American Water Resources Association
Washington Section
www.waawra.org
JANUARY-APRIL

President's Notes

Spring has arrived and we are ready to enjoy the new growth and return of sunshine and warmth to Washington State. As this year's president of the Washington Section of the AWRA, I would like to thank the board members and general members that have volunteered to serve on multiple committees to organize and lead our efforts to make this another great year. And am grateful for the leadership of past presidents to show the way, in particular, Allison MacEwan for her work in 2016, and for staying with us as president emeritus. I speak for the board that we will miss retiring board members Scott Kindred and Tyler Jantzen, whose long careers with the WA-AWRA board improved and developed the culture of our organization. We have new board members John Chandler, Dave Christensen, Tom Fitzhugh and Patrick Vandenberg, each of whom brings diverse academic and professional experience to the board. Please review the WA-AWRA website to become familiar with their histories. John, Dave, and Tom have volunteered to plan for the annual conference, and Patrick is refining our website and communications database. Take the opportunity to get to know our new board members at the next dinner meeting.

We're also grateful for the corporate sponsors that support our dinner meetings and annual conference by subsidizing student attendance at these events. And to our professional partners that share our interest in water resources and to exchange resources and information regarding each of our activities and achievements, and extend the water resource professional network. See our website for more information on sponsorship and partnerships.

We participate with and support two student chapters: Central Washington University is represented by Chapter president Dallin Jensen, and the University of Washington chapter is represented by liaison Seamus McLaughlin. Find out more about the student chapters by contacting Dallin Jensen or visiting the AWRA UW Student Chapter website. Our State chapter sponsors student chapter dinner meetings each year and participates in student mixers to bring students and professionals together for networking. Our first UW mixer in January was well attended to hear Dr. Faisal Hossain, who delivered a summary of his research in a presentation entitled, "Smart Use of Satellite Remote Sensing for Water Management and Food Security in Developing Nations".

Our monthly dinner meetings are underway and you should have received notice of our two April meetings in Ellensburg and Seattle. We are making best efforts to host meetings on both sides of the Cascades and provide the greatest opportunity for all members to participate. The Ellensburg meeting was presented by Paul Jewell of Kittitas County and Dan Haller of Aspect Consulting to describe the innovative water management strategies developed to address water right policies and drought conditions that have and will continue to constrain the availability of water for beneficial use. At our upcoming Seattle dinner meeting, Rhys Roth, Director of the Center for Sustainable Infrastructure will present a vision for water infrastructure needs and goals in the next 30 years. Your inbox will periodically contain notices for our future dinner meetings for June and July. The dinner meetings are the best way to meet other members.

Our annual conference committee has taken on the responsibility of maintaining the high quality of our annual conferences. Last year's conference had a record attendance due to the timeliness of the topic of rural water availability, and this year's conference could generate a similar interest as we review the Washington Water Code, 100 years after its establishment to look back at how the water law accommodated the expansion of water uses in the state, and to look ahead at the challenges the law will have to address to meet changes in water demand, uses, and availability. We welcome any and all members to join the weekly conference calls to help plan and organize the conference, and contribute your experience, connections, and insights. Contact me if you want to join.

And contact me about any questions you have about our committees, activities, meetings, sponsorships, and vision for the organization. I look forward to continuing the leadership of our community of water resource professionals, practitioners, and students. Send me an email at snelson@rh2.com.

In this Issue:

Steve Nelson is a licensed hydrogeologist and engineering geologist with 25 years of experience involving water resource assessment, development, management, remediation, and protection. Steve's project experience includes characterization of groundwater systems for groundwater supply; water reuse; water rights evaluation; aquifer testing and modeling of groundwater flow, contaminant fate and transport. Steve conducts geologic investigations to evaluate foundations for water infrastructure, geologic hazards and slope stability; and designs infiltration and construction dewatering systems. Depending on the season, find Steve trail running, skiing, climbing in the Cascades or Sierra, and/or fly fishing.

