

HYDRO VISIONS

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GROUNDWATER RESOURCES ASSOCIATION
OF CALIFORNIA

Summer 2003

GRA's Artificial Recharge Workshop Percolates in San Jose

BY TIM PARKER, GRA PAST PRESIDENT AND DIRECTOR;
DEPARTMENT OF WATER RESOURCES

Background

California faces many challenges to meet the future water demands from continued population growth. These include reduction of the Colorado River water allotment as well as water quality issues related to further contamination, analytical technology improvements, and potential lowering of water quality standards. About 30 percent of California's urban and agricultural demand in an average water supply year is met by groundwater. In drought years, this percentage increases to more than 40 percent. With the continued projected population growth, California's demand on groundwater will increase significantly over the next several decades. Of the tools California has to manage the challenges, artificial groundwater recharge will continue to be important and will grow in application over the next decade.

In recent years, the voters of California appear to be aware of the growing need for

projects to help supplement our groundwater supplies by providing substantial funds to local agencies through Proposition 13 and in the future, Proposition 50. For example, the nearly \$2 billion Water Bond 2000 (Proposition 13) approved by California voters in March 2000 specifically authorized funds for two groundwater programs: \$200 million for grants for feasibility studies, project design, and the construction of conjunctive use facilities; and \$30 million for loans for local agency acquisition and construction of groundwater recharge facilities and grants for feasibility studies for recharge projects.

Symposium Summary

More than 100 people gathered in San Jose April 30-May 2 to attend the joint workshop of the U.S. Geological Survey (USGS) and the California Department of Water Resources on "Artificial Recharge in California - Technical and Policy Challenges" held by the Groundwater Resources Association of California, co-sponsored by Wellenco Inc., of Bakersfield, and WDC Exploration & Wells of Woodland, California, and in cooperation with the Association of California Water Agencies and International Association of Hydrogeologists. The workshop was held April 30 and May 1 at the Hyatt Hotel in San Jose, a fitting location near some of the more mature artificial recharge facilities in the state that are operated by Santa Clara Valley Water District (SCVWD) and were the focus of the one-day field trip on May 2.

INSIDE

President's Message	2
Upcoming Events	3
Technical Corner	5
California Legislative Corner	6
Chemist's Corner	7
California Regulatory Corner	8
Alliance Corner	10
Education Corner	12
Editorial Page	13
Organizational Corner	14

Four sessions convened over the two days focused on the physical challenges and tools for getting water into the saturated zone, water quality and microbial considerations of the recharge water and of the existing aquifer, and legal & regulatory policy issues. The meeting was concluded with a lively roundtable discussion led by the USGS debating the roles of government and the private sector in artificial recharge. Highlights from each of the sessions are presented in the following sections. For additional information on the symposium, a complete summary is presented on GRA's website, and binders containing speaker contact information, slides, abstracts and other supplemental information can be obtained by contacting GRA (916-446-3626; www.grac.org/publications.pdf).

Continued on page 18

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



President's Message

BY JIM CARTER

I am pleased to report that GRA remains healthy and active in these sometimes distracting and sluggish times we find ourselves in these days. Our Master Calendar of Events is shaping up, and I am sure you will be pleased with the high quality programs that you have come to expect from GRA.

Tom Mohr, Santa Clara Valley Water District, GRA Director and Seminar Chair, and Rula Deeb, Malcolm Pirnie, Inc. are co-chairs of the Perchlorate Symposium titled Occurrence, Analysis and Treatment this July 31st in Sacramento. We have a terrific program lined up as well as a tour of the Aerojet facility, so I hope to see you there!

GRA is also well into the planning of the 24th Biennial GW Conference & 12th Annual GRA Meeting, scheduled for October 28-29 in Ontario. We also have two conferences in Southern and Northern California exploring the relationship between groundwater contamination and indoor air titled Subsurface Vapor Intrusion to Indoor Air. These conferences will be on September 30th and October 2nd, respectively. We are looking for sponsors for all of our upcoming events so if you have any questions please contact our Executive Director, Kathy Snelson at the GRA hotline.

GRA held our Lobby Day and it was a blast to be a part of. This is a truly eye opening experience, and I strongly encourage you all to attend next year. GRA can and should play a greatly needed role in helping out State Legislators craft good and technically sound bills to protect

our precious groundwater resources. In these times when new legislation is crafted from a Sunday's article in Parade magazine (as told by one of the staffers we met with, I kid you not), it is very important for our association to be an effective and politically neutral advocate for groundwater. We are making a concerted effort to establish GRA as the non-biased technical resource for our California Legislature, and our efforts are being recognized thanks to Tim Parker, Legislative Committee Chair, Chris Frahm, Jennifer Carbuca and the rest of his committee.

Finally, I have a favor to ask of all our current members. Please help me achieve my goal to have 1000 members by the end of this year. To do so, I ask you to convince your colleagues to join what I consider the finest groundwater-related association. GRA continues to grow in numbers, in our resources and in our areas of influence and I ask you to help me spread the good word! 💧

Thanks,
Jim Carter,
GRA President

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EXECUTIVE OFFICERS

President, Jim Carter
EMAX Laboratories, Inc.
Tel: 310-618-8889, ext. 105
Email: jcarter@emaxlabs.com

Vice President, Thomas M. Johnson
LFR Levine Fricke
Phone: 510-652-4500
Email: tom.johnson@lfr.com

Treasurer, David Von Aspern
Wallace Kuhl & Associates, Inc.
Tel: 916-372-1434
Email: dvonaspern@wallace-kuhl.com

Secretary, Paul Dorey
Vista Irrigation District
Tel: 760-597-3140
Email: wn6k@cts.com

DIRECTORS

David Abbott, Todd Engineers
Tel: 510-595-2120
Email: jorysue@msn.com

Susan Garcia, Colin L. Powell Academy
Tel: 310-631-8794
Email: ssgarcia55cs.com

Jim Jacobs, Environmental Bio-Systems, Inc.
Tel: 415-381-5195
Email: augerpro@sbcglobal.net

Vicki Kretsinger, Luhdorff & Scalmanini
Tel: 530-661-0109
Email: vkretsinger@lsce.com

Brian Lewis
Cal/EPA, Dept. of Toxic Substances Control
Tel: 916-255-6532
Email: blewis@dtsc.ca.gov

Tom Mohr, Santa Clara Valley Water District
Tel: 408-265-2607
Email: tmohr@valleywater.org

Tim Parker, CA Department of Water Resources
Tel: 916-651-9224
Email: tparker@water.ca.gov

Bill Pipes, Geomatrix Consultants, Inc.
Tel: 559-264-2535
Email: wppipes@geomatrix.com

Scott Slater, Hatch and Parent
Tel: 805-963-7000
Email: sslater@hatchparent.com

Martin Steinpress, Brown & Caldwell
Tel: 925-937-9010
Email: msteinpress@brwnald.com

Jim Strandberg, Malcolm Pirnie, Inc.
Tel: 510-735-3020
Email: jstrandberg@pirnie.com

Robert A. Van Valer, Roscoe Moss Company
Tel: 323-263-4111
Email: rvanvaler@earthlink.net

EXECUTIVE DIRECTOR

Kathy Snelson
(916) 446-3626 - Email: executive_director@grac.org

EDITOR

Floyd Flood
Email: editor@grac.org

WEB AND DATABASE MANAGER

Kevin Blatt
Tel: (510) 845-9623 - Email: grac@inreach.com

Upcoming Events

Perchlorate in Groundwater: Occurrence, Analysis, and Treatment

JULY 31, 2003, SACRAMENTO, CA

The Groundwater Resources Association of California (GRA), in cooperation with a number of other professional organizations, is developing a symposium in its Series on Groundwater Contaminants titled "Perchlorate in Groundwater: Occurrence, Analysis, and Treatment". The symposium will be in Sacramento on July 31, 2003.

Perchlorate (ClO₄⁻) has been found to impact drinking water aquifers in California and elsewhere leading to the closure of numerous municipal water supply wells. Perchlorate can be accidentally released to water bodies from a number of sources. It is a primary ingredient in solid propellant for rockets and missiles and therefore a common contaminant at aerospace facilities. In addition, perchlorate-based chemicals have been used in a range of industrial processes including aluminum refining, rubber manufacture and production of paints.

Information about the use, environmental behavior, and treatment of perchlorate is not abundant. This symposium will showcase experts on the occurrence and potential sources of perchlorate, its fate and transport characteristics, regulatory status, toxicology and chemical detection challenges. The program will also provide information about known impacts of perchlorate on water resources in California as well as current remediation/water treatment options. The symposium will feature speakers from regulatory agencies, universities, national laboratories, and industry and is expected to attract up to 350 participants.

The Symposium will consist of the following three sessions:

- ◆ **SESSION 1:** Sources, Occurrence, Geochemistry, Fate and Transport, Analysis and Toxicity of Perchlorate
- ◆ **SESSION 2:** Perchlorate in California
- ◆ **SESSION 3:** Treatment and Remediation

In addition to the above sessions, experts have been invited to participate in a panel discussion on policy and legal issues relating to perchlorate contamination at the end of this one-day event. This will be followed by a reception featuring poster and exhibitor presentations.

GRA is also coordinating a pre-symposium site visit to Aerojet's perchlorate treatment facility on July 30. This includes a tour as well as an overview presentation on the site. A dinner meeting hosted by GRA's Sacramento Branch will follow the Aerojet facility tour. The dinner meeting will include a lecture by Thomas Mohr (Santa Clara Valley Water District) on the San Martin perchlorate problem.

For additional information about the symposium, please contact GRA's Executive Director, Kathy Snelson, at 916-446-3626. Updated program information will be posted on GRA's Web site at www.grac.org. If you would like to receive automatic symposium updates electronically, please sign up for GRA's announcement distribution list at www.grac.org/joinemail.html. ◆

Symposium on Subsurface Vapor Intrusion to Indoor Air

**WHEN IS SOIL AND
GROUNDWATER CONTAMINATION
AN INDOOR AIR ISSUE?**

Two locations:

- ◆ *September 30, 2003* the Hyatt San Jose, San Jose CA
- ◆ *October 1, 2003* the Westin Long Beach, Long Beach CA

Sponsored by:

Groundwater Resources
Association of California

In cooperation with:

Department of Toxic Substances
Control, San Francisco Bay Regional
Water Quality Control Board

The potential for human exposures resulting from subsurface vapor intrusion to indoor air is a topic of significant concern and debate. This one-day symposium will provide attendees with an overview of the issues, along with a summary of the state of the science and practice in California. The workshop will also familiarize attendees with recent and emerging regulatory guidance, along with various tools and strategies that may be employed to evaluate site-specific exposures. The course will give an overview of predictive models, but will focus on the Johnson and Ettinger Model.

