood damage in Lewis County. He showed how, during the 2007 storm, much of the precipitation fell in a more defined, less diffuse area than during the 2006 storm. Using data from various gages in the Chehalis, Mr. Kimbrough showed how flows varied throughout the watershed.

Mr. Kimbrough gave a fascinating presentation on an intriguing topic, which, combined with the delicious dinner and lovely setting, made for an enjoyable and stimulating evening.

**On December 3-4, 2007 an atmospheric river making landfall.**




A satellite image of total precipitable water shows an atmospheric river making landfall on the Pacific Northwest Coast on December 3, 2007. Figure courtesy of the Cooperative Institute for Research in the Atmosphere and Colorado State University (CIRA/CSU).

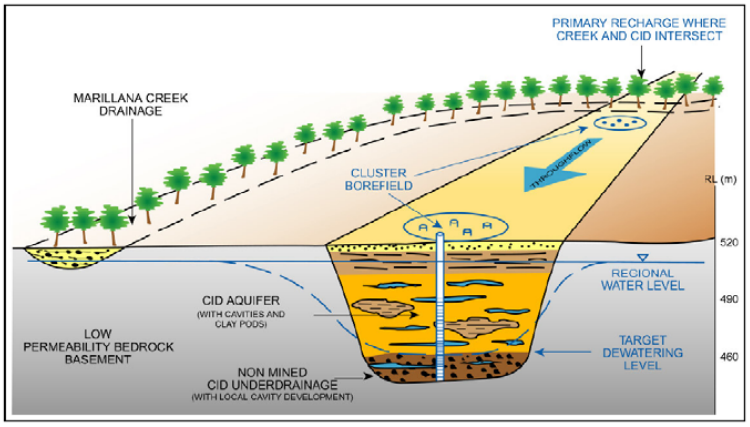
# Aquifer Storage and Recovery – June Dinner Meeting Review

**By Peter Sturtevant, CH2M Hill**

The latest dinner meeting of our 2008 series was a resounding success. Over 30 attendees were on hand to listen to Laura Jean Wilcox describe two Aquifer Storage and Recover (ASR) projects. Laura described ASR as the well injection of water into a local aquifer. Water is injected during times when it is abundant; for instance, a stream source during the rainy season. The injected is water is then pumped (recovered) during periods of high water demand and scarce water supply. This injected water is often recovered using the same well used for injection. Alternatively a group of down-gradient wells may be used. This strategy reduces reliance upon water sources that are highly seasonal in nature. It also avoids evaporative losses that always result from surface reservoir storage.

Nearly all groundwater tends to migrate and a key factor with ASR is the length of storage time. Water managers can track the injected water based upon it relative concentrations of common anions and cations (such as sulfate, carbonate, sodium, chloride). Plots of these anion-cation ratios are known as Stiff diagrams. These diagrams represent a distinctive "fingerprint"; injected surface water may have a very different fingerprint than the native groundwater. A number of factors control the amount of injected water that can be efficiently recovered. This recovered water is termed Target Storage Volume. Laura mentioned that a new term, "Managed Underground Storage," may soon supplant the traditional ASR term.

The first project Laura described was a start-up ASR project in Roseville, California, north of San Francisco. The groundwater in this rapidly growing suburban area had been largely depleted. The local water agency wished to establish a reliable water bank. Water from the Folsom Lake Reservoir was used to recharge the local aquifer for the Diamond Creek ASR Project. The water was first treated and chlorinated prior to injection to a depth of several hundred feet. This water was injected at a rate of 1,350 gpm. This water was later recovered from a series of down-gradient wells at a rate of up to 3,400 gpm. The water fingerprinting technique was used to keep track of the injected water and document the efficiency of its recovery. Monitoring revealed that the level of trihalomethanes (THMs) increased immediately down-gradient of the injection site. THMs are undesirable in drinking water above relatively low levels. In this case the THM concentration decreased to safe levels further down-gradient as the THM compounds naturally decayed. After 30 months of monitoring an optimum cycle of injection and recovery was developed. Roseville is still working out some water quality issues in order to gain approval for full-scale use.




