Sustainable Remediation Forum (SURF)
SURF 22: February 26 and 27, 2013
Berkeley, California

SURF 22 was held at the University of California at Berkeley's Clark Kerr Campus on February 26 and 27, 2013. SURF's meeting partner was the Berkeley Water Center. The meeting focused on SURF's outreach and technical initiative efforts, which are the backbone of SURF and help the organization maintain a leadership role in the sustainable remediation field. SURF members that participated in the two-day meeting are listed in Attachment 1. Participant contact information is available to members on the SURF website. After logging into the website, select "member resources" then "membership directory."

Day 1

The meeting began with Mike Rominger (meeting facilitator) recognizing and thanking the outgoing SURF Board of Trustees for their contributions to the organization. Members of the 2013 SURF Board of Trustees were announced based on the recent election. The 2013 SURF Board of Trustees was announced as follows:

- Officers
  - Nick Garson (President)
  - Angela Fisher (Vice President)
  - Karina Tipton (Secretary)
  - Grant Geckeler (Treasurer)
- At Large
  - Stewart Abrams
  - Buddy Bealer
  - Amanda McNally
  - Jake Torrens
  - Rick Wice
- Past President
  - Karin Holland

Mike discussed meeting logistics, ground rules, nonconfidentiality assumptions, export control laws, and antitrust issues. In addition, he thanked current SURF sponsors for supporting the organization. (Members interested in sponsorship opportunities should contact the SURF Treasurer at treasurer@sustainableremediation.org.)

Day 1 presentations and subsequent discussions are summarized in the subsections below. Attachments 2 through 5 contain the presentation slides for Day 1 of the meeting.

2012 Reflections and Path Forward for 2013

Karin Holland (SURF Past President) reviewed SURF's accomplishments in 2012, including an increase in international collaboration, new outreach approaches, and publication of technical initiative documents. She emphasized the increased international collaboration within SURF, with participants from five continents—Asia, Europe, South America, Australia, and North America—participating in quarterly conference calls. Some of these international SURF members are also participating in the development of a draft ISO standard (see SURF 21 notes for more information). In 2012, SURF held its first webinar to educate interested individuals about the basics of sustainable remediation. The organization also held its first conference call with members to communicate the status and progress of ongoing initiatives. Both outreach efforts were well received. The focus on communication throughout the year seemed to pay off—membership increased 32%, two additional student chapters were established, and regulatory participation increased. Work continued on SURF's technical initiatives, with the publication of "Integrating Remediation and Reuse to Achieve a Whole-System Sustainability Benefits" in the Spring 2013 issue of *Remediation Journal*.

Nick Garson (SURF President) presented a SURF organization chart showing the organization's nine voting members of the Board of Trustees, its functional support team, committees, technical initiatives, and student chapters. Technical initiatives for 2013 were presented (see below). Members wishing to propose a new SURF initiative must provide complete a template and submit it to the Board of Trustees for approval.

- Sustainable Remediation and Site Development
- Sustainable Remediation Site Rating System
- Water Conservation and Reuse
- Sustainable Remediation Resource Index (see page 13 of these notes for more information)
- International Sustainable Remediation (i.e., the white paper that will be developed based on SURF 21)
- ISO Standard (see SURF 21 notes for more information)
- Sustainable Remediation Research Support

Nick presented SURF's 2013 objectives and asked for feedback and input from participants. The objectives are to improve communications and transparency; increase membership, government agency engagement, and student chapter growth; publish technical information; promote greater use of website for information exchange; and expand domestic and international networks. Participants provided the following feedback and ideas for 2013 efforts:

- Publish technical information to stay relevant.
- Assess the use of funding or teaming arrangements to further promote sustainable remediation.

- ❐ Develop additional webinars to reach a broader audience; consider creating a Webinar Partnering Initiative.
- ❐ Emphasize the applicability of SURF meetings as continuing education hours to increase membership.
- ❐ Continue developing student chapters.
- ❐ Collaborate and share knowledge among SURF groups (e.g., research initiative members should collaborate with academic outreach members).
- ❐ Create an Advisory Board to provide SURF sponsors with consultation on sustainable remediation projects.
- ❐ Develop a sustainable remediation certification for student use to showcase their knowledge as they try to start careers in the remediation field.
- ❐ Solicit student articles that reflect SURF's mission for quarterly newsletter.
- ❐ Develop consensus about the definition of "sustainable remediation" to more effectively communicate about aspects related to the field.

To address the last item above, Angela Fisher (SURF Vice President) asked participants to define sustainable remediation on index cards. She will work with others to compile responses into a working definition that will be communicated to members.

Nick ended his presentation by showing participants a template designed to summarize key information generated during meeting breakout sessions and to be updated monthly by the committee and initiative team leaders to communicate status to the Board of Trustees. Presentation slides are provided in Attachment 2.

Reinventing Urban Water Systems to Increase the Sustainability of Cities

Dick Luthy (Stanford University) briefly described the work of ReNUWIt (Reinventing the Nation's Urban Water Infrastructure) and presented examples of recent research. ReNUWIt is an interdisciplinary, multi-institution National Science Foundation research center with the goal of changing the ways in which urban water is managed. At the center, four universities collaborate in long-term research that spans from the fundamental to the test-bed and systems levels. In addition, two dozen industrial partners ensure that barriers and various existing frameworks are understood and that research outcomes translate into practices. As an organization, ReNUWIt focuses on the following four themes: (1) considering wastewater as a resource, (2) broadening treatment options, (3) increasing water availability, and (4) establishing an enabling environment. Dick presented examples of the group's research in the areas of these themes, as summarized below. Presentation slides are provided in Attachment 3.

- ❐ Considering Wastewater as a Resource
  Research in this area includes tailored water for different reuse applications as well as decentralized systems and hybrid water-energy recovery systems.

- Tailored Water for Different Reuse Applications
  ReNUWIt is researching approaches to treat wastewater and produce water of different qualities for different reuse applications (e.g., irrigation, cooling, potable reuse, stream flow augmentation). Dick described a hypothetical example of a site on a coastline in which water resources are scarce. At such a site, local water resources could be better used with tailored water for reuse applications and decentralized systems. Dick explained that a new design and operational philosophy would be necessary to implement this approach. Tailored, on-demand water quality would be generated by the existing reclamation facility, and engineered systems with a high degree of flexibility and robustness would be required. Dick described a real-world example of decentralized tailored water reuse located at Mines Park, a Colorado School of Mines student housing complex.

- Hybrid Water-Energy Recovery Systems
  Dick described the potential of advancing anaerobic technologies so that anaerobic systems could be designed to capture carbonaceous matter in wastewater as methane and convert ammonia to energic nitrous oxide. The idea is to design new systems that would allow nitrogen, phosphorus, and methane to be recovered and converted into valuable products in ways that consume much less energy than current systems. It is conceivable to design wastewater treatment plants to produce more energy than is consumed, but these ideas need to be tested and evaluated at a reasonable scale and with a systems-wide perspective. Currently, ReNUWIt is working on a small system to determine the feasibility of some elements of this approach before designing a full-scale system.

❒ Broadening Treatment Options
ReNUWIt is working to broaden treatment options by exploring opportunities in which natural systems may play a larger role in the design of urban water infrastructure, as described below.

- Unit Processes and Natural Systems
  Current research focuses on a unit process approach and natural treatment system enhancement. Dick described research that involves unit process wetlands and bioinfiltration stations as efficient treatment technologies for urban stormwater and water reuse systems.

- Managed Aquifer Recharge
  Additional research to broaden treatment options focuses on urban aquifers. Dick discussed the current barriers associated with this approach, including the lack of operational standards, uncertain efficiency, and large footprint. He highlighted the Prairie Waters Project in Aurora, Colorado, which involves the reuse of water from the South Platt River. For many months of the year, the river comprises the metropolitan area's wastewater treatment plant effluent. A

combination of riverbank filtration and groundwater recharge greatly improves the water quality and removes trace organic contaminants.

- ❒ Increasing Water Availability
  Dick emphasized stormwater management and groundwater recharge as methods to increase water availability. Studies are being designed in collaboration with the Sonoma County Water Agency to assess opportunities to alleviate flooding while recharging groundwater aquifers. This work includes city and regional planning to help identify the most appropriate locations for stormwater capture and reuse.

- ❒ Establishing an Enabling Environment
  Dick described a case study to demonstrate how establishing an enabling environment can create opportunities for different methods of urban water management and make the business case for non-monetized benefits. The Calera Creek Water Recycling Plant in Pacifica, California, treats 4 million gallons of sewage per day. A project at the plant included the restoration of 30 acres of wetlands, riparian vegetation, and coastal scrub. By using ultraviolet disinfection for wastewater effluent (vs. chlorine), recycled water can be released into wetlands rather than discharged into the ocean. The restoration involved the following activities: a new creek channel was cut; composted topsoil was spread on the floodplain; 130,000 native plants and trees were planted; and a paved bicycle path was created along the creek.

After the presentation, participants asked Dick to provide additional detail on two publications shown on one of his slides and to comment on point-of-use treatment, beneficial reuse in non-arid regions, and irrigation standards.

- ❒ Publications
  Dick provided additional detail about publications developed by the East Bay Municipal Utility District and the Los Angeles Department of Water and Power, both ReNUWIt research partners. The publications are a result of strategizing about how to meet future water supply needs with the water we have today. Both the East Bay Municipal Utility District's *Water Supply Management Program 2040 Plan* and the Los Angeles Department of Water and Power's *Water System: Ten-Year Capital Improvement Program for the Fiscal Years 2010-2019* are available online. Dick believes that these documents are a good roadmap for the future.

- ❒ Point-of-Use Treatment
  Dick said that, although some elements of point-of-use treatment have been implemented, comprehensive point-of-use treatment systems have not been applied. He expects this consideration to become more important in the future.

- ❒ Beneficial Reuse in Non-Arid Regions
  One participant asked for advice on how to approach utilities about beneficial reuse in areas of the country that are not arid and have plenty of water. For these areas, Dick suggested natural treatment systems that focus on effective contaminant treatment or wastewater treatment processes that are energy self-sustaining. Dick also recommended that utilities consider some of the new approaches of stormwater and

nutrient management systems, which are applicable throughout the U.S. In the arid west, stormwater is viewed increasingly as a resource for future water supplies; in the humid northeast, stormwater is viewed as something to retain and discharge slowly to prevent combined sewer overflows.

- Irrigation Standards
  Dick agreed with one participant who mentioned the need for irrigation standards. He suggested that the proposed standards be an extension of Title 22, which lays out water quality standards for different irrigation types. California has years of experience of using recycled water for irrigation, which is regulated under 22 of the state health laws related to recycled water.

Remaking Civilization on Dirty Sites

Stephen Coyle (Town-Green) presented applications of sustainable design principles to remedial actions in Mongolia and Gabon. In both cases, the remedial actions balanced economic viability, conservation of natural resources and biodiversity, and the primacy of good urbanism and enhancement of the quality of life in the surrounding communities. A summary of the examples is provided below. Stephen presented the following lessons learned from these examples: (1) address air, water, and land pollution systematically where feasible; (2) deploy "high leverage," low-tech interventions whenever possible; and (3) employ performance measures beyond the need for short-term return on investment. Presentation slides are provided in Attachment 4.

- Ulaanbaatar, Mongolia
  In this city, multiple remediation measures are being implemented to mitigate a variety of toxic sources. As background, Stephen described the migration of nomads to the capitol city of Mongolia after the collapse of the Soviet Union in the 1990s. Most newcomers to the city erected their yurts on small, private lots called "gers" before building individual houses with no water or sewer and minimal electricity. The coldest capitol city in the world, Ulaanbaatar is now also the most polluted. Air, water, and soil has been contaminated by pollution from thousands of individual coal-fired heating and cooking stoves; coal-fired power plants and industrial activities; individual ger latrines, cesspools, and drains; solid waste landfills and dumps; coal, copper, and other mineral mining operations; and motor vehicles burning leaded fuel and diesel. Stephen said that targeted, systematic, and innovative remediation is required to address these complex contamination challenges. The remedial approach is detailed below.
  - Targeted Measures—Coal stove efficiency is being improved, and noncoal fuels are being supplied and combusted. Plans for a cleaner coal-fired power are underway, and renewable power plans include the installation of a mega wind farm and some solar power in an area with 230 annual sunny days. The ongoing remediation of key industrial sites will allow redevelopment that will have ecological, environmental, and human health benefits. Gradual upgrades to the ger areas (e.g., compostable latrines) are planned, and sanitary sewer systems will be installed in other areas where possible. Plans to manage and increase

solid waste diversion will slowly improve with an increase in recycling and reuse. Water conservation efforts continue in this dry climate, and leaded fuel and diesel use has decreased. However, targeted measures consist more of planning than action.

  - Systematic Measures—Plans are slowly being implemented to increase physical connectivity and improve sidewalks and transit systems so that the city can decrease automobile dependency and tailpipe emissions. Ger areas located close to the city center are gradually being replaced with high-density developments that facilitate transit, water, and sewer services, but little development is planned in the livable gradient between high and low densities. Although Stephen acknowledged that the redevelopment of these areas involves triple bottom line impacts, he said that the status quo is unsustainable and potentially deadly from a health perspective.
  - Innovative Measures—Some technologies and creative approaches will be considered as city planning progresses, including retrofitting existing buildings with insulation and weatherproofing; building waste-to-energy and biomass energy plants to generate power; designing heat, water, and sanitary waste systems at the block scale; and using noncrop fuels such as biodiesel. However, progress appears slow in comparison to the desire for economic growth from resource extraction.

- ❐ Libreville, Gabon
  This city in Central Africa has an inadequate solid waste management system and no central sewer system. Raw sewage and stormwater is dumped into the adjacent bay. Similar to Ulaanbaatar and other developing cities, the dominance of and dependency on motor vehicles increases air, water, and soil pollution daily. Planned remediation measures for this city include preserving and enhancing the existing forests and jungle, installing a city-wide sanitary sewer system, developing a solid waste management plan, and gradually increasing connectivity (i.e., installing sidewalks, increasing transit access, increasing infill, and establishing walkable new development).

One participant commended Stephen on an inspiring presentation and reflected that return on investment is one root cause of contamination challenges. Stephen responded that, in these examples, success was found by developing a return on *sustainable* investment.

Additional discussions focused on mechanisms associated with technology transfer and capital investment in the examples presented. Stephen said that technology transfer is generally being funded through funding organizations (e.g., World Bank), but also through government. For example, water treatment systems are being funded by the Japanese government or World Bank as partnership programs with nongovernmental organizations, contractors, or a jurisdiction.

