

# Water Resources Research & Extension Colloquium

*April 23, 2004, 8:30 am to 5:00 pm, Albrook 210, WSU Pullman Campus*

## **Agenda & Abstracts**

**Sponsored by**

**The State of Washington Water Research Center  
and WSU's Extension Water Quality Management Team**

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## Acknowledgments

The State of Washington Water Research Center and WSU's Extension Water Quality Management Team would like to thank the presenters of this colloquium for sharing their water resources- related projects and programs during this day-long interactive program. This colloquium would not be possible without their contributions.

## Agenda

- 8:30 - 8:45 am      **Welcome and Introduction**  
*Presenters:*      Michael Barber, Director, State of Washington Water Research Center, and Bob Simmons, State Co-Leader, WSU's Extension Water Quality Management Team
- 8:45 - 9:15 am      **Water Conservation Versus Technology-supported Lifestyles: Extension's Role in *Water Quantity* Education**  
*Presenter:*      James Dobrowolski, Department of Natural Resource Sciences, WSU
- 9:15 - 9:45 am      **Research Activities of the Soil Physics/Vadose Zone Hydrology Group**  
*Presenter:*      Gang Chen for Markus Flury, Department of Crop and Soil Sciences, WSU
- 9:45 - 10:15 am      **Fecal Coliform Transport after Winter Application of Dairy Slurry**  
*Presenter:*      Tamilee Nennich, Puyallup Research and Extension Center, WSU  
*Co-authors:*      Joseph Harrison and Debra Davidson, Puyallup Research and Extension Center, WSU
- 10:15 - 10:30 am      BREAK**
- 10:30 - 11:00 am      **Some Innovative Technologies for Internal Nutrient Load Reduction and Control in Lakes**  
*Presenter:*      Barry Moore, Department of Natural Resource Sciences, WSU
- 11:00 - 11:30 am      **Columbia County: A Case Study of the Impact of Direct Seed Farming on Environmental Health**  
*Presenter:*      Roland Schirman, WSU Columbia County Extension
- 11:30 am - Noon      ***In-Situ* Biobarriers: Microbial Reduction, Immobilization and Re-oxidation of Uranium**  
*Presenter:*      Brent Peyton, Department of Chemical Engineering, WSU

- Noon - 1:00 pm**      **LUNCH (not included with program)**
- 1:00 - 1:30 pm      **The Climate Friendly Farming Project and Water Resources**  
*Presenter:*      Chad Kruger, Center for Sustaining Agriculture and Natural Resources (Wenatchee), WSU
- 1:30 - 2:00 pm      **Design for Fish Passage at Culverts in Washington State**  
*Presenter:*      Rollin Hotchkiss, Department of Civil and Environmental Engineering, WSU
- 2:00 - 2:30 pm      **King County Extension Water Resources**  
*Presenter:*      Brad Gaolach, WSU King County Extension
- 2:30 - 2:45 pm**      **BREAK**
- 2:45 - 3:15 pm      **Increasing Residence Time in Constructed Wetlands using Bathymetric Controls**  
*Presenter:*      Fritz Fiedler, Department of Civil Engineering, University of Idaho
- 3:15 - 3:45 pm      **Pend Oreille County *Sense of Place* Program**  
*Presenter:*      Carol Mack, WSU Pend Oreille County Extension
- 3:45 - 4:15 pm      **Highlights of Agricultural Water Quality Research in the Department of Biological Systems Engineering**  
*Presenter:*      Shulin Chen, Department of Biological Systems Engineering, WSU
- 4:15 - 4:45 pm      **Equating Increased Irrigation Efficiency with Agricultural Water Conservation**  
*Presenter:*      Ray Huffaker, Department of Agricultural and Resource Economics, WSU
- 4:45 - 5:00 pm      **Closing**  
*Presenters:*      Michael Barber, Director, State of Washington Water Research Center, and Bob Simmons, State Co-Leader, WSU's Extension Water Quality Management Team

