GROUNDWATER RESOURCES ASSOCIATION OF CALIFORNIA
HYDRO VISIONS
VOLUME 25, NO. 2 SUMMER 2016

JOIN GRA TODAY

Summary of GRA Symposium on How to Fund Groundwater Sustainability

By Co-Chairs Christy Kennedy and Chris Petersen

On March 29th, 2016, GRA held its 15th SGMA event, How to Fund Groundwater Sustainability. This symposium drew over 100 attendees, sponsors and exhibitors to the Citizens Hotel in Sacramento, California. Symposium attendees comprised a good cross-section of the industry, including federal water-planning staff, Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB) staff and managers, urban and agriculture water agency representatives, and groundwater resource engineering and hydrogeology consultants.

This symposium focused on three aspects of funding the development of groundwater projects and Sustainable Groundwater Management Act (SGMA) implementation:

1. Obtaining outside funding
2. Developing the agency contribution, or "match," and
3. Generating revenue to implement a Groundwater Sustainability Plan (GSP).

With the passage of Proposition 1, water resources funding has received new attention. Speakers from state and federal programs identified how to find funding sources, and apply for and implement projects using grant funds.

Experts also discussed the various grant programs and how to meet grant criteria, and provided examples of successful grant-funded projects. Agency funding for the development of Groundwater Sustainability Agencies (GSAs) and GSPs was discussed, as well as various local funding mechanisms, including assessing and collecting fees for GSAs, joint-agency cost-sharing, and successful pump-tax programs.

This program was made possible by the hard work of the event planners, and financial assistance from sponsors and exhibitors:

Lead Planners

- Event Co-Chairs: Christy Kennedy (RMC Water and Environment), Chris Petersen (GEI Consultants & GRA President), and Leslie Dumas (RMC Water and Environment)
- Other Planning Committee Members: Tim Parker (Parker Groundwater Management) and John Ayers (GEI Consultants)

Financial Supporters

- Program Co-Sponsor and Exhibitor: GEI Consultants Inc.
- Exhibitor: Cascade Drilling
- Reception Bar Sponsor: RMC Water and Environment
- Refreshment Sponsor: Erler & Kalinowski, Inc.
- Refreshment Sponsor: Weiss Environmental Associates, Inc.

Continued on page 6…

The Groundwater Resources Association of California is dedicated to resource management that protects and improves groundwater supply and quality through education and technical leadership.

Inside this Issue

Features

Columns & Corners

HYDROVISIONS is the official publication of the Groundwater Resources Association of California (GRA). GRA's mailing address is 700 R Street. Suite 200, Sacramento, CA 95811. Any questions or comments concerning this publication should be directed to the newsletter editor at editor@grac.org or faxed to (916) 231-2141.

EDITOR
Steven P. Phillips
editor@grac.org

EDITORIAL BOARD
Adam Hutchinson | David Von Aspern
Kristen Calderon | Lisa O'Boyle | Tim Parker
Vicki Kretsinger Grabert

GRA Making a Difference in the SGMA Era

By Chris Petersen

Hello Again Folks,

Part of my routine each morning is to read the Sacramento Bee while enjoying my first cup of coffee. I always skim the weather page and check the status of rainfall and reservoir storage in northern California. This morning (May 1, 2016) I noted that Sacramento had received 16.38 inches of rainfall so far, compared to 13.74 at this time last year, versus 18.94 in a normal year. Unfortunately, the numbers in central and southern California are much more dismal. I asked myself this morning, "El Niño, what happened to you?" With California now bracing for its 5th year of official drought, the elements of a sustainable groundwater management program are taking shape. I am grateful that GRA is actively involved in the conversation and providing good information and expertise on sustainable groundwater management. I'd like to highlight a few recent examples of how GRA's leaders, with help from our committee and Branch members, are making a difference in this era of SGMA.

Shaping Groundwater Regulation

The California Department of Water Resources (DWR) has formed a Practitioners Advisory Panel (PAP) composed of about 20 expert groundwater practitioners representing a broad cross-section of the industry, such as consulting, academia, public water districts, private water companies, and agricultural water agencies. These experts are participating in multiple day-long meetings and providing verbal and written comments to DWR during the implementation of SGMA. Topics addressed to date include basin-boundary regulations, critical-basin designations, and Groundwater Sustainability Plan (GSP) regulations. Thomas Harter (current GRA Director) and Vicki Kretsinger (Director Emeritus) are both committing their time and talents to this effort.

GRA also formed a technical review committee, led by John McHugh (current GRA Director), to review and comment on the Draft GSP regulations. John and his team convened several conference calls to discuss and compile comments. This activity culminated in a very detailed set of specific comments addressing ways to clarify and improve the GSP regulations. Feedback from DWR on our comments has been very positive. You can view GRA's comments here.

The California Water Commission (CWC) is administering $2.7B in Prop. 1 funds for new surface and groundwater storage in California through the Water Storage Investment Program (WSIP). The CWC formed a Stakeholder Advisory Committee (SAC) to provide review and feedback over a 6-month period in 2015 during development of the WSIP regulations. GRA was invited to participate in the SAC as a voice for groundwater, and I was honored to represent GRA in this capacity along with Tim Parker (current Director). Tim and I participated in six monthly meetings and provided written and verbal comments on behalf of GRA. We also worked with other GRA members in preparing a formal comment letter on the WSIP regulations. You can view GRA's comments here.

Through Relevant Conferences and Webcasts

Immediately following the passage of SGMA in 2014, Tim Parker formed a GRA Sustainable Groundwater Management committee to provide relevant and timely information to our members, local agencies, and DWR and State Board staff tasked with regulating and enforcing SGMA. The following is a listing of the SGMA-related GRA webcasts and events that have occurred as the result of hundreds of GRA volunteer hours over the past 18 months.

- December, 2014 – SGMA GRACast #1
- January 21, 2015 – SGMA GRACast #2 – An overview of the Act, Agency, Legal and Technical Perspectives

Continued on the following page…

President's Message – *Continued*

- February 25, 2015 – SGMA GRACast #3 – Sacramento Groundwater Authority, Orange County Water Agency and Chino Basin Watermaster Perspectives
- March 18, 2015 – SGMA GRACast #4 – GSA Boundaries: Hydrogeological, Geopolitical, or Geomystical?
- April 15, 2015 – SGMA GRACast #5 – Legal Perspectives
- May 13, 2015 – SGMA GRACast #6 – Public Notification, Public Participation, and Consideration of All Interests of Groundwater Users and Beneficial Uses
- June 2, 2015 – GRA Workshop on *Groundwater Sustainability Formation*, Sacramento
- July 15, 2015 – SGMA GRACast #7 – Pre-SGMA Groundwater Regulation and Management: Existing Tools with Local Examples
- September 2, 2015 – GRA Workshop on *The New Groundwater Sustainability Plans – Raising the Bar on Groundwater Management*, Modesto
- October 21, 2015 – GRACast – Groundwater/Surface Water Interaction
- December 9, 2015 – GRACast – Proposition 1 Funding for Groundwater
- February 8–9, 2016 – GRA Workshop on *The Role of Models and Data in Implementing SGMA*, UC Davis
- March 15, 2016 – SGMA GRACast #8 – Draft GSP Regulations
- March 29, 2016 – GRA Symposium on *How to Fund Groundwater Sustainability*, Sacramento.

