

HYDRO VISIONS

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Summary of the 29th Biennial Groundwater Conference & GRA's 22nd Annual Meeting

California's Groundwater Future in the Balance: Integrating Quantity & Quality in a Changing Climate

By Jim Strandberg (co-chair), Chris Petersen (co-chair), Vicki Kretsinger, Brett Wyckoff, Brian Lewis, Ali Taghavi, Jean Moran, Daniel Wendell, Alyx Karpowicz, Karl Longley, and Chris Frahm

GRA convened the 29th Biennial Groundwater Conference & GRA's 22nd Annual Meeting, *California's Groundwater Future in the Balance: Integrating Quantity & Quality in a Changing Climate*, on October 8-9, 2013 in Sacramento, California. The conference featured an opening Plenary Session with senior water leaders discussing the challenges identified in the conference theme, ten concurrent sessions, presentations by the Northern and Southern California David Keith Todd Lecturers, **Dr. Jay Lund** and **Dr. David Huntley**, presentations of GRA awards, a Legislative Update, and a panel discussion on *Statewide Plans, Proposed Actions and Water Bond Funding Framework: What's the Future Hold for California's Groundwater Reservoirs*. A total of 200 attendees also viewed 19 poster presentations and gathered information from 22 exhibitors.

Conference co-sponsors were AMEC Environment & Infrastructure, Inc., and West Yost Associates. In addition to the conference co-chairs noted above, members of the Planning Committee also included representatives of eleven conference organizing entities.

Plenary Session

(Moderated by **Jim Strandberg**, *Erler & Kalinowski, Inc.*)

The plenary session featured three presentations followed by a panel discussion. **Mark Cowin**, Director of the California Department of Water Resources (DWR), provided an overview of groundwater conditions in the state, including an



Plenary session speakers Mark Cowin, Lester Snow, and Caren Trgovcich, and conference co-chair, Jim Strandberg.
Photo by Brian Lewis.

emphasis on its use (40% of the total water supply), continued overdraft in many of the same basins identified over 30 years ago (B118-80), renewed land subsidence in the San Joaquin Valley, key groundwater management legislation beginning 20 years ago (AB 3030, 1992), and the more recent accomplishments of CASGEM. He emphasized the importance of improving groundwater management by highlighting quotes from DWR's Director Harvey O. Banks, whose statements in 1957 resonate with today's groundwater conditions. Mark concluded with these thoughts on bold actions: advance

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Farewell to Kathy Snelson and Welcome to GRA's New Administrative Director

By Sarah Raker

Two years ago, my first message as President was an exposé on GRA's Executive Director Kathy Snelson. She and Mary Megarry have been assisting GRA for 13 years and have helped the organization grow and prosper. Kathy has been our essential guide, motivator, and work horse behind the scenes. Her attention to detail has made her invaluable during Board meetings and event planning. Through her innovation and diligence, we have accomplished so much these past 13 years. But change is inevitable. We are going to lose Kathy at the end of this year when she will be fully retired and will motivate her chickens and be a work horse on her ranch. Kathy and Mary will be greatly missed.

Since Kathy announced her retirement, I have been working closely with Kathy and the GRA Executive Committee to identify an association management firm to provide GRA with an Administrative Director and meeting planner, along with many of the other services needed for GRA to meet its goals.

I am very pleased to announce that GRA will be working with Smith Moore & Associates of Sacramento. Smith Moore & Associates works with other nonprofit associations in California whose primary workforce is made up of volunteers, like GRA. As stated in Smith Moore & Associates goals, "All of our services are tailored to the specific needs of each of our nonprofit association clients, ensuring the associa-

tion's leadership can focus on the vision of the organization while remaining confident its day-to-day operations are running smoothly. We strive to realize the growth potential of each of our organizations, working closely with volunteer leaders to assess the needs of the membership and embrace its goals and mission." I am confident that Smith Moore & Associates and GRA will make a great team.

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Farewell to Kathy Snelson and Welcome to GRA's New Administrative Director – Continued

Catherine A. Smith, CAE, is the President of Smith Moore & Associates and has more than 25 years of experience in association and nonprofit administration on local, state, national and international levels. She will serve as GRA's account manager. Catherine has presented at state and national forums, speaking on association management and governance issues. In 2000, Catherine received the Chair's Award for exceptional service from the California Society of Association Executives (CalSAE).

Sarah Kline will serve as GRA's new Administrative Director. Sarah works with Smith Moore & Associates on their internal operations, including fiscal oversight and professional development, and directly with its clients. She is the event planner for a Sacramento-based client with monthly luncheons and several special events and provides support on multiple other associations, as needed. Prior to coming to work for Smith Moore & Associates, Sarah was co-owner of a local family business, where she handled product and service contract negotiations, branding, employee management and human resources, as well as oversaw customer service and vendor relationships. Sarah also represented the company at tradeshow and professional association events.

Sarah will bring solid management skills to her role as GRA's Administrative Director. GRA is not that different from a family-owned business where volunteers (or family members) do a lot of the heavy lifting. When I asked Sarah how she will approach working with GRA, she responded "I am so looking forward to the opportunities and challenges that working with GRA will bring! I am confident that Catherine and I and the entire team at Smith Moore & Associates will be able to smoothly transition and keep GRA moving forward."

Kathy Snelson and I met with Catherine and Sarah during the recent 29th Biennial Groundwater Conference and 22nd GRA Annual Meeting in Sacramento. I was impressed with Catherine's experience working with other non-profits that serve professional organizations. For example, Smith Moore & Associates clients include the California Water Association and the California Association of Sanitation Engineers. I was also impressed with Catherine's ability to anticipate my concerns about transitioning to a new organization after so many years with Nossaman. Catherine is sensitive to this concern and considers the transition to

be a very important part of developing a good relationship with her firm. She'll work closely with GRA to make the transition a positive experience.

In closing, I would also like to welcome Ted Johnson, GRA's new President beginning in 2014. I am sure he will keep you apprised of GRA's progress and success working with Catherine, Sarah and Smith Moore & Associates. 💧

Cheers!



Cheers – Sarah Raker,
GRA President

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integrated water management, develop and adopt stronger standards for local/regional groundwater management plans for sustainable groundwater management, and consider legislation to provide needed local/regional authority.

Lester Snow, Executive Director of the California Water Foundation, stressed the importance of groundwater management in the era of California's "new normal." He described challenges California's water system faces today (aging infrastructure, chronic underinvestment, fragmented management, declining ecosystems, and chronic groundwater overdraft) and future challenges (climate change, increasing population, and more conflict). Lester addressed the decrease of groundwater storage in the Central Valley, owing to decades of unsustainable withdrawal, and the associated problems, including subsidence. He also highlighted the recent increase in newspaper articles on California's groundwater "crisis," including articles on the need to drill deeper wells due to declining groundwater levels. Lester concluded his presentation by emphasizing the need for improving groundwater management through regional empowerment.

Caren Trgovcich, Assistant Deputy Director of the California State Water Resources Control Board, identified current challenges to California's groundwater quality from point and non-point sources, and to the quantity of the resource. She noted the common elements of policy reports dating to 2009 are local groundwater management, focus on high use basins, and increased data monitoring and reporting. She stressed the need to establish water-level and water-quality thresholds, data management systems to evaluate trends and the status of thresholds, governance mechanisms to manage groundwater at the basin scale to prevent threshold exceedances, funding, and State or Regional Water Board

oversight and enforcement where local or regional management efforts are not protective. Local and regional agencies have tools and authorities to effectively manage groundwater; where these efforts are successful, the Water Boards should provide support, and focus on areas where problems exist and local management efforts are insufficient.

Groundwater Quality: Coordinating State, Regional and Local Programs *(Moderated by Vicki Kretsinger, Luhdorff & Scalmanini, Consulting Engineers)*

Daniel Cozad, Executive Director of the Central Valley Salinity Coalition, began this session with a brief overview of the collaborative efforts underway by the Central Valley – Salinity Alternatives for Long-term Sustainability (CV-SALTS) since 2008, along with a Memorandum of Understanding with the State Water Resources Control Board and Regional Board since 2009, to address Salt and Nitrate Management Planning in the Central Valley. The Central Valley enjoys productive and economically beneficial land uses; the Valley hosts 80% of California's irrigated lands. But, the Central Valley is paying for the accumulation of salt; the cost is estimated to be about \$1.58 billion in annual impacts statewide. Daniel used the analogy of a runaway freight train to emphasize that without the coordinated efforts and financial support of a multitude of stakeholders, the freight train was headed for a crash. However, many technical efforts are underway, strategies and future opportunities to better manage salt and nitrate are being identified, and the train is "back on the right track!"

GRA would like to thank Dr. Jay Lund and Dr. David Huntley for their exemplary service as GRA's David Keith Todd Distinguished Lecturers for 2013!



Steve Stadler, Deputy General Manager of Water Resources for the Kings River Conservation District, described coordinated efforts occurring in Kings Basin to tackle the area's most pressing groundwater issues, including groundwater depletion, water supply reliability, and water quality. The

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Kings Basin Water Authority includes 53 entities that have worked together in an exemplary effort to develop and implement an Integrated Regional Water Management Plan (IRWMP). The Authority has brought diverse groups together to rally around common interests rather than conflicts. The Kings Basin IRWMP contains many measurable objectives that the stakeholders are actively working to implement. One of these is to identify sources of water quality problems and to promote solutions to improve water quality. Most recently, efforts have included a Disadvantaged Communities (DACs) pilot project study to develop an inventory of DACs and to better engage DACs in the IRWMP process, particularly as related to addressing water quality issues.

Clay Rodgers, Assistant Executive Officer of the Central Valley Regional Water Board, presented a brief overview of the Long-Term Irrigated Lands Regulatory Program, including its history, goals, and the most recent groundwater-related aspects of the program. He described that *we*, with an emphasis on not only the Water Board, but also the agricultural community and numerous stakeholders, are trying to accomplish many goals together, including the protection of water quality for current and future generations while simultaneously ensuring that the new requirements are compatible with sustaining agriculture in the Central Valley. Key components of the new requirements include: a groundwater-quality assessment report that includes identification of the relative vulnerability of areas to agricultural contaminants; a trend monitoring program to assess regional groundwater-quality trends, and a management practices evaluation program that focuses on improving practices to protect groundwater. He indicated that coalitions are being encouraged to coordinate with other entities conducting regional groundwater monitoring to minimize duplication of efforts.