December 2016 AWRA-WA Dinner Meeting Summary
Treaty Talks: Paddling Up the Columbia River for People and Salmon

By Tom FitzHugh, Supervising Water Resources Scientist at

AWRA-WA's December dinner meeting featured the film Treaty Talks - A Journey up the Columbia River for People and Salmon, with an introduction by Adam Wicks-Arshak, one of the film's creators. The film documents a three month canoe journey from Astoria, Oregon (at the mouth of the Columbia River) to the river's source in British Columbia, which covered the 1,243 miles. Five dugout canoes were carved by students and community members in Kettle Falls, Inchelium, Wellpinit, and Spokane, Washington, to symbolize the five species of salmon native to the Pacific Northwest. The journey was undertaken as part of the struggle to bring salmon back to the Upper Columbia River, specifically highlighting the opportunity which exists for salmon restoration as part of the renegotiation of the Columbia River Treaty between the U.S. and Canada.

The film juxtaposes images of dugout canoes paddling, eddy-hopping, and sailing up the river with views of the immense concrete dams that comprise the hydropower and flood control system on the Columbia River. The images and accompanying interviews poignantly highlight the need to start a public conversation about salmon passage on the Columbia River. Currently salmon cannot pass beyond Chief Joseph Dam in central Washington. After moving past the 14 major dams on the Columbia, the canoers paddle through Kinabasket Lake and on upstream to the headwaters where the river is now a creek, at Lake Columbia, and then, leaving the canoes behind, they visit the true source of the Columbia, a spring rising out of the earth even further upstream.

While the dams on the Columbia have brought substantial hydropower and flood control benefits, these benefits have come at a cost which has affected not only salmon but also Native American communities and fisherman. The film emphasizes that improved technologies for fish passage at high-head dams, such as the "fish cannon", could be used to re-balance the needs of fish with power generation and flood control. Restoration of salmon runs in the Okanogan Basin exemplifies the progress that can be made through a combination of habitat restoration and improved fish passage. Three runs that were almost extinct in the 1990s have rebounded to impressive levels in recent years. The hope is that a renegotiated Treaty which places ecosystem health on par with the other benefits of dam operations will facilitate a similar revival on the upper Columbia River.

Tom FitzHugh is a Supervising Water Resources Scientist with MWH Americas, in Bellevue, Washington. He specializes in hydrologic modeling of surface water systems, including reservoir and water supply system operations, riverine and reservoir temperatures, and rainfall-runoff processes. His current work is primarily in California, analyzing water supply operations for water agencies and other clients in the Central Valley. Prior to joining MWH in 2015, he worked for the Bureau of Reclamation in Sacramento, California for 5 years, where he conducted modeling for long-term planning studies such as the Shasta Dam raise study and analysis of new environmental flow standards in the San Joaquin River Basin. From 1999-2009 he worked for The Nature Conservancy in Chicago and Olympia, where his responsibilities were regional conservation planning, analysis of environmental flows, scientific software development and training, and GIS. He has an M.S. in GIS and Remote Sensing from the University of Wisconsin-Madison, and a B.A. in Political Science from Lawrence University. In his spare time he enjoys hiking, learning and practicing Spanish, and following the Sounders and the Reign.

January 2017 UW - AWRA Student Mixer Summary
Smart Use of Remote Satelllite Sensing for Water Management and Food Security in Developing Nations
Dr. Faisal Hossain

By Patrick Vandenberg, Engineer at King County Wastewater Treatment Division, University of Washington Graduate and

On January 25th, 2017, the UW chapter of the Washington section of AWRA held its annual winter mixer. It was held at the Waterfront Activity Center on campus on a chilly Wednesday evening. It provided an excellent chance for students with interests in the water resources field to talk with professionals working in that field over pizza and snacks. About 50 people attended the event.

The main event was a presentation by Dr. Faisal Hossain, an associate professor in the UW Civil and Environmental Engineering department. Throughout his illustrious career, Dr. Hossain has been the recipient of a number of awards, and has applied his love of film making the the water resources field by creating a handful of documentaries based on various water resources issues. For example, his documentary "Bay of Hope" discusses how collaborative science on coastal vulnerability and engagement with local stakeholders contributes to increased resiliency, and was selected for screening at the 8th Eco-Film Festival in Malaysia in 2015.

Dr. Hossain's presentation at the mixer was called Smart Use of Satellite Remote Sensing For Water Management and Food Security in Developing Nations. This presentation investigates one of the signature struggles in water resources: what is the human impact on the timing and severity of surface water deficits and surpluses? By using remote sensing data (data collected either passively or actively via the use of satellites), can the disastrous effects of droughts and floods be mitigated? Can this technology be leveraged in developing nations, where even small differences in water availability or disaster preparedness can be the difference between prosperity and despair?

