



PRESIDENT'S NOTES

By Tyler Jantzen, P.E., CH2M Hill, AWRA-WA President

As the weather heats up, university classes end, summer vacations take place, field work season and in-water work windows get into full swing, we at AWRA-WA take a small break. But don't worry, we're already planning to ramp back up in the late summer and fall with stimulating dinner meetings both east and west of the mountains, and our premier event, the AWRA-WA Annual State Conference to be held on October 22 in Seattle.

As I look back on the first half of the year, I'm quite impressed with what we've done and where we've been. We hosted, or helped host, seven successful events catering to both students and professionals, in western, central, and eastern Washington. These events were (and continue to be) organized by an amazing group of volunteers, all with busy lives and careers, and all with a passion for water resources and a desire to give back to the water resources community. I am grateful for these volunteers' hard work. Thank you Megan, Tyson, Stan and the host of helpers each of you have by your side. Thank you also to our volunteer speakers, who give their time and expertise to share important updates and information on Washington water resources in exchange only



for dinner and a drink.

Two dinner events and one conference are written up in this newsletter. If you weren't able to attend all of them, I encourage you to read the summary.

Looking forward to the fall, I am excited by the lineup of potential dinner meeting speakers, and by the planning for the annual conference. While I believe we have some dinner meeting topics and

speakers already arranged, I want to help our dinner committee by soliciting topic and speaker ideas from you, our dedicated readers! If you have an interesting water resources-related project or research you'd like to share, or if you know somebody else who does, please send me a note at tyler.jantzen@ch2m.com and I will get it to the dinner committee.

Finally, as you may have seen by e-mail, on our website, or here in this newsletter, the annual conference registration is open! Log in to waawra.org and register now to take advantage of early bird pricing. Also, please consider forwarding the conference information (either this newsletter or the announcement e-mail) to colleagues interested in learning more about responding to the impacts of climate change on Washington water resources. The conference committee is hard at work booking truly stellar group of speakers to talk about the many facets of climate change affecting the state. As somebody who has been integrally involved in planning the annual conference for the past few years, I really appreciate the work of this committee, thank you Steve, Scott, and team!

I hope each of you has a great summer. Please stay safe out on the water, and bring great tales of Washington water adventure to share at our next event. I'll see you there.

-Tyler

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REGISTRATION FOR THE AWRA-WA STATE CONFERENCE IS OPEN!
OCTOBER 22, 2015

THIS YEAR'S TOPIC:

WATER RESOURCES AND CLIMATE CHANGE
ADAPTING TO A CHANGING WORLD

FIND ALL THE DETAILS ON PAGE 6

DETERMINING THE EFFECTS OF VEGETATION ON LEVEE STRUCTURAL INTEGRITY ON THE GREEN RIVER IN KING COUNTY, WASHINGTON

By Ashley N. Adams, University of Washington, Student Fellowship Winner

Introduction

The Federal Emergency Management Agency (FEMA) defines a levee as “a man-made structure, usually of an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.” Essentially, a levee’s main purpose is flood protection. In the 1960s when most of the levees along the Green River in King County were constructed, river and floodplain management was based on an engineered approach involving levee and dam construction without consideration of environmental impacts. Since these facilities were initially constructed, substantial maintenance has been needed, engineering practices have evolved, and environmental regulations have changed.

Beginning in the early 1990s, King County began using bioengineering methods in levee and revetment repair work. This bioengineering approach entailed the use of vegetation to not only provide bank stability, but also improve habitat conditions for salmon as mandated under the Endangered Species Act. Riparian vegetation has been shown to provide shade that helps regulate stream temperatures and provides refugia for fish; allochthonous inputs of organic matter; habitat for insects and other wildlife; and water quality control by trapping of sediment.

Levee repair work, particularly on the Green River, is costly and risks from levee failure are unacceptable to local decision-makers as the surrounding floodplain is densely developed and populated. For these reasons, King County has enrolled many Green River levees in the US Army Corps of Engineers (USACE) cost-share program under Public Law 84-99 (PL 84-99). Under PL 84-99 the USACE is authorized to provide emergency assistance to construct levee repairs following a disaster event. Eligibility for this cost-sharing program requires that levee sponsors comply with the USACE Rehabilitation and Inspection Program, which requires the removal of vegetation greater than two inches in diameter from levees. For many years, King County operated under a de-facto regional modification of the national standard implemented by the Seattle District Engineer, which required the removal of vegetation greater than four inches in diameter. A further modification of this regional allowance was formally adopted by the Seattle District in 2009, requiring vegetation in this size range to be limited to 4-foot diameter “clumps” spaced no closer than 35 feet apart on the levee slopes. The current interim policy is to not use vegetation to determine eligibility for federal financial assistance, however vegetation is still relevant to maintenance and inspection.