## **Abstracts**

*Abstracts are listed in the same order as the Agenda. In some cases, contact information is provided for the Presenter in lieu of an abstract.*

### **Water Conservation Versus Technology-supported Lifestyles: Extension's Role in *Water Quantity* Education**

*Presenter James Dobrowolski*

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### **Research Activities of the Soil Physics/ Vadose Zone Hydrology Group**

*Presenter Gang Chen, Author Markus Flury*

Department of Crop and Soil Sciences, WSU

The soil physics group at Washington State University does research on physical phenomena related to vadose zone hydrology. Specific research areas include: (1) characterization of water flow and solute transport in the vadose zone; (2) colloid-facilitated transport of contaminants through the vadose zone; (3) modeling sorption kinetics and transport of organic chemicals, colloids, and viruses; (4) characterization and evaluation of dye tracers for solute transport studies; and (5) quantification and modeling of dispersion during solute transport in porous media. In this presentation, selected research projects will be highlighted.

### **Fecal Coliform Transport after Winter Application of Dairy Slurry**

*Presenter Tamilee Nennich, Co-authors Joseph Harrison and Debra Davidson*

Puyallup Research and Extension Center, WSU

Application of dairy slurry during winter months has been assumed to increase the risk of nutrient and bacterial transport to the environment. The environmental risk of fecal coliform and *Escherichia coli* transport in runoff water from spreading dairy slurry during winter months was evaluated on a transitional-organic, grazing based dairy in southwestern Washington. Two applications of dairy slurry were applied, once in December 2003 and again in January 2004, by broadcast manure applicator to pastureland in an area approximately 3 to 4 times greater than routine farm practice. Sites along an intermittent stream draining the farm property and surrounding areas were selected to collect water samples. Soil samples were taken from plots in a buffer strip or slurry application area, and background levels of fecal coliform and *E. coli* were monitored in the soil and runoff water prior to slurry application. Water and soil samples were taken on a daily basis after slurry application and on a weekly basis for several weeks following application for determination of fecal bacteria. Rainfall events of 2.5 cm or greater occurred within the first 48 hours after each slurry

application. Bacteria counts increased above background levels during 1 sampling period (day 2 or 3 after application) at the water sampling sites most immediate to the slurry application area. Timely applications of dairy slurry during winter months appear to pose little risk of fecal coliform or *E. coli* transport to the environment under the conditions of this study.

**Some Innovative Technologies for Internal Nutrient  
Load Reduction and Control in Lakes**

*Presenter Barry Moore*

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**Columbia County: A Case Study of the Impact  
of Direct Seed Farming on Environmental Health**

*Presenter Roland Schirman*

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***In-Situ* Biobarriers: Microbial Reduction,  
Immobilization and Re-oxidation of Uranium**

*Presenter Brent Peyton*

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**The Climate Friendly Farming  
Project and Water Resources**

*Presenter Chad Kruger*

Center for Sustaining Agriculture and Natural Resources (Wenatchee), WSU

*Science* magazine recently published predictions by the University of Washington's Climate Impacts Group indicating that climate change could have severe consequences for water resources in the Pacific Northwest (Service 2004). The Cascade snow packs could be reduced by as much as 60% in the next 50 years reducing the reservoir of stored water for irrigation, hydroelectric power, fish and residential needs. This concern is further complicated by the likelihood of shorter winters, more erratic precipitation events and longer droughts. The Climate Friendly Farming™ Research and Demonstration Project is developing and implementing agricultural systems and practices that maximize the potential for agriculture to mitigate global climate change, and consequently

addressing current and future concerns about the availability and quality of our water resources. In addition to researching the potential contribution of agriculture to the reduction of greenhouse gas emissions and sequestration of carbon, Climate Friendly Farming™ is directly addressing water use and quality issues. Research and demonstration of reduced soil tillage, crop rotations and cover crops impacts soil quality by improving the water and nutrient retention capacity of the soil and by reducing erosion. Research and demonstration directed at reducing N<sub>2</sub>O emissions from irrigated crops is centered around improved efficiency of irrigation water management. The dairy component of the project is focused on improving dairy nutrient management and alternative electricity generation through anaerobic digestion. A related component of the project, the development of biomass-based energy sources, could further contribute to alternative sources of electricity generation, supplementing or reducing our demand for hydroelectric power.