At the heart of one of these challenges (applying remote sensing data to real-world scenarios) is the inherent limitation of the physical models usually used in hydrology. In order to be applicable to a wide variety of situations, a solution must consider political, infrastructural, economic, and human resource complications.

Dr. Hossain then discussed some of the technological details of remote sensing. In order a data product to be useful, the target must be easily distinguishable from the background. This is often achieved by analyzing only certain wavelengths of light. For example, surface water can be best distinguished from other elements by analyzing the near-infrared (NIR) range. Even greater confidence in the analysis can be attained by combining multiple remote sensing data sets.

Dr. Hossain outlined some of the research that he has done in applying remote sensing data to water management in developing countries. One example is approximating trans-boundary storage, or water

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Patrick Vandenberg, a native of Southern California, has called Seattle home for about two years now. He received his Bachelors of Science from UCLA and his Masters of Science at UW, both in Civil Engineering. He was formerly the University of Washington Student Chapter Representative to the AWRA-WA Board. Patrick currently works for King County as a hydraulic modeling engineer in the Wastewater Treatment Division. Before moving to Seattle, he worked as an environmental engineer for AECOM in Long Beach, CA. He enjoys playing ultimate Frisbee and volleyball.

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that is unaccounted for due to being just across a country's border (sometimes called "hidden water"). This water poses a very real flood risk to the downstream communities, but storage amounts are often unavailable due to political tensions or lack of access. In this instance, remote sensing can provide at least an approximation of the flood risk. Another notable example is using the effect of Earth's gravity on a specially designed satellite to estimate the change in groundwater storage in a region. The net change in the Earth's density directly below this satellite can be tracked and attributed mostly to the inflow and outflow of groundwater in that area. This has been effectively used in Pakistan to support groundwater pumping operational decisions. Other examples include estimating the residence time of water in reservoirs in southeast Asia and providing farmers with evapotranspiration estimates to inform better operational decisions.

There are, however, some drawbacks to using remote sensing technology. The product is by nature at a coarser resolution than low-altitude or ground measurements, making it of limited suitability for many applications. Additionally, the multiple products often do not always agree, an issue usually mitigated (when possible) by using ensemble measurements. In some cases, it can be difficult to distinguish the target from the background, which will further increase uncertainty in any conclusions drawn from that data set. Finally, the human capital needed to improve these products or provide training for their uses may sometimes prove challenging to find, since many of the target areas are very rural.

There are a number of promising next steps for the remote sensing field. One is improving on collaboration to build satellites capable of fulfilling the needs of multiple stakeholders. An ongoing aim of the remote sensing field is to support education and training to continuously improve both the quality and the applicability of the products. Also, leveraging emerging technologies, such as crowd-sourcing ground confirmation data or using low-altitude drones for higher resolution products, is of vital importance to the future of this field.

Special thanks to Dr. Hossain and the UW student chapter of AWRA for hosting such a worthwhile event.

April 25, 2017 AWRA-WA Dinner Meeting
Ivar's Salmon House on Lake Union

A NORTHWEST VISION FOR 2040 WATER INFRASTRUCTURE – THE 2017 REPORT JUST ISSUED BY CENTER FOR SUSTAINABLE INFRASTRUCTURE

Rhys Roth, Director of the Center for Sustainable Infrastructure

The Center for Sustainable Infrastructure (CSI) recently released an in-depth report on the future needs for water infrastructure for the Pacific Northwest. Rhys will share highlights of the Center's new report, "A Northwest Vision for 2040 Water Infrastructure", the most comprehensive effort to date to construct a regional shared vision for the future of water-related infrastructure in the Northwest.

See more details and register at
www.waawra.org/events

SAVE THE DATE!

The Annual 2017 AWRA
Washington State Conference

will be held on

Tuesday, October 3rd, 2017

at

the Mountaineers Seattle Program Center

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Stay tuned for further details!

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Biologically mediated soil nitrate accumulations in the lower Yakima Valley have isotope signatures which obscure groundwater input

By Dallin Jensen, Central Washington University Geological Sciences M.S. Program and AWRA-WA Student Fellowship Recipient

Introduction

The aquifers of the lower Yakima Valley have long been known to provide drinking water more than the Environmental Protection Agency's (EPA) Maximum Contamination Level (MCL) of 10 mg/L to private drinking wells. This spurred an EPA study which largely assigned blame to local dairy farms based on agricultural chemicals, stable isotope data and the assumption that anthropogenic inputs dominate nitrate sources to groundwater. However, the EPA study and undergraduate work at Central Washington University found nitrate in some wells and soil samples to be anomalously enriched in 18O, suggesting potential atmospheric nitrate inputs to drinking water wells. These findings, and a study at the Hanford Site 80 km away finding naturally occurring soil nitrate flushed into groundwater, prompted researchers to investigate soils as a potential source of nitrate to groundwater in this area.