My study was designed to examine the relationship between woody vegetation and the structural integrity of levees and revetments in King County, Washington. While an abundance of information has been gathered about the effects of native riparian vegetation on bank stability in natural riparian areas, less information is available on the role of vegetation in the structural integrity of levees and revetments, particularly

those in the Puget Sound Basin. To address these data gaps my study created a common set of terms, summarized previous findings, and provided results of a pilot study as well as recommendations for future study. These new contributions to the body of knowledge about vegetation and levee integrity will provide resource managers with new information on which to base decisions about ways to balance regional flood protection and environmental restoration goals.

King County entered into a sponsored research agreement with the University of Washington to determine whether levee vegetation makes levees and revetments more or less susceptible to flood damage. The goal was to see if the following hypothesis could be tested with existing information and if not, to develop a detailed study design with enough statistical power to determine whether vegetation affects levee stability.

Our null hypothesis stated: The structural integrity of levees and revetments repaired using native woody vegetation in accordance with Washington State and King County bank stabilization guidelines does not differ from that of facilities without native woody vegetation.

Study Site Description

This investigation was limited to the Green-Duwamish River Watershed in King County, Washington. From approximately river mile 11 to river mile 32. This section of river has the largest network of King County’s levee systems, and is also home to the vast majority of bioengineered levee repair projects in the county. Critical habitat has been designated for Puget Sound Chinook salmon and bull trout and has been formally proposed for steelhead in the study area. Bioengineered levee designs used by King County include in-channel large wood installation and riparian trees that provide shade, detritus and prey organisms to aquatic habitats. Specific limits on water temperature have been adopted in Washington State water quality standards to allow for salmonid survival. A Green River temperature water quality improvement report calls for buffers of native vegetation up to 32 meters tall. The vegetation specified in the King County and Washington State bank stability guidelines is native vegetation.

Methods

Initially, the investigation set out to compare levees repaired using bioengineering techniques with levees repaired using traditional rock. However, no digital information was available on bioengineered levee projects on the Green River that could be used to develop a study plan. Therefore, the study’s first task involved organizing files and documenting the institutional knowledge at King County on levee projects along the Green River. Fifty-four bioengineered repairs on the Green River were visited and geo-referenced. Based on information gleaned from the record data mining and field mapping exercises it became clear that comparisons of stability of bioengineered versus non-bioengineered levees could not be made. As such, a retrospective pilot study was undertaken to directly address the issue of the role of vegetation in levee stability. Using a control case method 12 documented levee

sites that incurred damage during November 2006 flooding were matched with undamaged sites on a one to one basis. Basic land cover type (e.g. trees, shrubs, grass, bare ground, impervious surfaces) was delineated through aerial photography taken prior to the flooding and percent cover of for each vegetation type was calculated for all sites.

Statistical analyses were performed using IBM SPSS Statistics 19 for Windows. Paired t-tests were performed for each damaged location and its corresponding control site to test the null hypothesis that the mean difference in vegetation cover between paired case and control observations is zero. The resulting means and standard deviations from the paired t-tests were then fed into a power analysis that was performed to determine sample size required to confidently detect a statistically significant mean difference between damaged and undamaged sites.

Results

Study results reveal the paired differences between percent cover of trees, impervious surfaces, and bare ground were not statistically significant between damaged and undamaged control sites. However, of the paired sites where trees were present in both the damaged site and the control site, the control site generally had more tree cover. Tree cover ranged from 0-17% at the damaged sites and 0-43% at the undamaged control sites. Median tree cover was 5% for the case sites and 5.5% for the control sites. Four cases and four controls had no tree cover. Three of these were matched pairs.

Of sites with tree cover, the case sites had an average of 9.6% tree cover and the control sites averaged 15.9% tree cover. Shrubs were present on all sites except for one control site and shrub cover was statistically higher on damaged sites than on control sites. Average shrub cover on the case sites at 61.5% and 46.7% on the controls. It was not possible to determine if shrub cover was native or non-native from the data collected.