Who should attend: The symposium is intended for regulatory agency personnel, consultants, responsible parties, property owners and developers

Continued on next page

Upcoming Events

interested in the latest strategies for understanding and addressing this exposure pathway.

Topics will include:

- Overview of the indoor air issue from the California perspective
- Case Study: a facility in Mountain View, CA
- Basis for predictive models
- Collection of field data: groundwater, soil, soil gas and physical parameters
- Background air quality and its impact on the assessment of vapor intrusion
- Engineering controls
- Hypothetical approach to a site
- Panel discussion

Speakers will include:

- *David Berry*, Department of Toxic Substances Control
- *Roger Brewer*, SF Bay Regional Water Quality Control Board
- *Robert Ettinger*, Shell Oil Products US
- *Dan Gallagher*, Department of Toxic Substances Control
- *Paul Johnson*, Arizona State University
- *Eric Nichols*, LFR Levine-Fricke
- *Patrick Wilson*, US EPA, Region 9

Call for vendors: Exhibit space is available. Please contact Mary Megarry of Groundwater Resources Association to reserve your space. Phone: (916) 446-3626 or email: mmegarry@nossaman.com

Hotel information: Please specify that you are attending the GRA symposium for the special hotel rate of \$119. Check our web page www.grac.org for additional information. •

24th Biennial Groundwater Conference and 12th Annual GRA Meeting

OCTOBER 28-29, 2003
DOUBLETREE HOTEL, ONTARIO, CA

The Role of Groundwater in Integrated Water Management

Keynote Speaker — Dr. Chip Groat, Director of USGS

Sponsors/Cooperators: University of California, California Department of Water Resources, Water Education Foundation, California State Water Resources Control Board, Groundwater Resources Association of California, U.S. Geological Survey, and the California Department of Health Services. Cooperating organizations include the International Association of Hydrogeologists.

Conference and Theme: For 48 years, the Biennial Groundwater Conference has provided policy-makers, practitioners, researchers, and educators the opportunity to learn about the current policies, regulations, and technical challenges affecting the use and management of groundwater in California. The theme of the 24th Biennial Groundwater Conference is “The Role of Groundwater in Integrated Water Management” and will emphasize the interconnected nature of water resources at basin-wide, regional, and global scales. Presentations will explore the role of groundwater in formulating water policies, planning and managing water resources, and optimizing beneficial uses.

Keynote: The Plenary session will begin with a keynote speech by Dr. Chip Groat, Director of the US Geological Survey. His speech will focus on recent publications and programs of the USGS

that have emphasized the integrated nature of water resources, challenges of groundwater sustainability, the importance of long-term groundwater monitoring for water resources management, the importance of assessing water availability and use, and national goals for collecting and disseminating the necessary information for integrated water resources planning and management. Following Dr. Groat, Plenary session talks are planned on climate change and its effect on groundwater and worldwide groundwater banking programs.

Venue: The two-day Conference features a Plenary session, concurrent policy and technical sessions, and a final general assembly. The session topics are:

- Regulatory and legislative actions affecting groundwater
- Developing a sound groundwater management plan
- Conjunctive management and water banking
- Wastewater Management
- Public outreach and public involvement strategies
- Desalination technologies
- Tools for quantifying groundwater resources
- Emerging contaminants

Continued on page 17

“Water 2025” – An Interior Proposal for Public Discussion on Water Issues

BY JANE H. GILL, CCGO

Water 2025 Plan: Preventing Crisis and Conflict in the West” is an initiative by Secretary of the Interior Gale Norton to hold a series of conferences in western states. The conferences, heralded by a number of press releases sent out by the Department of the Interior (DOI), endeavor to provide a basis for public discussion of the water realities that face the often and future drought-plagued west, in order that timely decisions may be made to avoid conflicts over competing water needs. The goal is to identify the watersheds facing the greatest potential risk in the next 25 years, evaluate the most effective ways of addressing water supply challenges, and recommend cooperative planning approaches and tools that have the most likelihood of success. A report on the recommendations of the meetings will be submitted to Secretary Norton and other Administration officials following assessment of the meeting discussions.

The proposal calls for concentrating existing federal financial and technical resources in key western watersheds and in critical research and development (such as water conservation and desalinization) that will help to predict, prevent, and alleviate water supply conflicts. The President’s FY 2004 budget calls for an initial investment of \$11 million for such efforts.

In a press release, published on the DOI website, Secretary Norton suggested a framework for focusing on the important points. This includes

Continued on Page 22

Technical Corner

Perchlorate from Safety Flares – a Threat to Water Quality

BY MIGUEL A. SILVA, SANTA CLARA VALLEY WATER DISTRICT

Results from a series of flare tests conducted by the Santa Clara Valley Water District confirm that flares can be a significant source of perchlorate (ClO_4^-) contamination to water, even when the flares are 100% burned. Up to 3,500,000 μg of perchlorate ions leached out of a single standard 20-minute unburned flare in just 3.5 hrs of contact with clean water. Fully burned flares leached up to 1,950 μg of perchlorate ions per flare.

More than 40 metric tons of flares were used by Santa Clara County public safety agencies in 2002 alone. Theoretically (assuming 100% homogenous full mixture and 0% mass losses), a single unburned 20-minute flare can potentially contaminate up to 2.2 acre-feet of drinking water to just above California Department of Health Services’ current Action Level of 4 $\mu\text{g}/\text{L}$.

Flare-water mixtures were monitored for pH, conductivity, temperature, and dissolved concentrations of perchlorate and nitrate (as NO_3^-), including dry weight analysis. A fully detailed report is available at www.valleywater.org.

Calculated Solutions to Common Groundwater Questions

BY EUGENE E. LUHDORFF, JR.

In 1989, I contracted a rare disease known as Guillain Barre’ Syndrome, which caused total paralysis. Advised to retire after eight months in the hospital and a minor stroke, I still wanted somehow to use my experience as a drilling contractor, professional engineer, and industry association officer. I decided to write a computer program for both groups.

In 1992, we all used some form of DOS or Apple operating system, and I elected to write the program in Quick Basic. It was to be therapy; a way to strengthen my hands and again use a computer. The completed Quick Basic program was comprised of a series of small subroutines that calculated the results of various equations commonly

used in groundwater studies and the industry. Since Windows is now the operating system for most PC users, I have recently converted the subroutines using Visual Basic for Windows. The program will not operate on any Apple format.

For engineers and hydrogeologists, I have prepared the following “calculators” to solve frequently used equations in the groundwater industry.

- Calculation of Transmissivity (solves for transmissivity using the flow rate and delta s)
- Coefficient of Storage (determination of storage using observation well data)
- Transmissivity and Storage using recovery data

Continued on Page 19

GRA Hits the Steps of the State Capital

BY TIM PARKER, CHRIS FRAHM,
AND MARTIN STEINPRESS

Fifty GRA members trekked to Sacramento for the 2nd Annual Legislative Symposium and Lobby Day on May 28 and found out what a change a year can bring. At last year's event, the effect of term limits was a major topic of discussion. With so many new legislators and staff, communicating the importance and complexities of groundwater issues was a challenge in and of itself. While this problem will be with us as long as we have term limits, (we will continue to do Groundwater 101 for legislative staff each year), we are also beginning to see (thanks in part to our own efforts!) a more knowledgeable group of legislators regarding the importance of groundwater.

As you might suspect, much of the discussion this year centered on the impact of the state budget crisis—in essence, the only new money for groundwater projects will be last year's Propositions 40 and 50, and even some of that may get drained away to help fill the roughly \$30 million budget shortfall. We also found that water quality issues (especially perchlorate) were dominating the year's bills.

The day began with the Honorable Carol Liu (Chairwoman of the Assembly Select Committee on Groundwater Quality) discussing the AB 599 interagency task force report to the Governor recommending data standards for groundwater quality monitoring. A number of other speakers briefed us on groundwater quality issues being addressed by the legislature, and Senator Mike Machado (Chair of the Senate Agriculture and Water Resources Committee) was the keynote speaker at lunch and discussed

California Legislative Corner

Prop 50 and the budgetary effects on water funding. In the afternoon, we broke up into groups and met with legislators and staffers. GRA's position statements on key legislation below provided us with our "talking points," which were developed from GRA's Legislative Guidelines adopted earlier this year by the GRA Board.

It was apparent that GRA's reputation as being the "go to" state organization for unbiased technical information on groundwater has increased dramatically in the last year, thanks to the Legislative Days and all the other efforts of the Legislative Committee and our Legislative Advocates Hatch and Parent. GRA especially wishes to thank the committee chair, Tim Parker, and Chris Frahm and Jennifer Carbuccia of Hatch and Parent, as well as all the volunteer speakers and participants for pulling off an educational, entertaining, and fruitful day at the state capitol. We are also grateful and wish to thank our co-sponsor, CH2MHill, and other sponsors Brown & Caldwell, Komex, and Integrated Resource Management, Inc.

GRA Legislative Symposium and Lobby Day Talking Points

Position Statements on Pending Legislative Issues. GRA supports priorities that emphasize protection of groundwater resources, water quality, and long term beneficial uses, as well as programs that utilize better management practices and implementation of timely and cost effective remediation actions. Control of sources, prevention of groundwater contamination, source clean up by responsible parties coupled with sound scientific principles must be statewide objectives. However, GRA also recognizes that our society is dependent on certain chemical usage and thus we must find appropriate economic and

environmental balance to ensure resource protection. Such bills include:

- ◆ **AB 1107/AB 1159 (Liu): Groundwater: uniform data standards.** Position: Support. These bills require SWRCB groundwater monitoring interagency task force to develop uniform groundwater data standards.
- ◆ **SB 543 (Machado): Water rights: groundwater cleanup operations.** Position: Support. This bill prohibits polluters who are ordered to clean up groundwater from selling or transferring said water until injured groundwater rights holders are provided replacement water supplies.
- ◆ **SB 1004 (Soto and Romero): Perchlorate.** Position: Support in Concept. This bill would require a person who causes or permits perchlorate to be discharged in any waters of the state to immediately notify the SWRCB.
- ◆ **AB 826 (Jackson): The Perchlorate Contamination Prevention Act.** Position: Support in Concept. This bill requires the Department of Toxic Substances Control (DTSC) to establish a perchlorate monitoring and survey program to locate where perchlorate is being used, stored, or disposed.
- ◆ **AB 1702(ESTM)/SB 923(Sher): Support in Concept.** These bills narrow the exceptions for discharge of petroleum by-products or from underground storage tanks, respectively.
- ◆ **Other Water Quality Bills GRA supports:** AB 698 (Lieber) and SB 204(Perata).
- ◆ **Prop 40 & 50/Funding Issues: Groundwater Inclusion and Support**

Continued on page 17

Polybrominated Diphenyl Ethers (PBDEs) Update

BY BART SIMMONS

PBDEs are widely used as flame retardants in plastic, foam, and fabrics in a variety of consumer and other products. Production has been increasing in the U.S., and is currently about 75-90 M lbs/year. PBDEs include a family of compounds (congeners) with different numbers of bromine atoms and different locations of bromine atoms. There are basically three formulations of PBDEs: "Penta," that includes tetra- and penta-BDEs; "Octa," that primarily contains Hepta- and Octa-BDEs; and "Deca," that contains the deca-BDE. Many studies have measured PBDE levels in human milk, blood, and fat; . Levels in Sweden rose exponentially until a decline that coincided with the ban of some PBDEs. Human and animal results from North America are generally much higher than those in Europe, although. High levels in California may be due to more stringent California flammability standards in California than in the rest of the U.S. The flammability standards are performance-based, and typically use a flame applied to a product (e.g., foam) or composite (e.g., an assembled couch). The Department of Consumer Affairs, which enforces the flammability standards, does not require the use of PBDEs, but most manufacturers use PBDEs to meet the requirements for foam, furniture, and textiles.