NOTES: Figure not to scale; CID = Channel Iron Deposit; RL (m) = reference level in meters

The second project described was the Yandicoogina iron ore mine in the Philbera Region of Western Australia. This region is a part of the country's famous Outback Area and the climate is hot and very dry. The ore is being mined from old river channel deposits. These deposits must be dewatered to allow mining to efficiently proceed. Water from mining dewatering operations is often simply discharged to a surface watercourse. However, in this case there was a strong desire to retain the water in the area for later reuse as mine process water. Seven injection wells were used to inject up to 650 gpm into other portions of the river deposits remote from the current mine operations. As these other areas are scheduled for mining in the coming decades, the stored water will be used as a supply for mine process water. The well injection system laid out for a large, remote mine is very different from that used by a modern urban water agency. Laura discussed some of the interesting differences. For instance one of Laura's slides showed one mine injection well temporarily receiving far more water than could be injected, resulting in the leakage of large quantities of water to ground surface. While such a situation would be a minor disaster in an urban area, it is a common occurrence at a remote mining site. At the time Laura left the site, one-third to one-half of the dewatering water was being used in the mine's ASR project.

There are about 80 ASR projects in the United States. There are three active ASR projects in Western Washington run by: Seattle Public Utility, Lakehaven Water District (Federal Way) and the City of Sammamish. ASR wells also operate in Yakima and Walla Walla. Several other projects in this state are being actively studied. This approach to managed water resources is becoming increasingly popular and the list of ASR projects is expected to grow.

## *Basin Sponsors of the 2008 WA-AWRA Conference:*

### WATER STORAGE IN WASHINGTON STATE

Sponsorship opportunities available at www.wa-awra.org.

# Announcing the 2nd Annual AWRA-WA Photo Contest

The photo contest will be conducted in conjunction with the Washington Section of the American Water Resources Association annual conference on October 23, 2008. This was a great success at last year's conference, and we look forward to your participation.

We'd like to see your best photos submitted in the following categories:

- The American West and Water
- Humans and Water (includes infrastructure)
- Wildlife and Water

Recognition will be given for the top three overall winners and the best in each category:

**First Prize - $100** Second Prize - $50 Third Prize –WA State Section membership

The best submission in each category will also win a complementary admission to an upcoming AWRA-WA dinner meeting. Winning photos will be displayed at the conference.

Submissions are due by October 8, 2008 via e-mail to: ceinberger@golder.com

Guidelines:

- Please submit photos one at time (5 photo maximum – 5MB limit per photo). JPEG format only please.
- Minimum 300 dpi resolution (minimum resolution of 3,600 x 2,400 pixels).
- In the submission e-mail, include your full name, e-mail, phone number, and address, category for submission, and a short caption.
- Each photo file should have a unique name followed by your first initial and last name.

Judging will be conducted by UW student chapter members and WA state chapter board members.

**We look forward to seeing your beautiful photos!**

# Student Poster Session

All current or recently-graduated students are invited to submit an abstract briefly describing their university-level research on a water resources topic. Selected abstracts will be invited to display at a special poster session to be held at the Conference. Registration fees will be waived for poster session participants.

E-mail your abstract (200 words or less) no later than October 7 to: **psturtev@ch2m.com**