Impressive list isn't it? And none of this would be possible without the tireless efforts of our event leaders, committee members, event speakers and sponsors. Thank you all very much for helping shape the SGMA conversation. Each of the GRACasts listed above are available for purchase in the GRACast Store and GRA members get a $25 discount per GRACast; check it out at: http://cart.grac.org/. Did you know that GRA members have access to view and download PDF versions of presentations from previous GRA conferences? Come on now, if you're not already a GRA member, what are you waiting for? Sign up here today!

By Providing Lawmakers with Useful and Timely Information

Our Legislative Committee, chaired by Tim Parker with legislative advocacy support provided by Brownstein Hyatt Farber Schreck LLP (Brownstein), does a fantastic job of tracking and even helping introduce legislation relevant to groundwater protection and improvement. Each year GRA, the California Groundwater Coalition and Brownstein join forces to organize the Annual Legislative Symposium, which brings lawmakers and policy experts together with groundwater experts for a full day of information sharing and networking. GRA has been organizing this event since 2001, and this March we hosted another successful Legislative Symposium.

By Focusing on the Right Issues

In 2011, the Contemporary Groundwater Issues Council (CGIC) was formed to help GRA focus on meeting the needs of the state's water stakeholders by providing relevant, timely forums (workshops, conferences, etc.) to share experiences with, and potential solutions for, the state's most pressing groundwater issues. The CGIC is co-chaired by Vicki Kretsinger, Thomas Harter and Tim Parker. These GRA leaders organize and convene a facilitated workshop each spring to solicit critical advice and feedback to GRA on its wide array of educational, extension, and legislative-outreach programs. Council members include a select group of executives and leaders from a range of disciplines and backgrounds at the local, state, and national level representing regulatory agencies, research and educational institutions, NGOs, water users, the public at large, and consultants sharing a common interest in the management, protection, and use of groundwater resources in California. The Council complements the roles of GRA's Board of Directors and committees by providing external input from groundwater leaders around the state on key ongoing or future groundwater-related issues, challenges, and opportunities. This provides focus and relevancy to our events, webcasts and other GRA activities. The next CGIC meeting is scheduled for May 26th, 2016; key outcomes will be reported in the next edition of *HydroVisions*.

What else is GRA up to?

Branches

In my inaugural Presidents Message, I explained that GRA currently has 5 Branches and that I believe our organization would benefit by expanding the number of Branches and increasing the level of communication between our Branch and state leaders. Well, I'm happy to report that we are already making great strides in this area under the leadership of Adam Hutchinson (Officer of Special Projects) and Steve Phillips (Vice President). This past quarter, Adam has formed a GRA Branches Committee and convened an initial conference call with this group to discuss both expansion and networking between Branches and with GRAs Directors. Adam and his team identified Riverside County and Northern Sacramento Valley as prime targets for new Branches. Steve Phillips personally traveled to Chico to meet with local groundwater professionals to begin building the foundation

Continued on the following page…

President's Message – *Continued*

of a new GRA Branch in this important part of the state. Please contact Adam or Steve if you would like to join our Branches Committee and get involved in an exciting growth area for GRA.

Board of Directors Meeting

Your GRA Directors meet for a full day each quarter to present and discuss committee reports, review status of our action items and agree on new actions. In the spring of each year, we have our planning retreat, which is two full days of meetings, with time to socialize and network in the evenings. During the second day of the planning retreat, we set longer-term goals for the organization and brainstorm ways to improve our overall effectiveness. This year, we met at the USGS Office in San Diego (thank you Steve Phillips) on May 14-15. I'll report on our new initiatives and opportunities for you to get involved creating the future of GRA in the next Presidents Message.

Until Next Time!

CP

Summary of GRA Symposium on How to Fund Groundwater Sustainability –

Continued from page 1

Opening Keynote Speaker

Our opening keynote speaker for the event was **Gary Bardini,** DWR's Deputy Director in charge of the Integrated Water Management Program. Mr. Bardini provided perspectives on The Sustainable Groundwater Management Act: What Does it Really Mean?

Gary Bardini delivers opening keynote.

Mr. Bardini reflected on the early years of his career, which involved groundwater modeling in the Merced Basin, and the importance of good judgement in setting up and running the groundwater models at a time when computer programing was cumbersome and modeling was much slower and more labor intensive than today.

He set the backdrop for the SGMA by noting that groundwater was not addressed when the state established a water accounting framework in 1914, and summarized the numerous efforts by DWR over the past 3 decades to improve the adequacy of groundwater management through legislative and financial incentive programs. Despite these efforts, groundwater conditions have continued to degrade and the current drought has made it clear that "we are living with too little and wanting too much." These conditions made the 2014 passage of the SGMA possible.

Mr. Bardini observed that challenges for SGMA implementation include funding, coordination and sharing of information like never before, holding groundwater management plans to a higher standard than we have in the past, and establishing water balances that all parties agree to. DWR is committed to meeting all of the SGMA's legislative deadlines while providing technical and financial assistance to ensure that SGMA implementation will succeed. To meet these challenges, the California Water Plan will have to change and adapt to the Act in an unprecedented way. DWR is considering organizational realignments to be better able to provide local technical support. DWR will have to be more involved in helping to move water between GSAs for many of them to achieve sustainability.

He concluded by drawing again from the early years of his professional career and explaining that even with the new advances in software and hardware, the need for good judgement is never more important as we embark on this new era in California groundwater management—implementation of the SGMA.

State and Federal Funding Programs

In the following session, speakers from state and federal agencies discussed their various grant programs, how to meet grant criteria, and highlighted successful grant-funded projects. Speakers **Trevor Joseph** and **Tracie Billington** of DWR, and **Joe Karkoski** (SWRCB) and **Paula Landis** (California Water Commission), described the funding soon to be available for groundwater through Proposition 1 implementation via the storage investments, groundwater cleanup, and sustainability chapters.

Continued on the following page…

Trevor Joseph provided an update on the draft GSP regulations.

Joe Karkoski described SWRCB role in administering Proposition 1 funding.

Paula Landis provided an overview of the Water Storage Investment Program, which will help fund increased groundwater storage and conjunctive use in CA.

Julie Grim explained how to access funding for groundwater through the NRCS.

Summary of GRA Symposium on How to Fund Groundwater Sustainability – *Continued*

Other state funding that is currently available through the SWRCB, for groundwater projects with a water recycling component, was highlighted by **David Balgobin** (SWRCB). Federal funding opportunities, including from the United States Bureau of Reclamation (Reclamation) and Natural Resources Conservation Service (NRCS), were also identified. **Julia Grim** (NRCS) discussed multiple grants and loan opportunities for agricultural producers. **Jayne Strommer** of Delta Diablo discussed the ability to leverage outside funding and Delta Diablo's success through the Western Water Coalition—a recycled-water group that provides a nexus for groundwater agencies using recycled water for recharge. Funding is also available from the federal government through Reclamation's WaterSMART grant program, which was described over the lunch hour by **Tom Hawes** of Reclamation.

Developing the Agency Contribution and Revenue

The afternoon sessions were devoted to exploring development of the agency contribution, which includes the "match" for grant funding and generating revenue through SGMA programs. In the first session of the afternoon, speakers discussed the mechanics of programs, the latest developments in Prop 218, what we can learn from the energy sector, and how funding may play out in Ag-dominated areas. **Michael Colantuono** of Colantuono, Highsmith & Whatley, and **Roger Moore** of Rossman and Moore, LLP, provided a legal perspective on how to pay for GSPs. Michael gave an excellent overview of the Proposition 218 process, shedding light on its nuances for many in the audience. Following the legal perspectives on opportunities and challenges for funding, **Kimberly Quesnel** of Stanford's Water in the West Program gave an overview of successful funding models from similar industries, including the PACE program for solar. **Richard Howitt** of UC Davis discussed the economic impact of the SGMA, water markets, and the potential for using remote sensing to detect high water use; he also shared his perspective on setting up GSPs to enable trading and flexibility in order to roll with the ebbs and flows of water years.