PBDEs are unique among persistent organics because they are found in humans, although the route of exposure to humans is uncertain. Current research is focusing on house dust as a possible route, although PBDEs have been found in a variety of animals and

Chemist's Corner

in environmental samples, suggesting that the food web may also be a source. The PBDEs are hydrophobic (water-hating) compounds and are not expected in significant quantities in fresh water. However, sewage sludge and sediments have accumulated PBDEs up to the ppm range. Analysis of sediment upstream and downstream of a Swedish plastics plant found three PBDE congeners at a total of 14 ug/kg (ppb) upstream, and a total of 2250 ug/kg downstream (DeWit, 2000). Therefore, sediment concentrations are expected to increase until there is a reduction in sources.

Analysis for ppt levels of PBDEs is generally done with Gas Chromatography - High Resolution Mass Spectrometry. Analysis at the ppb and ppm levels can be done with Gas Chromatography - Low Resolution Mass Spectrometry or gas Chromatography with Electron Capture Detection (GC-ECD). These techniques are widely available in environmental laboratories, but sample extraction and clean-up techniques need to be validated for specific sample matrices.

U.S. EPA is conducting scientific peer reviewed risk assessments for the major PBDEs. The Penta-PBDE peer review was scheduled for June. Since the PBDEs have been in production for decades, they were not included in the Pre-Manufacturing Notice (PMN) process that now applies to new chemicals under the Toxic Substances Control Act (TSCA).

A bill in the California legislature (AB 302) would require labeling of PBDE-containing products and would eventually ban the sale of those products in California. In May, the US EPA Region 9 sponsored a conference and roundtable on PBDEs in foam, in which. One of the speakers described the successful efforts of IKEA to remove all brominated flame

retardants from their product line. Alternatives to the PBDEs are in development, and the US EPA Office of Toxic Substances is reviewing the application for new uses of chemicals already currently registered.

Questions remain on the extent of environmental contamination and routes of exposure for PBDEs; additional studies will help to understand the ultimate fate of these chemicals.

Bart Simmons is with the Hazardous Materials Laboratory, California Department of Toxic Substances Control (DTSC), California Environmental Protection Agency (Cal-EPA). Opinions are those of the author and are not necessarily those of DTSC or Cal-EPA. Mention of products or services does not constitute endorsement by DTSC or Cal-EPA.

References

De Wit, C.A., 2000. Brominated Flame Retardants, Report 5065, Swedish Environmental Protection Agency.

CCGO Highlights

BY JANE H. GILL, RG, CCGO
EXECUTIVE DIRECTOR

CCGO Conducts the 4th Annual Legislative Drive-In

CCGO delegates Rick Blake, Sue Jagoda, Tim Parker, and Jim Jacobs descended on the Capitol for the annual Legislative Drive-In on March 4. Themes this year were to support the various programs under budget cuts in the California Geological Survey (CGS), State Mining and Geology Board (SMGB) and Board of Geologists and Geophysicists (BGG); promote strong science programs in the schools; and increase diversity in the sciences. CCGO also supports legislation to protect groundwater and the environment, and the wise use of natural resources.

CCGO delegates spent the entire day in Sacramento, in meetings with CGS, SMGB, Department of Conservation, Office of Education, BGG, and the Governor's Office of Appointments. CCGO also met with California State Geologist Jim Davis, senior staff in the offices of Senators Byron Sher and Liz Figueroa, and Assemblymen Joe Nation and Manny Diaz. CCGO thanks GRA for hosting a reception for the delegates at the offices of Nossaman, Guthner, Knox, and Elliott.

Sixth Annual CCGO Fundraisers a rousing success

The enthusiasm of California geologists soared on May 12 and 13 with the presence of Dr. Chester F. "Skip" Watts, the 2003 Richard H. Jahns Distinguished Lecturer. His talk emphasized that potential hazards from rock falls and rockslides are on the rise as land development reaches into previously untouched areas, and at the same time, a new generation of decision makers is emerging who are unaware of

California Regulatory Corner

the fundamental principles of mass wasting, leading to some expensive and tragic examples of preventable disasters. Skip's philosophy dovetails perfectly with CCGO's mission, and his outstanding slides and dynamic presentation emphasized to the attendees of both meetings the reasons that CCGO was established. The meetings were held in conjunction with AEG SoCal and AEG SF, and were chaired by AEG member Betsy Mathieson, of Exponent Failure Analysis. The 2003 CCGO Awards presented at the May Fundraisers included the following:

- 💧 **CCGO Community Geologist Award** - John Karachewski of AAPG (For a California geologist who has made a major difference in the profession and the public perception of geologists because of volunteer work or community service). John has donated the use of his spectacular photographs free for many years. (www.geoscapesphotography.com/)
- 💧 **CCGO Founders' Award** - Robert Tepel (For a California Geologist for life-long contribution to the profession and substantial contributions toward furthering the mission of CCGO). Bob is the principal founder of CCGO;
- 💧 **CCGO Gold Award** - Betsy Mathieson (For officers and volunteers of CCGO who have shown extraordinary dedication towards advancing the mission of CCGO);
- 💧 **CCGO Presidential Award** - Jane Gill (For officers and volunteers of CCGO who have shown dedication towards advancing the mission of CCGO);
- 💧 **CCGO California Geologist Hall of Fame, Living Legends Award** - Tom Dibblee, Jr. (For a living California

geologist who has done extraordinary lifetime work towards improving the profession of geology).

CCGO/AIPG Geoscience Awards presented at California Science Fair

CCGO members and AIPG representatives Jim Jacobs (AIPG President) and Dave Sadoff (AIPG VP) judged and presented the CCGO/AIPG Geoscience Awards at the California Science Fair on May 20. The awards included \$250.00 from CCGO to winners of Senior and Junior Divisions. AIPG subsidized travel costs for the judges. The Junior Division winner was Eric Leidersdorf of Los Angeles County for his project "Use Your Head(land)! An Experiment in Shore Protection". Mr. Leidersdorf explored the differences to shoreline and currents caused by breakwater geometry. The Senior Division winner was Allison Suarez of Calaveras County for her project "Solving the Mystery of the Penn Mine Wetland". Ms. Suarez wished to find out what caused the low pH in the Penn Mine wetland during the 2002 rainy season; and why the wetland removed dissolved iron during the rainy season while most other dissolved metals increased. For the complete press release, go to <http://ccgo.org/Education/2003SFA.html>

CCGO 2003 Legislative Research Grant

The California Council of Geoscience Organizations (CCGO) is seeking a California student to assist us in accomplishing one of our goals and objectives. This student would research compiled lists of geoscience-related regulatory databases, compile a list of proposed laws, regulations, ordinances, statutes, codes, and guidelines, and work with CCGO to undertake research necessary for preparation of position and background papers. CCGO will provide a stipend of \$1000 for this

work, and the student will be considered for future work. For more information, please go to www.ccco.org or contact the CCGO Executive Director at JaneHGill@aol.com. Email only, please.

CCGO Programs under Siege

The Strong Motion Instrumentation Program (SMIP) and Seismic Hazards Mapping Program (SHMP) of the California Geological Survey (CGS) strong-motion sites are both in danger of being cut in the current legislative session due to the state budget crisis. CCGO urges you to write your legislator on this issue. Details on the programs, sample letters, and addresses are posted at www.CCGO.org.

California Tightens Drinking Water Standards

BY JANE GILL

California's Department of Health Services has finalized new regulations that tighten standards for several drinking water contaminants to lower than federal standards. The changes are as follows: 1,2,4-trichlorobenzene (from 0.07 mg/L (the federal standard) to 0.005 mg/L); atrazine (0.003 mg/L to 0.001 mg/L); cyanide (0.2 mg/L to 0.15 mg/L); ethylbenzene (0.7 mg/L to 0.3 mg/L); methoxychlor (0.04 mg/L to 0.03 mg/L); and oxamyl (0.2 mg/L to 0.05 mg/L). Atrazine's detection limit for purposes of reporting also changed. The new limits become effective June 12. You can view the regulations at <http://www.dhs.cahwnet.gov/ps/ddwem/publications/Regulations/MCLrevision/s6-12-03.pdf>.

California Regulatory Corner

DPR Proposes New Groundwater Protection Regs

BY JANE GILL

The California Department of Pesticide Regulation (DPR) has proposed new regulations to prevent groundwater contamination by identifying areas susceptible to pesticide contamination. One of six boards and departments within Cal/EPA, DPR regulates the sale and use of pesticides to protect human health and the environment. According to DPR Director Paul Helliker, the new regulations ensure safe pesticide use, while giving a wide range of options to growers.

The cornerstone of the proposed regulations is CalVul ("California Vulnerability"), a DPR-developed computer model, which identifies broad geographic areas where pesticides may run off or leach into soil. The model was constructed using almost 20 years of well monitoring and other data now compiled in DPR's well inventory database. The database and CalVul have enabled DPR to identify critical factors, including farming practices and soil conditions, associated with the soil-applied herbicides that most often find their way into groundwater.

Current regulations are guided by the Pesticide Contamination Prevention Act (Assembly Bill 2021), in which pesticides detected in groundwater were likely to be prohibited from use unless future contamination could be controlled. The program was based on limited mitigation measures and applied only to the one-square-mile "pesticide management zones" around contaminated wells. Only eight actively registered pesticides have been found in California groundwater after almost 20 years of groundwater monitoring. The proposed regulations focus on

preventing further contamination from those pesticides; DPR will continue to monitor for other pesticides in groundwater, and take action as appropriate.