Miranda Fram, Chief of the USGS Groundwater Ambient Monitoring and Assessment Program (GAMA) Priority Basin Project (GAMA-PBP), was unable to be present due to the federal government shutdown. Her activities, which demonstrate the importance of coordination among the many state, regional, and local groundwater-quality programs that have many overlapping goals and interests, were a key driver for this session's concept. Miranda was to present information on the USGS National Water Quality Assessment (NAWQA) program and the State Water Board's GAMA-PBP, particularly groundwater quality studies in the Eastern San Joaquin Valley. The GAMA-PBP is assessing shallow groundwater quality in the Kings and Madera-Chowchilla Subbasins, including sampling of about 75 shallow domestic and monitoring wells this fall. The program will also monitor decadal-scale trends in deeper aquifers that are used for public drinking-water supplies, including resampling of about 25 wells previously sampled in 2005. In July 2013, Miranda shared the activities planned for the GAMA-PBP with Regional Board staff and representatives of the East San Joaquin Water Quality Coalition to facilitate potential opportunities for collaboration.

Recent Innovations in Groundwater Remediation to Improve Supply Reliability (Moderated by Bruce Marvin of Geosyntec Consultants)

Dr. Paul Johnson of Arizona State University presented an overview of the National Research Council Report he contributed to, *Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites*. He provided a simple definition of complex sites as sites requiring greater than 50 years to clean up to the extent practicable. The size of the problem is enormous: more than 126,000 sites in the US have yet

to reach closure, and reaching closure will cost more than \$127 billion. The primary challenges of complex site remediation are that current technologies are generally incapable of achieving restoration to unlimited use and unlimited exposure status, and that the site management decision-making process is both complex and insufficiently defined.

Dr. Graham Fogg of UC Davis provided an overview of matrix diffusion and preferential flow, two transport processes that contribute to the remediation difficulty at complex sites. His research into these processes over the last 20 years has suggested that an empirical approach is valuable to address the scale-dependency of these processes and the resulting uncertainty in contaminant fate and transport.

Dr. Fred Payne of ARCADIS US dovetailed with Graham's work in academia, demonstrating that hydraulic conductivity is far more heterogeneous than is often reflected in models; ten percent of a geologic cross section often carries over ninety percent of contaminant mass discharge. His examples showed that higher-resolution site characterization helps focus remedial efforts and improve outcomes.

Owen Cadwalader of Geosyntec Consultants highlighted how the rapid advancements in the last decade of internet-connected sensors can improve decision-making by delivering and processing larger volumes of data to managers and stakeholders. He forecasted the increased use of sensor technology for improving remediation results, and provided examples of both existing and emerging sensors.

Dr. Shlomo Neuman, the 2013 GRA Lifetime Achievement Award recipient, asked the session about how to address the uncertainty in the subsurface flow regime while remediating groundwater. This led to a stimulating discussion amongst the attendees and panelists.

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Department of Water Resources' Role in California's Groundwater (Moderated by Brett Wyckoff, DWR)

All four speakers were from DWR and presented information on recent projects and programs within DWR with relevance to regional and statewide groundwater management.

Abdul Kahn presented progress on the *Groundwater Content Enhancements (GCEs) in the California Water Plan Update 2013*. Dr. Kahn reviewed the objectives of the GCEs, which represent a comprehensive improvement in the way groundwater resource management is presented in the California Water Plan (CWP). The enhanced groundwater information will be released through a statewide summary section in the CWP, in individual sections for each Hydrologic Region, and through a stand-alone groundwater report. He described the major topics to be covered in the groundwater sections, including groundwater supply and development, groundwater monitoring efforts, aquifer conditions, groundwater management, conjunctive management inventory and assessment, groundwater sustainability, data gap analysis, and case studies. He presented a case study of the Tulare Lake Hydrologic

Region, and examples of information that will be included in the Regional Report. Dr. Kahn's presentation concluded with recommendations on improving groundwater management in California.

Louis Moeller presented *Groundwater Use Determination in the Water Portfolios of the California Water Plan*. Because exact groundwater extraction volumes are not available on a statewide basis, he explained how the groundwater extraction volumes are estimated for inclusion in the water portfolios of the state's hydrologic regions.

Dan McManus presented the *California Statewide Groundwater Elevation Monitoring Program (CASGEM) Basin Prioritization*. The California Water Code specifies that DWR prioritize the State's 515 groundwater basins and subbasins, using criteria such as population, number of wells in a basin, irrigated acreage overlying a basin, and reliance on groundwater within a basin. He described the data sources used in developing the basin prioritization methodology, and how those data were combined using a Basin Prioritization Tool developed by DWR to rank all basins in priority, ranging from "high" to "very low." He concluded by explaining how the basin prioritization data would be used by DWR.

Steven Springhorn discussed his involvement in *Mapping the Base of Fresh Groundwater in the Sacramento Valley*. He described how the project used new, improved data sources to enhance an older groundwater mapping project in the Sacramento Valley. The mapping results are extremely useful and beneficial for groundwater management agencies in the Sacramento Valley.

Hydraulic Fracturing: A Threat to California's Groundwater Resources? (Moderated by Brian Lewis, Department of Toxic Substances Control)

Donald Gautier of the U.S. Geological Survey was to present *Potential for Future Petroleum Development in California*. Unfortunately, Dr. Gautier's presentation was cancelled because of the government shutdown. Based on earlier planning discussions, one of his key points was that the most promising and active source area of the Monterey Formation that could be subjected to hydraulic fracturing may be significantly smaller than is commonly assumed or reported in the popular press. He would have shown maps of both the Southern San Joaquin Valley (figure 1) and the Los Angeles Basin (figure 2).

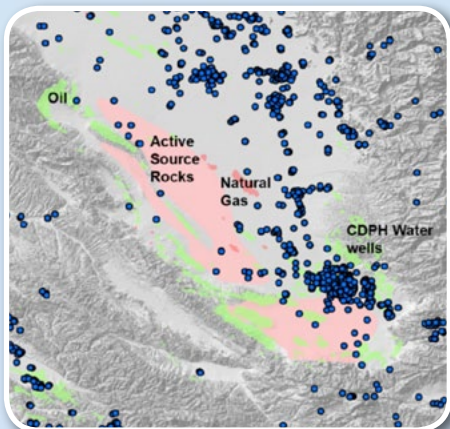


Figure 1. Kern County Basin oil fields, source rocks, active source rocks, and water supply wells. Base map of source rock by Donald Gautier, USGS, 2013.

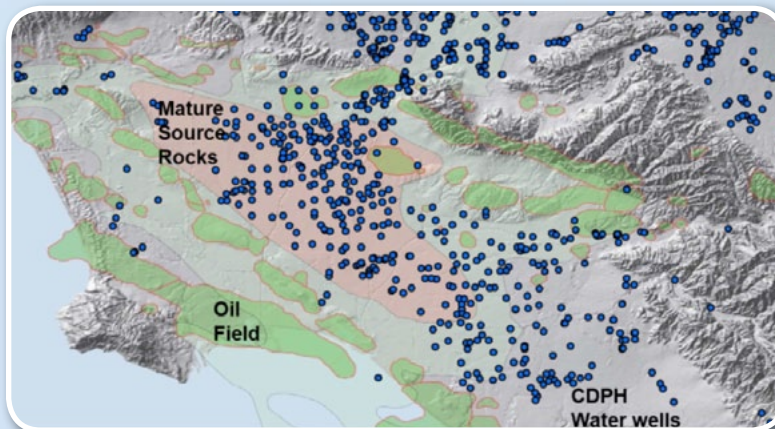


Figure 2. Los Angeles Basin Oil Fields, Mature Source Rocks, and Water Supply Wells. Base map of source rock by Donald Gautier, USGS, 2013.

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Interestingly, the active source rocks of the Monterey Formation (pink) are located inland, away from the more traditional oil fields along the coast. In addition, about 1,000 water wells regulated by the California Department of Public Health overlie the source rock of the Monterey Formation. Most of these water wells are located in the Los Angeles basin.

Mark Zoback of Stanford University presented *Development of Hydrocarbon Resources with Horizontal Drilling and Multi-Stage Hydraulic Fracturing*. Professor Zoback discussed the hydraulic fracturing process and the benefits of increased production of natural gas and oil resources. He also discussed several environmental issues, including potential contamination of aquifers, impacts to limited water resources, and induced earthquakes associated with injection of waste water. Many of the active shale gas plays in other areas of the United States are much deeper than the overlying aquifers. However, he pointed out that leakage of fracking fluids from damaged well casing or improper cement seals posed a potential risk to shallower groundwater resources. Verification of proper well construction and seals is critical for ensuring environmental protection prior to hydraulic fracturing. To minimize earthquakes, he also recommended mapping and avoiding injection into potentially active faults, limiting injection rates, monitoring seismicity, assessing the risk, and abandoning injection wells, if necessary. Recycling of waste water would also minimize the stress on local water resources.

Tim Kustic of California Division of Oil, Gas, and Geothermal Resources (DOGGR) presented *The Regulation of California's Oil and Gas Wells and Proposed Regulations for Hydraulic Fracture Stimulation Operation*. Mr. Kustic provided an overview of DOGGR mandates, which include "preventing damage...and waste...to underground and surface waters." DOGGR com-

pleted public input and issued revised draft regulations in December 2012. Recent passage of Senate Bill 4 (State Senator Fran Pavley) further modified DOGGR's draft regulations. The Senate Bill requires a geologic review, advanced notification, and well testing. The regulations also require groundwater monitoring before, during, and after hydraulic fracturing, and disclosure of chemicals. Senate Bill 4, the purpose of which is to provide baseline data and to increase transparency of well stimulation techniques, will be implemented in late 2013. It requires a statewide Environmental Impact Report, permits for well stimulation, and adoption of new regulations.

Chronic Groundwater Level Declines: Options for Improved Management for Protection of Water Supply and Quality (Moderated by Ali Taghavi, RMC Water & Environment)

The goal of this session was to present a broad spectrum of issues, challenges and opportunities with regards to long-term and chronic declines in groundwater levels, and how various agencies have used adaptive management practices to address these issues.

Gary Serrato of Fresno Irrigation District discussed the groundwater overdraft conditions in the Kings basin, and related impacts on production wells and groundwater quality. He presented how the regional plans are being developed to systematically address the overdraft issue with the aim of slowing down the problem.

Howard Franklin of Monterey County Water Resources Agency presented the case of Salinas Valley historical overdraft conditions and seawater intrusion. He noted that several large projects, including Nacimiento and San Antonio reservoirs, Castroville Seawater Intrusion Project, and Salinas Valley Water Project have been con-

structed to augment the water supplies in the basin, and reduce the overdraft conditions.

Brian Lockwood of Pajaro Valley Water Management Agency discussed the problem of over-pumping in the basin and resulting seawater intrusion. He noted that stakeholders prepared a Basin Management Plan (BMP) in 1993 as a road map to address the problem. The 2012 update of the BMP provided key elements for further addressing the problem, including significant conservation and reduction in pumping, as well as new sources of supply. Both Salinas Valley and Pajaro Valley have started aggressive programs of using recycled water in-lieu of groundwater for agricultural water supplies.