Starting a Student Chapter at Stanford University: Challenges and Opportunities

Jay Thompson (President, SURF Stanford Student Chapter) briefly described the Stanford chapter, presented the major opportunities for SURF student chapters, and discussed some of the challenges encountered when forming a student chapter of SURF. Presentation slides are provided in Attachment 5.

- Chapter Beginnings and Current Activities
  In Fall 2012, several students at Stanford University founded a student chapter of SURF. The group has grown to 10 members, most of whom are highly involved with the group. The group typically meets twice per month to discuss business and SURF topics in current literature. Activities include working on a case study, discussing academic journals, or presenting the results of independent study.

- Opportunities
  Jay said that chapter members believe that a substantial opportunity exists to establish new SURF student chapters. Student chapters can serve an important educational purpose by disseminating knowledge from professionals to students. In addition, opportunities for independent research exist within student chapters. The Stanford student chapter emphasized this potential for professional development and knowledge creation and found this to be the most successful tactic to recruit new members.

- Challenges
  Stanford chapter members believe that the limited number of potentially interested students and unfamiliarity with the concept of sustainable remediation are the primary obstacles to establishing and sustaining a new student SURF chapter.

  - Students interested in remediation often represent a small subset of the total number of students enrolled in environmental engineering programs. As such, finding students directly interested in remediation can be difficult. Active leadership is needed to recruit new members and effort should be made to recruit students from outside the traditional academic disciplines.

  - Often few, and possibly none, of the students joining a new SURF student chapter have an understanding of the basic concepts of sustainable remediation. A lack of relevant institutional knowledge within other student groups or the faculty exacerbates this problem. Stanford chapter members believe that SURF can best address this problem by both creating a "Suggested Reading" list for new chapters and, where possible, matching local professional SURF members to student chapters to help build institutional knowledge within the student chapter.

Stanford student chapter activities focus on deliverables, and Diana Lin (Vice President, SURF Stanford Student Chapter) presented an example of one deliverable involving the life-cycle analysis (LCA) of a remedial action at Hunters Point Shipyard in San Francisco, California. The objective was to quantify and compare the environmental impacts of traditional dredge and fill technology vs. activated carbon amendment to remediate polychlorinated biphenyl (PCB)-contaminated sediment. Diana reviewed the major impacts for the dredge option (i.e., transportation) and the activated carbon option (i.e., production). She noted that using a virgin activated carbon amendment has over 2½ times greater environmental impact than dredging. Diana presented recommendations based on the LCA, including using a recycled activated carbon amendment to reduce costs by 20% and environmental impacts by 80% and analyzing the impacts of using coconut shell based activated carbon. Presentation slides are provided in Attachment 5.

Participants complimented the presenters and offered the following suggestions:

- Develop a presentation or poster for Battelle conference.
- Recruit members from the earth sciences, geology, economics, and social sciences departments at your university.
- Become knowledgeable about existing resources to help recruit members from other departments.
  - *Guidelines for Social Life Cycle Assessment of Products* by the United Nations Environment Programme and Society of Environmental Toxicology and Chemistry (http://www.unep.fr/shared/publications/pdf/DTIx1164xPA-guidelines_sLCA.pdf)
  - SimaPro, a quantitative tool to assess sustainability
- Share this presentation with other student chapters.

Day 2

The remaining Day 2 presentations and subsequent discussions are briefly summarized below. Attachments 6 and 7 contain the presentation slides for Day 2.

Redefining Remediation Goals with Long-Term Monitoring Data

James Hunt (University of California at Berkeley) examined the monitoring data available at sites where contaminants were released to the subsurface beginning in the 1950s, with site investigations and remedial efforts continuing for more than 20 years. These example sites illustrate the advantages of a broader view of remediation as a system that requires data management, data visualization, and the development of models that predict long-term effectiveness and permit scaling from one location to another. Presentation slides are provided in Attachment 6.

- Example 1: Natural Gas Compressor Stations (Southeastern California)
  Two Pacific Gas & Electric Company natural gas compressor stations (Hinkley and Topock) released Cr (VI) to the subsurface from evaporative cooling wastes. As background, James explained that pumping natural gas requires cooling and that evaporative cooling systems produce brines. At the Hinkley station, chromate was released between 1952 and 1964. A site investigation began in November 1987;

groundwater extraction was initiated in October 1992 and was stopped from June 2001 to March 2005. Since that time, limited groundwater extraction occurs. Despite these activities, the groundwater plume showed little change from 1988 to 2002. James discussed the significant amount of site data available and its format, which he noted is not user friendly. Based on an analysis of results, groundwater elevation data show active groundwater withdrawal and recharge. Chromium concentrations in groundwater are variable near the source and do not change with time. In addition, no evidence exists of long-term decreasing concentrations downgradient of the source. At the distant end of the plume, some evidence of upper stratification is present. When compared to the Hinkley station, the Topock station shares a similar operational history of brine disposal and similar vertical stratification. James showed a timeline comparing the operations and investigations at both sites and wondered if any lessons were learned and shared between sites. He doubted that lessons learned were shared because the sites are regulated by two different California regulatory agencies. James said that the key message of this example is two-fold: (1) the identification of long-term sources of groundwater contamination within the subsurface is just as important as plume chasing, and (2) remediation is an integrated system.

- Example 2: Seepage Basins
  At the Department of Energy's Savannah River site in South Carolina, seepage basins received low level waste containing uranium, tritium, fission products, and nitrate. Similar to the first example presented above, a significant amount of data is available at this site. Because tritium is an excellent tracer, an aquifer inventory of tritium was performed. The amount of cumulative tritium in the aquifer was determined based on inflow and outflow data, and monitoring well data were analyzed to verify the tritium inventory. Although a comparison of these approaches differs by a factor of two, the observed exponential decay of tritium in the aquifer is faster than the tritium decay rate reflecting groundwater transport from the site. To further integrate the data, a flushing model was used to provide a conservative estimate for observations at a particular well for both decaying tritium and conservative nitrate. James said that this example illustrates that it is hard to find simple models when an abundance of data exists because of the tendency for scientists and engineers to embrace complexity rather than use approximate models suggested by actual data.

Participants discussed the activity timelines presented and speculated about the various reasons for delays in the process.

Comprehensive Detection of Perfluorochemical Precursors for Improved Remediation Strategies

Erika Houtz (University of California at Berkeley) presented her work developing a method to indirectly quantify the concentrations of potential perfluorinated acid precursor compounds. The results summarized below could inform subsequent cleanup efforts of aqueous film-forming foams (AFFF)-contaminated groundwater and soil by providing techniques to assess the scope of fluorochemical contamination and by providing a model site to observe the consequences of several different remediation approaches on perfluorinated acid precursor transformation. Presentation slides are not available.

- ❒ AFFF Overview
  As background, Erika provided an overview of AFFF, including its operational history and the challenges associated with identifying the active fluorochemical ingredients in various AFFF formulations. AFFFs are complex mixtures of hydrocarbon and fluorocarbon surfactants that have been used by the military, airports, and municipalities since the 1960s to extinguish hydrocarbon fuel based fires. At many military bases, extensive remediation of hydrocarbon contaminants has been undertaken without consideration of the AFFF fluorochemical compounds that are also present. Where AFFFs have been deployed in unlined fire training areas, high concentrations of poly- and perfluorinated substances have been detected in groundwater. Among these contaminants, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), have received considerable attention due to concerns about their presence in drinking water. In addition to PFOA, PFOS, and their shorter chained homologs, AFFF formulations contain more complex polyfluorinated compounds that can be converted into perfluorinated acids by chemical or biological transformation. These polyfluorinated compounds are referred to as perfluorinated acid precursors. Because these precursors may be transformed to their more mobile perfluorinated acid forms upon in situ chemical oxidation or enhanced bioremediation, it is important to characterize the precursor contamination prior to initiating remediation.

- ❒ Method
  Erika explained that the direct measurement of these precursor compounds and their transformation products in field samples is limited by lack of available standards. Consequently, a method was developed to indirectly quantify the concentrations of potential perfluorinated acid precursor compounds. In this study, samples were exposed to hydroxyl radicals to convert precursors to perfluorinated carboxylic acids, which were then measured by liquid chromatography-tandem mass spectrometry (LC-MS/MS). This precursor oxidation assay was used to measure precursor concentrations in groundwater and soil extracts from an AFFF-contaminated fire training area where fire training occurred from the 1960s until 1990.

- ❒ Results
  Only about half of the total precursor content in the AFFF-contaminated groundwater and soil could be identified with reference precursors, suggesting that typical analytical protocols would not capture most of the AFFF-related precursor contamination. The overall concentration of precursors in soil and groundwater samples as a percentage of the total concentration of fluorochemicals was lower than all reference AFFF formulations. These results suggest that net production of perfluorinated acids has occurred over time in the fire training area from transformation of AFFF-derived precursors. In on-site areas that were extensively remediated with oxygen sparging wells, enhanced production of perfluorinated acids from precursor compounds was observed.

Participants asked questions about the biodegradation of perfluorinated acid precursor compounds, the potential of regulatory requirements for these compounds, and the extent to which oxidation could be occurring naturally in the environment. A brief summary of the discussion is provided below.

- Biodegradation
  Erika said that, in microcosm experiments, perfluorinated acid precursor compounds did not have adverse effects on microbial populations. The biotransformation of some precursor compounds occurred co-metabolically under aerobic and nitrate-reducing conditions.
- Regulatory Requirements
  Erika believes that perfluorinated acid precursor compounds will *not* be added to the current U.S. regulatory framework, but recommended that remediation practitioners consider these compounds during remediation planning because they represent an ongoing source of compounds that are regulated (i.e., PFOS and PFOA).
- Naturally Occurring Oxidation
  The ratios of concentrations of specific analytes in field samples versus AFFF samples can be a useful tool for inferring whether the transformation of precursor compounds has occurred. She has performed advanced analysis in this area and will be publishing her work along with the study presented.

One participant complimented Erika on the chemistry involved in the study, but recommended the use of incremental sampling to obtain representative samples (vs. discrete samples) in future studies.

Breakout Session Reports

SURF members participated in breakout sessions for the following initiatives: Academic Outreach, Government Outreach, Sustainable Remediation Resource Index, Sustainable Remediation Rating and Certification System, Groundwater Conservation and Reuse, and Research. These initiatives are the backbone of SURF and help the organization maintain a leadership role in the sustainable remediation field.

- Academic Outreach Initiative
  This group met twice during the meeting, led by Co-Chair Mike Miller (CDM Smith). The first breakout session was designed to obtain feedback from SURF members about the roles and responsibilities of a SURF Mentor for SURF student chapters. A detailed summary of the breakout session is provided in Attachment 7. The group will use the information gathered in the session to develop a plan to support and nurture SURF student chapters through a SURF Mentor Program. The second breakout session focused on the SURF Student Chapter Design Competition. The session was designed to obtain feedback from SURF members about the design submittal requirements, judging criteria, role of SURF Mentor to the student teams, and competition guidelines. After the meeting and based on the results of this discussion (see Attachment 7), the group will develop numeric scoring criteria for the competition.

- ❒ Government Outreach Initiative
  This group met once during the meeting to discuss two topics: (1) the development of a standardized presentation about sustainable remediation for government employees and (2) the development of a standardized implementation plan for reaching out to state regulators. Co-Chair Buddy Bealer (Shell) led the discussions and provided further detail about these efforts. The goal is to have a team of SURF members for each state that would develop its own implementation plan and strategy for outreach. The group is meeting every other week to ensure progress, and Buddy encouraged SURF members to participate either as a reviewer of the planned standardized presentation or as part of an outreach team for a particular state. The six-panel template summarizing the session is provided in Attachment 7.

- ❒ Sustainable Remediation Resource Index (SRRI)
  This group met twice during the meeting to brainstorm about the value of the proposed index and its potential use. Co-Chair Mary Kean (Sustainable Silicon Valley) led the discussion. At the end of the two breakout sessions, consensus was reached to stop the Sustainable Remediation Resource Index initiative and instead put efforts toward creating a new technical initiative to develop a case study template and a user-driven, online case study repository. Participants agreed that the hard work performed to date by the SRRI initiative members should be preserved and acknowledged the leaders of the initiative, Mary Kean (Sustainable Silicon Valley) and Pamela Dugan (Carus Corporation), commending them for their work. Detailed notes from the sessions are provided in Attachment 7.

- ❒ Sustainable Remediation Rating and Certification System
  This group met once during the meeting to review the results of a survey sent to SURF members and to obtain volunteers to write various sections of the planned white paper entitled *Review of Publically Available Sustainability Rating Systems*. Co-Chair Dick Raymond (Terra Systems) led the discussion. Responses to the survey were received from 65 SURF members and are posted on the website in the Collaboration Area. In general, results indicate the desire for an inexpensive, user-friendly rating and certification system. Volunteers for writing the white paper were obtained. Presentation slides and the six-panel template summarizing the session are provided in Attachment 7.

- ❒ Groundwater Conservation and Reuse Initiative
  This group met once during the meeting to identify action items related to the completion of a document summarizing the importance and relevance of groundwater conservation and reuse as part of sustainable remediation. Co-Chair Paul Hadley led the discussion, which focused on how to present the case studies in the document.

- ❒ Research Initiative
  This group met once during the meeting to continue brainstorming about how to make SURF relevant to remediation research. Chair Stewart Abrams led the discussion and

focused on firmly establishing initiative members, dividing up responsibilities, and establishing timeframes and milestones for various action items. A high-level legal review of the initiative is planned. Presentation slides and the six-panel template summarizing the session are provided in Attachment 7.

Future Meetings

The next SURF meeting (SURF 23) will focus on Societal Perspectives in Sustainable Remediation and will be held July 23-25, 2013, at the University of Illinois at Chicago in Chicago, Illinois. Information regarding the details of the meeting is posted on the SURF website. If you are a SURF member and would like to help plan or host an upcoming meeting, e-mail Mike Rominger (meeting facilitator) at mike.rominger@sustainableremediation.org.