Under the proposed regulations, scattered "pesticide management zones" (now a total of about 313,000 acres statewide) will be replaced by broader "groundwater protection areas" (GWPA's); DPR has identified about 2.4 million acres statewide that would qualify as GWPA's under the new regulations. A few highlights of the proposed regulations:

Seven pesticides now listed as groundwater contaminants (atrazine, simazine, bromacil, diuron, prometon, bentazon, and norflurazon) will require use permits within GWPA's;

Specific use practices, with mitigation options, will be required with any permits issued for those pesticides;

Protection areas may be designated as "runoff GWPA's" that require proper soil preparation before a pesticide application (such as tilling), or "leaching GWPA's" if soil conditions allow downward movement of pesticides with irrigation percolation.

A fact sheet on DPR's Ground Water Protection Program and a summary of the proposed regulations may be found at http://www.cdpr.ca.gov/docs/emppm/gwp_prog/factsheet.pdf. For the full text of the proposed regulations, go to www.cdpr.ca.gov/docs/legbills/rulepkgs.htm. The DPR press release is at <http://www.cdpr.ca.gov/docs/pressrsls/april10.htm>.

NGWA Upcoming Conferences

Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Remediation

Costa Mesa, California, will play host to the 20th annual National Ground Water Association exhibit and conference, "Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Remediation," set for August 20-22 at the Hilton Costa Mesa. Preconference workshops will be held on August 19; the exhibition will be held August 20-21.

The event, presented by NGWA and the American Petroleum Institute and cosponsored by the Groundwater Resources Association of California, will feature sessions on site characterization and monitoring, natural attenuation processes, MTBE and ethanol, remediation technologies, cleanup goals and site closures. Preconference workshops will focus on LNAPLs, oxygenates, site models for characterizing and remediating contaminant release sites, and indoor air/vapor pathways.

Additional cosponsors are the U.S. EPA Region 9 Office of Underground Storage Tanks and the California State Water Resources Control Board. For information or to register for either of these conferences, visit the "Events & Education" section of the NGWA Web site, www.NGWA.org, or contact NGWA's customer service department at (800) 551-7379.

NGWA Co-Sponsors Darcy and Hubbert Sessions and Offers Darcy Lecture at GSA Annual Meeting in Seattle

The Association of Ground Water Scientists and Engineers, an NGWA membership division, is pleased to co-sponsor two commemorative topical

Alliance Corner

sessions at this year's GSA Annual Meeting, which will take place November 2-5 in Seattle, Washington.

Of 152 proposed sessions, 33 are related to hydrogeology, sessions are listed at <http://gsa.confex.com/gsa/2003AM/top/index.epl>. The final number of sessions will depend on the number of abstract submissions. The deadline for submissions is 12 a.m. PST, July 15.

Among the occasions being recognized with topical sessions are the 200th birthday of Henry Darcy and the 100th birthday of M. King Hubbert. "*Henry Darcy's 200th Birthday: Fundamental Advancements Through Observation and Analysis*" will include a historical

perspective of Darcy's accomplishments and recent, observation-based research that will fundamentally change our understanding of ground water flow and mass transport phenomena and help identify future research needs. Co-conveners for this session are Vicki Kretsinger (vkretsinger@lsce.com) and Graham Fogg (gefogg@ucdavis.edu). The session is co-sponsored by NGWA, the GSA Hydrogeology Division, the History of Geology Division of GSA, and the History of Earth Science Society. The Call for Abstracts for the Darcy session is posted at <http://www.ngwa.org/education/index.html> under GSA's November calendar listing.

Continued on page 17

California Groundwater Association Regulator Training, More Seminars Planned

BY MIKE MORTENSSON, CGA EXECUTIVE DIRECTOR

Almost 50 personnel from regulatory agencies ranging from Long Beach to Quincy attended the highly successful CGA Basic Water Well Construction workshop at the California Environmental Health Association (CEHA) Annual Education Symposium in Napa this spring. Attendees received information on a variety of CA well standards and laws, geology and groundwater location, geophysical logs, drilling and well installation methods. A second Water Well Construction session will be held in southern California in the fall.

Well rehabilitation, geophysical logs and videos, constant pressure pump systems, and "fishing" methods for lost equipment are a few of the seminars being planned for CGA's 55th Annual Convention and Trade Show being held November 6-8 at Caesars Tahoe in Lake Tahoe, Nevada. The 2003 NGWA McEllhiney Lecture will also be presented. The trade show will be full of displays and rigs, and will include new systems that may help consultants and contractors meet NPDES and Stormwater permit requirements for well discharges. The State Water Resources Control Board has adopted a statewide general permit for well development and pump and aquifer testing discharges. CGA is continuing to focus on discharges and to promote the development of Best Management Practices and permit standards to minimize the impacts to well owners. If you'd like more info on the CGA convention and a chance to win a free stay at Caesars Tahoe during the convention, give us a call at 707-578-4408, fax to 707-546-4906 or email wellguy@groundh2o.org.

GSA Annual Meeting in Seattle

COMMEMORATIVE DARCY AND
HUBBERT SESSIONS; CALL FOR
ABSTRACTS – **DEADLINE JULY 15**

Among the occasions being recognized at this year's GSA Annual Meeting, which will take place November 2 – 5 in Seattle, are the 200th birthday of Henry Darcy and the 100th birthday of M. King Hubbert. "M. King Hubbert at 100: The Enduring Contributions of Twentieth-Century Geology's Renaissance Man" will review Hubbert's contributions to hydrogeology, structural geology, tectonics, and petroleum geology and explore his legacy as scientist, educator, citizen, and visionary. Invited presenters and their topics include: T.N. Narasimhan (University of California, Berkeley), "Hubbert as Citizen-Scientist: An Introduction"; Gregory Barenblatt (University of California, Berkeley), "Dimensional Analysis"; Craig Bethke (University of Illinois), "Ground-Water Motion and Hydrodynamics of Petroleum Entrapment"; Mark Zoback (Stanford University), "Hydraulic Fracturing"; Peter McCabe (USGS), "Longevity of Fossil Fuel Resources"; Fred Meissner (Colorado School of Mines), "Hubbert as Teacher". Co-conveners are Alan Fryar (afryar1@uky.edu) and T.N. Narasimhan (tnnarasimhan@lbl.gov). The M. King Hubbert session is co-sponsored by the GSA Hydrogeology Division; the National Ground Water Association (NGWA; an Associated Society of GSA); the U.S. National Chapter of the International Association of Hydrogeologists, and the History of Geology, Geophysics, Sedimentary Geology, and Structural Geology and Tectonics Divisions.


"Henry Darcy's 200th Birthday: Fundamental Advancements Through Observation and Analysis" will include

Alliance Corner

a historical perspective of Darcy's accomplishments and recent, observation-based research that will fundamentally change our understanding of groundwater flow and mass transport phenomena and help identify future research needs. Invited presenters include: John Cherry (University of Waterloo); Ghislain de Marsily (University of Paris); John Wilson (New Mexico Institute of Mining and Technology and Executive Director of the Consortium of Universities for the Advancement of Hydrologic Science Incorporated [CUAHSI]); and Charles Harvey (Massachusetts Institute of Technology). Co-conveners for this session are Vicki Kretsinger (vkretsinger@lsce.com) and Graham Fogg (gefogg@ucdavis.edu); the session is co-sponsored by NGWA, the GSA Hydrogeology Division, the History of Geology Division of GSA, and the History of Earth Science Society. The Call for Abstracts for the Darcy session is posted at <http://www.ngwa.org/education/index.html> under the November Calendar listing for GSA.

Volunteered oral presentations on these and related topics are welcomed. Abstracts must be submitted on-line at <http://gsa.confex.com/gsa/2003AM/index.epl>; follow the Topical Sessions link to #50 for the Darcy session and #51 for the M. King Hubbert session and check "hydrogeology" as a review category. **The deadline for submissions is midnight, Pacific Time, July 15, 2003.** Please note that abstracts will be subject to peer review and that acceptance cannot be guaranteed. In addition, GSA

specifies that a person cannot be listed as speaker on more than one volunteered abstract (invited presentations are excepted).

The 152 proposed sessions (33 related to hydrogeology) are listed at <http://gsa.confex.com/gsa/2003AM/top/index.epl>. The final number of sessions will depend on the number of abstract submissions, so get those abstracts in! Among other offerings, three field trips and two distinguished lectures are planned. Steve Gingerich (USGS) will reprise "Island and Coastal Hydrogeology of Hawaii" October 26 – 31. Roy Gephart (Pacific Northwest National Laboratory) and colleagues are offering "Geohydrology of the Hanford Nuclear Waste Site in the South-Central Columbia Plateau" November 5 – 7. Steve Ingebritsen (USGS) and colleagues will lead "Hydrogeology of Cascade Range Volcanoes: Mount St. Helens, Mount Hood, and Central Oregon" November 6 – 8. The Hydrogeology Division luncheon, business meeting, and Birdsall-Dreiss Distinguished Lecture (by Jean Bahr) will take place on the afternoon of Monday, November 3. On Tuesday afternoon, the hydrogeology poster sessions will be held, followed by the NGWA Henry Darcy Distinguished Lecture. Richelle Allen-King will present "A Hydrogeochemist's Perspective on Organic Contaminant Transport in Groundwater." The Hydrogeology Division student reception will follow Richelle's lecture. Detailed information is available at www.geosociety.org/meetings/2003/. 