Courtney Howard and **Paavo Ogren** of San Luis Obispo County presented the overdraft issues in their county. Courtney discussed the process of developing the recently adopted groundwater management Plan. Paavo noted that the Plan provides some solutions to the problem, but needs enforcement measures for implementation.

Collegiate Groundwater Colloquium (Moderated by Jean Moran, California State University, East Bay)

Five students presented their research findings during GRA's fifth annual *Collegiate Groundwater Colloquium*. The Collegiate Colloquium offers an opportunity for practicing groundwater professionals to learn about students' recent research, and gives students an opportunity to present their work to an audience of groundwater professionals. Submissions are solicited from undergraduate and graduate students through their faculty advisors and can be on any topic related to groundwater occurrence, contamination, remediation or management. This year, one undergraduate and four graduate

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2013 Collegiate Groundwater Colloquium speakers (from left to right) Stephanie Urióstegui, Sarah Beganskas, Jeff Kubran, Samayyah Williams and Katherine Dlubac.

students from California universities gave excellent presentations on topics ranging from tracing artificial recharge to remediating groundwater nitrate.

Sarah Beganskas, a graduate student at UC Santa Cruz, described an active, ongoing project in the Pajaro Valley, where stormwater is captured for recharge at an instrumented 2.5 acre infiltration basin (figure 3). Spatial and temporal variations in infiltration rate are being explored using tracers, such as heat, and by analyzing sediment distribution and character. Collectively these results will help to evaluate the efficacy of linking stormwater capture and managed aquifer recharge (MAR).

Stephanie Urióstegui, a doctoral candidate at UC Santa Barbara and Lawrence Scholar fellow at Lawrence

Livermore National Laboratory, explained the advantages of using sulfur-35 to trace recharge and transport of groundwater at MAR sites on the <1 year timescale (figure 4). She showed results from successful applications at the Rio Hondo and Orange County MAR facilities, where interpreted sulfur-35 activity levels from surface water and groundwater samples offered new insight into seasonal patterns in subsurface travel times of <1 year.

Katherine Dlubac, a doctoral candidate in Geophysics at Stanford University, showed the results of NMR logging, using a slimhole NMR logging tool, for determining hydraulic conductivity (K) in wells from the High Plains aquifer in central Nebraska. Her results indicate that NMR logging has the potential

to provide low-cost, high-resolution estimates of K to inform remediation efforts at contaminated sites.

Jeff Kubran, a recent graduate of the M.S. program at UC Santa Barbara, Bren School of Environmental Science and Management, discussed a water supply optimization strategy for managing hexavalent chromium. The project used the Santa Ynez River Water Conservation District, in Santa Barbara County, as a case study, and modeled supply across multiple climate conditions and potential Cr(VI) MCLs using the ratio of system capacity to customer demand as a metric for comparing scenarios (figure 5). Results indicate that supply- and demand-side management actions can increase system reliability and resilience.

Samayyah Williams, an undergraduate student and McNair Scholar at California Polytechnic University Pomona, described a woodchip bioreactor experiment for denitrification of the Cal Poly Pomona groundwater supply, which is affected by high nitrate concentrations. The experiment tested rates of denitrification for different levels of labile carbon, examined possible sulfide inhibition, and explored the structure and dynamics of the microbial communities that are established in woodchip bioreactors (figure 6).



Figure 3. Infiltration basin in Pajaro Valley, CA.

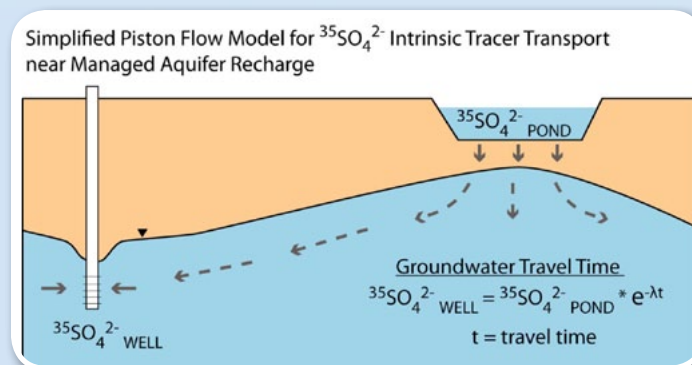


Figure 4. Simplified piston flow model for $^{35}\text{SO}_4^{2-}$ intrinsic tracer transport near managed aquifer recharge.

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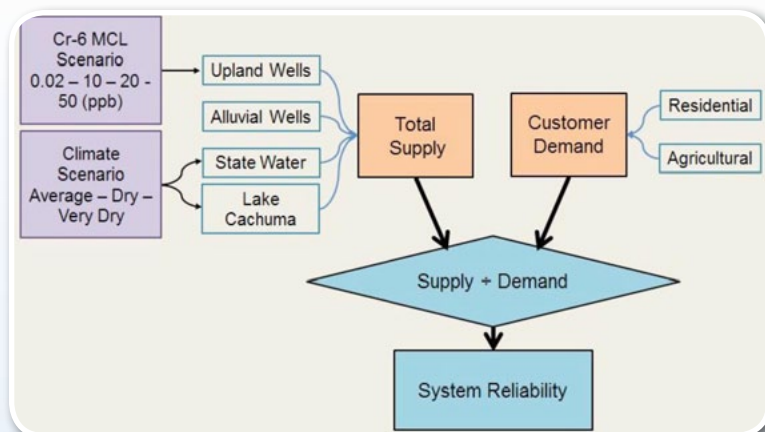


Figure 5. Water-supply system reliability metric for hexavalent chromium and climate scenarios.



Figure 6. Experimental woodchip bioreactors.

Session 4A: Impacts of Groundwater Pumping on Surface Water: Supply, Environmental, and Legal Considerations (Moderated by Daniel Wendell, The Nature Conservancy)

Although we know that all pumped groundwater ultimately comes from surface systems, the failure of the state to regulate groundwater has resulted in widespread impacts to surface water ecosystems and water rights.

Dr. Jeanette Howard, Associate Director for Science with The Nature Conservancy, discussed groundwater-dependent ecosystems and the services they provide to people. Examples of significant pumping impacts on these systems include seasonal stranding of salmon runs along the Shasta River, extensive seasonal drying of the Cosumnes River, and death of riparian vegetation along large stretches of the Carmel River.

Daniel Wendell, Associate Director for Groundwater at The Nature Conservancy, illustrated how increased groundwater pumping from 1922 to 2009 resulted in declining water levels, loss of basin storage, and resulting impacts to stream flow. A graph of

particular interest showed how streams in the Sacramento Valley were once net gaining, but are now net losers of water.

Dr. Ali Taghavi, Principal with RMC Water and Environment, discussed short- and long-term effects of “groundwater substitution” programs in the Sacramento Valley. He showed that in the short term (months) pumped groundwater is obtained from storage, and that only over the long term (years) do stream impacts begin, and that these impacts then persist for decades. It was stressed that impacts are not seasonal, and that the groundwater system is not “reset” during the subsequent winter.

Buzz Thompson, Stanford University, discussed legal issues surrounding these impacts to the environment and established surface water rights. Buzz emphasized that the state currently has legal authority to address these issues, but is hampered by cost and political will. The State Water Resources Control Board could play an enlarged role in groundwater management through enforcement of reasonable use. The public trust doctrine may also eventually come into play, possibly via legal actions against state and local agencies for failure to protect the public’s interests.

Strategies to Sustainably Manage Groundwater Quality and Quantity in an Uncertain Climate Future (Moderated by Alyx Karpowicz, SF Bay Regional Water Quality Control Board)

Andrew Schwartz of the Department of Water Resources described the increasing variability in California’s precipitation and snowpack, and how increasing temperatures are causing earlier snowmelt; the combined effects inhibit our ability to capture that water for use during times of the year it is needed most.

Two of our planned speakers, **Lorraine Flint** and **Randall Hanson**, both of the USGS, could not join us due to the federal government shutdown.

In their place, **Dr. Graham Fogg** of UC Davis presented *Groundwater is the Key to Climate Change Adaptation*, which detailed how dependent California is on water and what the primary sources of that water are. He also addressed degradation of groundwater quality from chronic overdraft, and recharge to basins from irrigation water.

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Summary of the 29th Biennial Groundwater Conference & GRA's 22nd Annual Meeting – Continued

Reza Namvar of RMC Water and Environment presented his climate change model showing impacts on future water supply and demand in agricultural and urban areas of the Sacramento region. The simulated changes in surface-water and groundwater demand will help regional water managers plan for the future.

The take-home message from this session is that much of the climate change impact on groundwater revolves around excess use and the inability to capture and use snowmelt due to runoff early in the year when demand is low.



Graham Fogg from UC Davis, presenting in the place of Randall Hanson and Lorraine Flint from the USGS. Photo by Brian Lewis.

Legislative Update

Tim Parker of Parker Groundwater and GRA's Legislative Committee Chairman, and **Chris Frahm** and **Rosanna Carvacho**, GRA's Legislative Advocates from Brownstein Hyatt Farber Schreck, gave the Annual Legislative Report during lunch on the second day of the Conference. Tim discussed the important role that GRA plays in the legislative process in Sacramento, including an example where GRA was

called upon by a Senator to discuss an idea for a bill and to provide feedback and technical guidance.

Chris thanked **Tim**, the Legislative Committee and GRA's board of directors for their hard work throughout the year reviewing legislative proposals and staying engaged as different issues arose. **Chris** reviewed the history and success of GRA's legislative program, and the encouraging signs she has seen in new legislators with a high level of engagement on water issues, even though it is their first year in the Legislature.

Rosanna briefly discussed the bills that GRA took a position on during the 2013 legislative year. More information on the specific bills can be found in the California Legislative Corner in this issue of *HydroVisions*. **Rosanna** also provided an overview of the Water Bond discussion that occurred in the Legislature this summer and the role that GRA played in the process.

Integrated Planning and Groundwater Management

(Moderated by Chris Petersen, West Yost Associates)

Mike Antos of the Council for Watershed Health discussed the use of stormwater as a resource for groundwater recharge, for which Los Angeles is the hub of research and policy on this topic. He stated that urban stormwater is an underutilized resource that, in Los Angeles, causes pollution issues in the ocean. If managed correctly, stormwater is a local resource that can improve the environment and create jobs.

Cathy Lee of the City of Roseville provided a very informative overview of Roseville's Aquifer Storage and Recovery (ASR) Program, highlighting lessons learned over the past 10 years. **Cathy** mentioned several firsts: first ASR program in the Central Valley of California, first ASR program permitted under the new State Boards General

Order, and first well in California to use silica beads in place of a natural filter pack. **Cathy** stressed the importance of public outreach and education, in addition to solid technical planning and design, in developing a successful ASR program.

Matt Zidar, Principal Consultant with GEI Inc., discussed integrating technical and policy solutions in managing and reversing groundwater overdraft. **Matt** described how Consolidated Irrigation District, located in the Kings River Basin of San Joaquin Valley, is working within the context of the Kings River Integrated Regional Water Management Plan and their local Groundwater Management Plan to prevent further overdraft to groundwater within their service area.