ATTACHMENTS

Attachment 1
SURF 22 Participant Contact Information

SURF 22 Participant Contact Information

Name	Company
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Abrams, Stewart	Langan Engineering
Adams, Kathy	Writing Unlimited, LLC
Aragona, Keith	Haley & Aldrich
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Bealer, Buddy	Shell
Blanchard, Charles	GES, Inc.
Breunig, Hanna	University of California, Berkeley
Britt, Randy	Parsons
Bruton, Tom	University of California, Berkeley
Candelaria, Chelsea	ERT, Inc.
Chambers, Deni	Northgate Environmental Management
Cho, YeoMyoung	Stanford University
Choi, Yongju	Stanford University
Clark, Dave	BNSF Railway
Clements, Steve	SCS Engineers
Drugan, Sophia	Kleinfelder
Dugan, Pamela	Carus Corporation
Fisher, Angela	GE Global Research
Garson, Nick	The Boeing Company
Geckeler, Grant	TPS TECH
Gill, Zann	ECOdesyn Lab
Glenn, Christopher	Treadwell and Rollo, A Langan Company
Hadley, Paul	California Dept. of Toxic Substances Control
Harclerode, Melissa	CDM Smith
Hardenburger, Ryan	University of California, Berkeley
Hasegan, Diana	Langan Engineering
Hawley, Elisabeth	ARCADIS
Hendrickson, Nancy	CH2M HILL
Holland, Karin	Haley & Aldrich
Hsieh, Ching-Hong	Stanford University
Hunt, James	University of California, Berkeley
Jasmann, Jeramy	Colorado State University
Jasper, Justin	University of California, Berkeley
Kean, Mary	Sustainable Silicon Valley
Keddington, Patrick	Haley & Aldrich
Larsen-Hallock, Lorraine	California Dept. of Toxic Substances Control (retired)
Lescure, Dan	Conestoga-Rovers & Associates
Lin, Diana	Stanford University
Maco, Barbara	U.S. EPA Region 9
Makerov, Mike	BNSF Railway
Mancini, Kristin	ARCADIS
McNally, Amanda	AECOM
McNew, Jason	EA Engineering, Science, and Technology, Inc.
Miller, Mike	CDM Smith
Morales, Ed	Sonoma Bank
Mouzakis, Katherine	Colorado School of Mines

SURF 22 Participant Contact Information

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Osowski, Matthew	WRA, Inc.
Pabst, Leah	Conestoga-Rovers & Associates
Raymond, Dick	Terra Systems, Inc.
Rominger, Mike	MCR Facilitation Services
Sedlak, David	University of California, Berkeley
Skance, Olivia	Chevron
Smith, Maile	Northgate Environmental Management
Sun, Bo	University of California, Berkeley
Taylor, Teke	ERM
Thompson, Jay	Stanford Univeristy
Tipton, Karina	Brown and Caldwell
Torrens, Jake	AMEC
Tuveson, Alex	SCS Engineers
Vadpey, Nicholas	University of California, Berkeley
Van Buren, Jean	University of California, Berkeley
Vanderkooy, Matt	Geosyntec
Venkatasubramanian, Sowmya	Parsons
Walkosak, Christina	FMC Corporation
Wice, Rick	Tetra Tech
Wiedmer, Arthur	University of California, Berkeley
Woodward, Dave	AECOM

Attachment 2
2012 Reflections and Path Forward for 2013

SURF

SURF 22

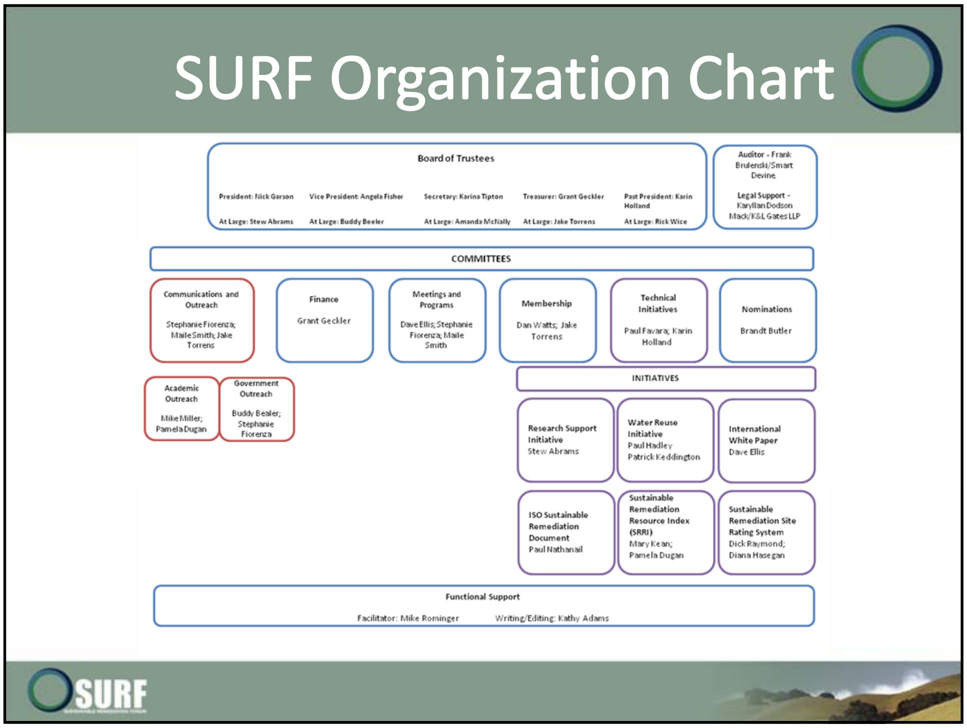
UC Berkeley

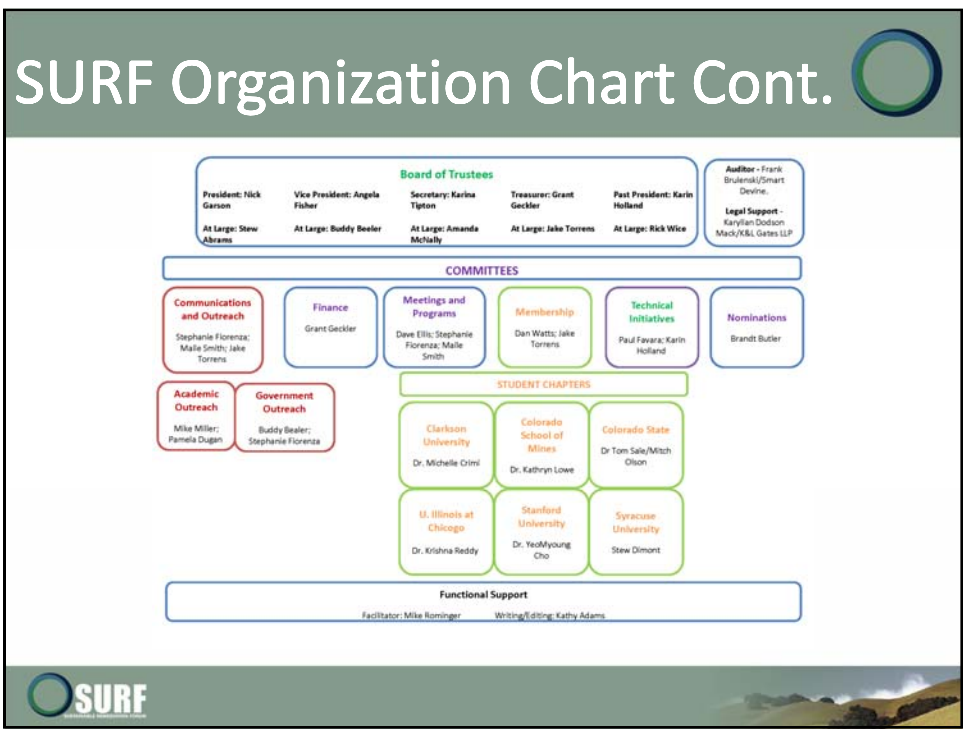
2012 Reflections & Path Forward for 2013

1

2012 Accomplishments

- Increased international collaboration
  - Quarterly SURF affiliate calls
  - ISO
- New outreach approaches
  - Webinar
  - Teleconference with our membership
- Student chapter growth
- Active technical initiatives
  - Imminent publication
- Greater regulatory engagement
- Membership growth to 200+


SURF Organization Chart
Board of Trustees
President: Nick Garson
Vice President: Angela Fisher
Secretary: Karina Tipton
Treasurer: Grant Geckler
Past President: Karin Holland
At Large: Stew Abrams
At Large: Buddy Beeler
At Large: Amanda McNally
At Large: Jake Torrens
At Large: Rick Wice
Auditor - Frank Brulenski/Smart Devine
Legal Support - Karyllan Dodson Mack/K&L Gates LLP
COMMITTEES
Communications and Outreach
Stephanie Fiorenza; Maile Smith; Jake Torrens
Finance
Grant Geckler
Meetings and Programs
Dave Ellis; Stephanie Fiorenza; Maile Smith
Membership
Dan Watts; Jake Torrens
Technical Initiatives
Paul Favara; Karin Holland
Nominations
Brandt Butler
Academic Outreach
Mike Miller; Pamela Dugan
Government Outreach
Buddy Beeler; Stephanie Fiorenza
INITIATIVES
Research Support Initiative
Stew Abrams
Water Reuse Initiative
Paul Hadley
Patrick Keddington
International White Paper
Dave Ellis
ISO Sustainable Remediation Document
Paul Nathanail
Sustainable Remediation Resource Index (SRRI)
Mary Kean; Pamela Dugan
Sustainable Remediation Site Rating System
Dick Raymond; Diana Hasegan
Functional Support
Facilitator: Mike Rominger
Writing/Editing: Kathy Adams
SURF


SURF Organization Chart Cont.
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Brandt Butler
Academic Outreach
Mike Miller; Pamela Dugan
Government Outreach
Buddy Beeler; Stephanie Fiorenza
STUDENT CHAPTERS
Clarkson University
Dr. Michelle Crimi
Colorado School of Mines
Dr. Kathryn Lowe
Colorado State
Dr Tom Sale/Mitch Olson
U. Illinois at Chicago
Dr. Krishna Reddy
Stanford University
Dr. YeoMyoung Cho
Syracuse University
Stew Dimont
Functional Support
Facilitator: Mike Rominger
Writing/Editing: Kathy Adams
SURF

SURF's 2013 Initiatives

- Technical initiatives
  - Sustainable remediation and site development
  - Water conservation and reuse
  - Sustainable remediation site rating system and certification program
  - Sustainable remediation resource index
  - International Sustainable Remediation (White Paper)
  - ISO Standard
  - Sustainable remediation research support

SURF

5

New Initiative Process

- Each New Initiative Proposal will provide the following information, and submitted to the Board of Trustees for review and approval:
  1. Summarize the initiative's mission and objectives
  2. Outline the benefits to the SURF membership and the remediation industry
  3. Identify the team lead(s)
  4. List the initial team members
  5. Estimate the timeline and/or level of effort

SURF

6

New Initiative Proposal

Brief Description

Mission

Key Objectives

Benefits to SURF Membership/Remediation Industry

Team Lead(s)

Initial Team Members

Anticipated Timeline and Level of Effort

Milestone	Duration	Level of Effort

Any Other Relevant Information

SURF

2013 Objectives

- Improve communications & transparency (Board, members, sponsors, initiatives, committees, meetings)
- Increase membership
- Increase government agency engagement
- Student chapter growth
- Publish technical information
- Promote greater use of website for information exchange
- Expand domestic & international network

- Member suggestions?
  - What should SURF focus on in 2013?
  - What should SURF do differently?

SURF

Committee/Initiative/Chapter Name

Team Members: ▪ Lead – XXX ▪ XXX ▪ Board Liaison - XXX	**Objectives:** ▪ XXX
Accomplishments: ▪ XXX	**Next Steps:** ▪ XXX
Upcoming Meetings/Presentations: ▪ XXX	**Help Needed:** ▪ **Help Needed: Board** • XXXX ▪ Help Needed: Membership • XXXX

SURF

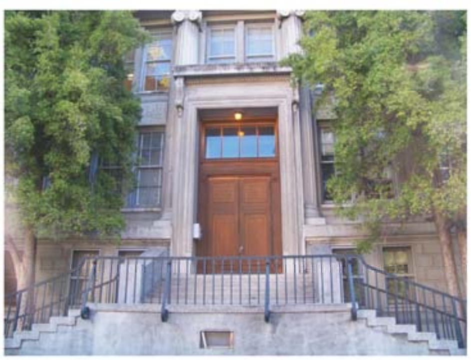
Attachment 3
Reinventing Urban Water Systems to Increase the Sustainability of Cities

Re-inventing the Nation's Urban Water Infrastructure [ReNUWIt]

Re-Inventing Urban Water Systems to Increase the Sustainability of Cities

Richard G. Luthy, Stanford Univ.

(David L. Sedlak, UC Berkeley and many others)



ORE OCEAN AND RESOURCES ENGINEERING since 1966

IN THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY AT THE UNIVERSITY OF HAWAI'I AT MĀNOA

U.S. NAVAL UNDERWATER CONSTRUCTION TEAM 1

Physiochemical processes
phase partitioning
mass transfer
contaminant (bio)availability

Natural system phenomenon
sediments & benthic processes

Water availability & infrastructure
changing framework for urban water

ReNUWIt

- Collaboration among four universities engaged in long-term research
- Research that spans from the fundamental to the test-bed and systems-level
- Outcomes that translates to practice – two dozen industrial partners
- Informed by understanding institutional frameworks & integration

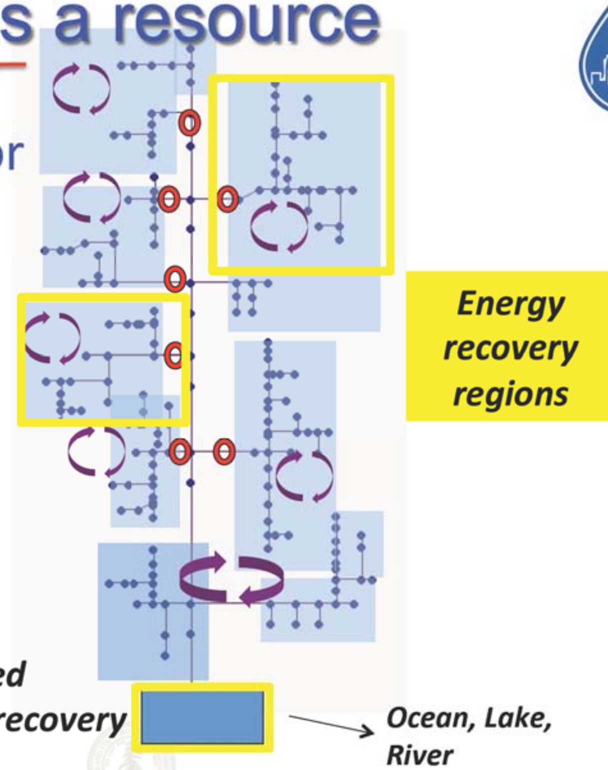
MINES

NM STATE UNIVERSITY

Wastewater as a resource

Tailored water for different reuse applications

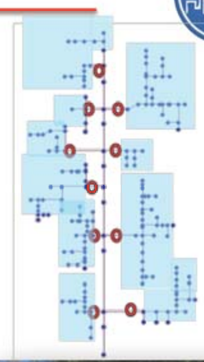
Decentralized systems & hybrid water-energy recovery systems