California Water Quality Coordination Program

BY CHRISTINE FRENCH,
REGIONAL WATER QUALITY
LIAISON, UC CENTER FOR
WATER RESOURCES

The California Water Quality Coordination Program is sponsored through the University of California Center for Water Resources as a means to tie together the efforts and resources of water quality programs throughout the state. One task we have undertaken to achieve that purpose is the development of a page on the Center for Water Resources website (www.waterresources.ucr.edu – Water Quality Program link) highlighting resources within the state, and organized by themes. The themes are the same as those identified by the USDA Cooperative State Research, Education, and Extension Service's

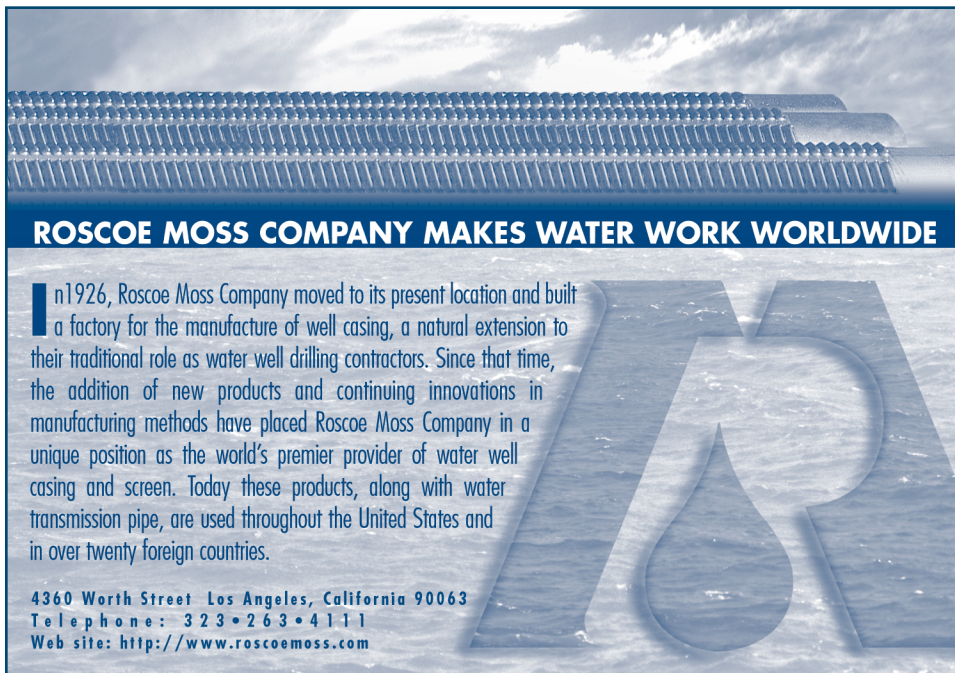
Education Corner

(CSREES) National Water Quality Coordination Program, which include Animal Waste Management, Drinking Water and Human Health, Nutrient and Pesticide Management, Pollution Assessment and Prevention, Watershed Management, and Water Conservation and Agricultural Water Management. Although still in development, the Water Quality Program website is envisioned to provide information and links as they relate to those various themes. Educational materials developed through the program, and focused around the same themes, will also be available on the website.

To further coordinate efforts and resources, we are an active member of the Regional (EPA Region 9) CSREES Water Quality Coordination Program. The goals of the regional program reflect the same desire as our state program to make research, education, and extension resources of the university system more accessible to federal, state, and local water quality improvement efforts, but on a larger,

regional scale. To assist in the realization of this goal, we are participating in the development of a regional website. The regional site is currently scheduled to go online June 1, 2003, and will be a link from the national CSREES site at www.usawaterquality.org. This site will provide information on a regional scale (the region includes Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of Northern Mariana Islands, Federated States of Micronesia, Guam, and Palau) of common issues, projects, and extension resource materials.

Between the two websites, we expect to provide a useful resource for agencies and individuals interested in water quality issues, whether the focus is on an agricultural, urban, or household level. Serving as a liaison between regulatory agencies, stakeholders, and program coordinators, for both the state and regional programs, Christine French is interested in hearing any feedback visitors to the websites may have. To provide information about your program, or gather information about ours, please contact Christine at 909-787-4327 or christine.french@ucr.edu.



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"California Dreaming"

GUEST EDITORIAL
BY MARTIN STEINPRESS, R.G.,
C. HG., GRA DIRECTOR

Imagine this: You are starting a groundwater investigation. You go to the State's website for well records and groundwater information and can download not just water levels for the region, but reports of previous investigations in the area, the locations of all nearby wells, well construction information (including screen interval!), geologic and geophysical data, and water quality data. Instead of being limited to a myopic analysis of the area in question, your groundwater investigation is unconstrained by a well confidentiality law and under-funded data management. You must be dreaming, right? No, you are in Arizona, New Mexico, or any other western state or, for that matter, almost any other state in the U.S.

Check out the following state websites for examples of well information (Thanks to Betsy Woodhouse of Southwest Hydrology for these links):

- ◆ **Arizona:** Well logs are available online at the Well55 registry: <http://www.water.az.gov/adwr/content/ImagedRecords/default.htm>
- ◆ **Nevada:** Well logs for Nevada available online at: <http://water.nv.gov/IS/wlog/wlog.htm>
- ◆ **New Mexico:** Well logs can be ordered through NM Bureau of Geology & Mineral Resources: http://geoinfo.nmt.edu/publications/other_pubs.html and from the Office of the State Engineer: <http://www.seo.state.nm.us/water-info/index.html>

Unfortunately, California is a different situation. It is the only western state (and one of only two states in the U.S.) with a well confidentiality law and largely inaccessible groundwater data. While we spend billions to promote groundwater

Editorial Page

storage and conjunctive use, practicing professionals generally do not have access to the basic data necessary to make informed recommendations and decisions. Homeowners cannot anticipate the water level and water quality of a new well based on neighboring wells. Unless one is working for a public agency, you cannot even get drillers logs for nearby wells. In addition, increasing security concerns have reduced the availability of water quality data from the Department of Health Services, even for many investigations conducted by licensed or registered professionals to protect groundwater supplies.

If California's groundwater resources are truly important, why should individual property rights and a drilling company's desire to limit competition outweigh access necessary for the protection of that resource? How bad must our water supply crisis get before California changes this unsatisfactory situation? As detailed previously in *HydroVisions* (http://www.grac.org/Fall_2001.pdf), GRA sponsored legislation in 1994 to allow greater access to well completion reports by registered groundwater professionals, but last minute lobbying of the Governor by special interests killed the effort.

Perhaps the development of uniform data management standards and transfer protocols resulting from the AB599

Interagency Task Force can lead to both improved data quality and greater availability of essential data for groundwater professionals (see http://www.leginfo.ca.gov/pub/bill/asm/ab_1151-1200/ab_1159_bill_20030221_introduced.pdf). The lithologic data on well completion reports is typically sketchy at best, and one recommendation of DWR's Bulletin 118 Update 2003 is to augment driller's logs, where feasible, with geophysical logs (<http://www.waterplan.water.ca.gov/groundwater/118index.htm>). Once groundwater data are standardized, the quality improved, and compiled in a database such as the State Board's online Geotracker database (<http://geotracker.swrcb.ca.gov/>), groundwater professionals need access to that data and information to more effectively protect human health and the environment.

We welcome feedback on this important issue, and look forward to developing the increased support necessary to make changes in the California's system.

Martin Steinpress is GRA's HydroVisions committee chair, and Chief Hydrogeologist and National Groundwater Resources Service Leader in Brown and Caldwell's Walnut Creek, California office (925-210-2408; msteinpress@brwncald.com). ◆

Deep Waters



Organizational Corner

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2003 ANNUAL AWARDS PROGRAM

NOMINATIONS REQUESTED
FOR THE GRA LIFETIME ACHIEVEMENT
AND KEVIN J. NEESE MEMORIAL AWARDS

The GRA Awards Committee is accepting nominations for GRA's 2003 Lifetime Achievement and Kevin J. Neese Memorial Awards (see description below). Nominations for either award should indicate the reason you are making the nomination, a brief statement of qualifications of the nominee and your full contact information. Email nominations to Brian Lewis, Awards Committee Chair, at blewis@dtsc.ca.gov by July 23, 2003. Nominations will be reviewed at GRA's August 16, 2003 Board meeting, and the awards will be presented at GRA's Annual Meeting on September 28-29, 2003. Should you have any questions about the nomination process, please contact Brian Lewis.

Goal

The purpose of the GRA Awards Program is to recognize noteworthy projects and unique individual contributions related to the protection and management of groundwater in California.

Objectives

The objectives of the Annual Awards Program are:

1. To provide recognition to individuals who have demonstrated leadership and continuous dedication in the field of groundwater management;
2. To provide recognition for unique contributions to the field of groundwater management in 2002; and,

3. To provide recognition to GRA (as an organization) whose mission is dedicated to resource management that protects and improves groundwater through education and technical leadership.

Awards

LIFETIME ACHIEVEMENT: presented to individuals for their exemplary contributions to the groundwater industry, contributions that have been in the spirit of GRA's mission and organization objectives. Individuals that receive the Lifetime Achievement Award have dedicated their lives to the groundwater industry and have been pioneers in their field of expertise.

Previous Lifetime Achievement Award winners include:

2002 – Thomas W. Dibblee, Jr.

2001 – Carl Hauge

2000 – Joseph H. Birman

1999 – David Keith Todd

1998 – Eugene E. Luhdorff, Jr.

KEVIN J. NEESE: recognizes significant accomplishment by a person or entity within the most recent 12-month period that fosters the understanding, development, protection and management of groundwater.

Organizational Corner

Previous Kevin J. Neese Award winners include:

2002 – Glenn County Water Advisory Committee for formulating a significant groundwater management ordinance that was adopted by the Glenn County Board of Supervisors.

2001 – American River Basin Cooperating Agencies and Sacramento Groundwater Authority Partnership for fostering the understanding and development of a cooperative approach to regional planning, protection and management of groundwater.

2000 – Board of Directors of the Chino Basin Watermaster for delivering a remarkable OBMP that created a consensus-based approach for making water supplies in the Chino Basin more reliable and cost effective.

1999 – Governor Gray Davis for his work and leadership in addressing MTBE. 💧

GRA Branch Officer Appointed to California's State Mining and Geology Board

Julian Isham, GRA's San Francisco Bay Branch Vice President, has been appointed by Governor Gray Davis to California's State Mining and Geology Board. Mr. Isham, of EMCON/OWT, a subsidiary of The Shaw Group's environmental and infrastructure division, has more than 29 years experience in engineering, hydrogeologic investigations, groundwater resource development, groundwater contamination studies, mining and waste management. He has worked on many solid waste projects in the State of California, including a number of groundwater demonstration projects for private and public sector clients to substantiate the effectiveness of a single composite landfill liner system.

Congratulations Julian! 💧

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For additional information, visit GRA's Web site at www.grac.org or contact Kathy Snelson, GRA Executive Director, at executive_director@grac.org or 916-446-3626.