Groundwater Quality Treatment – Advancements Toward Improved Supply Reliability

(Moderated by Karl Longley, Central Valley Regional Water Quality Control Board)

Jess Brown of Carollo Engineers discussed a two-stage, fixed-bed biological drinking-water treatment process (BIOTTA™) that has been in development for initial application on groundwaters having excessive contaminant concentrations of perchlorate and nitrate; the unit has application to a broader suite of contaminants, including chrome 6 and VOCs. He pointed out that the process does not produce a troublesome waste stream; instead, it converts the contaminants into innocuous products or less toxic products.

Yoram Cohen of UCLA provided a very informative discussion of the desalination of brackish groundwater using distributed smart water systems (SWS) employing reverse osmosis treatment. He pointed out that these systems are easy to operate remotely

Continued on the following page...

Summary of the 29th Biennial Groundwater Conference & GRA's 22nd Annual Meeting – Continued

and are suitable for distributed treatment. He stated that high recovery (>90%) brackish water desalination with more efficient residuals management produces a minimal brine stream volume that can approach zero liquid discharge and provides opportunity for salt recovery.

Thomas Mohr of the Santa Clara Valley Water District pointed out that a new paradigm is needed to replace the practice of drilling new wells when existing wells become contaminated with one or more of an ever growing list of contaminants. This paradigm must address (1) the need to treat a large number of groundwater contaminants to very low levels, (2) the need to provide effective barriers to groundwater contamination where possible, (3) the need for more effective and preferentially preventive groundwater monitoring, and (4) the legal issues and costs associated with today's groundwater supply realities.

Statewide Plans, Proposed Actions and Water Bond Funding Framework: What's the Future Hold for California's Groundwater Reservoirs? (Moderated by *Chris Frahm*, GRA Legislative Advocate, *Brownstein Hyatt Farber Schreck*)

The closing session included a panel of Sacramento "heavyweights" who engaged in an informative and lively discussion about the "big picture" of California water – statewide plans, water bonds, and what it all means for groundwater.

Paul Helliher of DWR kicked off the panel with an update on the Bay Delta Conservation Plan (BDCP) and the Governor's then-pending (since released) Water Action Plan. Delta Vision Foundation's **Charles Gardiner** followed with a report on "the rest of the story," the Foundation's BDCP "Plus," emphasizing the need for integrated planning and facilities beyond conveyance. **Doug Obegi** weighed in with NRDC's "portfolio" alternative, emphasizing the important role of conservation and local water supply development. **Debbie Davis** provided additional perspective from the Administration including how important it will be to meet the needs and special challenges of disadvantaged communities. **Tina Leahy**, Principal Consultant to the Assembly Water, Parks and Wildlife

Committee, hit it out of the ballpark with a lively presentation (of her own views on) legislative perspectives on both the water bond and BDCP. All speakers agreed that a Delta solution is critical to the State's water future. GRA's own **Tim Parker** was the cleanup hitter, explaining why groundwater is the "great integrator" of water supply planning and objectives and therefore must be front and center no matter what plan or water bond is ultimately adopted and approved by the voters.

In closing, all speakers acknowledged the tough road that lies ahead to meet the state's future water supply needs in a cost-effective manner – and that governance issues remain one of our greatest challenges. 💧



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SAVE THE DATE

Groundwater Resources Association of California

Compounds of Emerging Concern in Groundwater

FEBRUARY 4-5, 2014 – CONCORD, CA

About the Symposium

Emerging contaminants present numerous technical and institutional challenges to society and to environmental and public health professionals. Increasingly sensitive analytical techniques have detected the presence of previously unregulated chemicals in actual or potential sources of drinking water. In some cases, the impacts of these chemicals to human health and the environment are uncertain. Many emerging chemicals remain unregulated, but the number of regulated contaminants will continue to grow slowly over the next several decades.

GRA's one and a half day event will profile the latest developments in detection, risk assessment, remediation and regulation of emerging contaminants in groundwater. Experts from academia, regulatory agencies, consulting, industry, and the legal arena will participate in moderated speaker sessions, poster sessions, and round-table panel discussions.

Symposium Format and Topics

The symposium will start after lunch on Tuesday afternoon. An opening keynote presentation will be given by Dr. Andrea Leeson with a Department of Defense perspective on emerging groundwater contaminants. The rest of the afternoon will be dedicated to discussions on chromium. The chromium session will be co-chaired by Kevin Sullivan of PG&E and Richard Makdisi of Stellar Environmental and will feature six presentations, including a regulatory perspective by Dr. Bruce Macler (US EPA), a toxicological perspective by Deborah Proctor (ToxStrategies), as well as case studies by Yvonne Meeks (PG&E), Leighton Wong (Glendale Water and Power) and Dr. John Izbicki (USGS). The day will conclude with a poster session and a student paper competition featuring the work of students from universities nationwide.

On Wednesday February 5, the day will start with a session on perfluorinated compounds (PFCs) co-chaired by Dr. Ron Porter of Noblis and Dr. Ramona Darlington of Battelle. Discussion topics include the fate and transport of PFCs and industry practices highlighting a variety of technologies. Speakers include Dr. Linda Lee (Purdue University), Dr. Chris Higgins (Colorado School of Mines), Dr. Shaily Mahendra (UCLA), Dr. Jennifer Field (Oregon State University) and Elisabeth Hawley (ARCADIS). The second session on Wednesday will be chaired by Bill DiGuisseppe (CH2MHill) and will focus on 1,4-dioxane. This session will feature six presenters including Dr. Pat Evans (CDM Smith), Tom Mohr (Santa Clara Valley Water District), Dora Ogles (Microbial Insights) and others. A third session after lunch will be co-chaired by Dr. Eric Suchomel (Geosyntec) and Brian Lewis (DTSC) and will focus on other contaminants of emerging concern, including polybrominated diphenyl ether (PBDE), NDMA and 1,2,3-TCP. This session will also have a presentation on hydrofracturing as a potential source of emerging contaminants in groundwater. The symposium will conclude with a panel discussion moderated by David Woodward (AECOM) and Dr. David Sedlak (UC Berkeley) on predicting and managing the next generation of emerging groundwater contaminants.

Dates & Details

GRA EVENTS & KEY DATES

(Please visit www.grac.org for detailed information, updates, and registration unless noted)



GRA Symposium

Compounds of Emerging Concern in Groundwater

Feb. 4-5, 2014 | Concord, CA

GRA Board Meeting

Feb. 22, 2014 | Sacramento, CA

GRA Conference

Groundwater Issues and Water Management Strategies Addressing the Challenges of Sustainability in CA

Mar. 4-5, 2014 | Sacramento, CA

GRA Legislative Symposium and Lobby Day

Apr. 8, 2014 | Sacramento, CA

Additional information

Please contact the symposium co-chairs, Rula Deeb (rdeeb@geosyntec.com, 510-932-9110), Kevin Sullivan (KMSu@pge.com) and David Sedlak (sedlak@berkeley.edu) for information about the technical program.

GRA welcomes co-sponsors as well as lunch, break, reception and student paper competition sponsors. If you are interested in exhibiting your organization's services or products, or being an event sponsor, please contact Sarah Kline (skline@grac.org, 916-446-3626). 💧

SAVE THE DATE

Groundwater Resources Association of California

Groundwater Issues and Water Management—Strategies Addressing the Challenges of Sustainability in California

MARCH 4-5, 2014 – SACRAMENTO, CA

A GRA Conference Organized in Cooperation with USCID,
The U.S. Society for Irrigation and Drainage Professionals

About the Conference

The last few decades have seen mounting water management challenges, particularly those associated with increased reliance on groundwater resources throughout the West. This growing reliance on groundwater is due largely to the expansion of permanent crops, more intensive irrigation practices, increased urban and environmental competition for water supplies, and reduced surface-water supplies due to drought and increasing regulatory restrictions. Coupled with overdraft, land subsidence and other ongoing issues associated with groundwater use, this increased reliance on groundwater resources heightens the concern over the long-term sustainability of the resource.

GRA, in cooperation with the United States Committee on Irrigation and Drainage (USCID), a nonprofit international professional society that aims to foster sustainable, socially acceptable and environmentally responsible irrigation, drainage and flood control systems and practices for providing food, clothing and shelter to the people of the United States and the World, are organizing a Conference that provides a unique opportunity for attendees to access simultaneously the technical and policy challenges facing groundwater resources.

This Conference will address a wide range of issues that are linked to groundwater resources and management challenges, including the interaction between surface and groundwater, groundwater banking and conjunctive use, the continued investment in water resources infrastructure and modern irrigation technologies, meeting water quality objectives, and managing floodwaters for beneficial use. We are soliciting papers and presentations that synthesize these issues in an important conference relevant to today's water managers.

Who Should Attend?

The co-located Conference will provide an ideal forum for irrigation districts, academia, consultants, regulators, and federal, state and municipal water managers to learn about

new ideas and technologies available to deal with the issues related to the challenges of groundwater resources and water management in California and throughout the West. The Sacramento setting provides an excellent opportunity to share these ideas, given its history as the center of state government, proximity to extensive irrigated lands and an abundance of water resources quantity and quality challenges.

Conference Format

A half-day field tour on Tuesday morning (March 4, 2014) will be followed by lunch and joint USCID/GRA Plenary Sessions featuring a wide range of presentations specifically for irrigation managers and groundwater professionals. Presentations during concurrent USCID and GRA Technical Sessions and a Poster Session will occur on Wednesday, March 5, 2014. Participants at the USCID and GRA Conferences may attend the Wednesday concurrent Technical Sessions of either organization. USCID will continue Conference activities on Thursday and Friday (March 6 and 7). Friday, March 7 includes a day-long study tour of Sacramento-area water activities. Each organization is independently administering their Conference. GRA participants that desire to stay for the Thursday sessions and/or the Friday field trip will have the opportunity to purchase registration for the additional day, or days, from USCID.

Additional information

For conference topics and other info:
<http://grac.org/giwm.asp>

Contact Chris Petersen (cpetersen@westyost.com; 530-792-3239), Steve Phillips (sphillip@usgs.gov; 916-278-3002) or Vicki Kretsinger Grabert (vkretsinger@lsce.com; 530-661-0109). 💧

Wells and Words

By David W. Abbott P.G., C.Hg., Consulting Hydrogeologist

Tools in the Hydrogeologist's field kit—The Imhoff Settling Cone

The Imhoff Settling Cone is a simple, essential, and inexpensive instrument used to rapidly measure the total suspended solids (TSS) in water¹; the field version (< \$40) is constructed of rigid and durable plastic, and the laboratory version (<\$200) of the instrument is usually made of glass. The Imhoff Cone is a clear funnel-shaped device with a plug in the bottom measuring about 18 inches tall with an inside diameter of about 4 inches at the top, tapering to about ¼ inch at the bottom of the cone. It holds over one liter (1,000 milliliters [mL]) of water. A removable mated-plug at the bottom of the cone (a) temporarily seals the bottom of the cone, which becomes a container; (b) acts as a uniform and flat pedestal for sediment accumulation; and (c) when removed, allows easy cleaning and removal of the sediment in the cone. Variably-spaced graduations are inscribed along the side of the cone in order to measure the TSS of a 1,000 mL sample of water. The graduations range from 0.1 mL at the bottom of the cone to 250 mL at the top. This scale is used to measure the volume of solids that settle to the bottom of the cone. Note that one mL is equal to one cubic centimeter (cc).