The final session was a collection of case studies from across the state, including rural and urban examples of funding programs either in development stages or in motion, ranging from pump-tax models, multi-agency cost-share JPAs, and a newly-formed water district in the San Luis Obispo area that just went through its Proposition-218 vote on March 8th. Rob Swartz of the Sacramento Groundwater Authority shared the financing structure of the agency and provided an overview of their annual funding; expenses; fee model, which includes a groundwater extraction fee; and grant successes. Patrick Sweetland of Daly City described interagency agreements and a cost-sharing mechanism for a multi-agency GSP in the San Francisco Peninsula, and discussed the background of shared modeling practices and funding streams that brought them to their present arrangement. Paul Hendrix of Tulare Irrigation District shared the Mid-Kaweah GSA formation plan, which is utilizing a Joint Powers Agreement and planned expenditures. John Diodati

Continued on the following page…

Michael Colantuono described how Prop 218 could be used to locally fund SGMA compliance and provided practical tips on rate-making.

Roger Moore noted that legislative history suggests that the authors of SGMA envisioned Prop 26 as a likely funding source.

Kimberly Quesnel with Standford's Water in the West Program.

Richard Howitt is Professor Emeritus of Agricultural and Resource Economics, UC Davis Center for Watershed Sciences.

Summary of GRA Symposium on How to Fund Groundwater Sustainability – *Continued*

shared experiences gained from developing and proposing a new water district and financing structure for groundwater basin management for the Paso Robles Groundwater Basin, including the county's recent Proposition-218 process.

Program Evaluation and Lessons Learned

The lure of education on SGMA funding strategies and swift pacing of the day kept everyone attentive the full day. Longer breaks for office check-ins and side meetings were incorporated into the schedule and several audience members took full advantage of the park setting across the street to conduct fresh-air meetings or conference calls after lunch.

As always, GRA provides great networking opportunities and the Funding Symposium was no exception. As part of the 2-day conference (it was held back-to-back with GRA's Legislative Symposium), a reception was held in the Citizen Hotel's upscale "Scandal Bar," where against a backdrop of legal texts and velvet curtains at least 40–50 attendees joined in hearty discourse regarding the need for, and challenge of, funding SGMA program development. This clearly is a topic ripe for future explorations by GRA. Other topic areas suggested by attendees for a future event include:

- How different agencies and consultants fit into SGMA
- Problems GSAs are facing
- Sharing of SGMA experiences
- Groundwater markets
- Next phases of GSA formation and associated challenges
- Guidance on models
- Successful funding strategies for GSAs
- Future actuals in GSA/GSP costs
- SGMA and groundwater techniques, methods and technologies
- Implementation of GSP climate change.

"The funding symposium was a valuable and informative experience. The speakers from funding agencies, such as DWR, SWRCB and CWC, offered succinct and practical presentations regarding their grant programs and how they may help fund groundwater sustainability projects required under SGMA. Also particularly useful and thought-provoking were the speakers who presented results of their own groundwater and water infrastructure program development and funding pursuits. I would not hesitate to attend another similar GRA symposium."

Hawkeye Sheene,
AMEC Foster Wheeler

And the good news is, we hear you! GRA's next SGMA event is being held on June 8–9, 2016, at the Hilton Sacramento Arden West in Sacramento. This two-day conference will explore the majority of these topics above—join us for this and other events in our SGMA series!

Photos taken by Chris Petersen.

Rob Swartz, Senior Project Manager, Sacramento Groundwater Authority.

Patrick Sweetland, Director of Water and Wastewater, Daly City.

Paul Hendrix, General Manager of Tulare Irrigation District.

Dates & Details

GRA EVENTS & KEY DATES

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

Sustainable Groundwater Management Act Symposium: Developing Groundwater Sustainability Plans for Success
June 8-9, 2016 | Sacramento, CA

GRA 25th Annual Meeting
Sept. 28-29, 2016 | Concord, CA

GRA Symposium
Oil, Gas and Groundwater in California
Nov. 2-3, 2016 | Bakersfield, CA

For information on how to sponsor or exhibit at an upcoming event, please contact Sarah Kline at skline@grac.org.

25th Groundwater Resources Association Annual Meeting

2016: Groundwater Supply, Quality and Sustainability: The Challenges Ahead

SEPTEMBER 28-29, 2016 – CONCORD, CA

Conference Details:

Still in the midst of a historic drought, California is facing major challenges in the areas of groundwater supply, quality, and sustainability. With the passing of the Sustainable Groundwater Management Act (SGMA) in 2014, and the Department of Water Resources' recent release of Draft Groundwater Sustainability Plan Emergency Regulations, water management agencies have a lot on their plates. Now the questions arise: How do Groundwater Sustainability Agencies (GSAs) comply with the new regulations? How do GSAs fund these plans? Is the technical and monitoring data available to draft successful plans? The formation of GSAs is the first step toward groundwater management in California; subsequent steps require involvement of groundwater stakeholders as an integral component of the planning process, from rural agriculture to urban water utilities. Together, these entities will shape the future of California's groundwater. Facing the compound issues of climate change, regional to local water quality issues such as salt management and emerging contaminants, and the complex effects of changes in groundwater/surface water interactions, it is more important than ever to ensure California is on the path to sustainable, responsible management and protection of California's groundwater resources.

GRA's 2016 Conference and 25th Annual Meeting will provide policy makers, practitioners, researchers and educators the opportunity to learn about the current policies, regulations and technical challenges affecting the protection, use and management of groundwater in California. This year's conference will focus on the information and tools that California needs to face the challenges in addressing ongoing drought and climate change, compliance with SGMA, and ongoing and emerging water quality issues. Attendees will learn from real-world case studies on groundwater management; replenishment and recharge; drought response success stories, including agricultural water conservation efforts; and walk away with concepts and solutions that they can apply to their local groundwater management issues.

Cooperating Organizations

California Department of Water Resources, Water Education Foundation, Association of California Water Agencies, State Water Resources Control Board, San Francisco Bay Regional Water Quality Control Board, United States Geological Survey, California Department of Toxic Substances Control, California State University East Bay, Orange County Water District, International Association of Hydrogeologists

Conference Details:

The two-day conference features an opening plenary session, concurrent sessions on groundwater supply/management and quality/contamination, lunch presentations, President's Reception, Collegiate Colloquium, GRA's 2016 Northern and Southern California David Keith Todd Lecturers, exhibitors, poster presentations,

Continued on the following page…

and a final panel of industry leaders. Featured sessions and topics for podium and poster presentations include:

Drought and Climate Change – Managing for Uncertainty

- Case Studies and Success Stories – Agriculture, Municipal and Industrial
- Future Climate Change Scenarios – Development by DWR and Local Planning for Risk and Reliability

SGMA – Legal, Policy, and Compliance

- GSA Formation Update
- Pros and Cons of GSAs versus Adjudications
- GSA Coordination – Multiple GSAs and Inter- and Intra-basin Coordination
- Development and Integration of Groundwater Sustainability Plans
- Best Management Practices

SGMA – Technical Challenges for Groundwater Sustainability Plans

- Data Availability and Assistance for GSAs
- Innovations in Modeling and Data Management – Finding Common Ground
- Groundwater Monitoring Networks – Are They Adequate?
- Well Registration and Extraction Reporting
- Basin Boundaries and Priorities – How Have They Changed?