Wastewater as a resource

- Treat wastewater and produce water of different qualities for different reuse applications (e.g., irrigation, cooling, potable reuse, stream flow augmentation, etc.)
- Already implemented on a large, central scale at West Basin, CA

Wastewater as a resource



- Better use of local water resources with distributed water infrastructure
- A new design and operational philosophy
  - **Tailored**, on-demand water quality generated by the same reclamation facility
  - Requires engineered systems with high degree of **flexibility and robustness**

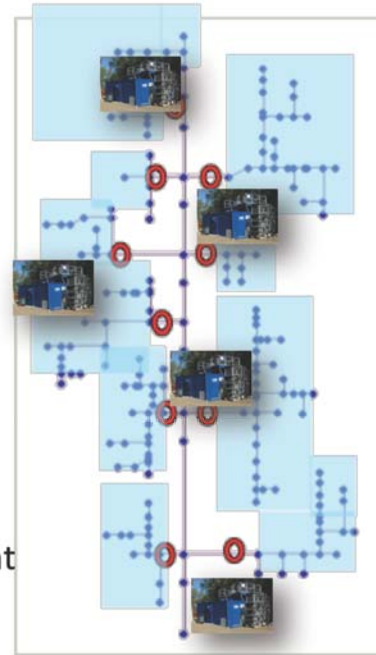
Distributed tailored water reuse

Non-potable reuse:

- Landscape irrigation
  - Challenges
    - Seasonal application
    - Nutrient-rich effluents
    - Decentralized use
- Cooling water
- Groundwater recharge
- Habitat restoration
- Car wash, fountains

Potable reuse

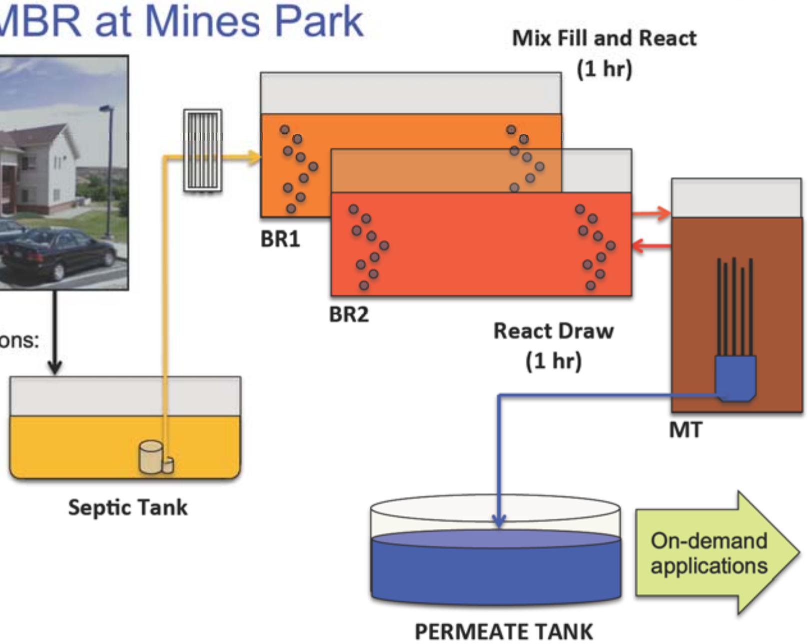
- Point-of-entry treatment



Decentralized tailored water reuse

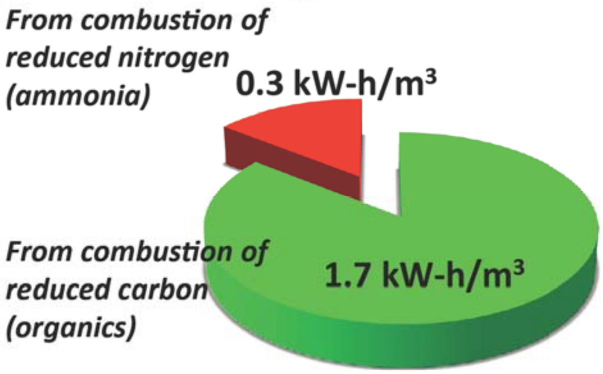
SBR/MBR at Mines Park

Average influent concentrations:
COD = 270-560 mg/L
sCOD = 110-210 mg/L
NH_4^+-N = 24-37 mg/L
Ortho-P = 8-16 mg/L



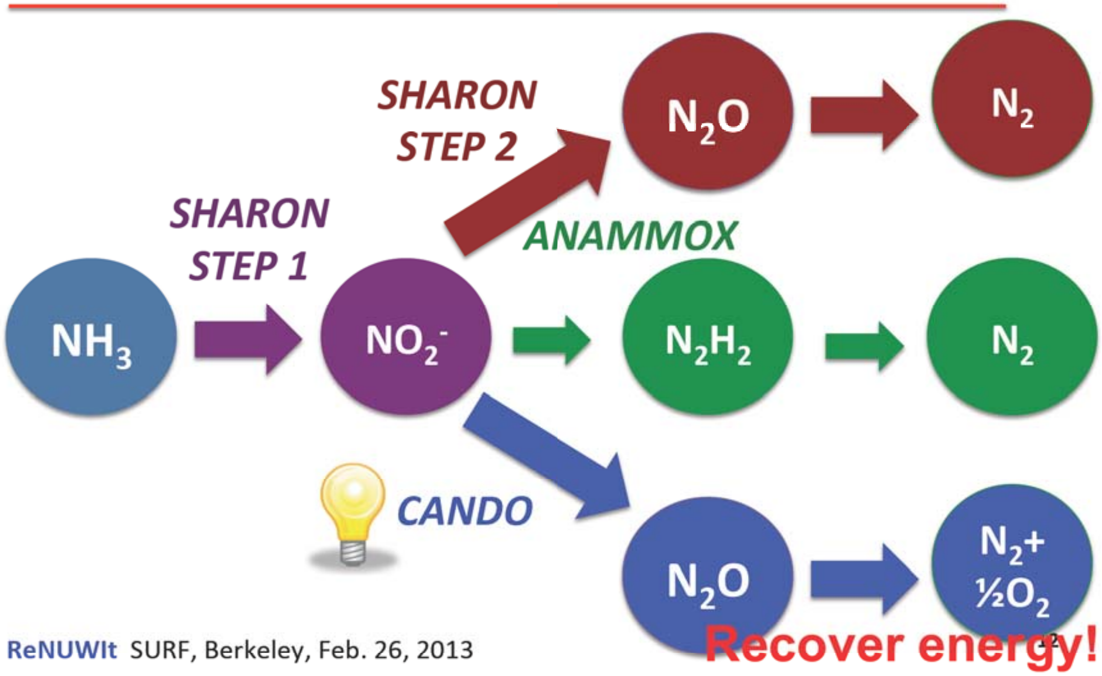
Wastewater as a resource -- Energy positive systems

Advancing anaerobic technologies



***2 kW-h/m³* potential to reclaim water & energy**

Wastewater as a resource -- Energy positive systems



Anaerobic treatment & N mngt.

- Development partnerships
  - **"Distributed lab" with bench-scale testing**
  - **Demonstration of N_2O + CH_4 combustion**
  - **Future pilot-scale system**

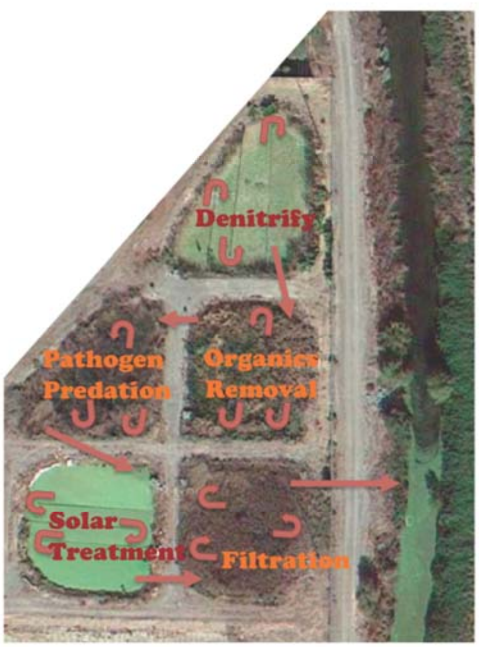
Scherson, Y. et al., 2013. *Energy & Environmental Science* 6:241-248.

DELTA DIABLO SANITATION DISTRICT

EBMUD

SOUTH BAYSIDE SYSTEM AUTHORITY FOR WATER QUALITY

Broadening treatment options



- **Unit Processes Wetlands**
  - **-hydraulic control**
  - **-proper order**
  - **-optimized**
  - **-multiple barriers**
- **Footprint**
- **Maintenance**

Modular approach: Unit processes

Solar

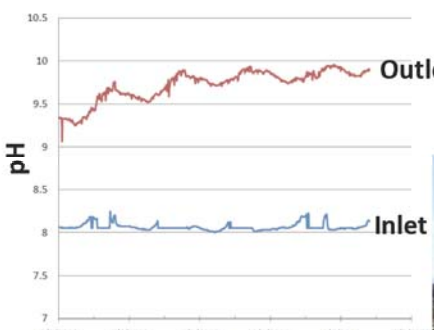
Vegetated

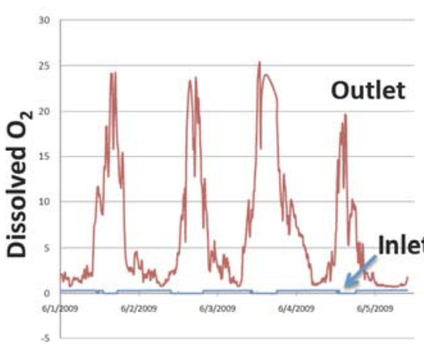
Bio-Filtration

Type		Design Controls
Ponds	→	Depth, HRT
Basins	→	Depth, velocity, substrate
Surface	→	Vegetation type, depth, HRT
Subsurface	→	Substrates, vegetation, HRT
Zooplankton	→	Vegetation, HRT
Bivalves	→	Organisms, HRT, food source