### **Design for Fish Passage at Culverts in Washington State**

*Presenter Rollin Hotchkiss*

Department of Civil and Environmental Engineering, WSU

While debates continue over how to operate our large hydroelectric facilities in the Columbia Basin for endangered salmonid species, a quieter effort has been underway to replace, rehabilitate, and redesign culverts to allow free passage of salmonids both upstream and downstream. This presentation will focus on current regulations and recent research that supports fish passage through culverts.

The Washington State Department of Fish and Wildlife has issued design guidelines for fish passage through culverts that include three options: zero slope, hydraulic design, and stream simulation. Recently completed research at WSU provides technical design procedures for the latter two options. The Washington guidelines are the most progressive in the nation and are commonly consulted from other States. The guidelines, however, are relatively new and will likely be modified based upon research underway at a unique culvert test bed facility at the Skookumchuck Fish Hatchery in western Washington.

### **King County Extension Water Resources**

*Presenter Brad Gaolach*

WSU King County Extension

### **Fish & Ditch Research**

This is a five-year research project on the effects of maintenance of agricultural waterways on water quality, fish habitat, vegetation, and sediment control. We are in the second year of sampling on this project. This research is a collaboration amongst the State of Washington Water Research Center, the Center for Sustaining Agriculture and Natural Resources, the Department of Biological Systems Engineering, the Department of Statistics, the Department of Natural Resources, WSU King County Extension, and the University of Washington Ecosystems Science Division. A 2004 briefing report is available.

## **Educational Series**

*Water Quality Curriculum* - King County Extension has a U.S. Department of Agriculture 406 grant to develop a modular curriculum looking at overall watershed health and how land uses (from mountains to ocean) impact water quality and quantity. This curriculum can be used as a stand-alone training source (12-weeks) or modules used to supplement other stewardship/volunteer training (see handout for details). We would like to have reviewers/editors lined up to help finalize each module.

*Extension Watershed Stewards (EWS)* - This is a nine-week volunteer training program (like Master Gardeners). In exchange for this 70<sup>+</sup>-hour training on the basics of watersheds, wetlands, streams, water quality, forestry, native plants, wildlife and other natural resource topics, volunteers give back 60 hours to the program. King County EWS is in its 15<sup>th</sup> year.

*Extension Livestock Advisors (ELA)* - Another train-the-trainer program, ELAs receive 80 hours of training over 10-weeks on basic animal management and farm best management practices (e.g., mud, manure, and pasture management). Volunteers return 80 hours of service in the first year and 20 hours each year following. The program is in its 3<sup>rd</sup> year of re-birth.

*Living on the Land* - This 10-week, 25-hour series reaches landowners directly. The program targets new small-acreage landowners/"lifestylers" who are new to living in a rural area. The course is adapted from SARE curriculum looking at water, soil, pasture, and animal care.

*Forest Advisors/Coached Planning* - Work with private forest owners on how to better manage their forests along with training volunteers (using the train-the-trainer system) to provide greater one-on-one education.

*Extension Education Night* - On the second Wednesday of the month, King County Extension Water, Land, Forest, Farms, and Food (WLF<sup>3</sup>) faculty and staff offer a public education class related to some component of the WLF<sup>3</sup> mission. Class descriptions are available at <http://metrokc.gov/wsucce/EdNights/index.htm>

## **Conservation Tools**

The Conservation Tools Education Program brings together public and private organizations working to conserve natural lands in the Puget Sound region. This coalition of partners has included WSU County Extension offices, county agencies, conservation districts, land trusts, fishery enhancement groups, and other non-profit organizations. These partners identify undeveloped, habitat rich areas that provide multiple public benefits such as pollution and flood control, farm and forest resources, wildlife habitat, and aesthetic value.