SGMA – Funding Mechanisms

- How will GSAs Raise Money for Planning, Administration and Plan Implementation?
- Federal, State, and Local Funding Opportunities
- Cost Sharing and Innovative Approaches
- Other Considerations – Prop 218 and Prop 26 and Impact Fees

Uplands and Lowlands – Surface Water/Groundwater Interaction

- Quantifying and Understanding Surface Water/Groundwater Interactions
- Assessing Impacts on Beneficial Uses
- Stormwater Capture Opportunities
- Conjunctive Use

Regional Water Quality Issues

- Salt and Nutrient Management
- Agricultural Practices and Innovations
- Upcoming Changes in Groundwater Policy

Advances in Groundwater Remediation

- Emerging Treatment Technologies
- Combined Remedy Case Studies

New and Innovative Site Characterization Methods and Tools

- Advanced Methods for Hydrogeologic Analysis
- Tools for Visualizing the Subsurface

Contaminant Trends, Site Cleanup Objectives, and Performance Monitoring

- Emerging Contaminants
- Regulated Contaminants in Drinking Water – Recent Updates
- Vapor Intrusion Issues
- In-Situ Remediation Systems
- Performance Monitoring Case Studies

Modeling and Visualization

- New and Updated Tools and Applications
- Regional and Local Scale Modeling Advances
- Model Integration – Inter- and Intra-basin

Groundwater Replenishment/Recharge

- Challenges and Successes of Operating Recharge Systems
- Legal, Policy and Regulatory Compliance
- Research Efforts and New Technologies
- Recharge Utilizing Stormwater – Agricultural, Rural and Urban-scale
- Conjunctive Use
- Recharge with Recycled Water
- Advances in Recharge Estimation
- Use of Water from Groundwater Remediation Treatment Systems

Collegiate Groundwater Colloquim

GRA seeks to increase participation by university and college faculty and students in its events. The Collegiate Groundwater Colloquium presents students who are conducting highly relevant research in the general areas of the conference theme. The colloquium and reception provide students with an excellent opportunity to showcase their research and attendees an opportunity to learn from the frontier of groundwater science and engineering. For more information, including student scholarship opportunities, please contact Dr. Jean Moran at jean.moran@csueastbay.edu.

For Additional Conference Information Contact:

Jim Strandberg: jstrandberg@westyost.com or 925-949-5825
Steve Phillips: sphillip@usgs.gov or 916-278-3002

Sponsor and Exhibitor Opportunities

If you are interested in being a co-sponsor or exhibiting your organization's services or products, please contact event coordinators at conference@grac.org or by telephone - Sarah Kline 916-446-3626 or Abigail Madrone 530-761-0250.

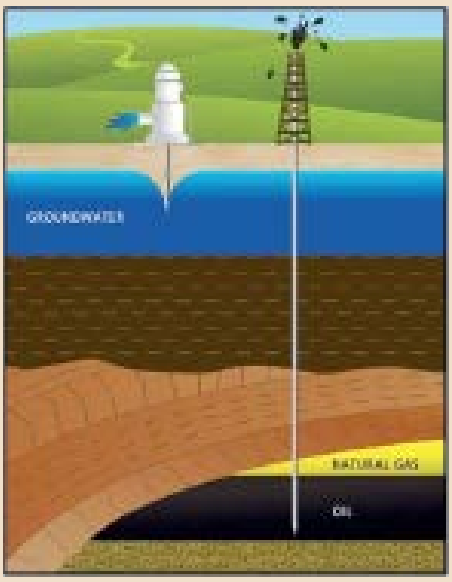
Register for Sponsor & Exhibitor Opportunities

SAVE THE DATE

California Oil, Gas and Groundwater 2016:

The Latest in the Monitoring, Regulations, Implementation, and Legislation related to Groundwater Protection from Oil and Gas Activities

NOVEMBER 2-3, 2016 – BAKERSFIELD, CA



GRA has organized a follow-up symposium to our highly successful February 2015 event in Long Beach, CA on the wise protection and monitoring of California groundwater near oil and gas exploration sites. At that time, implementation of Senate Bill SB-4 (2013-Pavley), related to new oil and gas well stimulation requirements, was just getting started, and required (among other things) the State Water Resources Control Board to develop model criteria for groundwater monitoring.

The California Oil, Gas, and Groundwater 2016 symposium is intended to provide the latest information on the successful applications and/or problems encountered with the current requirements for groundwater monitoring and protection related to oil and gas activities in California. It is intended for petroleum and groundwater geologists, engineers, policy-makers, regulators, legislators, academia, and other interested parties to learn about current practices, operations, requirements and the successes and challenges that create the context for the relationship between petroleum production and groundwater management in California.

Exhibitor and Sponsorship opportunities are available for this event to showcase your company's related products or services. Please contact Sarah Kline, GRA Administrative Director, at skline@grac.org; 916-446-3626.

NOTE: Draft agenda to be posted soon.

Wells and Words

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

The Nexus Between Energy and Water Wells – Why Well Development Matters

Water is heavy at about 8⅓ pounds (lbs) per gallon (gal); 1 cubic foot of water (about 7.5 gal) weighs approximately 62.5 lbs between the temperatures of 40 and 60°F[1,2]. This means if a well is pumping 800 gallons per minute (gpm), the pump is lifting (or moving) 6,666 lbs per minute (3⅓ short tons per minute), or about 200 tons per hour; 6,666 lbs is equivalent to about the average curb weight of two 4-door sedans[3]. Pumping groundwater from a large municipal, irrigation, or industrial water well generally represents a large amount of kinetic energy expended to lift groundwater against gravity to the ground surface for beneficial use. Energy is the capacity for doing work and overcoming resistance[4]. Helweg[5] wrote in 1982 that "Inefficiencies in ground-water supply systems waste 7.6 × 1012 British Thermal Units (BTU) per year … most of the ground-water costs comes from pumping costs…" (1 BTU = 0.00029301 kilowatt-hour [kWh]). Individually, domestic water wells that pump a few gpm are relatively insignificant, but collectively (perhaps greater than 500,000 domestic wells) can total to a large amount of energy and associated delivery costs.

The economic cost (in dollars) to pump groundwater from a well can be estimated using the following equation (modified from Helweg et al.[6])[7,8,9]:

$$C = \frac{0.746 \times Q \times K \times t \times [s + h + SWL]}{(3{,}960 \times \mu_p \times \mu_m)}$$

where,

C = total cost of power, dollars ($)
Q = discharge, gpm
K = cost of electricity, $ per kWh
t = elapsed time of pumping, hour (hr)
s = drawdown, feet (ft)
h = hydraulic resistance in piping and system head (ft)
SWL = static water level (ft)
μp = pump efficiency (estimated 79.96%)[10]
μm = motor efficiency (87.54%)8
0.746 = conversion factor, horsepower to kW
3,960 = conversion factor, (gpm) (feet) to horsepower

Note that (s + h + SWL) is the total dynamic head (TDH) of the system. If the equation is expanded and re-arranged, lumping the constants together and including some assumptions (values of μ_p and μ_m), then it can be simplified to:

$$C = \underbrace{[\gamma \times SWL \times Q \times K \times t]}_{\text{Term 1}} + \underbrace{[\gamma \times h \times Q \times K \times t]}_{\text{Term 2}} + \underbrace{[\gamma \times s \times Q \times K \times t]}_{\text{Term 3}}$$

This equation is broken down into three distinct terms that can be evaluated separately. Term 1 is the cost to pump water from the SWL to ground surface, which is borne for any water well, regardless of the well efficiency. Term 2 is the cost to pump the water to system head above the wellhead and overcome any frictional losses in the pipe conveyance system, including the pump column. Term 3 is the cost to lift groundwater from the pumping water level (PWL) to the SWL. Gamma is a constant of 2.691E-04. For this discussion I will ignore the second term (i.e., assume that the hydraulic resistance in the pump column, piping, and system pressure above the wellhead is zero) in order to isolate and focus on the first and third terms to evaluate how well efficiency affects the cost of well operation. Term 2 will be addressed in a subsequent installment of Wells and Words.