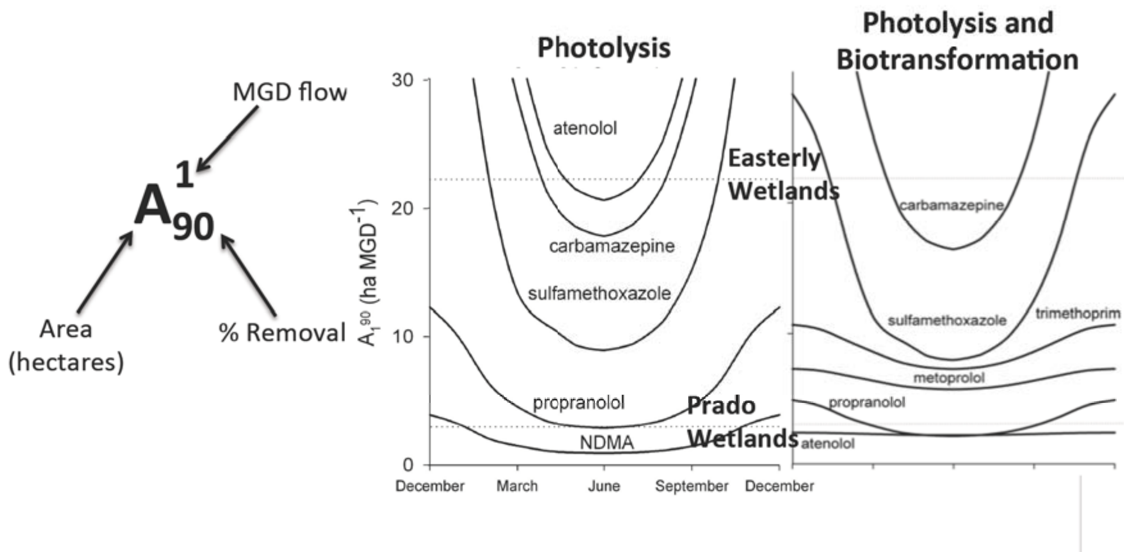
Shallow Open Water – promote photolysis

Test Bed: Discovery Bay, CA
Receives nitrified effluent
Retention Time ~2 days





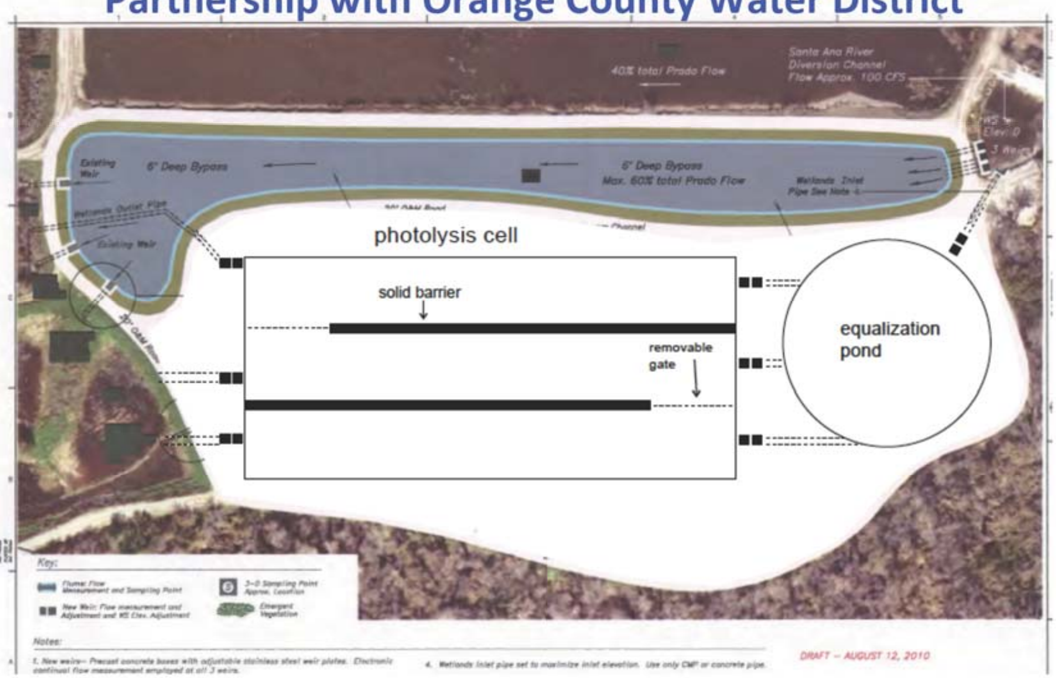
Footprint for Chemical Removal



Jasper & Sedlak, *ES&T, accepted*

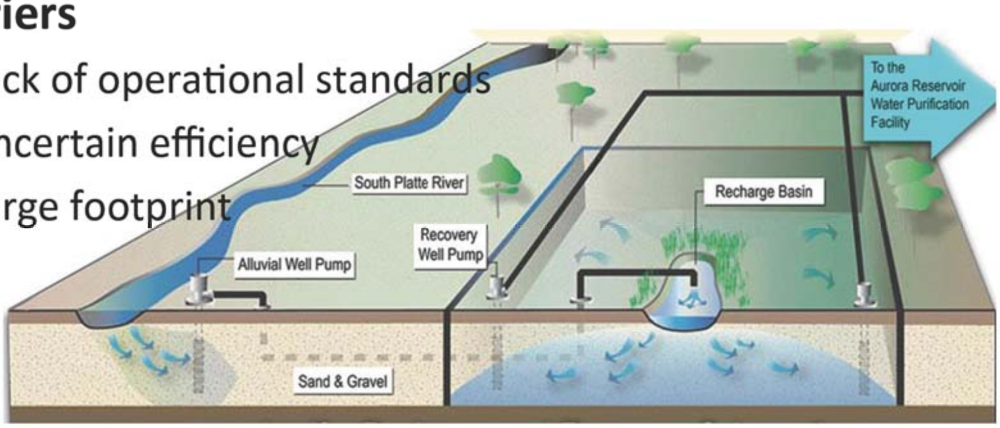
Up-scaling the Open Water Cell

Partnership with Orange County Water District



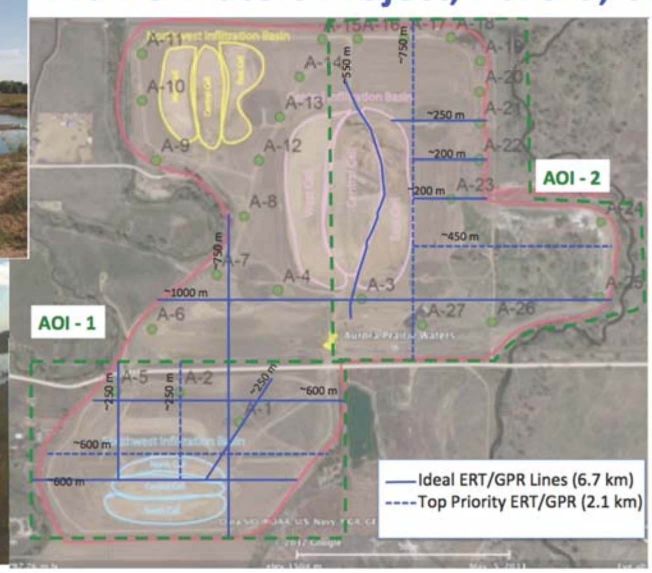
Broadening treatment options

- **Urban Aquifers (managed aquifer recharge)**
  - Urban runoff
  - Water reuse
- **Barriers**
  - Lack of operational standards
  - Uncertain efficiency
  - Large footprint

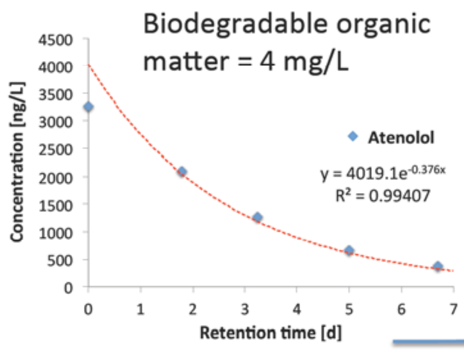


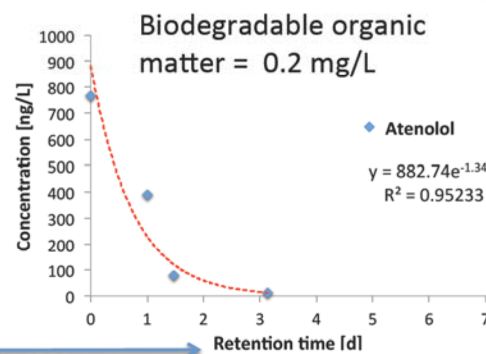
Broadening treatment options

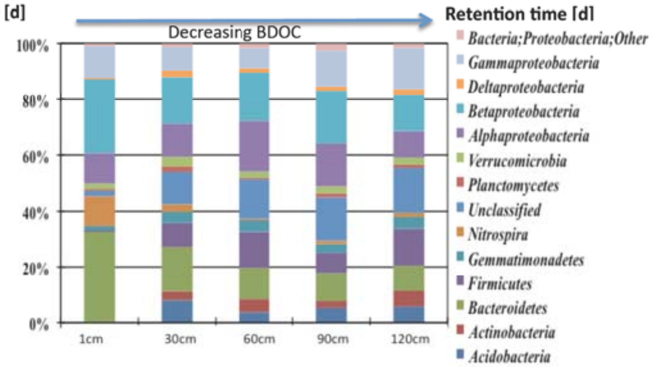
Managed aquifer recharge: Prairie Waters Project, Aurora, CO



Trace organic chemicals & MAR



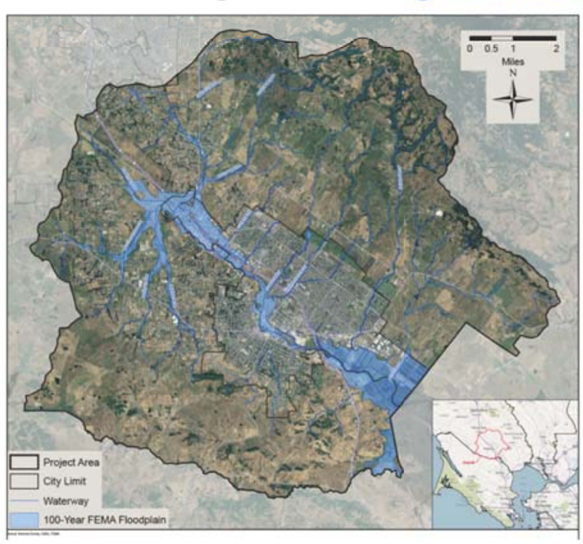




21

Increasing water availability & establishing an enabling environment

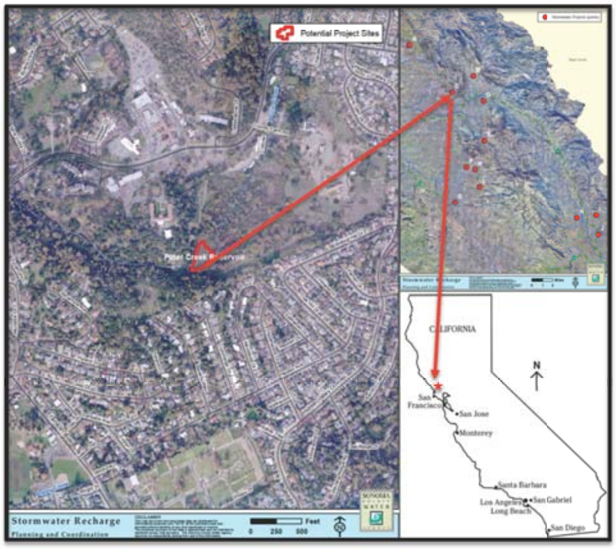
Stormwater management & groundwater recharge

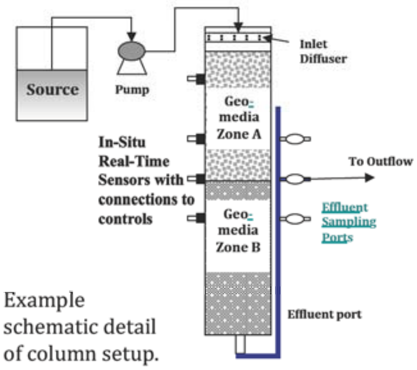


Sonoma County Water Agency

San Francisco Bay Area

Increasing water availability & establishing an enabling environment





Example schematic detail of column setup.

Sonoma County Water Agency

Establishing an enabling framework

Decision-making & ecosystem restoration

Before | After

Privately owned rock quarry → Public park with bike path
Degraded channelized stream → Restored riparian habitat

Calera Creek: stream flow augmentation for ecosystem restoration vs. ocean discharge

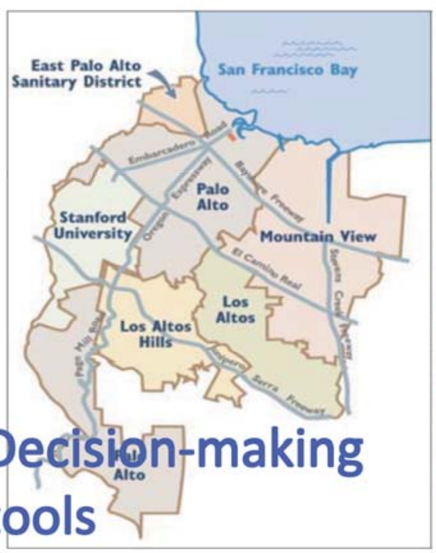
Establishing an enabling environment

- How to “make the business case” for non-monetized benefits?

Calera Creek WRP, Pacifica, CA

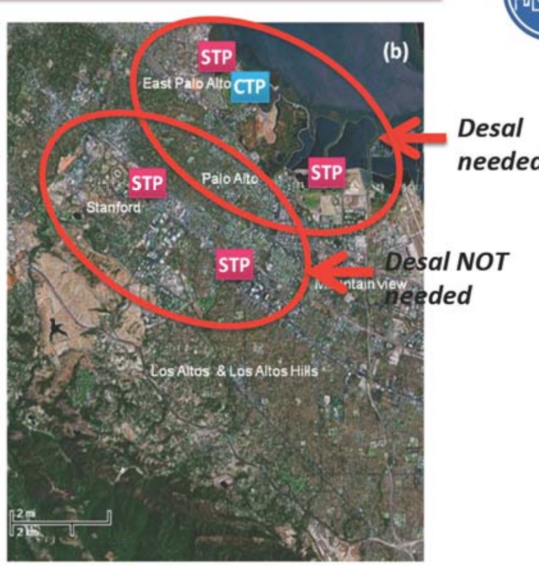
Brentwood WWTP, Brentwood, CA

Establishing an enabling environment



Decision-making tools

Locations of main sewer collection points for Palo Alto catchment – case study



Locations of potential satellite treatment plants (STPs) and centralized treatment plant (CTP)

Combinatorial options for water and energy recovery at different scales

Alternatives

CWR- Centralized Water Reuse
CER Centralized Energy Recovery
SWR- Satellite Water Reuse
SER - Satellite Energy Recovery
HWR- Hybrid Water Reuse
HER- Hybrid Energy Recovery

Alternatives	Water reuse scale	Energy recovery scale
1. CWR	Centralized Water Reuse	No
2. CER	No	Centralized Energy Recovery
3. CWR_CER	Centralized Water Reuse	Centralized Energy Recovery
4. SWR	Satellite Water Reuse	No
5. SWR_CER	Satellite Water Reuse	Centralized Energy Recovery
6. SWR_SER	Satellite Water Reuse	Satellite Energy Recovery
7. HWR	Centralized & Satellite	No
8. HWR_CER	Centralized & Satellite	Centralized Energy Recovery
9. HWR_HER	Centralized & Satellite	Centralized & Satellite
10. No Recovery	No	No

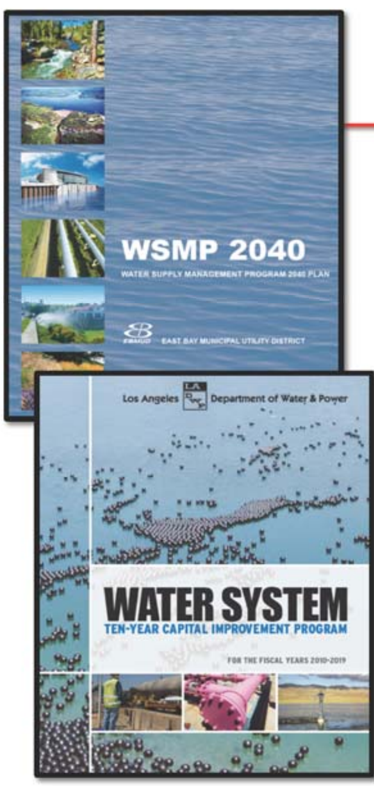
Palo Alto Test Case: Performance data and weights used for preference assessment of alternatives

Alternatives	Initial investment cost ($M)	Present O&M cost ($M)	Resource recovery revenue ($M)	Net life cycle cost ($M)	Net energy gain (kWh/yr)	Water self-reliance enabled by recycled water (%)
1. CWR	73	103	191	-26	-17	31
2. CER	11	97	46	61	1.5	0
3. CWR_CER	85	139	237	-23	1.5	31
4. SWR	71	89	162	-10	-21	26
5. SWR_CER	85	134	219	-11	2.0	26
6. SWR_SER	101	138	250	-25	1.2	31
7. HWR	63	90	162	-20	-18	26
8. HWR_CER	75	129	212	-19	1.6	26
9. HWR_HER	88	134	241	-32	1.3	31
10. No recovery	0	61	0	61	-17	0
Weights[a]	10	6	9	9	6	8

Recommendation: Hybrid water & energy recovery

Locations of main sewer collection points

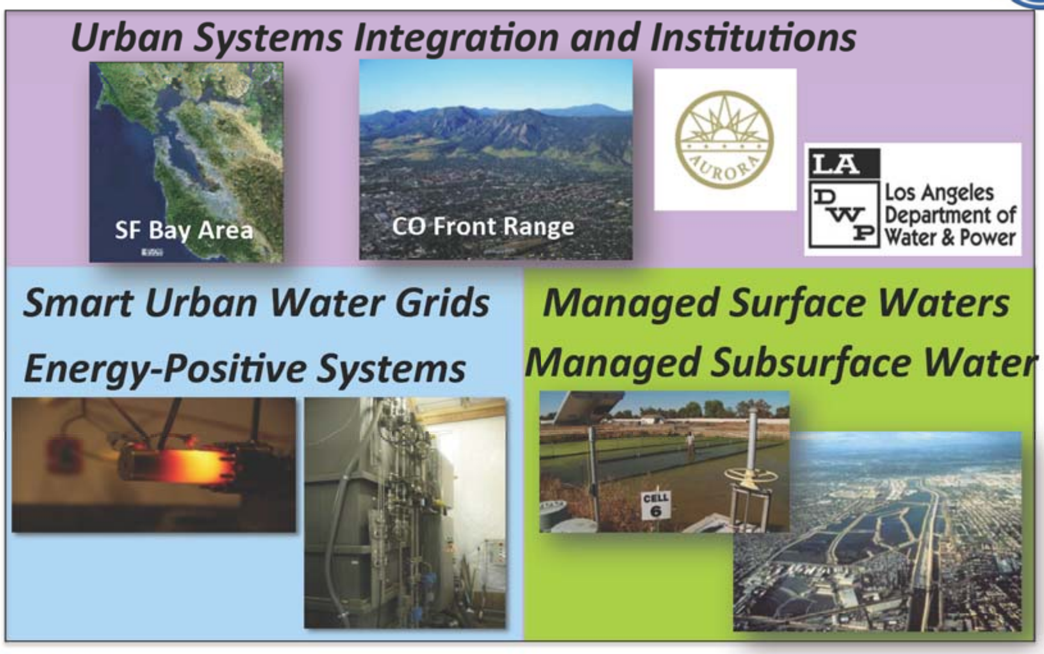
Locations of satellite treatment plants (STPs) and centralized treatment plant (CTP)



Integrated solutions

- Smart water grid/energy positive systems
- Maximize water recycling
- Stormwater capture/reuse
- Expand groundwater use
- Improved ecosystems & urban aesthetics
- Financially & socially sustainable solutions

Changing framework for urban water



Attachment 4
Remaking Civilization on Dirty Sites

how did civilized places
get so DIRTY?