Power analysis indicates that a much larger sample size of at least 54 matched cases and controls would be needed to determine a more statistically robust result for the effect of tree cover on levee damage. The steps taken for the pilot study should be duplicated in a larger study. However, it will prove challenging to match all damaged sites with bioengineered sites on the Green River given the number of variables to be considered when matching.

Conclusions

This study has demonstrated the complexity of conducting an empirical, scientific study on the effect of woody vegetation on the structural integrity of levees and revetments. There remain many issues with policy, interpretation, terminology, and data gaps. The literature review and pilot study have revealed complications with trying to isolate vegetation as the sole cause of structural stability keeping all other factors constant. Future research should focus on site-specific investigations to take into account local differences in geology, hydraulic conditions, levee material, local flora and fauna, and weather patterns, as well as regional environmental and economic circumstances. The issue of woody vegetation and levee stability remains controversial. However, continued research on the subject is helping pave the path to effective collaboration among a wide array of interested parties and stakeholders.

SPEED NETWORKING AT UNIVERSITY OF WASHINGTON

By Patrick Vandenburg, University of Washington

The speed networking event at UW was a resounding success! 12 professionals and about 30 students were present for a wonderful evening at the Vista Cafe.

Students mixed with water resources professionals over refreshments, asked them questions during a town hall-style panel discussion and had a chance to network and ask more personally relevant questions during the one-on-one portion.

It proved to be an excellent chance for students to find out more about the field of water resources and learn about the various career paths available to them. Special thanks to our esteemed panelists!

WATER LAW IN WASHINGTON CONFERENCE

PRESENTED BY LAW SEMINARS INTERNATIONAL

Location: Courtyard Pioneer Square, Seattle

Date: July 27 and 28, 2015

Event Information

The legal, policy, and environmental landscape for water law in Washington continues to evolve. Building on prior years' conferences, the Washington Water Law conference will explore current policy priorities in Olympia beginning with an opening address by Thomas Loranger, Water Resources Program Manager for the Washington State Department of Ecology. We will provide updates on litigation in the courts and before the Pollution Control Hearings Board, as well as on the just-concluded legislative session.

This conference promises thought-provoking discussions of numerous current issues of interest to water law practitioners, water users and resource managers. Beginning with an optional "Water Law 101" presentation on the fundamentals of water law, the conference brings together experts from a variety of perspectives and disciplines to share their experiences, challenges and insights regarding the changing water rights landscape, with a special focus on recent decisions addressing drought year water rights permitting and management, in-stream flow rules and the rural water supply dilemma, recent cases addressing the intersection of land use and water rights law, and the role of science in water management.

What You Will Learn

- Optional Water Law 101
- The Department of Ecology's priorities for water resources in Washington
- New developments at the intersection of water rights and land use
- The regulation of instream flows after *Swinomish v. Ecology*
- Another drought year: What is in the forecast and what do we have in our toolbox?
- Streamflows in the Columbia River
- Other recent decisions and pending cases to watch

APRIL DINNER PRESENTATION REVIEW:

KING COUNTY'S JACQUE KLUG

By Scott Kindred, Kindred Hydro, AWRA-WA Board Member

Jacque Klug, Project Manager for King County's Wastewater Treatment Division, gave a presentation on King County's recycled water program at the Pyramid Alehouse in Seattle, Washington. The presentation attracted a large crowd, including 14 students.

Jacque gave a brief overview of the recycled water production process, which relies on a variety of tertiary treatment processes to convert sewage into water suitable for reuse. The treatment technologies used by King County are capable of creating recycled water that is suitable for irrigation, toiled flushing, car-washes, and discharge to surface and ground water. Direct potable water re-use facilities are currently being developed in New Mexico and Texas.

King County's facilities produce recycled water that typically contains zero total coliform but low levels of nutrients (such as nitrate and phosphorus in particular) remain after treatment is complete. These nutrients are needed by plants and can reduce the required amount of applied fertilizer, thus saving money for some users.

Jacque also addressed concerns regarding pharmaceuticals and personal care products that remain in recycled water. For example, Bisphenol A (BPA), which is typically found in plastics and detected in recycled water at trace levels, is one constituent of concern. However, the concentrations of recycled constituents are generally low enough in recycled water that it would take 22 years for a child playing in a park irrigated with recycled water to receive the same committed dose of BPA that he/she ingests in food during a single day.