It is evident from Term 1, which estimates the cost of lifting water from the SWL, that deeper SWLs and larger discharges result in greater power required to do the work. Recall that work is force times distance, and power is the rate at which work is done[11].

The well efficiency determines the amount of drawdown (the PWL minus the SWL) used in the third term and represents the cost to pump the water from the PWL to the SWL. If the well was 100% efficient, then the drawdown in the well would be about the same as the drawdown in the aquifer outside the well. Frictional losses that can occur between the aquifer and the pump intake reduce the well efficiency; causes include incomplete or ineffective well development to remove drilling fluids and to correct damage to the well/borehole-aquifer interface, friction due to filter-pack losses, and screen-intake losses. The total amount of drawdown in a pumping well depends on the well efficiency and the drawdown in the aquifer. Smaller well efficiencies mean greater drawdowns and deeper PWLs, resulting in higher electrical costs (power) to lift groundwater to the ground surface.

Example 1: A recently installed 16-inch diameter irrigation well was drilled to a depth of 800 ft and has a 24-hr projected well efficiency of about 29%. The SWL was about 22 ft below ground surface. A 4-hr pumping test was conducted at 800 gpm with a PWL of 227 ft (a drawdown of 205 ft); the aquifer transmissivity was about 22,700 gpd/ft. The projected 24-hr specific capacity (SC) is about 3.34 gpm/ft of drawdown (dd);

Continued on the following page…

Wells and Words – *Continued*

the theoretical SC is about 11.35 gpm/ft of dd. The cost of electricity is about 14.75 cents per kWh[12] ($0.1475 per kWh). The cost to pump 800 gpm from a lift of 22 ft (SWL) to the ground surface (Term 1) for 18 hrs per day for one year (yr) is $4,590. The cost to lift the water to the SWL from the PWL (Term 3) for this seriously inefficient well is $42,768 per yr. The total cost to pump the water from this inefficient well for one year is at least $47,358. This is equivalent to about $49 per acre-foot and uses about 321,100 kWh which could power about 29 average USA residential homes (11,000 kWh per home)[13] each year; note that the California average annual residential usage is about 6,700 kWh.

A well development program could be conducted to increase the well efficiency. A reasonable target would be to increase the well efficiency to 70%. This would result in a PWL of about 123 ft or a lift of 101 ft to the SWL. Re-calculation of Term 3 of the equation results in a cost to lift the water to the SWL of about $21,071 — or a total cost of $25,661 ($26.5 per acre ft); this is about 46% less expensive than an under-developed well, for a savings of about $21,697 per yr! If successful, the well development could reduce the annual power requirement of an under-developed well from 321,071 kWH to about 173,973 kWh, or to the equivalent of about 14 average USA residential homes.

For this project the contractor provided a cost estimate for additional well development: $29,437. If the well development program is successful, and can attain 70% efficiency, then the well development program would pay for itself in reduced electrical costs in less than fourteen months. Well development has additional benefits, including extending the life expectancy of the well and the pump, which would reduce overall annualized capital costs and increase well reliability.

Example 2: A recently installed 4.5-inch diameter domestic well that supplies 3 houses was drilled to a depth of 600 ft in fractured rock; it has a well efficiency of about 19% after 24-hrs of pumping. The SWL was about 58 ft below ground surface. A 24-hr pumping test was conducted at 25 gpm with a PWL of 216 ft (dd of 158 ft); the aquifer transmissivity was about 1,300 gpd/ft. The 24-hr SC is 0.16 gpm/ft of dd; the theoretical SC is about 0.86 gpm/ft of dd. The cost of electricity is about 17.76 cents per kWh ($0.1776 per kWh)[12]. The cost to pump 15 gpm from a depth of 58 ft (SWL) to the ground surface for 12 hrs/day is $182/yr; this is 10,800 gal/day. The cost to lift the water to the SWL from the PWL (216 ft, or 158 ft of dd) for this well is $496/yr. The total cost to pump the water from this small domestic well with low efficiency for one year is at least $678. An increase in well efficiency to 38% could reduce the annual pumping cost to $326; a savings of $352/yr! If the well was 100% efficient then the dd would be about 3.5 ft and the cost to lift the water from the PWL to the SWL would be $11 — a total cost of $193/yr.

Sometimes an aggressive and effective well-development or well-rehabilitation program can significantly reduce operating costs to deliver groundwater to customers, especially in cases where the SWL is deep, the well efficiency is low, or it is a high-capacity well.

[1] Poehls, D.J. and G.J. Smith (editors), 2009, Encyclopedic Dictionary of Hydrogeology, Academic Press, Amsterdam, the Netherlands, 517p.

[2] Anderson, Keith E., unknown, Water Well Handbook, Missouri Water Well and Pump Contractors Association, Inc., 281p.

[3] http://cars.lovetoknow.com/List_of_Car_Weights

[4] McKechnie, Jean L. (editor), 1979, Webster's New Twentieth Century Dictionary of the English Language (second edition), William Collins Publishers, Inc.

[5] Helweg, Otto J., 1982, Evaluating and Improving Existing Ground-Water Systems, NGWA, Groundwater, Vol. 20, No. 4, pp 402-409.

[6] Helweg, Otto J., V.H. Scott, and J.C. Scalmanini, 1982, Improving Well and Pump Efficiency, American Water Works Association, 6666 W. Quincy Ave., Denver, CO, 158p.

[7] Helweg, Otto, 1982, Economics of improving well and pump efficiency, NGWA, Groundwater, Vol. 20, No. 5, pp 556-562.

[8] Conlon, Thomas, G. Weisbro, and S. Samiullah, 1999, We've been testing water pumps for years: Has their efficiency changed?, published in the Proceedings of the 1999 ACEEE Summer Study of Energy Efficiency In Industry, 12p.

[9] http://www.engineeringtoolbox.com/water-pumping-costs-d_1527.html

[10] http://www.mcnallyinstitute.com/06-html/6-01.html

[11] Bueche, Frederick, 1969, Introduction to Physics for Scientists and Engineers, McGraw-Hill Book Company, New York, 907p.

[12] U.S. Energy Information Administration, Table 5.6A, Average Price of Electricity to ultimate customers end-use sector by State, January 2016 and 2015. Access at URL on April 2, 2016. 14.75 cents per kWh is for all Sectors (Example 1) and 17.76 cents per kWh for residential (Example 2).