Many high value natural resource lands such as fresh and marine shoreline areas, wetlands, and forestlands are in private ownership. Conservation Tools Education Program partners educate private landowners about the variety of conservation tools available for land protection, focusing on non-regulatory, incentive-based programs [e.g., current use taxation (reduction) programs and easements]. They provide guidance to help landowners understand the application requirements,

consequences, and incentives associated with each option. Property owners have been educated by means of education materials, workshops, and one-on-one site visits.

### **Noxious Weed Biocontrol**

King County Extension is home to the western region of the Washington State Noxious Weed Biological Control Program (centered in Ferry County). This program looks at collecting, re-distributing, monitoring and educating about the use of biological control agents for noxious weed control. The goal is to reduce the use of herbicides used to control large stands of weeds.

### **Research**

*Organic Flea Beetle Control* - Brad Gaolach is conducting a one-year on-farm research project looking at organic control of flea beetles on brassica greens.

*Conservation Biological Control* - Brad Gaolach assists with Renee Prasad's (Department of Entomology PhD student) research looking into both conserving and enhancing biological control options for cabbage root maggot.

### **Tentative**

*University of Washington (Bothel) Wetland* - Our office has been approached by the University of Washington Bothel campus to help them with monitoring of wetland that is an integral part of the campus. This wetland is used as part of capstone (similar to senior thesis) projects for students at all three University of Washington campuses. We are just beginning discussions as to what King County Extension's role might be.

*Brightwater (King County Wastewater Treatment)* - King County is building a wastewater treatment facility for southern Snohomish and northern King County. They are committed to having education and outreach as an integral component of the new facility. King County Extension has been in discussions with them on how Extension might be part of that mission.

### **Increasing Residence Time in Constructed Wetlands using Bathymetric Controls**

*Presenter Fritz Fiedler*

Department of Civil Engineering, University of Idaho

Physical, chemical, and biological treatment processes are all time dependent, in that treatment effectiveness increases with the amount of time a particular contaminant is treated (i.e., time spent in the reactor). It follows that the treatment efficiency of constructed treatment wetlands (reactors) depends primarily on the residence time of the polluted storm water (Walker, 1998). Many complex reactions occur within wetlands, but treatment effectiveness is ubiquitously improved when residence time increases. We have discovered, through high-resolution hydraulic modeling, that wetland bottom topography (bathymetry) has a large effect on residence time. Based on modeling results, we have developed a wetland design procedure aimed at maximizing residence time and thus

improving water treatment. Results indicate that residence time may be improved by more than 100% when comparing a wetland with little topographic control to a properly designed wetland.

### **Pend Oreille County *Sense of Place* Program**

*Presenter Carol Mack*

WSU Pend Oreille County Extension

Since 1999, Pend Oreille County Extension has offered *Sense of Place*, a unique program designed to acquaint new landowners with water and natural resource management issues. This program responds to a 31% population increase in ten years, and accompanying threats to water and wildlife habitat.

A mailed survey to small-acreage landowners in 1997 found they bought property for a lifestyle change, had little interest in farming for profit, had a high interest in wildlife, and were not being reached by traditional Extension programming.

The *Sense of Place* program engages this audience through a quarterly newsletter and classes. Land stewardship information is the focus, but marketing centers on topics of high interest to attract attendance. Past subjects have included geology, bats, fishing and stream ecology, wildlife, Kalispel Indian culture, bird watching, and watershed history and geography. Every class is evaluated and response helps determine future topics.

Since 2001, the Kalispel Tribe of Indians has been a major partner, funding \$25,000 of project expenses and Extension staff time annually through an EPA sec.319 grant. Community groups and agencies contribute articles and teach classes. Collaborators include Forest Service, wildlife agencies, school districts, conservation organizations, and Extension colleagues.