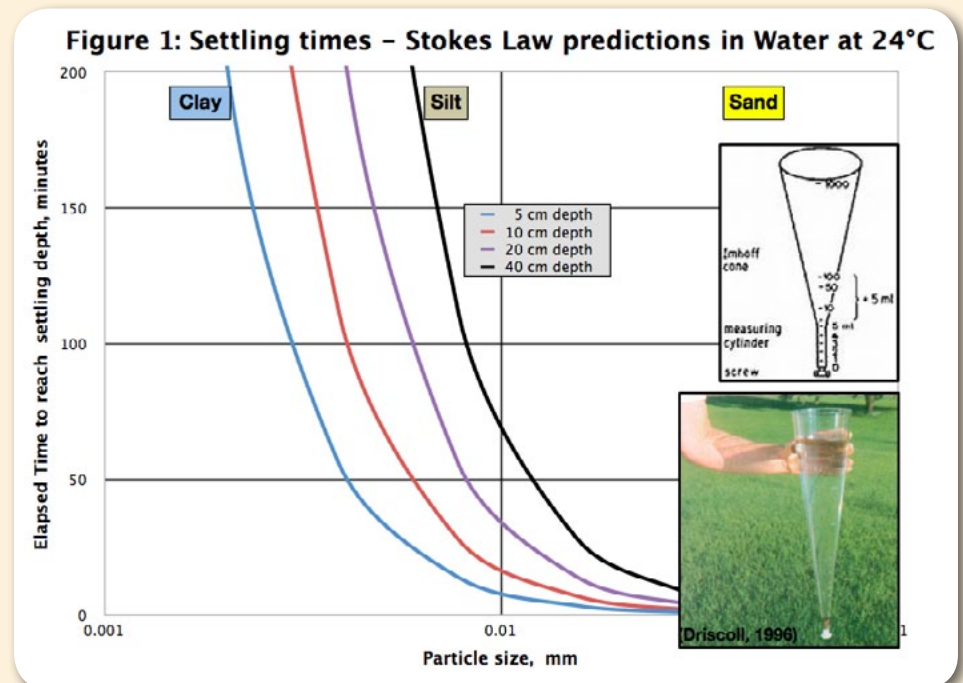
The Imhoff Cone is a valuable tool for use during well development to estimate sand production during short intervals of time, especially during abrupt, rapid, and aggressive cycles of backwashing and pumping. Another more accurate device that is often used in conjunction with the Imhoff Cone during later stages of well development, and during continuous pumping², is the Rossum Sand Tester³. The wastewater industry also uses the Imhoff Cone to estimate the total volume of settling solids in wastewater⁴. During

well development, sand is encouraged to enter the production well to (a) remove sediment-size particles smaller than the well screen aperture size, thereby increasing the permeability of the filter pack and sediments near the screen; (b) remove flat or plate-like particles surrounding the well screen, thus reducing mechanical blockage; (c) promote better hydraulic continuity of the filter pack between the well screen and the wall of the boring (aquifer); and (d) reduce and/or eliminate discharge of sand during long-term production.

Well efficiencies usually are attributed to the annular-filled space (filter pack) between the outside diameter of the screen and the walls of the boring damaged by the drilling process. Sand production of a well, especially during development, is normal and should gradually decrease with time and at lower pumping rates. A production well that is installed in unconsolidated sediments and produces absolutely no sand during initial well development programs may indicate me-

chanical clogging, improper well screen aperture size, or ineffective well development methods with insufficiently applied development energies. In summary, relatively small amounts of sand should be removed during the mechanical and over-pumping phases of well development in order to reduce or eliminate sand production during long-term well use.

During well development, a sample of the discharge water is collected using the Imhoff Cone, usually at the bottom (or lowest part) of the discharge pipe. The sample is allowed to stand for a period of time, after which the TSS is measured from the scales inscribed on the cone. Depending on the size of the suspended solids, settling times may range from a few minutes to several hours according to Stokes Law⁵. Stokes Law states that the rates of settling of spherical particles in a fluid can be estimated using the following equation: $v = C \times r^2$, where v is velocity in centimeters per second (cm/sec), r is the particle radius in cm, and C is a constant incorporating the relative



Continued on the following page...

Wells and Words – Continued

densities of the fluid and particle, acceleration due to gravity, and the viscosity of the fluid⁶. The standard settling time for the wastewater industry is about 1 to 2 hours^{4,7}; the settling time during well development and pumping tests could be less than two minutes for sand-size particles. Many geologists are familiar with Stokes Law from having conducted pipette analysis, which is a method of particle-size analysis for fine-grained sediment (silts and clays), made by removing samples from suspension with a pipette at various depths in a settling tube⁸.

A graph with particle size in millimeters (mm) along the x axis and elapsed time (in minutes) of particle settling on the y axis is shown in Figure 1. Predicted settling rates were estimated using a re-arranged⁸ Stokes Law with water temperature at 24° centigrade for 5, 10, 20, and 40 cm depths in a standard settling tube. The length of the Imhoff Cone at the 1,000 mL graduation is about 40 cm; hence, the sand fraction of a sample settles to the bottom of the cone after a very short period of time (less than 2 minutes). The finer fractions (silts and clays) in suspension can take anywhere from 30 minutes (silt-size) to several hours or more to settle to the bottom of the Imhoff Cone. The insets of Figure 1 show Imhoff Settling Cones.

Methodical and systematic use of the Imhoff Settling Cone can provide supplemental field information to evaluate the real-time response and effectiveness of well development and to predict long-term trends in sand concentrations during constant discharge pumping tests. Acceptable sand concentrations depend on the application and use of the water, ranging from (a) 1 part per million by volume (ppm/V) for food processing, (b)

5 ppm/V for potable and industrial water supply systems (ideally 0.7 ppm/V for wells directly discharging into the water conveyance system), and (c) 15 ppm/V for flood-type irrigation^{2,9}. Observe that the acceptable range of sand concentrations is significantly lower (at least two orders of magnitude) than the Imhoff Cone can measure (0.1 mL per 1,000 mL or 100 ppm). Hence, virtually no sand (one or two grains) should be detected in the Imhoff Cone with a properly designed and developed well. 💧

¹ Poehls, D.J. and G.J. Smith, 2009, *Encyclopedic Dictionary of Hydrogeology*, Elsevier Press, Amsterdam, The Netherlands, 517p.

² Roscoe Moss Company, 1990, *Handbook of Ground Water Development*, John Wiley & Sons, NY, 493p.

³ Rossum, John R., 1954, *Control of Sand in Water Systems*, *Journal of American Water Works*, Vol. 26, No. 2. See also Roscoe Moss, Technical Memorandum 005-7.

⁴ Rossum, John R., 1954, *Control of Sand in Water Systems*, *Journal of American Water Works*, Vol. 26, No. 2. See also Roscoe Moss, Technical Memorandum 005-7.

⁵ Krumbein, W.C. and L.L. Sloss, 1963, *Stratigraphy and Sedimentation*, W.H. Freeman and Company, San Francisco, CA, 660p.

⁶ American Geological Institute, 2005, *Glossary of Geology* (Fifth Edition), Editors: Klaus K.E. Neuendorf, James P. Mehl, Jr., and Julia A. Jackson, American Geological Institute, Alexandria, VA, 779p.

⁷ Tchobanoglous, George and Franklin L. Burton, 1991, *Wastewater Engineering: Treatment, Disposal, and Reuse* (Third Edition of Metcalf and Eddy, 1930), McGraw-Hill Book Company, Inc., NY, 1334p.

⁸ Folk, Robert L., 1974, *Petrology of Sedimentary Rocks*, Hemphill Publishing Co., Drawer M, University Station, Austin, TX, 182p.

⁹ California Groundwater Association (CGA), October 1994, *CGA Standard Practice Series: Sand Discharge in Wells*, 5p.

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Legislative Update

By Tim Parker, GRA Legislative Committee Chairman,
Chris Frahm and Rosanna Carvacho, GRA Legislative Advocates

GRA's Legislative Committee and Board of Directors had another very active year in the Capitol, tracking more than 40 bills. The Committee also hosted another highly successful Annual Legislative Symposium and Lobby Day, in partnership with the California Groundwater Coalition. Additionally, the Committee was very engaged with the water bond discussions that occurred in the Legislature, and formed a Hydraulic Fracturing Workgroup that commented on draft regulations and developed *Policy Principles for Hydraulic Fracturing in California*.

GRA Supported/Opposed Legislation

AB 69 (Perea) – Establishes the Nitrate at Risk Area Fund to fund solutions for disadvantaged communities with nitrate-contaminated drinking water. GRA supported the provisions of this bill that dealt with groundwater monitoring. The bill was not heard in committee but may receive a hearing in 2014.

SB 4 (Pavley) – Provides a comprehensive statutory framework for hydraulic fracturing in California. Any oil company that seeks to “stimulate” wells after January 1, 2014 will have to file satisfactory certifications of compliance with groundwater testing, neighborhood notification and public disclosure of chemicals, well history and locations online. GRA supported this bill, which was signed by Governor Brown on September 20.

SB 620 (Wright) – Amends the Water Replenishment District Act to increase the penalty for failure to pay the replenishment assessment for pumping water and eliminates the requirement that 80% of the district's reserve fund be expended for water purchases until fiscal year 2019-20. GRA supported this bill, which was signed by Governor Brown on October 8.

SB 658 (Correa) – Clarifies that the Orange County Water District can recover all clean-up costs for the Orange County groundwater basin. GRA supports timely remedial activities to enhance the long-term beneficial use of California's groundwater resources. GRA supported this bill because it is critical to the remediation of pollutants to ensure a safe water supply for the residents of Orange County. This bill failed to pass out of the Senate by the deadline and cannot move forward until January of 2014.

AB 145 (Perea) – Transfers the duties and responsibilities related to the regulation and oversight of drinking water, including the authority to administer the Safe Drinking Water State Revolving Fund, from the Department of Public Health to the State Water Resources Control Board. GRA took an oppose-unless-amended position on the bill, which was held in the Senate Appropriations Committee.