[13] https://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3

The Federal Corner

By Jamie Marincola, U.S. EPA

Department of Justice and EPA Announce $78 Million Superfund Settlement to Clean Up Groundwater Contamination at Southern California Superfund Site

A group of 66 companies have agreed to clean up contaminated groundwater at the Omega Chemical Corporation Superfund Site in Whittier, California. The settlement requires the companies to spend an estimated $70 million to install wells and operate a groundwater treatment system. In addition, the parties will reimburse EPA $8 million and the California Department of Toxic Substances Control $70,000 toward costs incurred in those agencies' past cleanup actions at the site. Design work on the new treatment system, extraction wells and piping will begin later this year and continue into 2017, with construction expected to begin in 2018. The former Omega Chemical Corporation facility operated from approximately 1976 to 1991 and handled drums and bulk loads of industrial waste solvents and chemicals that were processed to form commercial products. Subsurface soil and groundwater have high concentrations of trichloroethylene (TCE), perchloroethylene (PCE), Freons and other contaminants. For more information, visit this site.

Crude Oil Byproducts in Groundwater Plumes

A new study suggests that the degraded breakdown products of oil-spill contaminants in groundwater could be just as important to monitor as the original contamination itself. At sites where crude-oil or petroleum-hydrocarbon fuel spills have occurred and contaminants have entered groundwater, naturally-occurring microbes in the soil can digest or break down the original crude oil, producing byproducts known as metabolites. The metabolites are more soluble in groundwater than the parent compounds and are transported from the original source forming a groundwater plume. Results of a recent U.S. Geological Survey study suggest that at oil-spill sites where residual sources are present, the monitoring of metabolites or breakdown products may be an important part of an effective evaluation of the fate and effects of groundwater contaminant plumes. The study examined two crude-oil spill sites in Minnesota and focused on the occurrence and fate of the combination of all dissolved-organic-carbon metabolites in existing contaminant plumes. This new research, "Crude oil metabolites in groundwater at two spill sites," published in the journal Groundwater, is available online here.

New Remedy Selection and Optimization Tool for Green and Sustainable Remediation Planners

NAVFAC SiteWiseTM Version 3.1 and User Guide is an Excel-based remedy selection and optimization tool for green and sustainable remediation (GSR) planners. It was developed jointly by the Department of the Navy, Army Corps of Engineers, and Battelle. The software and companion guidance were recently updated with modules for sediment remediation technologies including dredging, capping, and monitored natural recovery. The updated guide includes instructions for using SiteWise and the basis of calculations. The updated tool will aid in evaluating the unique aspects of sediment remedies using GSR metrics. View the user guide and download SiteWiseTM here.

USGS Continues to Write History

The fourth volume of the comprehensive history of the U.S. Geological Survey, Minerals, Lands, and Geology for the Common Defence and General Welfare: Volume 4, 1939–1961, has been issued as an electronic document. Volume 4 focuses on the United States and the USGS in war and peace from the beginning of World War II in Europe to the end of the administration of President Dwight D. Eisenhower. During this period, the USGS developed and adapted new instruments and methods that included airborne magnetometers and radiometers, advanced seismometers, stereoscopic plotters for topographic mapping, geophysical logging (detailed records of geologic formations penetrated by a borehole), and geological sampling from deep wells. To learn more about the new volume, visit this site.

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

Groundwater in India

By Bart Simmons

On a recent trip to Pondicherry, India, I observed the manual drilling of a well, shown below, which got me thinking about local groundwater. India switched from surface-water storage to groundwater beginning in the 1940s, principally to reduce the incidence of cholera. Groundwater supply in the country is generally considered good, although the quality varies dramatically.

Industrial expansion in the 1960s led to contamination with fertilizer and pesticides. WHO and UNICEF funded an effort to create a large-scale system of tube wells for drinking water, to control cholera and to avoid surface-water contamination. Since the major concern was pathogenic bacteria, routine chemical testing was not done. An estimated 80% of the rural population and 50% of the urban population use groundwater. In rural India, very shallow tube wells are used, such as the one pictured above, which I estimated to be about 25 feet deep. Contaminants of concern are bacteria, nitrates from fertilizers, pesticides, hexavalent chromium, cyanide, cadmium, and mercury. The largest geogenic contaminants are fluoride, arsenic, iron, and salinity.

A survey conducted in Chennai (the home of gin & tonic and India Pale Ale), the capital of Tamil Nadu (the state which includes Pondicherry), found 60% of the groundwater to be "unfit for consumption." I visited Fort St. George, the site of the East India Company, the first British settlement in India. The water contamination is betrayed by the overwhelming septic stench near the Cooum river.

Arsenic contamination is primarily in the Ganga river plain and other river basins originating in the Himalayas, in northern India. Complicating the picture, recent work showed that arsenic contamination may also be present in Pleistocene aquifers > 150 m deep. Arsenic has accumulated in rice grown with groundwater, leading to concern for rice consumption.

In 2000, India withdrew 273 km3 of groundwater, contributing to both arsenic mobilization and declining water levels.

One solution is the harvesting of rainfall during monsoons. Another is the construction of check dams, which collect runoff during periods of heavy rainfall. Treatment to reduce arsenic, e.g., zero-valent iron, have had limited success. At least one treatment, iron electrocoagulation, has been demonstrated to remove both arsenic and *E.coli*.

India has a unique groundwater history, and may require unique technologies to ensure a sustainable, safe drinking-water supply.

Bart can be reached at bartonps@aol.com.

Evolution of Geology Licensing Requirements in California: Defining a Geological Sciences Degree

By Laura Racca, PG Senior Register, Geology and Geophysics
Board for Professional Enigeers. Land Surveyors and Geologists

Groundwater management is a multidisciplinary field which draws upon the knowledge and skills of a wide variety of experts. The laws and regulations that govern licensed professionals in California are essential to ensuring that this critical work is done by qualified individuals. Licensed Professional Geologists serve an integral role in protecting groundwater supply and quality in California.

The California Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG, or the Board) is charged with safeguarding the life, health, property, and public welfare by regulating the practices of professional engineering, land surveying, geology, and geophysics. The Board provides this public service by qualifying and licensing individuals, establishing regulations, enforcing laws and regulations, and providing information so that consumers can make informed decisions.

> Protection of the public shall be the highest priority for the Board for Professional Engineers, Land Surveyors, and Geologists in exercising its licensing, regulatory, and disciplinary functions. Whenever the protection of the public is inconsistent with other interests sought to be promoted, the protection of the public shall be paramount.
>
> –California Business and Professions Code

So what is licensing? Licensing is the formal permission from a governmental authority to do something. A professional license is required by law for a variety of disciplines, including those professions regulated by BPELSG. Qualifying for a professional license includes equal parts education, work experience, and successfully passing the appropriate examinations.

In 1968, the Geologist Act (later renamed the Geologist and Geophysicist Act) was enacted by the legislature to regulate the practice of geology in California. The original 1968 legislation required that applicants for a geology license have either graduated with "a major in geology," or "completion of 30 semester units in geological science courses leading to a major in geology." At the time, many applicants had completed courses in geology, and had the required experience, but did not have geology degrees.

In 2004, changes were initiated to require that all applicants for a geology licensure have graduated with "a major in geological sciences." The rationale for these changes was that it was no longer common to receive an application from someone without a degree and therefore this option was unnecessary. However, this change has generated confusion among potential licensees regarding what educational qualifications are necessary to become licensed as a geologist in California.

This confusion results in the Board receiving applications for a geology license from applicants who do not qualify. The predominant practice area for non-qualified applicants is in the environmental cleanup industry. The drivers for this trend appear to be the interdisciplinary nature of environmental cleanup, along with the requirements by California regulatory agencies that environmental reporting documents include a signature by a licensed professional.

The definition of the term geological is "pertaining to geology." Therefore, a "major in geological sciences" means graduation with a science degree pertaining to geology. However, applicants for geology licensure interpret the "major in geological sciences" through the lens of their own experience. Oftentimes, applicants have degrees in fields only minimally related to geology.