King County has three recycled water facilities. The south treatment plant in Renton produces recycled water that is used for irrigating a nearby nursery, soccer fields, and landscaping. The Carnation facility has a design capacity of 0.37 million gallons per day and uses a membrane bioreactor treatment facility to create Class A reclaimed water. All of this water is directed to a nearby wetland. The Brightwater facility also uses a membrane bioreactor and has a design capacity of 21 million gallons per day. This water is used for the Willows Run Golf Course, irrigation, process water, and toilet-flushing at King County facilities and will eventually be made available to other irrigators in the Sammamish Valley. Ultimately, switching irrigators in the Sammamish Valley to recycled water may help keep about 7 cubic feet per second flowing in the basin during critical low-flow summer months.

Jacque provided a brief review of the reclaimed water regulations in Washington State. Reclaimed water was first authorized in 1992 and in 1997 the state developed interim standards that are currently used for permitting and design. Work on an updated rule was conducted from 2007 to 2011, but was suspended due to a fiscal-related state suspension of rule-making. In 2014, Ecology re-initiated work on the revised rule. Work continues on a number of outstanding issues related to water rights, water quality standards, disinfection requirements, and communications to the public. Ecology plans to

Continued on Page 6: Klug

CONFERENCE REVIEW: AWRA-WA AND AWRA-ID EAST

By Stan Miller and Steve Nelson, AWRA-WA Board Members

On April 9th the Washington Section sponsored a half-day conference titled "Rural Water Supply in the Inland Northwest". The event was held at the Spokane County Water Reclamation Facility. The meeting was cosponsored by the Idaho Section of AWRA and received financial support from the CH2M Hill and GeoEngineers Spokane offices. This was the first event of its kind since the mid-1980's.

The 32 attendees included a panel of seven speakers and nine students representing the University of Idaho, Washington State University, Eastern Washington University, Gonzaga University, and Spokane Community College. The corporate support provided free registration for the students attending the event.

The half-day program was split into two general sessions with a keynote presentation during lunch. The first session summarized the conditions and issues of rural water supply and availability, the regulatory framework, and future demands for rural water in Spokane County, Washington, and Kootenai County, Idaho. The second session covered supply and mitigation strategies to meet future demands, including the potential for creating rural water districts in areas where pumping from exempt wells frequently results in loss of water availability due to excessive drawdown, water banking strategies, and aquifer storage and recovery schemes. The keynote featured an update on the status of the adjudication of the Rathdrum Prairie Aquifer in Northern Idaho.

Following lunch, Rob Lindsay from the Spokane County Water Resources Program provided a tour of the Spokane Regional Water Reclamation Facility for conference attendees interested in the plant operation.

The event was well attended, and there appears to be a demand for similar types of conferences focusing on water resource issues in the Inland Northwest. To meet this demand AWRA-WA will consider planning such an event on at least a biannual basis.

Some highlights of the sessions

Keith Stoffel, Eastern Region Section Water Resource Program Manager described the recent Washington State rulings (Swinomish Tribe vs. Ecology, 2013; Whatcom County vs. Hirst, 2015) that will affect policies towards managing the allocation and availability of water in closed basins. Keith described some of the efforts and challenges Ecology will face to align the statewide policies with the diversity of language and provisions (and some contradictions) in current Washington State instream flow rules, and provide water availability guidance to counties.

Mike Hermason with the Spokane County Water Resources Program described the Future Demand Study for Spokane County, which is intended to forecast growth in consumptive and non-consumptive water use based on projections of population, timing and types of water use. The study relied upon data from county geographic information and reports from surveys of public and residential use,

***Continued on Page 7:
Conference East***

CWU APRIL STUDENT CHAPTER MEETING:

TROUT UNLIMITED'S JUSTIN BEZOLD

By Jason McCormick, Aspect Consulting, AWRA-WA Board Member

The AWRA-WA April dinner meeting in Ellensburg featured a talk from Justin Bezold, the Yakima Basin Project Manager for Trout Unlimited-Washington Water Project (TU-WWP). We also leveraged the opportunity to present the newly formed (January 2015) Central Washington University Student Chapter (CWU Student Chapter) with a framed Certificate of Formation from the AWRA national. AWRA-WA recognizes the great value of Student Chapters, and we're excited to support our new CWU team. The event was held at the Palace Café in downtown Ellensburg, attended by 10 professionals and 20 students.