Continued Changes in the Legislature

Assembly member Freddie Rodriguez was elected to the Assembly in September to fill the vacancy left by Norma Torres, who was elected to the Senate in May. Two vacancies remain in the Assembly, in the 45th and 54th Districts.

Changes in committee membership or chairs are expected to occur in January when the Legislature reconvenes. We will keep you informed of how any changes affect the committees most important to GRA.

Appointments

In September, Governor Brown appointed Laura King Moon to the position of Chief Deputy Director at the California Department of Water Resources (DWR). Prior to this ap-

pointment, Moon was DWR's Project Manager for the Bay Delta Conservation Plan. Moon holds a M.S. degree in energy and resources from UC Berkeley.

Overall Status of the Legislative and Policy Climate in California

Chronic, decadal groundwater depletion in many basins in the state is getting more attention and visibility, with the release of the USGS Central Valley Hydrologic Model and GRACE satellite imagery in the last few years, a recent Administrative Draft of California Water Plan Update 2013, and many wells going dry statewide. A number of actions are taking place, as described below.

Governor's Office of Planning and Research Activities

Staff from the Governor's Office of Planning and Research have been making visits across the state in areas where wells have been going dry to interview local water agencies to better understand their situation and needs. There is consensus being developed that something different needs to be done to give local agencies incentives and, if necessary, additional authority to improve groundwater management to address groundwater depletion. Depending on the climate during the next year or two, there may be some significant proposals from the Governor's Office and the Legislature to change groundwater management in the California.

State Water Resources Control Board Groundwater Conceptual Strategy Workplan

The SWRCB has developed a draft conceptual strategy for groundwater resources management in the state. It lays out several principles for setting thresholds for groundwater levels and

Continued on the following page...

Legislative Update – Continued

quality, and possible regulatory actions and controls. The draft is available [here](#).

California Water Action Plan

The Natural Resources and Environmental Protection Agencies, in conjunction with the Department of Food and Agriculture, released the California Water Action Plan (CWAP) on October 31. The plan is a high-level planning document to provide the Administration's vision for California's water resources future and to help tie together the California Water Plan, Delta Plan and Bay Delta Conservation Plan.

The plan focuses on ten key actions:

- Make Conservation a California Way of Life
- Increase Local and Regional Self-Reliance
- Achieve Co-Equal Goals for the Delta
- Protect and Restore Important Ecosystems
- Manage and Prepare for Dry Periods
- Expand Water Storage Capacity
- Provide Safe Drinking Water for All Communities
- Improve Flood Protection
- Increase Operational and Regulatory Efficiency
- Identify Sustainable and Integrated Financing Opportunities.

The CWAP can be viewed [here](#). Additionally, the Association of California Water Agencies (ACWA) released its own version of a CWAP, which is available [here](#).

Water Bond 2014

As the Legislative session started in January, it was unclear if replacing the current water bond, which is slated to be on the November 2014 ballot, with a smaller bond would be a topic of discussion. It was not until the summer that the discussions around the water bond began to heat up due to the Assembly forming a Water Bond Working Group made up of Legislators from throughout the state and Chaired by

Assembly member Rendon, who is also the Chair of the Assembly Water, Parks and Wildlife Committee.

The work of the Assembly Water Bond Working Group culminated in the introduction of their proposed water bond bill, AB 1331 (Rendon). Senator Wolk introduced a water bond bill, SB 42, at the start of the Legislative Session that was a placeholder and did not include much detail, including dollar amounts. In September, with the discussion in the Assembly, Senator Wolk amended her bill to more closely mirror the Assembly bill, AB 1331.

During this entire process GRA was engaged with the Assembly Water Bond Working Group, submitting written comments and testimony each step of the way, and will continue to do so as this discussion progresses in 2014.

Delta Plan

The Delta Plan is a comprehensive, long-term management plan for the Delta. Required by the 2009 Delta Reform Act, it creates new rules and recommendations to further the state's coequal goals for the Delta: improve statewide water supply reliability, and protect and restore a vibrant and healthy Delta ecosystem, all in a manner that preserves, protects and enhances the unique agricultural, cultural, and recreational characteristics of the Delta.

The Delta Plan was unanimously adopted by the Delta Stewardship Council on May 16, 2013. Subsequently its 14 regulatory policies were approved by the Office of Administrative Law, a state agency that ensures the regulations are clear, necessary, legally valid, and available to the public. The Delta Plan became effective with legally-enforceable regulations on September 1, 2013. More information is available [here](#).

Bay Delta Conservation Plan

The Administration's Draft Bay Delta Conservation Plan, which was delayed by the federal government se-

questration, will be released in the next month. The plan contains the approach for Delta ecosystem restoration, and the project to divert water, using two tunnels, from north of the Delta to the Californian State Aqueduct south of the Delta. More information on the BDCP is available [here](#).

California Water Plan Update 2013

The Administrative Draft California Water Plan Update 2013 was released earlier this month and the final meeting of the California Water Plan Update 2013 Public Advisory Committee was held October 29-30 in Sacramento. To access the Administrative Draft, click [here](#). The regional sections contain summary information on groundwater and should be checked for accuracy by local agencies. The "California's Groundwater" volume of the Water Plan is scheduled to be released in early January 2014.

Looking Ahead

It looks like the end of this year and next year are going to be very important for groundwater and water generally in California. GRA plans to provide input to the Governor's Water Action Plan and to the SWRCB's Groundwater Strategy in 2013. The Bay Delta Conservation Plan process will continue, the California Water Plan will be completed, the regulations for hydraulic fracturing will be crafted and the water bond will need to be addressed. GRA will continue to be an important source of information and sound science for legislators and staff and for the Administration through 2013, and into 2014, as these conversations continue. 💧

SAVE THE DATE

April 8, 2014

**Annual Legislative
Symposium
and Lobby Day**

The Federal Corner

By Jamie Marincola, U.S. EPA

Workbook Helps Users to Develop Climate Change Adaptation Plans

EPA released a draft workbook for environmental professionals and city managers to help identify and manage risks associated with climate change. The document, *Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans*, provides systematic approaches for building local capacity to understand and manage risks associated with climate change to protect future generations. The workbook was produced by EPA's Climate Ready Estuaries program, which works with 28 National Estuary Programs and the coastal management community to assess climate change vulnerabilities, develop and implement adaptation strategies, and engage and educate stakeholders. To learn more, visit <http://water.epa.gov/type/oceb/cre/index.cfm>.

New USGS Tool Expedites Assessment of Seawater Intrusion in Coastal Aquifer Systems

The U.S. Geological Survey has developed a hydrologic modeling tool that will aid in planning for water-supply sustainability and preparing for the potential impacts of climate change in regional coastal aquifer systems. In a collaborative effort among USGS, academia, and the private sector, a new modeling tool, called the Seawater Intrusion (SWI2) Package, was developed for the popular USGS

MODFLOW-2005 groundwater modeling program. As the most widely used groundwater flow model in the world, MODFLOW features a comprehensive range of options for simulating many different hydrologic components. The package is fully documented and accessible at <http://water.usgs.gov/nrp/gwsoftware/modflow2005/modflow2005.html>.

EPA Tracks Seasonal and Rain-Dependent Streams

EPA has used the National Hydrography Dataset to create a county-by-county map of the percent of the population that receives at least some of its drinking water from streams that are seasonal, rain-dependent or headwaters. The analysis revealed that at least 117 million Americans get drinking water from these waterways. To check out the map, and look up county-specific data, visit <http://water.epa.gov/type/rsldrinkingwatermap.cfm>.

USGS Publishes Study on Groundwater Contributions of Flow, Nitrate and Dissolved Organic Carbon to the Lower San Joaquin River

Researchers examined a 59-mile reach of the San Joaquin River from Vernalis to Salt Slough in order to quantify and characterize groundwater discharged to the river. The study found that loading from groundwater sources constituted about 9% of the dissolved inorganic nitrogen and 7% of dissolved organic carbon in that particular stretch of the river. To read more, visit <http://pubs.usgs.gov/sir/2013/5151/>.

EPA Releases RE-Powering Mapper

Many contaminated lands, landfills, and mine sites are particularly well-suited for renewable energy development because they are situated in close proximity to critical infrastructure such as electric transmission lines and roads, located near areas with high energy demands, and offered at lower land costs when compared to open space. EPA RE-Powering America's Land initiative recently released an updated RE-Powering Mapper tool that provides preliminary screening results for renewable energy potential at contaminated properties tracked by EPA and partnering state agencies. Through continued collaboration with the U.S. Department of Energy's National Renewable Energy Laboratory, the tool now covers more than 66,000 sites and includes screening criteria for solar, wind, biomass, and geothermal potential at various levels of development. States with agencies that have joined this effort include California, Hawai'i, Oregon, Pennsylvania, New Jersey, New York, West Virginia, and Virginia. View or download at http://epa.gov/renewableenergyland/rd_mapping_tool.htm.

Jamie Marincola is an Environmental Engineer at the U.S. Environmental Protection Agency, Region 9. He works in the Water Division on Clean Water Act permitting and community outreach. For more information on any of the above topics, please contact Jamie at 415-972-3520 or marincola.jamespaul@epa.gov.

GRA MEMBERS – Renew in 2014 to Continue GRA's 2013 Success!

It's time to renew your GRA membership for 2014. You can renew online via GRA's Web site, www.grac.org, or you can request a hard copy dues renewal invoice from Kevin Blatt at dbadmin@grac.org. To save time and effort, GRA recommends that you renew online as the process is secure and seamless. It will also help GRA to keep related expenses to a minimum.

Thank you for your continued participation in protecting and improving California's groundwater supply and quality.

New Private Well Owner Training and Technical Assistance Tools Becoming Available

By Cliff Treyens, NGWA Public Awareness Director

Beginning in September, the National Ground Water Association began developing a set of new private well owner training and technical assistance tools under a cooperative agreement with the U.S. Environmental Protection Agency. The purpose of the tools is to educate and motivate private well owners to protect their health by acting in ways that protect their well water quality.

Private Well Owner Hotline – A new private well owner hotline operated by the NGWA went into operation September 24. The toll-free number is 855-420-9355 (855-H2O-Well). The hotline hours are Monday-Friday, 10 a.m. to 4 p.m. Eastern Time except for national holidays.

The purpose of the hotline is to help private well owners with questions relating to water quality (such as water testing and treatment), well maintenance and construction, and groundwater protection. NGWA encourages you to use whatever communications channels at your disposal to share the hotline number with private well owners.

Private Well Owner Tip Sheet – The Private Well Owner Tip Sheet is a monthly, one-page newsletter about tools that can help private well owners reduce risks to their water supplies. The first issue was sent out to an extensive list of private well owners and state/local officials in early October. Anyone can sign up to receive the monthly tip sheet via email by going to www.wellowner.org. If you're reading this article and haven't signed up for the tip sheet, please do so and again consider making the well owning public aware of this tool.