Organizational Corner

GRA Welcomes the Following New Members

FEBRUARY 4, 2003 - JUNE 16, 2003

Aguilar, Jeff	Cambria Environmental Technology, Inc.	MacLeod, N. Scott	Cambria Environmental Technology, Inc.
Bennett, Peter	Geomatrix Consultants, Inc.	Makerov, Mike	URS Corporation
Bold, Jeff	Montgomery Watson Harza	Marinai, Rob	Cambria Environmental Technology, Inc.
Boockoff, Leslie	Geomatrix Consultants, Inc.	Mearon, Sarah	Geomatrix Consultants, Inc.
Bourgault, West	Geocon Consultants, Inc.	Meyers, Matt	Cambria Environmental Technology, Inc.
Brady, John	Southern California Water Company	Molnaa, Barry	ARCADIS Geraghty & Miller, Inc.
Briney, Leah	WRIME, Inc.	Munz, Melody	Cambria Environmental Technology, Inc.
Brittingham, Jeff	Geomatrix Consultants, Inc.	Nagle, Brady	Cambria Environmental Technology, Inc.
Campbell, Andrew	URS Corporation	Nelson, Nicole	Daniel B. Stephens & Associates, Inc.
Carr, James	J Carr Consultant	Niland, Joe	Montgomery Watson Harza
Clark, Michael	Kleinfelder	Olson, Jason	Cambria Environmental Technology, Inc.
Clark-Riddell, Robert	Cambria Environmental Technology, Inc.	Peekema, Richard	
Cloud, Michael	County of Santa Cruz, Dept. of Public Works	Procyk, David	Hydrolab
		Ramirez, Elena	Iris Environmental
Duke, Harold	DTSC, Reg I	Regan, Tom	Bookman-Edmonston
Eyre, Julie	Geomatrix Consultants, Inc.	Rogers, Brad	England Geosystem, Inc.
Fallon, Mike	Montgomery Watson Harza	Russell, Larry	REED International Ltd.
Flores, William	Wallace-Kuhl & Associates, Inc.	Sterling, Jenny	Daniel B. Stephens & Associates, Inc.
Fordham, Eric	GeoPentech, Inc.	Stevens, Kristen	ARCADIS Geraghty & Miller, Inc.
Fruciano, Edana	Alpha Analytical, Inc.	Swanson, Ken	Boyle Engineering Corporation
Gaarder, Jeffrey	Cambria Environmental Technology, Inc.	Taghavi, Ali	WRIME, Inc.
Gianquinto, Jason	Boyle Engineering Corporation	Tana, Cameron	ENVIRON International
Gibbons, Marianne	Treadwell & Rollo, Inc.	Tapia, Joseph	Carollo Engineers
Haney, Doug	Geomatrix Consultants, Inc.	Tonkin, Matthew	S.S. Papadopoulos and Associates, Inc.
Hewitt, John	California Farm Bureau Federation	Tosk, Tambrey	LEE & RO, Inc.
Howard, Mark	Howard Pump, A Division of Beylik Drilling	Umstot, Todd	Daniel B. Stephens & Associates, Inc.
		Vavricka, Emily	DPR
Howell, Bill	Baseline Environmental Consulting	Weiss, Richard	Weiss Associates
Hubbard, Patrick	Treadwell & Rollo, Inc.	Wheeler, Randy	Wallace-Kuhl & Associates, Inc.
Hudson, Bryant	Lawrence Livermore National Lab	Worsley, Jennifer	Apex Envirotech, Inc.
Itagaki, Sachiko	Kennedy/Jenks Consultants	Zemo, Dawn	Zemo & Associates LLC
Jacobson, Jan	Montgomery Watson Harza		
James, Terry	Montgomery Watson Harza		
Kessel, Lowell			
Leclercq, Darcie	Wallace-Kuhl & Associates, Inc.		
Linderfelt, William	HydroTerra		
Litwin, Yoram	Ramlit Associates		
Loizeaux, Nick	Iris Environmental		

Jim Jacobs Travels to Jamaica in March on Fulbright Grant

GRA Director and CCGO Past President Jim Jacobs recently shared environmental assessment and remediation concepts used in the United States with academics, students, regulators, and professionals in Jamaica on a Fulbright Senior Specialist Grant. His host for the March 23 through April 5, 2003 assignment was Professor Jasminko Karanjac at the University of the West Indies (UWI), Mona Campus in Jamaica. The Council of International Exchange of Scholars (CIES) selected Jacobs for this award. The Fulbright Program started shortly after WWII to promote mutual understanding and respect between the United States and other nations, and is administered by the U.S. government through the CIES in cooperation with over 140 countries. The program emphasizes academic and professional excellence, with awards based on open competition.

Presentations at UWI

Jacobs' presentations at UWI included a variety of groundwater topics typical of developing countries, and other issues specific to Jamaica. Unlined landfills outside of Kingston, situated in areas of shallow groundwater along the south shore, reflect challenges in handling solid waste in this tiny area. Aluminum processors in the central highlands produce high-sodium wastewater that is discharged into unlined ponds. Sodium-rich water percolating into local fractured limestone aquifers, saltwater intrusion caused by overpumping, and nitrate contamination of groundwater associated with sugar cane industry agricultural practices were some of the other topics. Environmental problems specific to the local economy included some interesting information on Jamaican rum. Rum is distilled in a centuries-old tradition utilizing a fermentation and distillation process, leaving a mash waste product called "dunder". When released to the environment,

it contributes to anoxic conditions in local streams and groundwater, leading to major fish kills.

A three-hour seminar for professionals included environmental remediation technologies in the United States and an overview of environmental regulations in the USA. Following the lectures and seminar, Jacobs and Dr. Karanjac met with a number of high-level U.S. Embassy and senior Jamaican government environmental personnel to discuss the environmental needs of Jamaica and ways the U.S. programs might assist the island. Jacobs ended his assignment by reviewing the syllabus for a new Masters Degree Program in Water Resources Management, developed this spring by Professor Karanjac of UWI, and planned for implementation in Fall 2003 and Spring 2004. For further information, Jim can be contacted at [Environmental Bio-Systems, Inc. augerpro@jps.net](mailto:augerpro@jps.net).

24th Biennial Groundwater Conference and 12th Annual GRA Meeting - Continued from Page 4

- Contaminant fate and transport
- Calculating a groundwater budget
- Transboundary and international issues

Poster Presentation: Registered participants are invited to present posters summarizing results of their professional work that are relevant to groundwater issues in California. Participants interested in giving a poster presentation are invited to prepare and submit an abstract. The deadline for submitting an abstract is August 8, 2003. Visit conference web sites for instructions.

Visit the University of California Water Resources Center web site, <http://www.waterresources.ucr.edu>, for more details as they develop. For more information, contact Pamela Dick at the UC Center for Water Resources, (909) 787-4327. Information will also be posted at www.grac.org.

NGWA Upcoming Conferences - Continued from Page 10

"*M. King Hubbert at 100: The Enduring Contributions of Twentieth-Century Geology's Renaissance Man*" will review Hubbert's contributions to hydrogeology, structural geology, tectonics, and petroleum geology and explore his legacy as scientist, educator, citizen, and visionary. Co-conveners are Alan Fryar (afryar1@uky.edu) and T.N. Narasimhan (tnnarasimhan@lbl.gov). The session is co-sponsored by the GSA Hydrogeology Division, NGWA, the U.S. National Chapter of the International Association of Hydrogeologists, and the History of Geology, Geophysics, Sedimentary Geology, and Structural Geology and Tectonics Divisions. Detailed information is available at www.geosociety.org/meetings/2003/.

Mark Your Calendars

"Ground Water in Coastal Zones: Availability, Sustainability, and Protection," is the theme for this year's Annual Meeting and Conference of the Association of Ground

Water Scientists and Engineers, an NGWA membership division. The event is part of the NGWA Ground Water Expo, which is December 9-12 at the Orange County Convention Center in Orlando, Florida. For more information or to register, visit NGWA's Web site at www.NGWA.org, or call NGWA customer service at (800) 551-7379.

GRA Hits the Steps of the State Capital - Continued from Page 6

Details on all the bills and their status can be found at <http://www.leginfo.ca.gov/pub/bill/asm/>

In light of the current budget crisis, current and future bond funding will likely be the only source of State monies for the protection of groundwater resources and long term water reliability. For these reasons, **GRA strongly supports maintaining groundwater quality, monitoring and infrastructure development in any such funding decisions or allocation vehicles.**

GRA's Artificial Recharge Workshop Percolates in San Jose - Continued from Page 1

Session One: Overview of Artificial Recharge

Session one provided an overview of some artificial recharge projects which have been implemented across the United States, and current and planned artificial recharge in California, including an inventory and categorization of current activities, the role of artificial recharge in long-term water-resource planning for the state, status of grant programs and other mechanisms for funding/facilitating artificial recharge programs. The session included discussions on subsurface considerations for recharge projects, and techniques for quantifying groundwater recharge. Bill Alley, Chief of the Office of Groundwater at the U.S. Geological Survey (USGS), started off the symposium by discussing general methods of artificial recharge (spreading, well injection, and induced from surface-water bodies), and providing an overview of some USGS historic artificial recharge studies. John Woodling, Chief of the Conjunctive Water Management Branch, California Department of Water Resources (DWR), described a historic definition of conjunctive use as combining surface and groundwater storage in a coordinated plan, the maximum service will be attained from these waters. Components of conjunctive use programs include a surface water supply, conveyance, recharge facilities, groundwater storage capacity, extraction facilities, and institutions to manage the program. Daniel B. Stephens, founder Daniel B. Stephens & Associates, Inc., discussed subsurface considerations of artificial recharge projects, and Bridget Scanlon, Research Scientist at the University of Texas at Austin, Bureau of Economic Geology, provided an overview of techniques for quantifying recharge. An update on California Department of Water Resources Bulletin 118: California's Groundwater was presented at lunchtime

by Carl Hauge, Chief Hydrogeologist, California Department of Water Resources.

Session Two: Hydrologic Challenges of Artificial Recharge

The second session included presentations on some saturated and unsaturated flow considerations (including facility design and operation), use of models (simulation and optimization) to evaluate project benefits and potential impacts, surface-water/ground-water interaction, variability and uncertainty in surface water supplies, and monitoring design and instrumentation. Alan Flint, Research



GRA's Santa Clara Valley Water District field trip visits diversion structure for the District's Alamitos Recharge Ponds on the Guadalupe River in San Jose on May 2, 2003.

Hydrologist, US Geological Survey, Water Resources Division, presented information the role of unsaturated zone, which plays a critical role in transporting and storing artificially recharged water. Detailed characterization of the unsaturated zone, including geologic logging, geophysical methods, and borehole instrumentation, is a critical part of determining suitability of a site for artificial recharge, as well as the most effective methods of surface or subsurface application of water. Steve Phillips, Hydrologist, US Geological Survey, Water Resources Division, presented information on non-standard techniques used to monitor hydraulic and subsidence-related effects of an aquifer-storage-recovery (ASR) program,

conducted in Lancaster, California, in cooperation with Los Angeles County and the Antelope Valley-East Kern Water Agency. Wes Danskin, Research Hydrologist, US Geological Survey, Water Resources Division, discussed how groundwater numerical simulation and optimization techniques are applied in a variety of ways for groundwater resources management to more effectively utilize available water, allocate groundwater resources, and evaluate conjunctive water management options. James Reilly, Water Resources Engineer, Stetson Engineers, Inc., presented an overview of the Chain of Lakes Recharge Project in the Livermore Valley of the Zone 7 Water Agency of Alameda County, where optimization of recharge will be a key requirement of a successful project.