Many colleges and universities have unintentionally added to the confusion by creating a variety of interdisciplinary degrees to address current challenges, such as climate change and other environmental issues. Geology curriculums have generally been characterized by variety and flexibility, and have historically applied knowledge from other scientific disciplines, such as chemistry and physics. It appears that this flexibility of curriculum very often results in newer interdisciplinary majors being combined with traditional geology programs. There is also a misperception by some in industry that because geologists often work in the environmental field, environmental science (or related interdisciplinary degrees) and geology are equivalent.

The lack of a standardized curriculum for geology degrees, and of national accreditation for geoscience programs at the college or university level, has been recognized by licensed Professional Geologists for many years. Passionate arguments for and against accreditation have been made. The discussion has included professional societies worldwide and been the subject of dedicated educational summits sponsored by the National Science Foundation.

Continued on the following page…

Evolution of Geology Licensing Requirements in California: Defining a Geological Degree – *Continued*

In the absence of recognized national accreditation (such as ABET for engineering) or standard curriculum, the Board is looking to identify reasonable, defensible educational requirements for geology licensure in support of its core mission. The Board's efforts to address this issue began in 2012, and recently culminated in a series of workshops conducted to solicit input from industry, academia and other interested stakeholders on the education requirement. A narrated video of the workshop slides summarizing the research conducted is available on YouTube here.

So what has the Board learned? *The fundamental core skills required to be a competent geologist have remained remarkably unchanged over the last 50 years*. Basic geologic skills apply across industries and through time as the specific job tasks that geologists are asked to do have changed. Coursework that demonstrates the ability to use the scientific method; the ability to measure, map, evaluate and communicate geologic data; and the ability to develop appropriate conclusions based on that data, is critical to ensuring that licensed Professional Geologists have a minimum level of competency necessary for protection of the public.

In considering how to proceed, the Board has benefited from comments provided by stakeholders as a result of the workshops held in February 2016. The feedback received included a dominant preference for a list of classes that includes an explanation or statement describing the skills and competencies expected out of each course. Stakeholder comments have expressed support for defining the education requirements for a Professional Geologist license, and an appreciation of the effort to clarify the requirements so applicants have a specific objective standard that is easy to understand.

A draft of proposed amendments to Title 16, California Code of Regulations §3031 was submitted for the Board's consideration at the April 2016 Board meeting. In order to give the Board more time to study the proposed language, no action was taken. The proposed amendments will be on the Board's agenda for the June 9–10, 2016 meeting in Riverside. Meeting materials, including the proposed language, will be posted on the BPELSG website.

After approval of the proposed amendments by the Board, a Notice of Proposed Rulemaking will start the formal rulemaking process. There will be opportunities for public comment and input during this process before the adoption of any changes to the regulations. Updates regarding this process will be announced on the Board website, and via e-mail and social media. To ensure that you receive these notices, make sure you subscribe to the Board's email list.

Laura Racca can be reached at 916-263-2406 or Laura.Racca@dca.ca.gov.

GRA Welcomes the Following New Members

FEBRUARY 2 – MAY 1, 2016

Walker, Kenneth	GSI Environmental Inc.
Colantuono, Michael	Colantuono, Highsmith & Whatley, PC
Sheldon, Andrew	Ventura County Watershed Protection District
Wilson, Jennifer	Fugro Consultants, Inc.
Mendrin, Josh	The Mendrin Group
Green, Jim	Haley & Aldrich, Inc.
Silva, Chris	Brown & Caldwell
Roff, Doug	AECOM
LeCesne, Adrian	Brownstein Hyatt Farber Schreck
Diaz, Jessica	Brownstein Hyatt Farber Schreck
Davis Fadtke, Kristal	California Department of Fish and Wildlife
O'Maitiu, Ronan	OTT Hydromet
Guerre, Chris	DTSC
Gala, Satya	GEI Consultants, Inc.
Cain, Brent	GEI Consultants, Inc.
Coats, Danielle	Eastern Municipal Water District
Benham, Crystal	RMC Water & Environment
Gage, Kelley	Eastern Municipal Water District
Dressler, Scott	AECOM
Holland-Chominsky, Kim	AMEC Environment & Infrastructure, Inc.
Henry, Kimberly	AMEC Environment & Infrastructure, Inc.
Emmens, Robert	BESST INC
Perkins, Carol	CuestaGeo Consultants
Parkinson, Craig	Parkinson Geologic Services
Treis, Tania	Panorama Environmental, Inc.
Hunt, Alex	ICF International
Dragomir, Diana	
O'Callaghan, Theron	California State University, Sacramento
Kleinecke, Larry	TErracon Consultants, Inc.
Brittian, Preston	Pacific Resources
Archuleta, Jennifer	Integral Consulting Inc.
Miliband, Wes	Stoel Rives LLP
Monks, Kathy	Tetra Tech
Berg, Carolyn	County of San Luis Obispo
Amezcua, Jeanie	
Wegley, Chad	Provost & Pritchard
LaForge, Justin	
Gardner, Kelly	Raymond Basin Management Board
Harms, James	RHP Risk Management Inc
Fredricey, Dustin	PES Environmental, Inc.
Amador, Dominick	RMC Water & Environment
Nolan, Scott	Water Renewal Solutions
Turner, Joseph	Kleinfelder Inc.
Canfield, Colleen	Haley & Aldrich, Inc.
Luft, Sue	
Silva, Chris	Brown and Caldwell
Emmens, Robert	BESST INC
Kale, Julie	California State University, Sacramento
Jost, Gary	Trico Welding Supplies, Inc.
Unson, Julie Ann	
Parker, Jason	davenportsmith
Atkinson, Mark	
Anderson, Robert	Geosyntec Consultants
Rubier, Regina	City of Stockton

GRA Extends Sincere Appreciation to the Chairs, Sponsors and Exhibitors of the Annual Legislative Symposium

CHAIR:
Tim Parker

CO-CHAIRS:
Rosanna Carvacho
Chris Frahm

TITLE SPONSOR:
CTX Holdings

BREAKFAST SPONSOR:
Golden State Water Company

LUNCH SPONSOR:
Dudek

REFRESHMENT SPONSORS:
Water Resource Consultants
GHA Water Inc.

EXHIBITORS:
GEI Consultants
Cascade Drilling

2016 Contributors to GRA – Thank You

As of Feburary 2, 2016

PATRON *($500-$999)*

CORPORATE *($250-$499)*
David Abbott

CHARTER *($100-$249)*
Matt Becker
Stanley Feenstra
Sally McCraven
Steven Phillips
Iris Priestaf
Brian Wagner

SPONSOR *($25-$99)*
Lydia Beth Ainsworth
Charles Almestad
Douglas Bleakly
Kevin J. Brown
Christine Bucklin
Adres Cano
Samantha Caruthers-Knight
Julie Chambon
Bob Cleary
Michael Colantuono
Gary Dickenson
Randy Dockery
Jessica Donovan
Scott Furnas
Chip Gribble
Thomas Harter
Barbara Hennigan
Charles Jenkins
Christopher Johnson
Nicholas Johnson
Dirk Kassenaar
Carol Kendall
Ted Koelsch
Claire Kouba
Taras Kruk
Bruce Lewis
Mario Lluria
Douglas Mackay
Richard Makdis
Robert Marks
Robert Martin
Dan McManus
Angelica Mercado
Peter Mock
Jason Muir
Alec Naugle
Scott Nolan
Aaron O'Brien
Sorab Panday
Tim Parker
William Pipes
Lisa Porta
Cheryl Prowell
Eric Reichard
William Sedlak
Phyllis Stanin
Sylvia Stork
Eddy Teasdale
Mike Tietze
Maria Vishnevskiy
Katharine Wagner
Brian Whalen
Terry Winsor
Jeremy Wire
Brett Wyckoff
Gus Yates
Steve Zigan
Confluence Environmental Field Services
EMAX Laboratories, Inc.
Griffith & Masuda
Horizon Environmental, Inc.
Sustainable Technologies
The Source Group, Inc.
The Water Group LLC
WZI Inc.