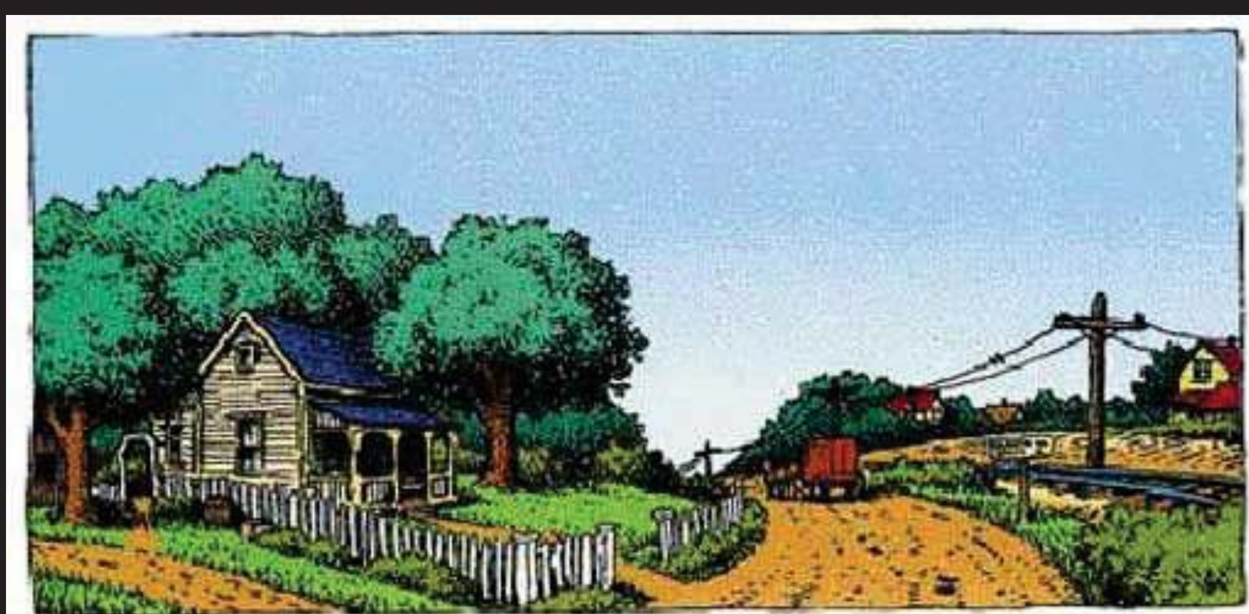
we began with Nature…

"A Short History of America" by R. Crumb

We "civilized" by rail and trail

We developed with resilience

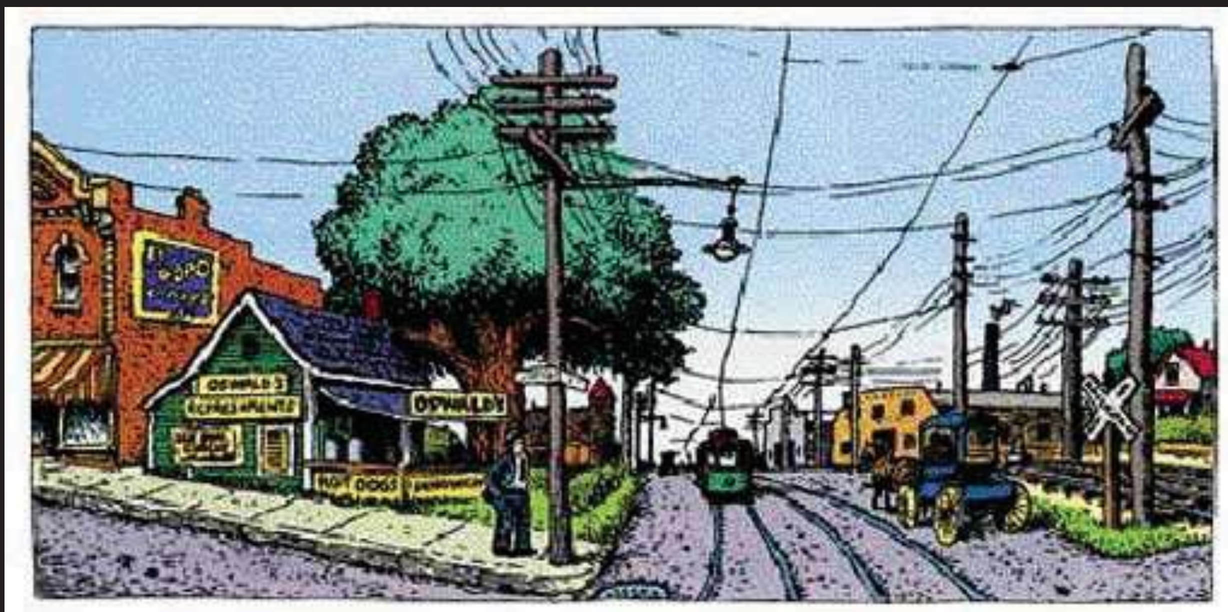
Using renewable technologies



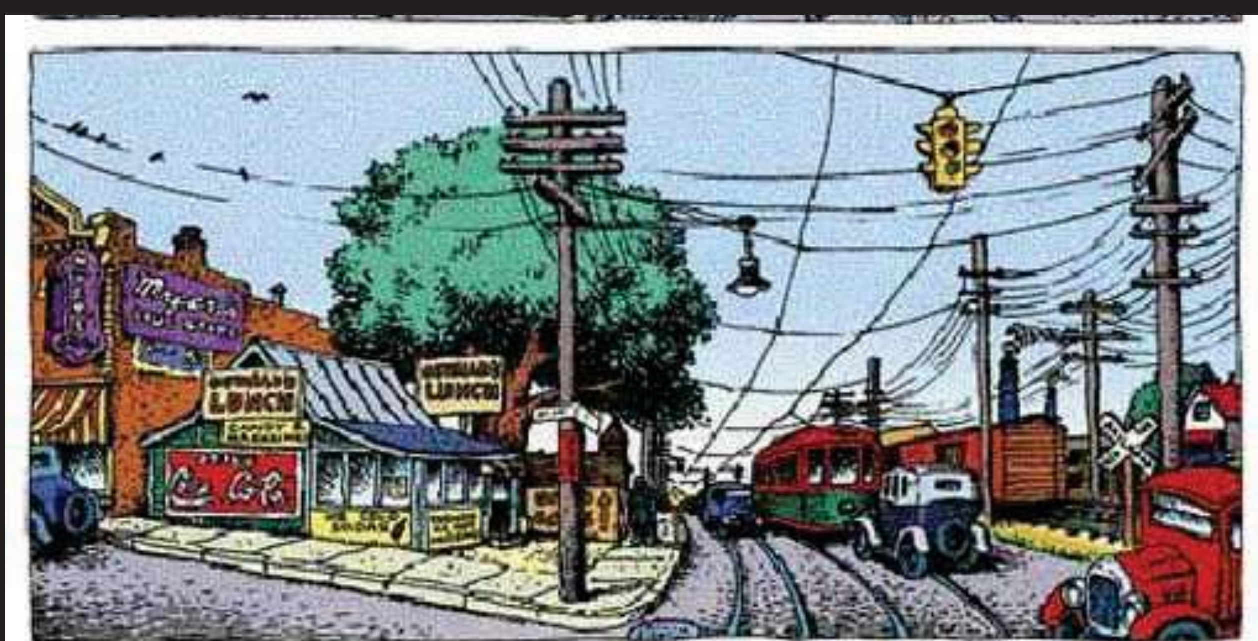
Building a civilization…

By consuming resources and
Generating waste

Still, within a mostly “sustainable” balance



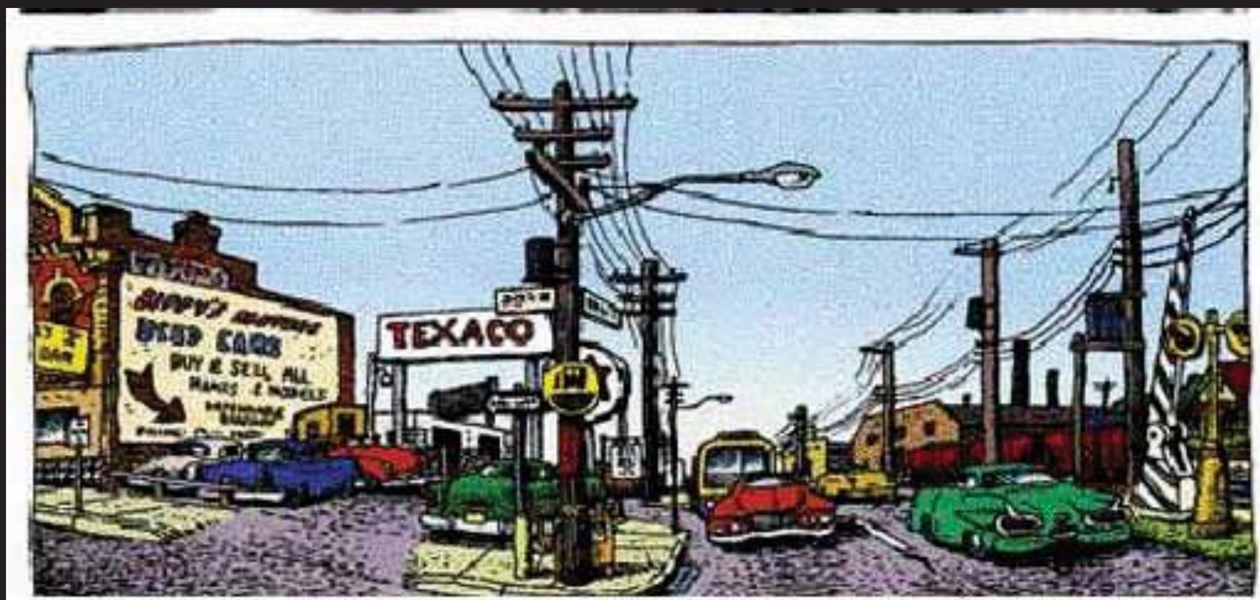
By 1925, technology and cheap fuel produced private autos



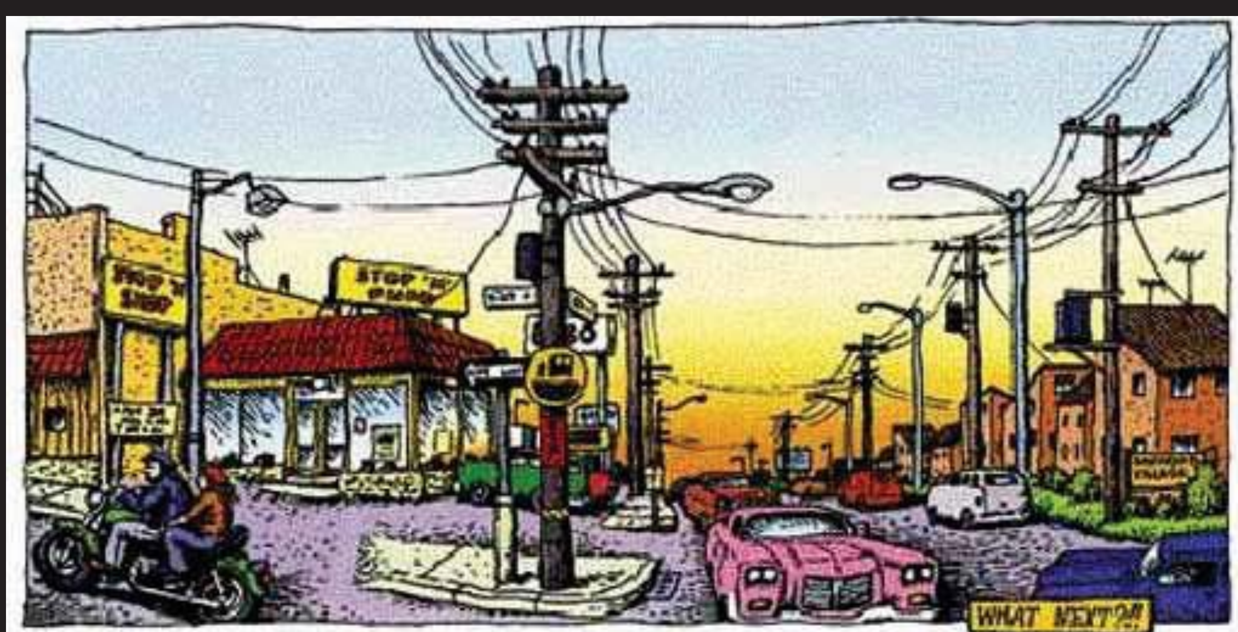
and products that generated More consumption and waste