Site Description/Methods

The lower Yakima Valley is one of the most productive agricultural regions in the American West3 largely supported through large scale irrigation projects which bring water from the adjacent Cascade range. The lower Yakima Valley naturally experiences limited groundwater recharge which has allowed the development of carbonate rich soils across a large portion of the valley. The 20th century widespread implementation of rill irrigation throughout the Yakima Valley, has led to high rates of modern groundwater recharge to shallow alluvial aquifers. Our study investigates the possibility of nitrate inputs to groundwater due to land use conversion to irrigated agriculture inducing the flushing of natural soil solutes to shallow alluvial aquifers.

The collection of soil samples from soil series containing significant carbonate content was emphasized as the presence of carbonate was used as a potential indicator for the accumulation of atmospheric chemicals. Locations RC1, and RC2 (unirrigated agriculture) were selected for closer chemical and isotopic analysis after preliminary results showed nitrate concentrations greater than 2 mg/l for some soil leachates. At location IN two pits and one road cut were sampled to compare nitrate in a roadcut with a shrub steppe setting (IN-1) uncultivated road right of way (IN-4), and in an apple orchard (IN-3). IN-4 had the highest nitrate concentrations and was selected for closer analysis. Soil samples were mixed with deionized water to collect data on soil chemistry. δ18O, 15N, and Δ17O isotope data were collected and compared to likely source ranges and groundwater values in conjunction with chemical data on nitrate and carbonate content in Figure 1, along with typical source ranges, data from local EPA groundwater study, and the range of values found in natural pore water nitrate at the Hanford Site7 (~50 km east). The EPA groundwater study largely attributed well water nitrate contamination to dairy manure with several outliers indicative of a significant atmospheric nitrate contribution. Δ17O values were used to determine the fraction of nitrate from atmospheric sources.

All samples from soil pit IN-4 (6 m from apple orchard), except for the deepest sample, exhibited δ15NNO3- values within the natural soil range observed at the Hanford site. Land use data was obtained for sample site IN and only chemical ammonia fertilizer has been used on the site since at least 2004. This made a significant manure component unlikely. This presents an argument that it is naturally occurring nitrate detected. The 75–90 cm soil sample however, exhibits a lower δ15NNO3- value indicating a mixture of chemical fertilizer and natural soil nitrate. Thus, this nitrate may have throughflow input from the apple orchard approximately 6 m away. Interestingly, this soil sample yielded relatively low nitrate concentrations of 1.5 mg.

Soil samples taken from RC2 are interpreted as a surficial commercial fertilizer input, with increased naturally occurring nitrate concentrations with depth. Naturally occurring nitrate is interpreted to predominates at and below the relatively impermeable carbonate rich caliche layer at the depth interval 90–105 cm. The significant Δ17O values below 90 cm indicate between 8 and 10 percent of this largely natural soil nitrate has not been biologically mediated and is atmospheric in origin.