Other well owner tools on the horizon – Other tools being developed include:

- A series of private well owner Webinars beginning early next year

[While well owners are the primary target audience, statelocal officials are encouraged to view the Webinars for their own edification and so that they can consider promoting them to their well owning publics]

- A series of learn-at-your-own-pace online learning modules for private well owners beginning in November *[These online training modules also are open to state/local officials]*
- A year-round public awareness campaign promoting the new private well owner tools involving monthly news releases; a nationally syndicated news article, and TV and radio spots; and National Groundwater Awareness Week and Protect Your Groundwater Day

- Enhancements to NGWA's WellOwner.org website including a landing page where well owners can access all the new training and technical assistance tools being developed under the U.S. EPA cooperative agreement.

All these training and technical assistance tools will be easily accessible through the Internet, free and available 24 hours a day. Even the Webinars will be recorded and uploaded for viewing at any time by well owners. If you have any questions about the tools, contact NGWA Public Awareness Director Cliff Treyens at ctreyens@ngwa.org or 614-898-7791, ext. 554. 💧

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David K. Todd Distinguished Lecturers for 2014

GRA proudly announces **Mr. Carl Hauge** (northern California) and **Dr. Jay Famiglietti** (southern California) as speakers for the fourth annual David Keith Todd Distinguished Lecture Series. The objective of this lecture series is to foster interest and excellence in applied groundwater science and technology through GRA-sponsored lectures at California universities and GRA events. This GRA educational program promotes the understanding and implementation of groundwater assessment, protection, and management.

GRA awarded Dr. David Keith Todd a Lifetime Achievement Award in 1999 for his important contributions to groundwater science and technology. GRA further honors his legacy as a groundwater science and education leader by naming the distinguished lecture series in his honor. Lecturers for this series are nominated and evaluated by the Education Committee to represent GRA and David Keith Todd's legacy.

Mr. Carl Hauge will present in northern California and Dr. Jay Famiglietti will present in southern California. Each speaker will present at least five lectures at universities, GRA Branch meetings and at the Annual Conference and Meeting. The David Keith Todd Lecture Series is funded by corporate sponsors, voluntary support from the lecturer's institution or firm, and host universities. Universities that are interested in hosting a lecture should contact Lisa Kullen, Education Committee Chair (dkt@grac.org) no later than December 31, 2013. Look for the Lecture Series schedule to be posted on GRA's website and Facebook page.

Carl Hauge (Northern California)
Former Chief Hydrogeologist,
Department of Water Resources

Lecture: Groundwater—Past, Present, and Future



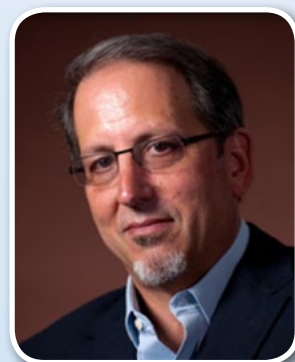
Mr. Hauge is a registered geologist and a certified engineering geologist, retired from his position of Chief Hydrogeologist for the Department of Water Resources, Sacramento (DWR). His service with DWR included work on groundwater, land subsidence, water management, proposed dam site evaluation, data management and well standard projects statewide.

He has also worked on timber harvest practices and stream protection with the Department of Forestry and Fire Control and the State Board of Forestry. In addition, his contributions include work on earthquake studies and urban geology as well as service as editor for the monthly magazine California Geology with the California Geological Survey. During Mr. Hauge's career, he was actively involved as a member of the Association of California Water Agency's Groundwater Committee, the California Groundwater Association from which he received the Jeremy C. Wire Technical Person of Merit of the Year Award, and the Groundwater Resources Association of California from which he received the 2001 Lifetime Achievement Award. He has spoken at numerous symposia and conferences throughout the state.

Dr. Jay Famiglietti (Southern California)
Professor of Earth System Science and
of Civil and Environmental Engineering
Director, UC Center for Hydrologic Modeling

Lecture: Water in the Balance: Observing Groundwater Depletion from Space

As Founding Director of the UC Center for Hydrologic Modeling, Dr. Famiglietti and his research team use satellites to track water availability and groundwater depletion on land, and have been working for many years towards improving hydrological prediction in climate models like those used in the IPCC. Before joining UCI in 2001, Dr. Famiglietti was a



faculty member in Geological Sciences at the University of Texas at Austin, where he helped launch the UT Environmental Science Institute. He is the past Chair of the Board of the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI), the past Editor-in-Chief of Geophysical Research Letters, and he has been a Visiting Professor at Stanford University. Famiglietti, a Fellow of the American Geophysical Union, served as the 2012 Birdsall-Dreiss Lecturer of the Geological Society of America. He has briefed U.S. and world leaders on global water issues, and he appears as a featured expert in the water documentary Last Call at the Oasis. He and his research group have published numerous papers and reports, and their work has been featured in major international news media. 💧

One Mouse Click to Help a Groundwater Student – GRA's Scholastic Fund Program!

By John Karachewski, Lisa Kullen, Paul Parmentier, and Thomas Harter

As we enter our fall membership drive, we'd like to turn our focus to giving back and supporting GRA's initiative to encourage groundwater scholarship. For about a decade, GRA's Branches have promoted the Scholastic Fund Program that benefits local universities and students through academic scholarships, travel grants to GRA conferences, and support to academic departments researching California's groundwater. To encourage donations to this important program, GRA partnered with the Water Education Foundation (WEF) to create a fully tax-deductible [Scholastic Fund Program](http://www.watereducation.org/secure/GRAScholastic.asp) under WEF's 501(c)(3) status. Members can make tax-deductible donations to the Scholastic Fund Program at: <http://www.watereducation.org/secure/GRAScholastic.asp>.

Each year, contributions to the GRA-WEF account are allocated to Branches for final distribution, as a match of the funds raised locally by that Branch (such as through sponsorship of dinner meetings). GRA-WEF donors thereby double the value of their contributions, as it becomes an incentive for Branches to increase local fundraising. Each GRA Branch then autonomously distributes the scholastic funds through their own local programs. Since 2009, GRA members and corporate donors have contributed over \$25,000 to the Scholastic Fund Program.

A recent recipient of a GRA travel award, Stephanie Urióstegui, a doctoral student in the Department of Earth Science at the University of California – Santa Barbara and a Lawrence Scholar Fellow at the Lawrence Livermore National Laboratory, describes the positive benefits of her experience in the inset.

Inspired by the positive impact of this program, Southern California GRA member Steve Zigan has once again generously provided a \$2,500 *challenge grant* to the GRA-WEF Scholastic Fund Program, to promote contributions from other members (see page 23 of [HydroVisions summer 2013](#)). To build on the benchmark \$2,500 individual-member contribution established in the first year of this partnership, Mr. Zigan's grant will match your donation with 50 cents on the dollar in an effort to boost our member donations to \$5,000, thereby claiming his entire challenge and bringing overall fundraising to \$7,500. We successfully met his challenge last year; your contribution to the [GRA-WEF Scholastic Fund](#) can help us achieve that goal again, either through clicking on this link or through the convenient "voluntary contribution" field on your membership renewal webpage. It's just one click to further groundwater education in California! 💧

As a recipient of a GRA-Water Education Foundation (WEF) student travel award, I presented my dissertation research at the Collegiate Colloquium of the 29th Biennial Groundwater Conference & 22nd GRA Annual Meeting. For graduate students like myself, participating in the Collegiate Colloquium is a tremendously valuable experience because it provides a unique opportunity to share our research with groundwater professionals outside of academia. The diverse audience of policy-makers, practitioners, researchers, and educators offers different perspectives and stimulates interesting follow-up discussions on our research. The GRA-WEF Scholastic Fund Program makes these experiences possible for many students by funding their travel expenses to attend and present their research at GRA meetings.

Based on the positive feedback and comments that I received following the Collegiate Colloquium, I eagerly sought out other opportunities to become more involved as a GRA student member. I recently joined the Education Committee as a student representative and I look forward to helping students succeed academically and professionally by encouraging them to become active GRA members.

On behalf of all the students that have benefited from the generosity of GRA members, Branch sponsors, and WEF partners, I sincerely thank you for your financial support and commitment to students.

Picture Your Research Featured in HydroVisions

Call for Submissions

HydroVisions is looking for submissions from students engaged in groundwater research, to highlight in our Student Corner.

Do you know of a student with something to share?

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- Research Papers
- Summary Blurbs

For further information, please contact:
editor@grac.org, subject "Student Corner"

2013 Annual Awards

The Groundwater Resources Association of California (GRA) presented its 2013 annual awards during the 29th Biennial Groundwater Conference and 22nd GRA Annual Meeting October 8-9, 2013 in Sacramento, CA.

The 2013 Lifetime Achievement Award was given to Dr. Shlomo P. Neuman, Regents Professor in the Department of Hydrology and Water Resources at the University of Arizona. Dr. Neuman was selected in recognition of his lifelong commitment to research on groundwater hydraulics, fracture flow and modeling, and to teaching quantitative courses in subsurface hydrology and fluid dynamics, numerical methods, and pumping test analysis to graduate hydrology students. He is credited with “blazing” the complexities of numerical solutions to be applied to well testing, some methods of which bear his name and have been incorporated into software packages such as AQTESOLV. Dr. Neuman has advised nearly 40 doctoral graduates and 30 master-level graduates, who now serve as university faculty, researchers and consultants



Sarah Raker, GRA president (left) presents the Kevin J. Neese Award to Santa Clara Valley Water District representatives (left to right) Vanessa De La Piedra, Harry Barrientos and Joan Maher.

throughout California and worldwide. A longtime hydrologist and Ph.D. who was Dr. Neuman's first doctoral student stated, “Shlomo has very few peers of his caliber, as a scientist, as a teacher, and as a human being.”

The 2013 Kevin J. Neese Award was given to the Santa Clara Valley Water District's (SCVWD) Domestic Well Testing Program. The SCVWD Domestic Well Testing Program was selected for implementing a free, voluntary testing

program that supplements the District's regional groundwater monitoring and provides domestic well owners with information on their water quality. The information helps domestic well owners better protect their health through understanding the results, contaminants, disinfection and treatment options. In the last twelve months, the District tested basic water quality at over 315 domestic wells. 💧



Dr. Leo Leonhart (left) presents the Lifetime Achievement Award to Dr. Shlomo P. Neuman.



Vicki Kretsinger Grabert, GRA Director and Founding President (left) presents the GRA President's Award to Sarah Raker.



Linda Vida, Director (retired) of the Water Resources Collections & Archives (left) accepts the Honorary Service Award from Rita Schmidt Sudman, executive director of the Water Education Foundation.