Roger Putty, Supervising Engineer, Montgomery Watson Harza (MWH), discussed the Stony Creek Fan Conjunctive Water Management Program's pilot recharge investigation, located in the Sacramento Valley between Redding and Sacramento. The project is a regional cooperative effort of the Orland Unit Water Users' Association, Orland-Artois Water District, and Glenn-Colusa Irrigation District, with local assistance provided by DWR. The project objectives include protecting local surface water and groundwater resources, improving water supply reliability and affordability, improving operational flexibility, to better utilize available water supplies, protect and enhance the environment.

Session Three: Water Quality and Microbial Challenges of Artificial Recharge

The third session focused on the water quality and microbial challenges of artificial recharge. Topics included organic and inorganic chemistry issues, changed environmental conditions and potential for mobilization of natural or man-made

contaminants, use of tracers, disinfection byproducts, reclaimed water quality issues, the role of emerging contaminants, evaluating and monitoring bacteria and viruses, transport of viruses and bacteria, new analytical methods, and design and operation issues. John Izbicki, Research Hydrologist, US Geological Survey, Water Resources Division, discussed the use of chemical and isotopic tracers to assess hydraulic connections between shallow and deep aquifers intended for injection and recovery of imported water in the East Bay Plain, CA. Roy Schroeder and Rob Anders, both with the US Geological Survey, Water Resources Division, presented the results of microbial and chemical tracer tests to assess fate and transport of recharged water in the Los Angeles basin. Miranda Fram, Research Chemist, US Geological Survey, Water Resources Division, presented on treated water considerations in ASR projects, including the formation of trihalomethanes (THMs) in chlorinated injection water in the Antelope Valley, CA. Bob Whitley, Executive Vice President, Whitley, Burchett & Associates, summarized the regulatory requirements for artificial recharge, including the evolving DHS guidance for recharge projects. Jill Densmore, Hydrologist, US Geological Survey, Water Resources Division, presented the results of nitrate studies in Yucca Valley, which have found septic systems to be a major contributor to water quality degradation. Steve Bachman, Groundwater Programs Manager, United Water Conservation District, presented an overview of the District's challenges (including overdraft, seawater intrusion, nitrates, faulted aquifers, improperly abandoned wells) and the role of groundwater recharge in addressing them. Ted Johnson, Senior Hydrogeologist, Water Replenishment District of Southern California, discussed the challenges of recycled water injection in the Los Angeles groundwater basins' seawater injection barriers, the largest of which is public perception. Ken Belitz of

Of the tools California has to manage its water challenges, artificial groundwater recharge will continue to be important and increase.

the U.S. Geological Survey wrapped up the session with an overview of AB 599 and the technical approach to the development of a statewide groundwater monitoring program.

Session Four: Policy Challenges Roundtable

The final session featured a roundtable on water rights, funding (federal, state, local, private), economics (cost-benefit analysis), water transfers, public perception, and legislation. The following panelists presented and answered questions on the policy challenges facing artificial recharge projects.

- 💧 **Naser Bateni**, Director of Water Resources, Bookman-Edmonston Engineering
- 💧 **Ron Donlan**, Parter, Ellison, Schneider & Harris
- 💧 **Gary Yamamoto**, Chief, Drinking Water Technical Programs, California Department of Health Services
- 💧 **Grace Chan**, Manager, Resource Planning & Development, Metropolitan Water District of Southern California
- 💧 **Mike Tognolini**, Senior Civil Engineer, East Bay Municipal Utility District
- 💧 **Jeff Micko**, Engineering Unit Manager, Santa Clara Valley Water District

Santa Clara Valley Water District Recharge Facilities Field Trip

On the day following the meeting, about 50 people attended a field trip to the Santa Clara Valley Water District, where artificial recharge to manage subsidence has been occurring since the 1930s. Attendees toured the recharge facility and spreader dam, and viewed the San Jose extensometer and the Coyote Creek Outdoor Classroom where the USGS has a multiple-aquifer monitoring well. Concern over significant water level drops and subsidence in Santa Clara Valley in the 1920's led to the formation of the Santa Clara Valley Water

Conservation Committee, the first focused-area studies of causes and plans for mitigation, and the subsequent forming of the Santa Clara Valley Water Conservation District. Since the 1930's, Santa Clara Valley has had an artificial recharge program to assist in restoring water to the underlying aquifers, reduce subsidence and minimize further declines in groundwater elevations. The water district currently operates 18 major recharge systems, which consist of a combination of off-stream and in-stream facilities.

GRA wishes to thank the SCVWD for hosting the field trip, as well as the workshop's co-sponsors, presenters, organizing committee, and moderators for contributing to a successful meeting. 💧

Calculated Solutions to Common Ground Water Questions - Continued from Page 5

- 💧 Drawdown Calculator (solves C. E. Jacob's modified non-equilibrium formula)
- 💧 Radius Calculator (radius of the cone of depression at zero drawdown when transmissivity, days of pumping, and storage are entered)
- 💧 Weight Calculator (determines the weight per foot and the total weight of an object casing materials)
- 💧 Horsepower Calculator (horsepower required to pump a given capacity (GPM) against a total dynamic head in feet at some input efficiency)
- 💧 Collapse Strength of Casing Materials
- 💧 Affinity Laws (define the effects of pump speed changes on centrifugal pumps)

The nine programs discussed comprise the suite of Professional tools offered in this package.

A Contractor suite has another comparable set of tools. If interested, please contact the author at 6449 Laguna Mirage Lane, Elk Grove, CA 95758, or by phone at 916-691-6962, or by e-mail at AC^XQ@msat.org. 💧

Sacramento Branch Highlights

BY STEVE PHILLIPS AND PAT DUNN

The speaker for the March 2003 meeting was Dr. Steven Book of the Department of Health Services (DHS) in Sacramento, who presented an update on DHS activities related to xenobiotics and artificial recharge. Dr. Book is Chief of the DHS Drinking Water Program's Monitoring and Evaluation Unit and advises staff and management of the Drinking Water Program on a variety of issues, including the health risks associated with drinking water contaminants. Contaminants in water recharged for indirect potable reuse is an important issue for DHS, which is in the process of developing a number of related guidance documents, advisory action levels, and regulations. Pharmaceuticals, over-the-counter drugs, common home-oriented products, hormones, and contaminants that act as endocrine disrupters present challenges with respect to regulation. The long-term effects of these contaminants on human health are largely unknown, and analytical methods for measuring very small concentrations of the more acute contaminants are not readily available. DHS will begin with guidance documents and advisory action levels for these types of contaminants, followed by regulations once the medical data and analytical techniques are further developed.

A legislative update was the topic of the April 2003 meeting, presided over by Chris Frahm, an attorney and lobbyist with Hatch and Parent and the legislative advocate for GRA. Ms. Frahm also is a former chairwoman of the Board of the San Diego Water Authority and former Vice-Chairwoman of the Board of the Metropolitan Water District. She covered a wide range of water-related topics tied to proposed or developing legislation,

including Colorado River issues, water quality and contamination issues, bond funds for water supply and infrastructure, urban and regional water management plans, and water conservation. Also discussed were recent bills related to standards for groundwater data, groundwater management plans, and groundwater contamination. GRA is planning to have an increased role in the legislative arena, so members are encouraged to contact Ms. Frahm with issues of concern (see grac.org for legislative information and contact information for Ms. Frahm).

In May 2003, Dr. Bryant Hudson and Dr. Jean Moran presented some nonstandard vulnerability assessment techniques for public supply wells. Bryant and Jean work for Lawrence Livermore Labs with the Ambient Groundwater Monitoring and Assessment program, sponsored by the California State Water Resources Control Board. The primary techniques they used in their vulnerability assessments were ultra low-level measurements of volatile organic compounds (VOCs) and groundwater age dating (using the tritium-Helium-3 method). Bryant provided some insight on the occurrence of excess air in recharge areas and associated changes in ground water chemistry. Jean provided information on the use of tritium-Helium-3, nitrates, low level VOCs and other anthropogenic compounds in ground water to assist in vulnerability assessments. Dissolved noble gases were used to better understand the age distribution of water into wells. The information was related directly to Sacramento Valley when Jean presented some oxygen isotope/river water recharge studies with water quality data from 28,000 wells. 💧

San Joaquin Valley Branch Highlights

BY BILL PIPES, PRESIDENT

The San Joaquin Valley Branch meets every third Thursday of the month. We continue to have a strong and diverse showing at our meetings. I would like to thank GRA member and geologist Greg Issinghoff, Central Valley RWQCB, for being in charge of our speaker program this year – the speaker lineup has been especially strong. The March 2003 meeting was held in Fresno and featured geologist Mr. Dwight Hoening, Vice President of Clayton Group Services. Dwight's presentation was "The Problem with Dry Cleaners: A Presentation on the Technical and Environmental Issues Posed by Dry Cleaning Operations". Dwight was formerly with the DTSC and the U.S. EPA.

At the April 2003 meeting in Fresno, we enjoyed a presentation by Dr. Robert Negrini of the Department of Physics and Geology, California State University at Bakersfield. Dr. Negrini spoke on "CSUB Kern Water Bank Project: Fundamental Geological Processes Governing the Aquifer Characteristics of Arid-Region Water Banks". Dr. Negrini's work includes a study of arsenic mobilization in San Joaquin Valley aquifer systems.

Ms. Tricia Wathen, P.E., Homeland Security Engineer, California Department of Health Services, Southern California Drinking Water Field Operations Branch spoke at the May 2003 meeting in Fresno. Tricia spoke on "Drinking Water System Security". Tricia impressed upon us the vulnerability of our water systems to terrorism and the steps her department is taking to reduce the threats. We also had a lively discussion of the decreasing availability of public well data to hydrogeologists – an issue being taken up by GRA at the state level.

The San Joaquin Valley Branch has been awarded a 2003 Stormwater Quality Public Information and Education Program Grant from the Fresno Metropolitan Flood Control District. I would like to thank GRA member and geologist Bruce Myers, Central Valley RWQCB, for taking the lead on getting this grant. We will be using the grant to fund a field trip to be held this fall on the Fresno-Clovis urban area water system.