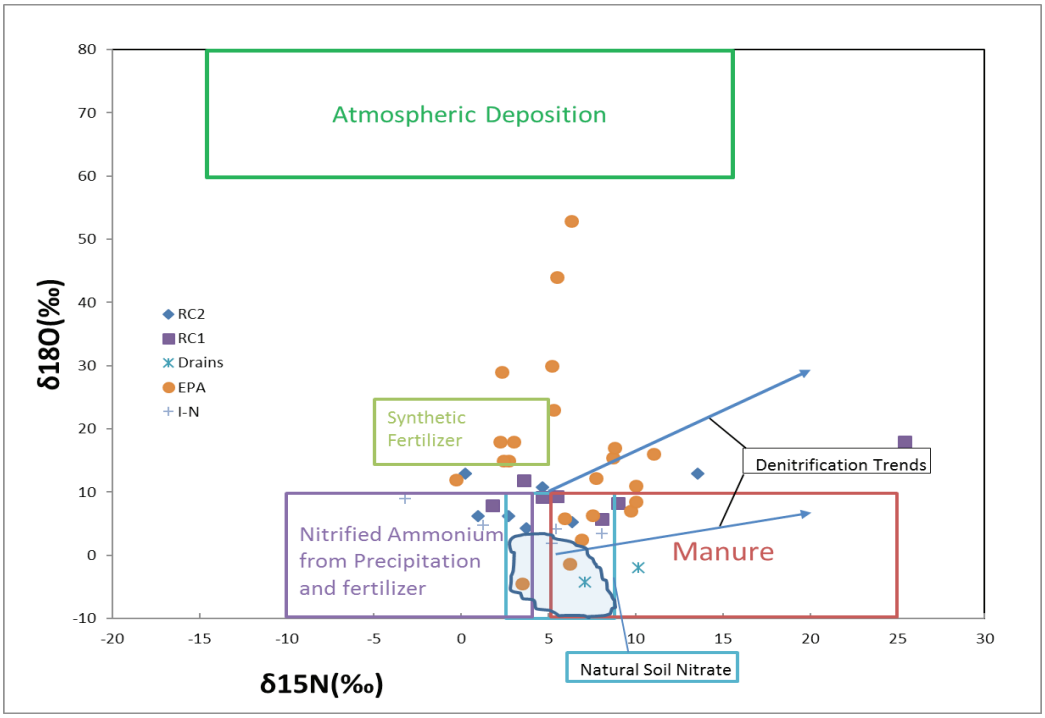

FIGURE 1. Chart of δ18O vs δ15N; typical nitrate isotope source ranges after Kendall et al. (2007), shaded region of natural soil pore water values for a study at the Hanford Site7 (80 km east), groundwater values plotted for an EPA study4 and soil DI extract values from this study. Arrows signify typical alteration of isotope signatures from bacterial denitrification.

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It is interpreted that soil nitrate at site RC1 largely stems from fertilizer and natural soil nitrate sources. A constant atmospheric content of nitrate (~10%) below 60 cm may be due to caliches ability to absorb water, while still forming a relatively impermeable layer protecting the underlying soil nitrate from being impacted by surface inputs upon formation. Further supporting the interpretation that is the striking similarity in atmospheric contribution to soils at the nearby RC2 sampling location below 90 cm. Of great interest is that these soils with a significant atmospheric nitrate contribution contained the highest nitrate concentrations in leachate for any soils sampled (10.6 mg/L for 90-105 cm at RC1). While it is possible a significant manure input exists in these soils, the distance to dairy operations makes this unlikely.

This study found soil naturally occurring nitrate which represents a potential source to groundwater upon flushing during irrigation. Isotope values were broadly congruent to the isotope results for nitrate in groundwater in the EPA4 study, which concluded nitrate in groundwater samples largely has a mixed manure and fertilizer input, with manure predominating However, consideration of a nearby study showing naturally occurring soil pore water nitrate concentrations of up to 500 mg/L7 suggests our data reflects naturally occurring soil nitrate, and commercial fertilizer as well as denitrification within the soil.

A mechanism for large quantities of nitrate to be transported into soils is millennial atmospheric deposition. A recent study has shown regions with precipitation regimes similar to the lower Yakima Valley (200–230 mm) have soils which atmospheric Δ17O values similar to those observed at RC1 and RC2 due to biological mediation. This mechanism may work in conjunction with the incomplete nitrogen cycling of biological soil crusts in western US deserts. These biological soil crusts have been documented to cover between 15 and 20 percent of the ground surface of the Central Washington Desert.

This atmospheric deposition, incomplete nitrogen cycling, accumulation of nitrate in the subsurface, and subsequent flushing to groundwater upon land use conversion to irrigated agriculture may be a significant source of groundwater contamination in the shallow alluvial aquifers of the lower Yakima Valley. This pathway additionally results in little to no of the 18ONO3- enrichment used to identify if the irrigation of caliche containing soils represents a significant nitrate source to groundwater. Studies into nitrate contamination of groundwater in this, and other semi-arid regions, should be careful to avoid assigning contamination entirely to a mixture of agricultural fertilizer and manure when isotopically similar soil nitrate accumulations in caliche may be present.