## CONFERENCE PROGRAM

# FUTURE OF WATER STORAGE IN WASHINGTON STATE

**THURSDAY, OCTOBER 23, 2008: BELL HARBOR / SEATTLE**

**8:30 – 9:00** **Keynote – James Waldo**, Esq., Gordon, Thomas, Honeywell, Malanca, Peterson & Daheim

**Session 1: CONTEXT –** Moderator, **David Herrera,** Skokomish Tribe

A. Climate Change: Water Planning Horizon Forecasts – **Julie Vano,** University of Washington Climate Impacts Group

B. Water 2025: Demand/Supply & Stretching Water Resources – **Tim Personius**, Bureau of Reclamation

C. Out-of-Stream Use: Demand & Potential Solutions – **Jeffrey Breckel,** Lower Columbia Fish Recovery Board

**Session 2: SURFACE WATER STORAGE –** Moderator, **Rob Masonis**, Trout Unlimited

A. Howard Hanson Dam Raise – **Greg Volkhardt,** Tacoma Public Utilities

B. Yakima Valley Storage – **Onni Perala,** BoR, SVID, retired

C. Columbia River Off-Channel Storage– **Mark Bransom**, CH2M Hill

**Session 3: GROUNDWATER STORAGE –** Moderator, **Matt Wells**, K&L Gates

A. Issues of an ASR Applicant - **Hal Thomas,** City of Walla Walla

B. Washington State Position on Groundwater Storage Issues – **Dave Nazy,** Ecology

C. Oregon State Position on Groundwater Storage Issues – **Donn Miller,** Oregon WRD

D. Groundwater Recharge of Reclaimed Water – **Chris Pitre**, Golder Associates

**Session 4: POLICY & FUTURE DIRECTION –** Moderator, **Joe Mentor,** Mentor Law Group

A. State Policy – **Keith Phillips** Environmental Policy Advisor with the Governor's Executive Policy Office

B. Water User Perspective – **Kathleen Collins** Washington Water Policy Alliance

C. How can we be sustainable? Environmental Flows Assessment – **Chris Konrad**, The Nature Conservancy

D. Economics of Storage – **Harry Seely**, WestWater Research

**Register on line or download mail-in registration forms at:**

**www.wa-awra.org**

## State Chapter Seeking New Members for the Board of Directors

The Washington State Chapter Board is seeking new board members to serve for the 2009 term which runs for 12 months starting in October, 2008. This is your chance to work with a diverse group of dynamic, influential members of the water resource community. The Board meets monthly and directs the activities of the chapter. You will work with committees that direct interesting activities such as publishing a bi-monthly newsletter, organizing an annual state conference, organizing a series of dinner meetings and student chapter activities or running an awards program. If you are interested, please e-mail the Nominations Committee Chair, Pete Sturtevant, by October 7, 2008 at psturtev@ch2m.com. Include a brief summary of your background in water resources and any AWRA-related activity (if any) you have participated in within the past year.

# NEW MEMBERS

**GSI Water Solutions, Inc.**
**Tim Abbe,** ENTRIX
**Susan Adams,** Washington Water Trust
**Lisa Adolfson,** ESA Adolfson
**Jon Ambrose,** GeoEngineers, Inc.
**Amy Carlson,** CH2M Hill
**Scott Coffey,** Camp Dresser & McKee, Inc.
**Lynn Coleman,** Dept of Ecology
**David Conlin,** GeoEngineers, Inc.
**Jim Gawel,** University of Washington
**Katie Kelleher,** City of Arlington
**Deborah Ladd,** Golder Associates
**Robert Kimbrough,** Washington Water Science
**Jerry Louthain,** HDR
**Derek McGregor,** GeoDesign
**David Monthie,** King County
**Steve Nelson,** RH2 Engineering
**Shirley Nixon,** Center for Environmental Law
**Jenifer Ramsey,** 2020 Engineering
**Jeff Schneider,** Golder Associates
**Arnie Sugar,** HWA Geosciences
**Ming-Yen Tu,** Camp Dresser & McKee, Inc.
**Matt Wells,** K&L Gates

**From:**
**http://wdfw.wa.gov/do/weekendr/weekendr.htm**

The **Dungeness crab** fishery remains open in marine areas 7E and 7N (east and north of the San Juan Islands) Wednesdays through Saturdays each week through Sept. 30. Three other marine areas - 4 and 5 in the Strait of Juan de Fuca and 13 in southern Puget Sound - are scheduled to remain open seven days per week through Jan. 2.

Marine areas 6 (eastern Strait of Juan de Fuca), 7 South (San Juan Islands), 8-1 (Deception Pass to East Point), 8-2 (East Point to Possession Point), 9 (Admiralty Inlet), 10 (Seattle/Bremerton), 11 (Tacoma/Vashon) and 12 (Hood Canal) closed to crabbing Sept. 1.

Recreational crabbers who were licensed to fish for crab in Puget Sound are reminded that they have until Sept. 15 to report their summer's catch to WDFW - whether or not they fished or were successful in catching Dungeness crab during the season. Completed cards can be mailed in or information reported online. Those who file their catch reports by the deadline will be entered in a drawing for one of 10 free 2009 combination fishing licenses, which allow the holder to fish for a variety of freshwater and saltwater species.