GRA Welcomes the Following New Members

AUGUST 23, 2013 – NOVEMBER 15, 2013

Aron-Gilat, Adi	Stanford Law School
Bare, Jerry	
Baroldi, Michelle	California State University, Long Beach
Battin, Matthew	Stantec Consulting Services Inc.
Blackmer, Rick	Equipoise Corporation
Bruton, Thomas	UC Berkeley
Butler, Jared	California State University, Long Beach
Cechini, Timothy	Yellow Jacket Drilling
Chang, Han-Ting	AquaNano LLC
Cook, George	Santa Clara Valley Water District
Dennehy, Peter	UC Davis
Dion, Mitch	CCWD
Erbele, Hannah	California State University, Long Beach
Harrison, Katrina	US Bureau of Reclamation
Hathaway, Emily	University of California, Davis
Heim, Susanne	Panorama Environmental, Inc.
Hennigan, Barbara	Butte-Sutter Basin Area Groundwater Users
Hubsch, Allen	Hogan Lovells US LLP
Kavounas, Peter	Chino Basin Watermaster
LaBruzzo, Patrick	San Jose State University
Lambert, Kendall	Bard Center for Environmental Policy
LeClaire, Joe	CDM Smith
Linck, Wendy	Antea Group
Markovich, Katherine	University of California, Davis
Marlatt, Matt	CH2M HILL
Marquez, Katiuchka	AMEC Environment & Infrastructure, Inc.

Minor, James
Moody, Scot
Nunez, Daniel
Oberoi, Varinder

OWlia, Rashid Reza
Pierno, Roger
Pimienta, Sandra
Reed, Brandon
Robins, Todd
Schueler, Dan
Smith, Lee N.
Stoika, Seth
Velazquez, Manny
Wagner, Robert
White, Kelly
Wolfgang, Carol Ann
Wordofa, Dwit
Yang, Stephen

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Regenesi
Treadwell & Rollo | A Langan
Company
University of California, Davis
Santa Clara Valley Water District
Stantec
TRC Solutions
Robins Borghei, LLP
Senninger Irrigation
Weintraub Tobin
BESST, Inc.
Laboratory Data Consultants
Wagner & Bonsignore Engineers
Environmental Science Associates
OTIE
University of California, Riverside
Wattminder Instruments

GRA Extends Sincere Appreciation to the Co-Chairs for its November 4, 2013 Workshop Collaborative Leadership: Negotiating Relationships to Improve Water Resources Planning

CO-CHAIRS

Tim Parker, Parker Groundwater
Dave Ceppos, Center for
Collaborative Policy
Dorian Fougères, Center for
Collaborative Policy

GRA Extends Sincere Appreciation to the Co-Chairs and Sponsors for the 29th Biennial Groundwater Conference & GRA 22nd Annual Meeting

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Jim Strandberg, Erler & Kalinowski, Inc.

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GRA 2014 Officers Elected!

The GRA Board of Directors elected the following officers for 2014: Ted Johnson, President; Chris Petersen, Vice President; Steve Phillips, Secretary; Bob Van Valer, Treasurer. Congratulations to all of you for being elected!

GRA's 2012 Annual Financial Statement is Now Online.

To review the statement, visit
www.grac.org/P&L2012.pdf.

Central Coast

By Jeff Kubran
Branch Secretary



In September, Brad Newton, PhD, PG of Newton Geo-Hydrology Consulting Services, LLC and Ryan Drake, Associate Attorney, Brownstein Hyatt Farber Schreck, LLP, presented *The Adjudication of the Santa Maria Groundwater Basin: Legal and Technical Implications and Future Management*. Brad described the Santa Maria basin (Basin) which is formed of unconsolidated fill; the majority of groundwater is withdrawn from the Paso Robles formation.

Local rainfall data from 1920 to 2012 indicate a dry period until the 60s and a subsequent wetter period through present. Reference evapotranspiration (ET_o) from the 1980s to 2012 and is about triple the rainfall, requiring substantial crop irrigation. Total water use for the area is about 10,000 AFY, about 40% from groundwater.

A well network was established in the 50s and 60s to monitor for seawater intrusion. These wells are designed with multiple screened intervals to monitor both fresh and saline zones. In 2009, one well had an indication of seawater intrusion. Generally, groundwater conditions in the coastal area have remained fairly constant, as the majority of groundwater pumping is farther inland.

Ryan Drake discussed the adjudication process and findings. The Basin had severe water shortages from the 30s, but imported supplies have kept groundwater levels relatively stable. Concerns over the aging infrastructure and population growth have led to litigation for water rights in the Basin. Three sources of groundwater for the Basin are natural recharge; return flows (imported water which percolates into the Basin), and salvaged water (water that would flow to the ocean during the rainy season but is stored in reservoirs). Twitchell and Lopez reservoirs are of concern due to loss of capacity from silting in.

The Santa Maria Court of Appeals decision is the first one on prescription in the last 50 years. Trial court litigation took place in multiple phases, which included the determination of Basin boundaries, extent of overdraft, and other issues. The appellants are landowners, known as the Landowner Group (LOG parties), and the Wine-man parties, who use groundwater for agricultural use on their lands. The respondents are public water purveyors that pump groundwater for municipal and industrial use.

The existence of a surplus makes this case different from most other basin adjudications. Absence of overdraft conditions for more than five years is not “disuse.” Further, the court highlighted that “the right of a municipality to acquire and hold rights to the use of water should be protected to the fullest extent necessary for existing and future uses” (Cal. Water Code § 106.5).

Most of the case was resolved by an agreement (Stipulation) between the Santa Maria Valley Water Conservation District, local cities, the public water producers, and most of the landowners. The Stipulation sets up a groundwater management program for the basin that calls for continuing judicial oversight, and for a plan known as the physical solution, which resolves any water rights claims. This physical solution divides the Basin into three management areas, and details the monitoring and managing of groundwater. Technical committees and a management area engineer run the program and use factors to identify water shortages and responses needed.

The Central Coast GRA would like to thank our scholastic sponsors, Dudek and Yellow Jacket Drilling, for their support. 💧

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San Francisco

By Jenny Cherney
Branch Secretary



In October, Dr. John Jansen, Ph.D., gave the National Ground Water Association 2013 William A. McElhiney Distinguished Lecture Series in water well technology, titled *Keeping the Pump Primed: Aquifer Sustainability*. Dr. Jansen is a principal and senior hydrogeologist for Cardno ENTRIX and works on a wide variety of groundwater projects around the country, specializing in high-capacity wells and groundwater resource management. Dr. Jansen discussed the fact that there are a number of issues related to aquifer sustainability that are relevant today and important to understand from technical, business and political perspectives. How your groundwater resources will fare in the future and how that will affect your business is an important question; Dr. Jansen examined how we can ensure the sustainability of our aquifers through sound science. He discussed whether groundwater contractors and scientists should confront economic and political challenges affecting the resource that is pivotal to the success of their businesses. According to Dr. Jansen, how “sustainability” is defined is important in developing appropriate tools and strategies that can be used

to protect groundwater systems. He summarized the information that must be gathered and compiled to build consensus and present a compelling case to regulators and policymakers.

States have varying approaches to aquifer management, reflecting their local conditions and history. Dr. Jansen highlighted the importance of considering how the approach in your state affects you and your business. Regulatory practices are evolving, and they must balance local economic and political realities with environmental needs to be accepted and successful. He presented and discussed meaningful ways that information can be provided, and consensus built, to help the regulatory evolution move in a positive direction. Dr. Jansen highlighted the steps needed for successful management from all perspectives. 💧

Southern California

By Emily Vavricka,
Branch Secretary



In October, Dr. Ying Wu, Principal Scientist with Hazen and Sawyer Environmental Engineers and Scientists in Los Angeles, California, presented *Hexavalent Chromium in Drinking Water – Occurrence, Regulations, Treatment and Costs*. In August of this year, the State of California released a draft maximum contaminant

level (MCL) of 10 micrograms per liter for hexavalent chromium. Many drinking water sources in California, especially groundwater, may be affected by the newly proposed MCL. To address this, Dr. Wu provided a brief overview of the occurrence of hexavalent chromium in California and the laboratory analytical methods needed to detect this lower level. She also provided information on the new regulations and the various treatment technologies used to treat hexavalent chromium, including weak-base anion exchange, reduction/coagulation/filtration and strong-base anion exchange. In association with the treatment technologies, Dr. Wu provided an evaluation of the specific costs for each, the potential complications associated with disposal of the waste brine, and the potential generation of hazardous waste from solids generated from the filtration process. As the lead project engineer for the City of Glendale hexavalent chromium research team for the past several years, she provided a real-world example application of these treatment technologies for hexavalent chromium; this information can prove to be vital when the new MCL is formally adopted.

Dr. Wu’s informative presentation spawned many good questions from the audience, including those regarding permitting requirements, and waste and brine disposal. The GRA Southern California Branch would again like to thank Cascade Drilling, who sponsored the local Southern California GRA Branch Scholastic Fund for the October meeting. The Branch would also like to thank all GRA Members and non-members for supporting the GRA Southern California Branch and attending the bi-monthly October meeting. 💧

Indian Grinding Rock State Historic Park

Indian Grinding Rock State Historic Park is located in the Sierra Nevada foothills near the town of Volcano. The park sits in a valley 2,400 feet above sea level and includes open meadows and large valley oaks, which provided the Native Americans with an abundant supply of acorns. The park was created in 1968 and preserves an outcropping of crystalline limestone and dolomite with approximately 1,185 mortar holes – the largest collection of bedrock mortars in North America. The crystalline limestone and dolomite occurs as an areally extensive block within the Paleozoic (?) metasedimentary rocks of the Calaveras Complex.

Chaw'se is the Miwok word for grinding rock – a slab of stone on which the people ground acorns and other seeds into meal, slowly forming the cup shaped depressions in the stone. Along with the mortar holes, the main grinding rock also features a number of decorative carvings, including circles, spoked wheels, animal and human tracks, and wavy lines. Some of these carvings are thought to be two or three thousand years old; however, due to weathering they are becoming difficult to see. This association of rock art and bedrock mortar pits is unique in California, except for one other small site.



Acorns are rich in nutrition, but are bitter because of their tannin. After the acorns were ground to a fine meal, the Miwok poured water through the meal to leach out the tannin. The prepared meal was mixed with water in a large, watertight cooking basket. Hot rocks were added to the acorn mush or soup and moved around with paddles until the meal was cooked.

Following the discovery of gold, miners poured into this area during the 1850s, forcing the Miwok out of their traditional patterns of residence and subsistence. Prospectors employing both hydraulic and quartz mining operations eventually surrounded the area; mine tailings are still present in the park's ravines. Following the mining activity, farms and ranches were established in the area. 💧

Additional information about Indian Grinding Rock State Historic Park is available at: http://www.parks.ca.gov/?page_id=553.

Photograph of grinding rocks (approximate GPS coordinates: 38.424364° and -120.642666°) by John Karachewski, Ph.D. (e-mail: Geoscapes1@gmail.com)