Dallin Jensen received one of the AWRA-WA Student Fellowships in February 2016. He is a M.S. student in the Geological Science Department at Central Washington University, and will begin a PhD program with University of Montana Department of Geosciences in Fall 2017. He can be contacted at: jensenda@cwu.edu

Two fellowships are offered annually to Washington State Students. One, the Rod Sakrison Memorial Fellowship Award, is awarded to a member of an AWRA Student Chapter at a Washington school. In 2007 the AWRA-WA board of directors dedicated this award to the memory of Rod Sakrison in recognition of his effort to increase student involvement in AWRA. Rod was a two-time board president and was instrumental in establishing the University of Washington AWRA Student Chapter. The second award will go to a student enrolled in a graduate program at a college or university in Washington State.

AWRA-WA 2017

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Thanks to our Media Partners!

AWRA-WA Committee Descriptions

Listed below is brief summary of each of the committees. According to our bylaws, each committee must have at least two board members on the committee. The committees that tend to be the best opportunities for new volunteers are the Conference, Dinner, and Newsletter committees, because these committees need to most support and have a number of different roles.

Awards: This committee manages the student scholarships and the Outstanding Service Award. For the student scholarship, this committee conducts outreach to Washington students and professors regarding the scholarship and reviews the applications for recommendation to the board. For the Outstanding Service Award, this committee seeks and nominates candidates who have contributed substantially to water resources policy in the state of Washington. Anyone who is interested in helping to spread the word about the scholarships in winter and spring, review applications in fall, and/or consideration of professionals for the award in spring and summer is welcome to join this committee. There should be some overlap in involvement with this committee and the student committee.

Conference: This committee is responsible for planning the annual state conference, including developing the topic, recruiting and managing speakers, marketing the conference, creating the program, and carrying out all logistics related to the conference. The conference is typically a one-day event in October or November. The conference chair hosts call in meetings and assigns and oversees all tasks. There are many roles in this committee and most of them can be conducted remotely. Water resources expertise and a big Rolodex are welcome for topic development and speaker choice in winter and spring, and experience/interest in logistics is welcome for marketing in summer and for conference organization in fall.

Dinner Committee: This committee is responsible for planning and executing five or six dinner/lunch meetings each year. Duties include finding and coordinating speakers, reserving the facility and ordering food, preparing event announcements, and introducing speakers. Dinners can occur anywhere in the state, although most are in the Seattle area. Anyone interested in suggesting speakers, planning an event or hosting an event is welcome to this committee.

Finance: This committee is chaired by the Treasurer. The committee assists the Treasurer with financial management of the Chapter. The finance committee creates and proposes an annual budget at the beginning of each year, and attends to other business as needed. Members of the finance committee also review monthly reports created by the treasurer. Financial experience is welcome but not required for this committee.

Membership/Communication: This committee is responsible for updating the section website, managing the member database, recruiting new members, administering the jobs email listserve, and communicating beyond the newsletter. This committee consists of the webmaster, membership manager, jobs email administrator, and other specific responsibilities as needed. The webmaster manages the look and organization of the website, up-dating pages as necessary, and creates events and sends out event announcements. The membership manager maintains the membership database, ensures that conference attendee memberships are updated, maintains the list for newsletter hard copy mailing, and proposes strategies for increasing membership. The jobs email adminis-trator collects and distributes information on job openings. This information is typically sent to the section and is actively gathered from job search engines. This committee is active year round, and anyone with skills and interest in providing a voice and look for AWRA-WA is welcome to this committee.

Newsletter: This committee is chaired by the Newsletter Editor. The committee develops newsletter topics, finds authors and articles and produces five or six newsletters each year. Generally someone other than the Editor is assigned formatting of the newsletter. Traditionally, every board officer provides at least one article per year either by writing one or soliciting one from a colleague. Committee members are responsible for finding the balance of the articles. Logistics support and the ability to solicit articles regarding water resources are welcome year round for this committee.

Strategic Relationships: This committee is responsible for developing and maintaining relationships with corpo-rate sponsors and co-marketing agreements with other organizations with a similar focus on water resources, as well as ensuring that the terms of sponsorship and agreements that apply to AWRA-WA are met. Those with strong and plentiful ties to potential corporate sponsors and other organizations are especially welcome in this committee in winter and spring, and those with a strong interest in internal organization and documentation are welcome in this committee in summer and fall.

Student Committee: This committee is responsible for supporting student chapters, including sharing infor-mation about event support and other traditions. The committee is also responsible for outreach to other university students in Washington State and working to develop other student chapters. Anyone interested in strengthening student chapters or growing student participation, especially in fall and winter, is welcome to this committee.

Interested in joining a committee? Contact any of the board members listed on p 5.

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