**2008 AWRA-WA BOARD MEMBERS**

President: **Jacqueline Klug**
(425) 649-7124
jklu461@ecy.wa.gov

Vice President: **Jamie Morin**
(206) 838-7654
morin@mentorlaw.com

Secretary: **Steven Hughes**
(206) 438-2159
steven_hughes@urscorp.com

Acting Secretary: **Pete Sturtevant**
(425) 453-5000
psturtev@ch2m.com

Treasurer: **Felix Kristanovich**
(425) 827-3243
fkristanovich@anchorenv.com

Editor: **Chris Pitre**
(206) 267-1166 x. 5007
cpitre@golder.com

Past President: **Cleve Steward**
(360) 862-1255
Cleve.Steward@amec.com

Director: **Jami Carter**
(425) 883-0777
jcarter@golder.com

Director: **Carl Einberger**
(206) 267-1166 x. 5006
ceinberger@golder.com

Director: **John Konovsky**
(360) 432-3894
jkonovsky@squaxin.nsn.us

Director: **Stan Miller**
(509) 477-6024
samillerh2o@comcast.net

Director: **Beth Peterson**
(425) 450-6286
Beth.Peterson@hdrinc.com

Director: **Rebecca Ponzio**
**(206) 240-0493**
reponzio@hotmail.com

Director: **Tom Ring**
(509) 865-4946
ringt@yakama.com

UW Student Rep: **Amy Yahnke**
aey@u.washington.edu
206-550-6915

Faculty Advisor: **Anne Steinemann**
(206) 616-2661
acstein@u.washington.edu

# WA-AWRA Dinner Meeting
# September 18, 2008

## Hydrological Variability, Reservoir Storage and Water Supply Reliability

### Stephen Burges, Professor Hydrology & Water Resource Eng.

### University of Washington

**Pyramid Ale House, Seattle, WA**

**5:30PM Social; 6:15PM Dinner; 7:00PM Presentation**

Dr. Steve Burges is a Professor of Civil & Environmental Engineering at the University of Washington. Dr. Burges's main focus is on hydrology, and hydrologic and water resources engineering. His work covers the spectrum of surface water hydrology, particularly uncertainties associated with flood and drought magnitudes, and water supply. He is currently working with colleagues on gravel bed river scour as it relates to salmonid spawning; measurement of rainfall -- at a point, and spatially with radar; mitigating the hydrologic effects of land-use change, particularly urbanization; determining data needed to support spatial hydrologic models; and exploring alternative reservoir release patterns conditioned on long-term forecasts, particularly for a variable future climate.

**Presentation Summary**: Water resource professionals face the challenge of planning for future water supplies in a changing climate. Dr. Steve Burges will speak to variability in annual river flow volume and demands, finding patterns in changing flow patterns, and data needs to define variability. Join us as Dr. Burges discusses storage reservoir design and water supply vulnerability. Don't miss this important topic, leading into the AWRA-WA 2008 Annual Conference: Present and Future Water Storage in Washington.

---------- Detach & mail with registration ---------- ----------

**September 18,, 2008 Dinner Meeting Registration**

Early Bird Mail-in Registration by September 11:
Member: $25
Nonmember: $35
Student: $15
No Dinner / Speaker Only: $15

Email Registration and Pay at the Door:
Member: $35
Nonmember: $45
Student: $15
No Dinner Option: $15

Name_____

Affiliation_____

Address_____

City_____State_____Zip Code_____

Phone:(_____)_____Fax:(_____)_____E-mail_____

Mail to: American Water Resources Assoc. WA. Section
P.O. Box 2102
Seattle, WA 98111-2102

**Checks only payable to "AWRA Washington Section"** No credit cards or purchase orders, please.

## 2008 Membership / Change of Address Form

( ↖ please circle, as appropriate ↗ )

Annual membership in the state chapter costs $25.

Name_____Position_____Affiliation_____

Street Address_____City_____State_____Zip_____

Phone(_____)_____Fax(_____)_____E-mail_____@_____

❑ Please indicate if you prefer to receive your newsletter electronically.

❑ Check if you would like to be actively involved on a committee:
You will be contacted by a board member.

2008 Membership Dues: $25.00. **Checks only.** Please make payable to **AWRA Washington Section**.

Mail to: American Water Resources Assoc. WA. Section
P.O. Box 2102
Seattle, WA 98111-2102

The American Water Resources Association is a scientific and educational non-profit organization established to encourage and foster interdisciplinary communication among persons of diverse backgrounds working on any aspect of water resources disciplines. Individuals interested in water resources are encouraged to participate in the activities of the Washington Section.

***Special Thanks!***
***To Golder Associates for word processing and graphics support on this newsletter.***

---

American Water Resources Association, Washington Section
P.O. Box 2102
Seattle, WA 98111-2102

(Change service requested.)

Non Profit
U.S. Postage PAID
Seattle, WA
Permit #1399