All leveraged by cheap energy and other natural resources

…creating dirtier air, water and soil

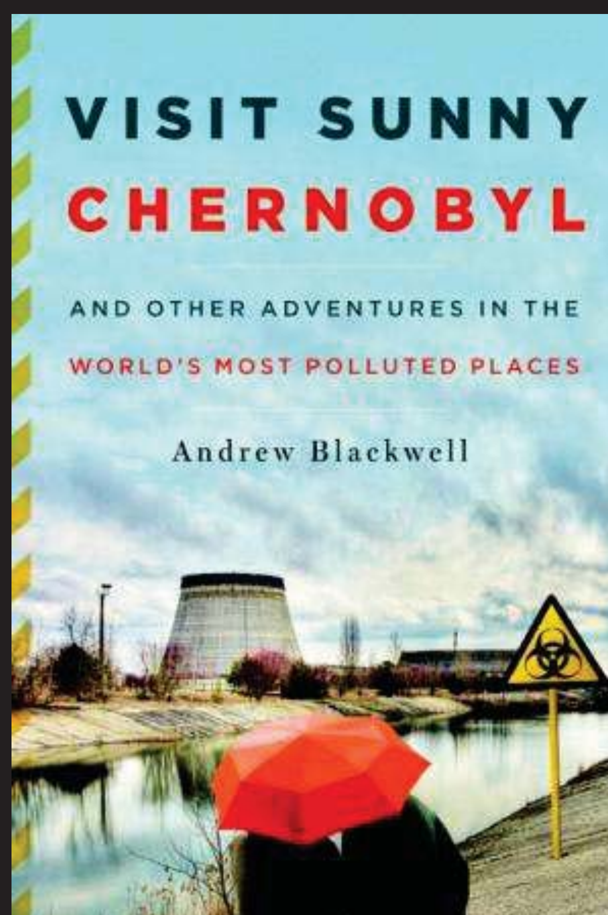


a civilization of growing toxic places and spaces



Others emulated our lifestyles

While others created their own very special, Dirty Sites



Example One: Ulaanbaatar (UB), Mongolia

Mongolia

For thousands of years in the land of Chinggis Khan, the sparse, scattered civilization lived a nomadic life on the Steppes with little inclination towards urbanization

Mongolia

With the collapse of the Soviet empire, in the 1990's, thousands began to migrate to cities

Ulaanbaatar, Mongolia

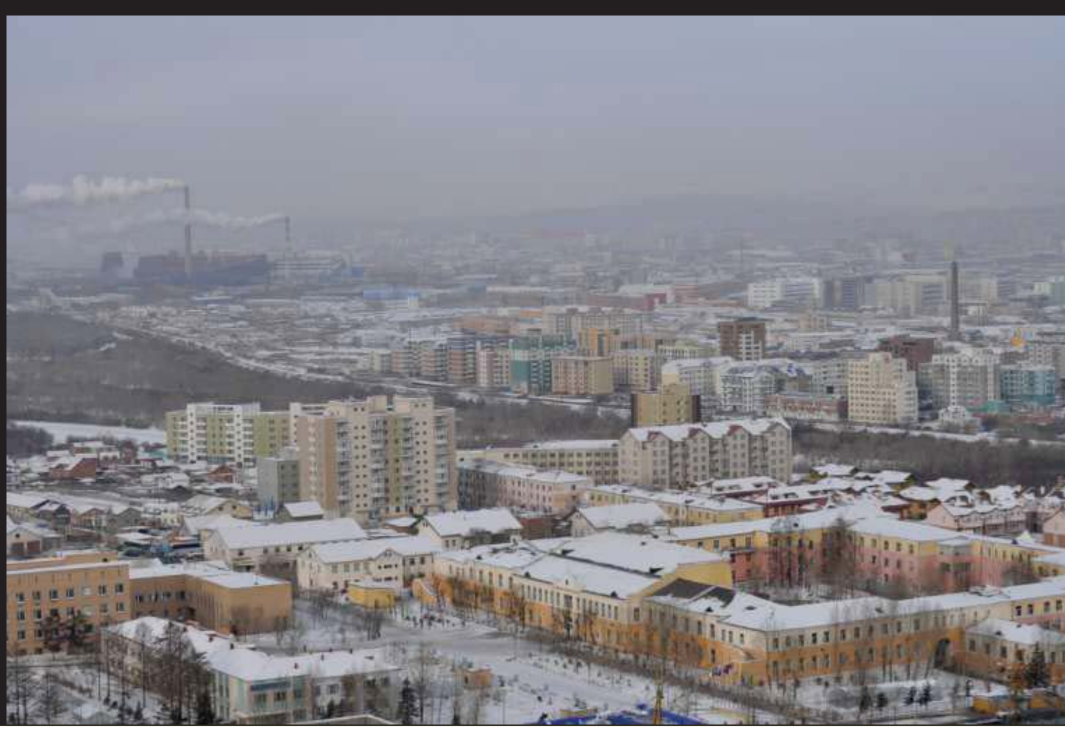
Most migrated to Capitol, the city of Ulaanbaatar, 1,500 meters above sea level on about 470 thousand hectares.

Ulaanbaatar, Mongolia

Most newcomers erected their yurts on small, private plots called ‘gers” before building individual houses, with no water or sewer, and minimal electricity

Ulaanbaatar

It’s the coldest capitol in the World



Ulaanbaatar

and the World's most polluted capitol – why?

Air and soil pollution from thousands of individual coal-fired heating and cooking stoves…

and air, water, and soil pollution from the coal-fired power plant and industrial activities

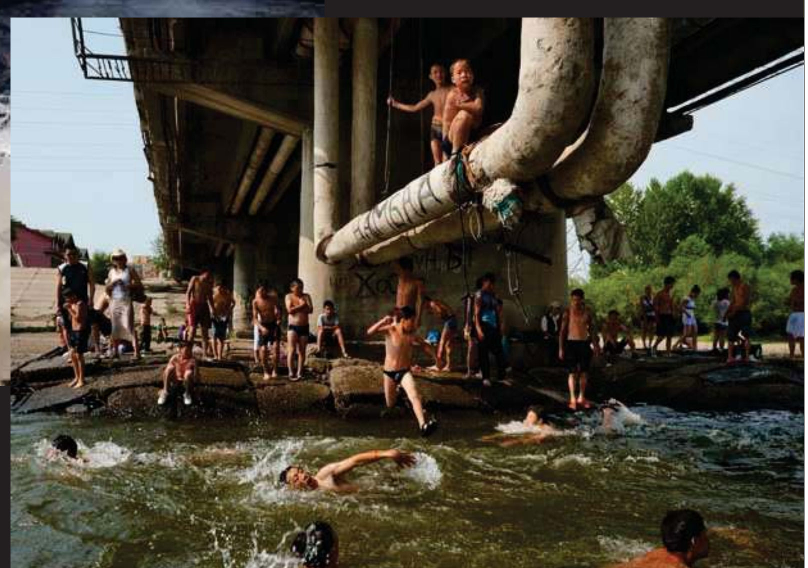
Water and soil pollution from individual ger latrines, cesspools and drains…

and buildings encroaching on, and latrines and garbage filling and polluting, drainage channels

Air, water, and soil pollution from solid waste land fills and dumps

All this contamination compounded by continually expanding, low density “ger” developments…

and increasing water pollution from coal, copper, and other mineral mining operations



On top of all this, air, water, and soil pollution from motor vehicles burning leaded fuel and diesel

Ulaanbaatar today

Dirty air, water, and land!

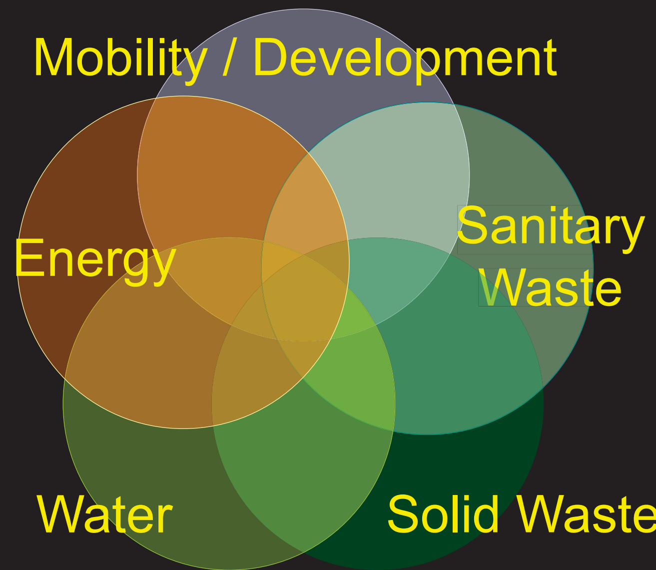
how do you remediate air, water and soil contamination?

how do you mitigate multiple sources of toxicity?

Targeted Remediative Measures

Formidable, overlapping challenges demanding multiple remedies

1. Energy
1. Mobility / Development
2. Solid Waste
3. Water
4. Sanitary Waste



First, improve coal stove efficiency, supply and combust non-coal fuels

Plans for a cleaner coal-fired power plant will hopefully manifest, and a mega wind farm should be installed; some solar power

Ongoing remediation of key UB industrial sites will allow redevelopment

Example:
Contamination from the treatment plant in the industrial area of Hargia

Hargia's remediation will improve the environment
- the ecosystems bounded on the River Tull -
and the health of population in the area of
Hargia in the Khan-Uul Khoroo district

Gradual installations of compostable and other types of efficient latrines at existing low density (ger) areas…

and the installation of sanitary sewer systems in new and redeveloped, higher density blocks

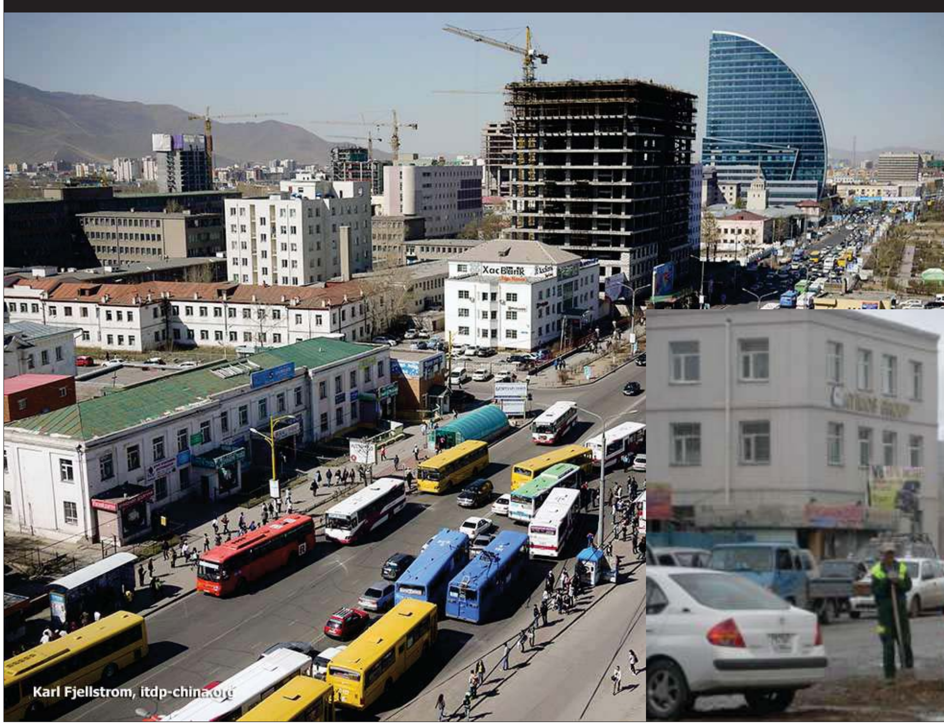
Solid waste management planning slowly improves recycling and reuse, reducing waste, and helps in the development of new landfills

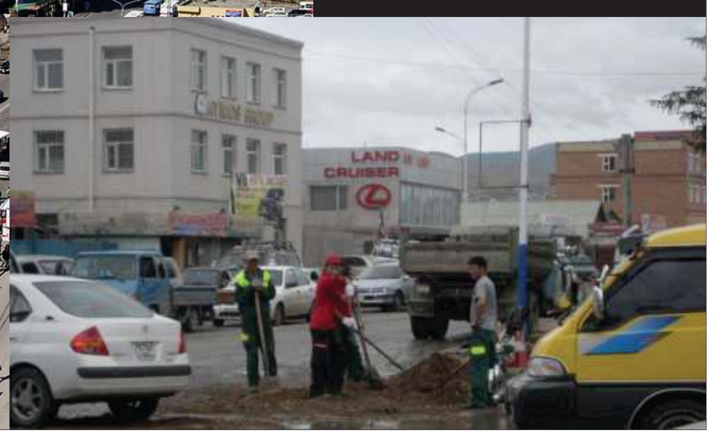
Ongoing work to conserve water, less effective efforts to clean up rivers and decrease water contamination from mining operations

Decreasing leaded fuel and diesel use; but no immediate plans to supplement petroleum with alternative fuels (e.g., bio-diesel)

Systemic Remediative Measures

By increasing connectivity, improving sidewalks and transit access, UB can decrease auto-dependency and reduce tail pipe emissions





Closer-in ger areas are being replaced with higher density developments that can facilitate transit service, and water and sewer service

We recommend increasing densities and uses to thresholds that facilitate the provision of water and sewer services, and walking to daily needs

Though the redevelopment of ger areas includes social, political, environmental, and economic impacts, the status quo is unsustainable and deadly

What about Remediative Measures inadequately deployed or not pursued?