Justin talked about the intersection of salmonid biology and habitat restoration. In other words, how do we find the right time and location to effectively implement restoration projects. Justin discussed the evolutionary history of salmonids, American manifest destiny, and challenges with 20th century management practices (hatcheries, dams, and land use). From the history he built on the "treadmill" concept of ecological demands for all fish species:

$$\text{Food} + \text{Shelter} + \text{Reproduction} = \text{Energy Demands}$$

Fish habitat and availability of food greatly affects Energy Demands and, ultimately, reproductive success. As such, understanding Energy Demands is important when targeting restoration of specific Endangered Species Act (ESA) listed fish populations.

To create favorable freshwater instream conditions that maximize Energy Demands, Justin suggests observing the environmental variables affecting a given water body to determine a restoration treatment. Some key environmental variables include temperature, discharge, substrate, gradient, pool-riffle-run ratios, channel type, riparian cover, and dissolved oxygen.

As Justin notes, dissolved oxygen is of critical importance, and is often strongly influenced by the preceding variables. Selecting a restoration treatment that maintains or increases dissolved oxygen is of the utmost impor-



Students meeting in Ellensburg with Justin Bezold to discuss salmonid biology.

THANKS TO OUR BASIN SPONSORS!



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FLOODPLAINS BY DESIGN: BREAKING DOWN THE SILOS FOR MULTIPLE USES

By Tom Bugert, The Nature Conservancy of Washington

As construction season starts up and the legislative session winds down, you may be wondering about all the recent buzz around “multiple benefits” and “Floodplains by Design.”

Administered by the Department of Ecology, Floodplains by Design is an innovative new state grant program that funds projects that substantively reduce flood risks and restore habitat, while also improving water quality, agricultural viability and recreational access.

This idea has piqued interest across the state. Ecology received more than \$175M in pre-applications for this new program from across the state. The Seattle Times just published an editorial about the approach as well, which is well worth a read.

The Department of Ecology, the Puget Sound Partnership and The Nature Conservancy – the three organizations that lead the initiative – have created a website where you can learn more about Floodplains by Design and the types of projects that it funds: www.floodplainsbydesign.org.

Of course, with a new approach to how our state does business, there’s a lot of education required as well. A robust effort has come together to educate agency staff, elected officials, local governments and others about what Floodplains by Design is and how it works.

If you would like to be kept apprised of Floodplains by Design events or opportunities, become involved or learn more, contact Tom Bugert (tom.bugert@tnc.org)

Klug: Continued from Page 4 issue a draft rule for public review and comment in the summer of 2015.

More information on King County’s recycled water program can be found here: www.kingcounty.gov/recycledwater.

More information on the Department of Ecology’s Reclaimed Water Rule can be found here: <http://www.ecy.wa.gov/programs/wq/reclaim/index.html>

Ellensburg: Continued from Page 5 tance when restoring ESA-listed fish populations.

Our three take-aways were:

1. Fish are complex with an energy budget structured for reproduction
2. Not all water is created equal for fish
3. Complex biological issues call for complex solutions

As our AWRA-WA presence east of the Cascades continues to grow, we welcome professionals on both sides of the Cascades to capitalize on education and social opportunities offered through dinner meetings.

Everyone is invited to join AWRA-A for the next east side dinner meeting to be held October 2015. And as always AWRA-WA thanks our sponsors and active participants from the CWU Student Chapter.

AWRA-WA STATE CONFERENCE

Location: Seattle Mountaineers Event Center, 7700 Sand Point Way NE, Seattle

Date: 22 October 2015 8:00 AM PDT

Event Information

This year’s conference will focus on the latest understanding of impacts of climate change to water resources in Washington State and potential strategies for adapting to these changes. The warm winter of 2015, perhaps a typical year in future decades, provides an interesting backdrop for discussing climate change impacts.

Although the rate and magnitude of climate change is uncertain, there is clear scientific evidence that global temperatures will warm considerable over the next century, resulting in significant changes to temperature and precipitation patterns across the globe. Most models predict that Washington State will experience significant reductions in snowpack, dramatically changing the runoff patterns for streams and rivers that drain mountainous basins with snow-dominated hydrographs. In general, runoff is expected to increase in winter months and decrease in summer months.