Program outcomes to date are 50% audience members new to Extension programs, 20 to 100 participants per class, and tripling of newsletter mailing lists. Of benefit to Extension is a strong group of well-educated, vocal program advocates. Post-class evaluations indicate better knowledge and awareness of watershed issues and increased use of best management practices.

### **Highlights of Agricultural Water Quality Research in the Department of Biological Systems Engineering**

*Presenter Shulin Chen*

Department of Biological Systems Engineering, WSU

The Agro-Environment and Bioproduct Engineering (AEBE) Research Group in the Department of Biological Systems Engineering focuses the group efforts on agriculture related environmental issues including water quality, watershed management, wastewater treatment and aquacultural engineering. The objectives of these efforts are to develop technical tools and management practices for watershed management in the Pacific Northwest with emphasis on salmon habitat restoration and Total Maximum Daily Load (TMDL) processes, to develop a decision support system for animal farm nutrient management and reduction of greenhouse gas emission, and to develop tools and technologies for cost-effective treatment of agricultural wastewater. This presentation will highlight the results of two studies, the first one is evaluates the environmental benefits of direct seeding and

the second one is the concept and development of next generation nutrient management systems for concentrated animal feeding operations.

**Equating Increased Irrigation Efficiency  
with Agricultural Water Conservation**

*Presenter Ray Huffaker*

Department of Agricultural and Resource Economics, WSU

Federal and state water law and policy in the West encourages farmers to increase their efficiency in applying irrigation water. The expectation is that more efficient irrigators will apply less water to meet crop needs. Consequently, conserved water can be made available for endangered species protection and other purposes without curtailing agricultural production. The presumed connection between increased application efficiency and agricultural water conservation has been touted widely in the popular press by water-policy pundits. It is one of the few sources of apparent agreement between farmers and environmentalists. Unfortunately, it runs counter to the hydrologic reality of Western river systems. This presentation considers what it means for an irrigator to be efficient in applying water, and concludes that, as a general rule, public policy should not encourage Western farmers to increase application efficiency with the expectation that water will be conserved. Adopting this policy can actually backfire and increase agricultural water use in the West. Reliable conservation generally requires that farms consume less water either by irrigating fewer acres, switching to crops requiring less water, or irrigating current crops at a deficit.

**Water Resource Education for  
Land Development Professionals**

*Presenter Bob Simmons*

WSU Mason County Extension

**Situation**

The population of the Southwest Puget Sound region is rapidly growing. Development practices and landscape modification play significant roles in determining the long-term health of our aquatic systems. A local needs assessment identified real estate professionals and developers as an underserved, yet high priority, audience for water resources education. Developers and real estate professionals with a background in water resource issues can make environmentally suitable decisions regarding development practices, as well as educate their clientele about land stewardship, water quality, and aquatic habitat.

**Actions**

A series of courses were developed and implemented to provide water resources education for professional development of developers and real estate professionals in the South Puget Sound region. The program is a series of courses that provides participants with certified clock hours they can use toward their biennial professional license certification. The seven courses cover the science, policy and regulation of the following water resource related issues: developing in shoreline areas; onsite sewage systems, forestry, wells and groundwater; landscaping; streams and salmon; wetlands; and low impact development techniques. This year the program expanded to provide specific

training on Onsite Sewage Systems to groups of real estate professionals directly in their office facilities. Participants receive a resource book specifically developed for each course that provides necessary background materials on the topics covered and contacts for assistance.

## **Results**

Since 1998, 1,112 real estate professionals have participated in the 40 programs offered in the South Puget Sound region. In 2003, there were 276 participants in the nine sessions offered. Course evaluations demonstrate that the information provided was relevant and useful for the participants in their work. Follow-up evaluations show that more than 90% of the program participants regularly share the information they learned with clientele and colleagues (I frequently receive letters and emails describing situations where the courses improved their ability to assist their clients in protecting water resources). The value of the courses is also illustrated by the fact that more than 50% of the participants have taken more than one course (at a cost of \$160 each) and that many participants learn about the courses through colleague recommendations.