The June 2003 meeting will be held in Bakersfield. The meeting is scheduled for June 17, 2003 at the Woolgrowers Restaurant in Downtown Bakersfield. Our speaker will be GRA member Mr. Tom Haslebacher, Geologist for the Kern Water Agency. Tom will be making a presentation on "Managing the Groundwater Resources of Kern County". Tom is the founding Vice President of the San Joaquin Valley Branch, and he has much experience in managing, monitoring, and protecting groundwater supplies in the Southern San Joaquin Valley. He happens to be one of the funniest geologists I know – it should be great meeting!

We will be taking the months of July and August 2003 off, and we will resume again in September. Please check out the GRA Web site for meeting announcements and other updates from the San Joaquin Valley Branch. 💧

Southern California Branch Highlights

BY TONY MAGGIO, PRESIDENT

The Southern California Branch has had two meetings, which held substantial interest to our members, since our last report. On March 19, 2003 the Branch's distinguished speakers included Mr. Ken Williams – Chief of the Underground Storage Tank Program for the Regional Water Quality Control Board (RWQCB) – Santa Ana Region and Mr. Dixon Oriola – Chief of the Well Investigation Program for the Los Angeles RWQCB.

Mr. Williams gave a regulatory update on the contaminants MTBE and its breakdown product, tertiary butyl alcohol (TBA). He presented site examples and illustrated the regulatory process involved in the petition for site closure.

Mr. Oriola spoke about the current state of affairs in California with the contaminant perchlorate. He covered areas within the region where perchlorate has been found, such as the Jet Propulsion Laboratory in Pasadena, and also spoke about the areas where it probably would be found if it were tested for. Areas over California that are at highest risk are the past and current military bases, where during the 1950's missile sites were established and tested. Mr. Oriola indicated that many of these sites have not been assessed adequately. The RWQCB is now in the initial stages of identifying potentially responsible parties (PRPs) who will be asked to sample for perchlorate.

At the May 14, 2003 meeting, Mr. Roy Herndon of the Orange County Water District spoke to our members about some of the challenges the District is facing within its groundwater basins. Groundwater deficits have become an issue. Percolated groundwater from rainfall contributes approximately 250,000 acre-feet of water to the aquifers. However, the 200 wells the District has in production extract 350,000 acre-feet. Some of the plans underway at the District to help stem the deficit include trying to increase storage behind the Prado Dam and injecting more groundwater along the Talbert Barrier using treated wastewater from Water Factory 21. This would have the dual benefits of decreasing saltwater intrusion while also adding more water to storage. An additional 70,000 acre-feet might be able to be injected. Mr. Herndon also hinted that eight new desalination plants are in the works up and down the coast.

Our next scheduled dinner meeting is on September 17, 2003, at the Wyndham Gardens Hotel in Irvine. Elections for Southern California Branch officers will be held at the November 12, 2003 dinner meeting. So if there are any interested professionals out there who may have thought about getting more involved with the organization, now is the time to start planning your move! 💧

“Water 2025” – An Interior Proposal for Public Discussion on Water Issues


- Continued from Page 5

“Six principles to guide the Interior Department in addressing water problems, five realities that drive water crises, and four key tools to help proactively manage scarce water resources”. The framework may be found at <http://www.doi.gov/water2025/Water2025-Exec.htm>.

Norton made several other statements regarding the “commitment by Interior to work with states, tribes, local governments and the public”, and indicated that decisions regarding water supply issues and the rights of the various entities, and in keeping with fiscal reality, should not be reached without adequate public discussion.

The series of meetings began on June 6 in Denver Colorado. It was attended by the Governor of Colorado, the Secretaries of Interior and Agriculture, Senator Ben Campbell and Congressman Mark Udall, the Under Secretary of Agriculture for Natural Resources, and the Assistant Secretary of the Interior for Water and Science, as well as a number of tribal, state, and local water and environmental leaders.

The next sessions will be in Phoenix on July 8, then Las Vegas on July 9, Sacramento on July 10, Salt Lake City on July 16, Boise on July 17, Billings on July 29, Albuquerque on August 12, and ending with Austin on August 14. Currently in the plans is a list of pilot projects to implement in Fiscal Year 2004.

The entire Water 2025 proposal may be found on the DOI website at www.doi.gov/water2025, and the presentation (a very large file in PowerPoint) may be found at www.doi.gov/water2025/ppt.html. Research on the topic is strongly encouraged, especially taking into account other points of view than found on the DOI websites. Several articles on the subject have already been posted; just use your search engine on the title. Following careful consideration, please take the time to voice your opinion through the DOI website. 

Groundwater Resources Assn of California Statement of Activities - Unaudited

FOR THE YEAR ENDED DECEMBER 31, 2002

Changes in Unrestricted Net Assets

Revenues:

Program Fees	\$295,852
Membership Dues	66,617
Contributions	1,605
Other Income:	
Advertising	1,200
Interest	1,143
Total Other Income	2,343
Total Unrestricted Revenues	366,417

Expenses

Program Expenses (Seminars)	226,359
Executive Director	39,460
Printing and Reproduction	51,798
Web Site	10,210
Contract Labor	7,793
Postage and Delivery	4,962
Dues and Subscriptions	5,097
Insurance	2,476
Fundraising	946
Travel	1,753
Professional Fees	800
Telephone	905
Lobbying Expenses	9,454
Bank Service Charges	5,498
Committee Expenses	2,656
License and Permits	55
Supplies	1,123

Total Expenses	371,345
Increase in Unrestricted Net Assets for the Period	(4,928)
Increase in Restricted Net Assets for the Period	0
Beginning Net Assets (Cash)	103,196
Ending Net Assets (Cash)	98,268

San Francisco Bay Branch
e-mail: sf.branch@grac.org

President: Gary Foote
Geomatrix Consultants, Inc.
(510) 663-4260
gfoote@geomatrix.com

Vice President: J.C. Isham
The Shaw Group
(925) 288-2381
julian.isham@theshawgroup.com

Secretary: Mary Morkin
Malcolm Pirnie
(510) 596-3060
mmorkin@pirnie.com

Treasurer: David Abbott
David Keith Todd Consulting Engineers
(510) 595-2120
jorysue@msn.com

Membership Chair: Bill Motzer
Todd Engineers
(510) 595-2120
bmotzer@toddengineers.com

Technical Chair: Jim Ulrick
Ulrick & Associates
(510) 848-3721
julrick@ulrick.com

South Bay Coordinator: Mark Wheeler
Crawford Consulting
(408) 287-9934
mark@crawfordconsulting.com

Past President: Linda Spencer
lindageo@earthlink.net

Central Coast Branch
e-mail: cc.branch@grac.org

President: Terry L. Foreman
CH2MHill
(805) 371-7817, x27
tforeman@ch2m.com

Vice President: Stephanie Osler Hastings
Hatch and Parent
(805) 963-7000, x415
shastings@hatchparent.com

Secretary: William (Bill) O'Brien, PE
Applications International Corp. (SAIC)
(805) 966-0811 x3208
obrienw@saic.com

Treasurer: Ryan Harding
Tetra Tech, Inc.
(805) 681-3100
ryan.harding@tetratech.com

Southern California Branch

President: Tony Maggio
SCS Engineers
(562-426-9544
email: amaggio@scseng.com

Vice President: Darrel Thompson
Shaw Environmental & Infrastructure
(949) 660-7532
email: dthompson@theshawgroup.com

Treasurer: Robert Ruscitto
ARCADIS
(714) 278-0992
e-mail: rruscitto@arcadis-us.com

Secretary: Carmen Guzman
ARCADIS
(714) 278-0992
e-mail: cguzman@gmgw.com

Member At Large: Steve Zigan
Environmental Resolutions
(949) 457-8952
email: szigan@eri-ug.com

Past President: Paul Parmentier

Past President: James Carter
EMAX Laboratories, Inc.
(310) 618-8889
email: jcarter@emaxlabs.com

Past President: Louis R. Reimer
Tait & Associates
(714) 560-8200
email: loureimer@aol.com

Sacramento Branch
e-mail: rshatz@navigantconsulting.com

President: Richard Shatz
Bookman-Edmonston
(916) 631-4027
rshatz@navigantconsulting.com

Vice President: Kelly Tilford
Golder Associates
(916) 786-2424
ktilford@golder.com

Secretary: Dave Zuber
Brown & Caldwell
(916) 854-5318
dzuber@brwnclad.com

Treasurer: David Von Aspern
Wallace•Kuhl & Associates, Inc.
(916) 372-1434
dvonaspern@wallace-kuhl.com

Member At Large: Pat Dunn
Jacobson Helgoth Consultants
(916) 985-3353
pdunn@jhcinc.com

Member At Large: Barbara Heinsch
Yolo County Div. of Integrated Wast Mgmt.
(530) 666-8858
bheinsch@jps.net

Member At Large: Steven P. Phillips
US Geological Survey
(916) 278-3002
sphillip@usgs.gov

San Joaquin Valley Branch
e-mail: wpipes@geomatrix.com

President: Bill Pipes
Geomatrix Consultants, Inc.
(559) 264-2535
wpipes@geomatrix.com

Secretary: Mary McClanahan
California Water Institute, CSU, Fresno
(559) 278-8468
mmcclana@csurfresno.com

Vice President: Tom Haslebacher
Kern County Water Agency
(661) 634-1450
thaslebacher@kcwa.com

Treasurer: Christopher Campbell
Baker, Manock & Jensen, a law firm
(559) 432-5400
clc@bmj-law.com

Dates & Details

GRA MEETINGS AND KEY DATES

(Please see page 3 or visit www.grac.org for detailed information, updates, and registration unless noted)

GRA Board Meeting August 16, 2003
Point Richmond, CA

GRA Symposium, July 31, 2003
Perchlorate in Groundwater: Sacramento, CA
Occurrence, Analysis &
Treatment

GRA Symposium, September 30, 2003
Subsurface Vapor San Jose, CA
Intrusion to Indoor Air October 1, 2003
Long Beach, CA

24th Biennial October 28-29, 2003
Groundwater Conference/ Ontario, CA
GRA 12th Annual Meeting

GRA Board Meeting November 8, 2003
Sacramento, CA

GRA Symposium, December 10, 2003
1, 4 Dioxane San Jose, CA

Other Key Dates *(programs in which GRA
is a Co-Sponsor or Cooperator)*

API/NGWA Petroleum August 19-22, 2003
Hydrocarbon Conference Costa Mesa, CA



GROUNDWATER RESOURCES ASSOCIATION
OF CALIFORNIA

915 L STREET, SUITE 1000
SACRAMENTO, CALIFORNIA 95814

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