The impacts associated with these changes in runoff patterns are substantial and widespread, and the conference will address impacts associated with fisheries, power generation, domestic and industrial water supply, irrigated agriculture, recreation (e.g., skiing, boating, and fishing), and flood control. Most importantly, the conference will focus on discussing various strategies to address these impacts. As always, we will include speakers with diverse backgrounds and alternative viewpoints and hope to stimulate discussions regarding potential solutions.

An evening reception will follow the conference with an opportunity to meet and mingle among water resource professionals, and the opportunity to enjoy a variety of hors d’oeuvres and select beverages.

Please contact one of the conference co-chairs with questions: Scott Kindred (scottk@kindredhydro.com) or Steve Nelson (snelson@rh2.com).

[Register on the AWRA-WA Website Today!](#)



President Kent Allen shows off the AWRA National certificate of formation for the new Central Washington University Student Chapter of AWRA-WA. Congratulations to the CWU chapter, Jason McCormick, and all the people who helped make this a reality in 2015!

OUTSTANDING CONTRIBUTION TO WASHINGTON WATER RESOURCES AWARD

CALL FOR NOMINATIONS

The AWRA Washington Section plans to honor an individual at the State AWRA Conference which will be held this year on October 22, at the Mountaineers Event Center in Seattle.

This award will be presented at the conference for outstanding contributions to the water resources profession in the State of Washington. Current State Chapter members are encouraged to send in a nominating letter for themselves or another candidate by July 31 of this year.

In addition to identifying a nominee, the letter must contain an explanation of how the candidate specifically meets the criteria listed below. An individual need not satisfy all of the criteria to win the award, and other appropriate factors brought up in the nomination letter may be considered.

- Outstanding contribution or achievement in the water resources field (broadly defined) in the State of Washington.
- Leadership, so that others are enabled, inspired or organized to advance the understanding, management or wise use of water resources.
- Degree of innovation.
- Interdisciplinary or bridge-building qualities.

Any person may be nominated for this award, but only current AWRA-WA members may submit a nomination. The nomination letter must be received by July 31, 2015.

The winner of the Outstanding Contribution award will receive a handsome commemorative plaque. In addition, the AWRA Board will make a donation to a water-related, nonprofit organization of the winner's choosing.

There are lots of people out there working hard to protect and enhance Washington's water resources. This is your chance to bring some much-deserved recognition to one of them.

Submit nomination letters to Tyler Jantzen by e-mail at Tyler.Jantzen@ch2m.com

Conference East: Continued from Page 4 and incorporated climate data to develop a water demand model which may be used to anticipate demands in drier and hotter years ahead.

Mark Solomon, Associate Director of the Idaho Water Resources Research Institute described northern Idaho's approach to forecast future demand for municipal supply from the Rathdrum Prairie aquifer. The study also relied upon geographic information, population growth projections, and shifts in irrigation practices for agriculture uses. Notably, predicted climate changes may not significantly affect the hydrology and availability of water in the highly productive aquifer.

Dick Price, the manager of Stevens PUD #1 provided information and ideas that may provide alternatives to individual well use when exempt wells dry up in high demand/low recharge areas. The greatest opportunities included shared water resources by connecting multiple wells to form small water systems, and individual on-site storage to manage the peak demands and low recharge rates. The greatest challenges are the costs of these systems, and the ability to demonstrate the adequacy of water to county planning and health departments.

Carl Einberger a hydrogeologist with Aspect Consulting described possible approaches for water banking to mitigate the effects of activating new water rights in the closed Little Spokane River Basin. Exempt wells are still the source of supply for new water rights, but cannot meet larger future demands, and may soon face similar restrictions to what is already in place in other closed basins. Water banking, which may include direct exchange of the paper rights, or interbasin transfer of real water, or storage of water to meet demands during periods of low stream flow interruption are under consideration. Of these alternatives, the possible direct transfer of water from the Pend Oreille River into the headwaters of the Little Spokane River is most intriguing. This scheme would provide a significant amount of water, but will require extensive engineering, economic, environmental impact analysis.

Kevin Lindsay of GSI Water Solutions, summarized the use of aquifer storage and recovery as a tool to provide water during low flow periods. Several schemes were described, all designed to divert and transfer a portion of high runoff flows into a natural storage system (aquifer) that could either be withdrawn or would naturally discharge into streams to provide summer water. The Walla Walla ASR system was described as the most developed in Washington State. Other less developed systems face greater challenges due to economics, ASR system management and ownership issues, and some water quality questions

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