SUPPORTERS
Gabrielle Boisrame
Aaron Cuthbertson
Ryan Fay
Claire Wilkin
Stephanie Uriostegui

GRA Extends Sincere Appreciation to the Chairs, Sponsors and Exhibitors of the *How to Fund Groundwater Sustainability* Symposium

CHAIR:
Christy Kennedy

CO-CHAIRS:
Christian Petersen
Leslie Dumas

CO-SPONSOR:
RMC Water and Environment

REFRESHMENT SPONSORS:
Erler & Kalinowski, Inc.
Weiss Associates

EXHIBITOR:
Cascade Drilling

Central Coast

By Bryan Bondy
Branch Secretary

On February 4, 2016 the Central Coast Branch was excited to have Dr. John Izbicki, Research Hydrologist with the United States Geological Survey. Dr. Izbicki's presentation was titled *Role of Environmental Tracers in Groundwater Remediation: Examples from Selected Case Studies*. Dr. Izbicki's presentation focused on the contaminants perchlorate and hexavalent chromium, which can move almost unattenuated with groundwater in some cases, creating large contamination plumes that extend for miles downgradient from source areas. Specifically, he focused on approaches for identifying plume margins and determining the extent of contamination at sites with high background contaminant concentrations from natural or other anthropogenic sources not associated with the primary release site. The approaches discussed include chemical and isotopic environmental tracers that can be used to identify the recharge source and hydrologic history, age (time since recharge), contaminant sources within large plumes and the processes affecting contaminant concentrations. The use of environmental tracers coupled with hydrologic data was examined at several sites in southern California.

Dr. Izbicki's presentation began with an overview of the use of environmental tracers to assess hydrologic and contaminant-transport processes. He discussed the use of stable isotopes of oxygen and hydrogen in water, and dissolved atmospheric gasses (nitrogen and argon), to characterize different recharge mechanisms affecting the dynamics of the regional perchlorate plume in the Rialto-Colton subbasin. He discussed the use of tritium, helium, and carbon isotopes and industrial gases to determine the age of perchlorate-impacted groundwater throughout the plume as a means of differentiating between different perchlorate sources. The use of chromium, oxygen, chlorine, and nitrogen isotopes to assess the source and movement of perchlorate and hexavalent chromium within several plumes was described. Lastly, Dr. Izbicki discussed the use of dissolved noble gasses to estimate groundwater recharge temperatures as a means of identifying regional differences in recharge processes (focused versus areal recharge) that cause regional differences in hexavalent chromium concentrations in the Central Valley.

Our Branch members very much enjoyed Dr. Izbicki's discussion and he was nice enough to stay after to make sure all questions had been answered; the meeting was well attended.

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?

- Articles
- Research Papers
- Summary Blurbs

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

Southern California

By Bert Vogler,
Branch Secretary

On January 27, 2016, the Branch dinner meeting featuring Behrooz Mortazavi, GRA's 2016 David Keith Todd Distinguished Lecturer for Southern California, who presented *Role of Groundwater in Integrated Water Resources Management*. He reviewed the political, environmental, and technical challenges for implementing an integrated resources plan. Local water resource planning by the Eastern Municipal Water District (EMWD) was used as a case study to demonstrate how the EMWD used its available groundwater resources to implement a successful integrated resources plan in Southern California.

On April 8, 2016, the Branch held a dinner meeting in cooperation with the Orange County Water District (OCWD), during which Ty Ferre, Ph.D., the lecturer for the 2016 Darcy Lecture Series in Groundwater Science, presented *Seeing Things Differently: Rethinking the Relationship Between Data, Models, and Decision-Marking*. Dr. Ferre's presentation focused on the use of models and data to support improved decision making; he made the case that most established approaches do not provide the information needed to make robust decisions under uncertainty. Rather, perspective needs to be changed concerning the use of models, changing our focus to identify threats and opportunities, and choosing to collect data that tests these outcomes. He explained that, fortunately, the tools we need exist, and we can implement them for real-world problems. The challenge is to change the way we think about the relationship between data, models, and decision making.

The Branch would again like to thank our speakers and all GRA members and non-members who participated in the January and April Branch meetings.

The Branch would like also to announce its current officers:

President: Paul Parmentier,
Paul.Parmentier@apexcos.com

Vice President: Toby Moore,
TobyMoore@gswater.com

Secretary: Herbert (Bert) Vogler,
HVogler@kleinfelder.com

Treasurer: Mike Hoffman,
HoffmanMJ@cdmsmith.com

Sponsor Coordinator:
Chris Converse, EnviroSupply

Scholarship Chair:
Erik Gaiser, Yellow Jacket Drilling

Technical Advisor:
Dan Nunez, Regenesis

Technical Advisor:
Chris Baker, Geokinetics

Technical Advisor:
Ben McVeigh, The Source Group

Technical Advisor:
Bill Sedlak, Tetra Tech

Tahoe National Forest

Lake Tahoe is the largest alpine lake in North America and is about 22 mi long by 12 mi wide. With an average depth of 1,000 feet and a maximum depth of 1,645 feet, it is the second deepest lake in the US and tenth deepest lake in the world. Lake Tahoe is also the sixth largest lake by volume in the US at 122,160,280 acre-ft, behind the five Great Lakes. Over 60 streams flow into the lake, but the Truckee River is the only outflow. The lake level is controlled by a small dam on the Truckee River at Tahoe City.

The Lake Tahoe Basin occupies a graben between the Sierra Nevada on the west and the Carson Range on the east. The basin formed about 2 million years ago and is the youngest of several extensional basins of the Walker Lane deformation zone that accommodates dextral shear between the Sierra Nevada-Great Valley Block and North America.

Starting in 1859, the Lake Tahoe landscape was transformed with the discovery of silver deposits near Virginia City and the Comstock mining boom. Lake Tahoe's timber, the "green gold" of the Sierras, was critical in supplying Comstock mines with bracing for shafts, building materials, and fuel. By the late 1880s, more than one-billion board feet of old-growth timber had been stripped from the Basin, causing logging companies to abandon the denuded landscape. Ninety percent of the present forest is less than 100 years old.

After 1950, year-round auto access changed sleepy Lake Tahoe towns into a booming four-season resort mecca. In 1960, Walt Disney helped to launch the first nationally-televised Olympic Games from Squaw Valley—and Tahoe entered an unprecedented new era of unbridled economic growth and land development. Increased runoff of sediment, sewage and fertilizers, and associated algal blooms, significantly decreased the clarity and purity of the lake water. The Tahoe Regional Planning Agency was created in 1969 to address problems associated with uncontrolled growth and was the first bi-state (California and Nevada) regional environmental planning agency in the country.

Photographed by John Karachewski, Ph.D., along the Ellis Peak Trail in the Tahoe National Forest.
GPS coordinates of general location (-122.233 and 36.067)
(www.geoscapesphotography.com)