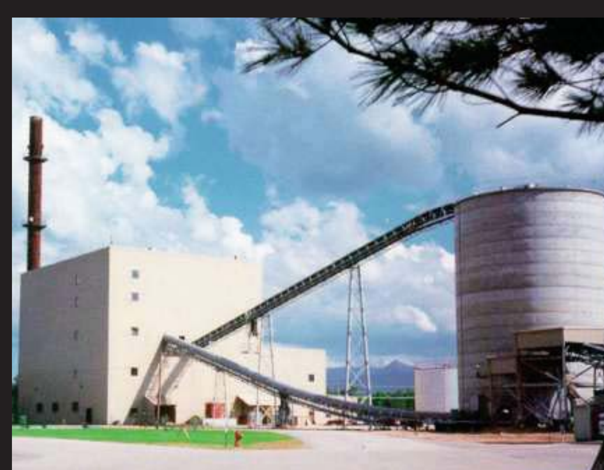
Little evidence of retrofitting existing buildings with insulation and weatherproofing…

Or solar heating and hot water use though UB receives about 230 sunny days annually

The potential for waste-to-energy and biomass energy generation

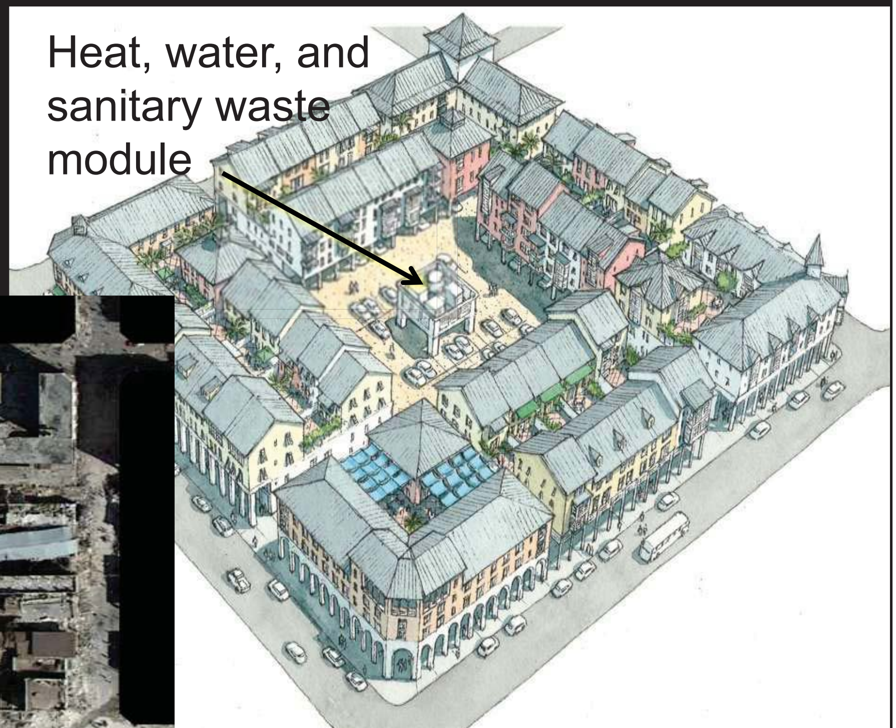
Typical 20 MW solid waste-to-energy plant

Typical 20 MW wood biomass energy plant



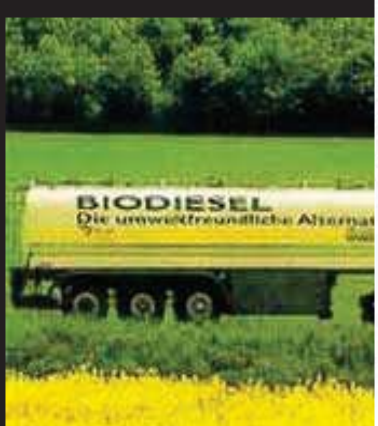
District heat, water, and sanitary waste systems for new developments at the block scale

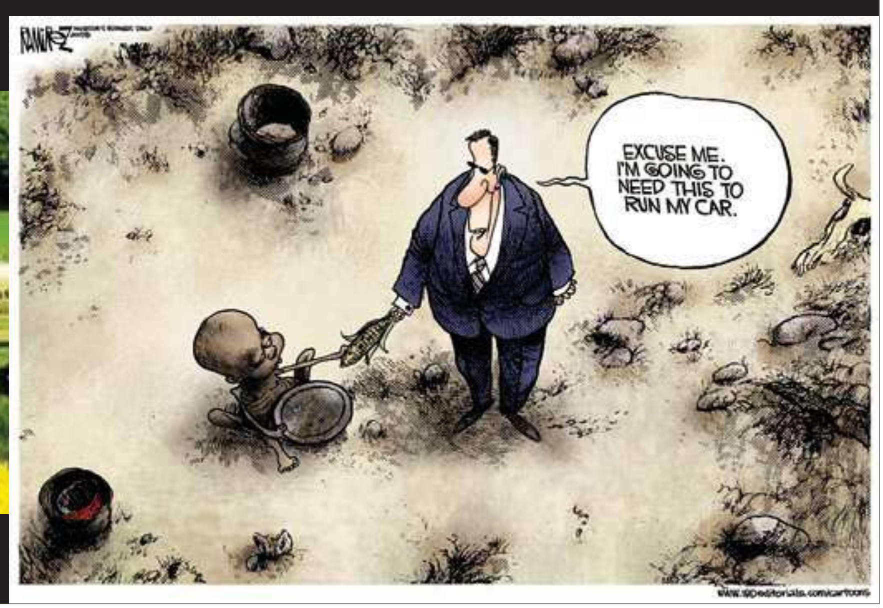
Insert module within new blocks



Alternative non-crop fuels such as biodiesel

Biodiesel is a renewable diesel fuel substitute from oilseeds, rape seed oil, yellow grease and fats, provided straight or as a blend.





Ulaanbaatar
Mongolia requires targeted, systemic, and innovative Remediation

Second Example: Libreville, Gabon

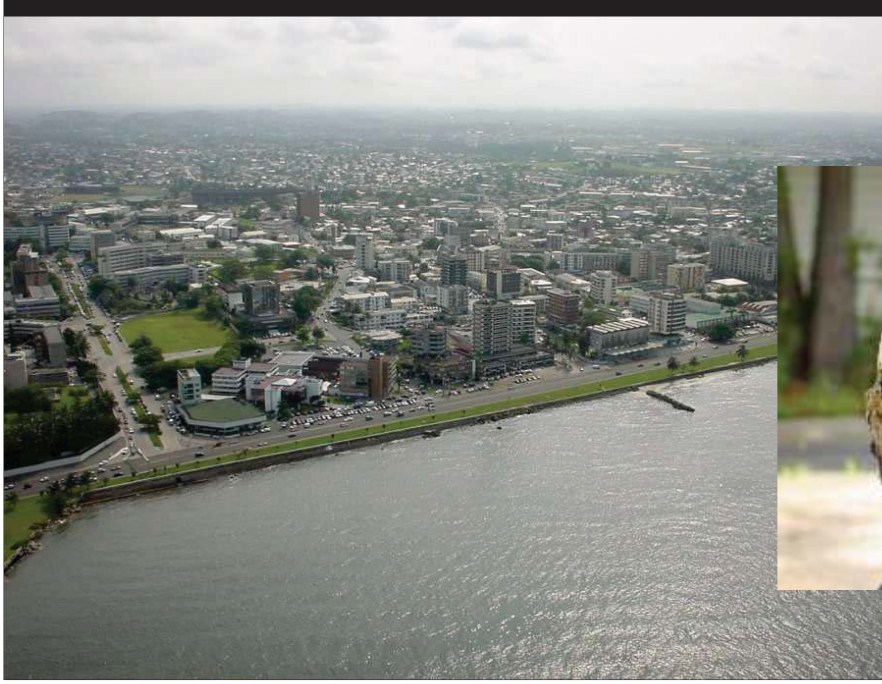
Libreville, Gabon

Libreville, Gabon

An emerging urbanism

with “dirty” water

No central sewer system – raw sewage and stormwater is dumped in the bay

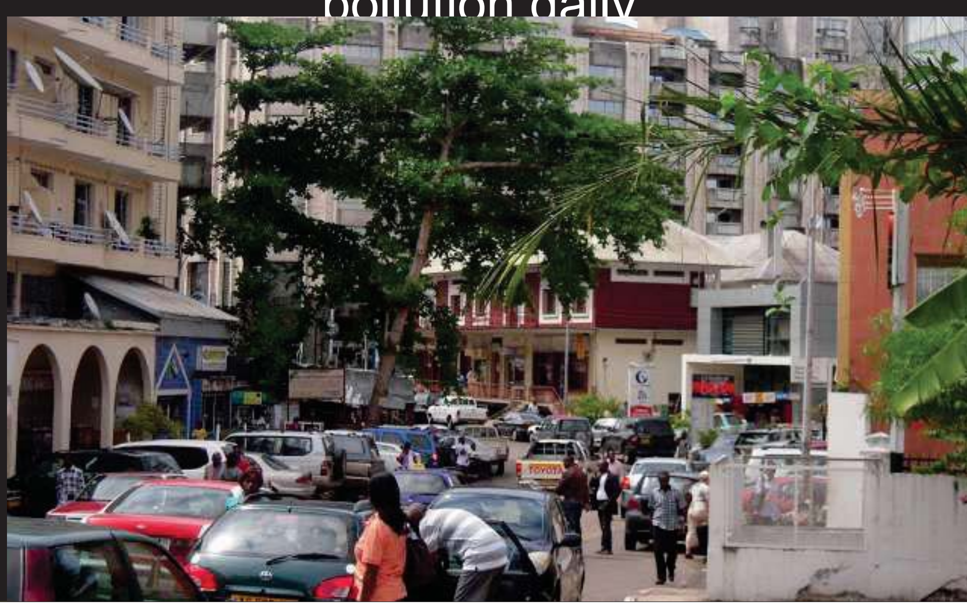


A mess of solid waste

Inadequate solid waste management system from building to collection to landfill

Increasing tail pipe emissions

Similar to Ulaanbaatar and other developing cities, the dominance of and dependency on private motor vehicles increases air, water, and soil pollution daily



Remediative Measures

1. Preserving and enhancing existing forests and jungle

2. Plans to install a city-wide sanitary sewer system

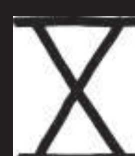
3. Developing a solid waste management plan

4. Gradually increasing connectivity, improving sidewalks, increase transit access, increasing infill and walkable new development

Lessons Learned

1. Address air, water, and land pollution and contamination systemically, whenever feasible (e.g., reduce the causes of auto dependency)
2. Deploy “high leverage”, low-tech interventions whenever possible (e.g., conserve energy first by insulating before adding renewable energy sources)
3. Employ performance measures beyond the need for short-term return on investment

Performance Measures

Time-Tested 

Vernacular 

Pervasive 

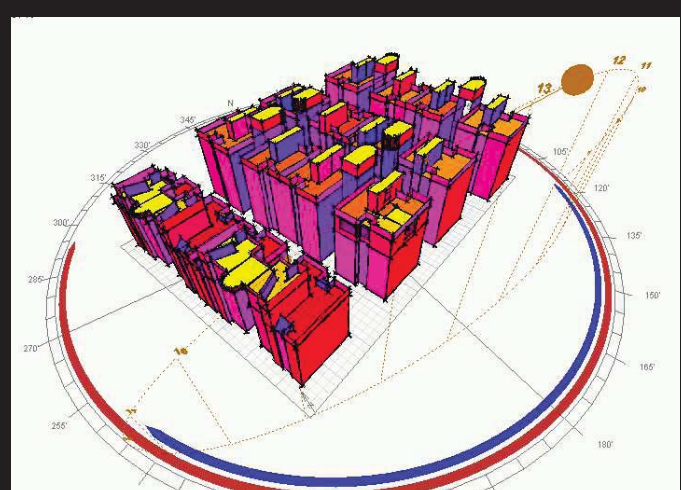
Virtuous 

Time-Tested

What has worked best, over time in the long run?
What remediation strategies, tools, and techniques have allowed certain places to protect or enhance their human and natural environments while others have failed?

Vernacular

What remediative, locally-based solutions can be employed with relative efficiency, effectiveness, and simplicity by the impacted people?



Example: Designing a building to absorb and retain the warmth of solar energy

Pervasive

What remedies offer broad applicability for a wide range of circumstances and over a diversity of environments?

Example: Making cities and neighborhoods walkable and bikeable

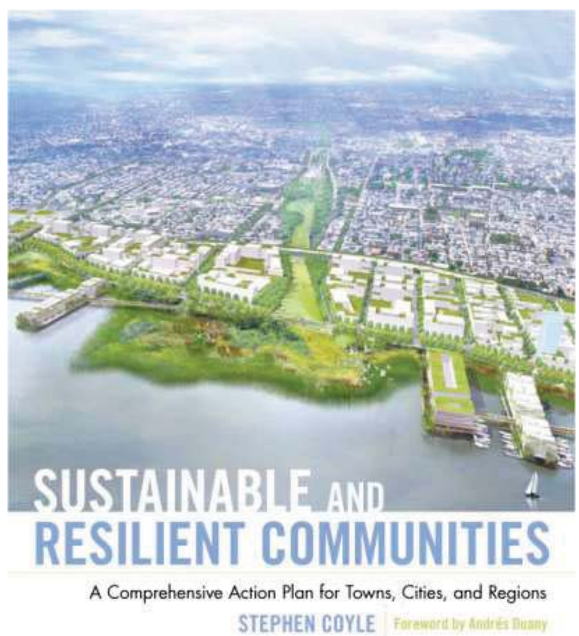
Virtuous

What remediation strategies, tools, and techniques will limit or reduce potential negative consequences, and leverage positive impacts, in the short and long term?

Education, the number one strategy! Technology can create unintended, adverse consequences

Thank You

Questions?



Steve Coyle, AIA LEED AP

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www.town-green.com

www.sustainableandresilient.com

510.755.8551

Attachment 5
Starting a Student Chapter at Stanford University:
Challenges and Opportunities

Starting a Student Chapter at Stanford University: Challenges and Opportunities

Jay Thompson, Diana Lin,
YeoMyoung Cho, Yongju Choi, Chinghong Hsieh
February 26, 2013
SURF 22
UC Berkeley

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Outline

- Objective
- Introduction
- Timeline
- Activities
- Challenges
- Opportunities
- Example of deliverable: HP LCA Case Study

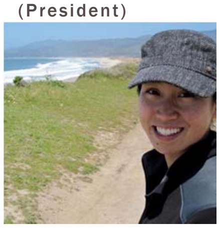
2

Group Members

Jay Thompson
(President)

Dr. Yeo-Myoung Cho (Advisor)

Dr. Ching-hong Hsieh



Diana Lin
(Vice President)

Yongju Choi
(Treasurer)

Other group members:
Dr. Sanjay Mohanty
Brian Halaburka
Niveen Ismail

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Timeline

1. Pamela Dugan pitches SURF to Jay and Chinghong
2. SURF proposed to small group at Stanford
3. Formed SURF chapter
4. Applied and accepted as an official student group at Stanford University
5. Recruiting new members
6. Activities
   1. Journal club
   2. LCA project for remediation
   3. Seminar series

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Member Expectations

- Knowledge development
  - Increasing interest in sustainability
  - Independent research
  - Defining and developing GSR
- Professional development
  - Networking opportunity
  - Developing mentor and mentee relationships

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Challenges

- New vocabulary
  - What is GSR?
- Lack of relevant institutional knowledge
  - Limited classes
  - Limited faculty expertise
- Expanding member base
  - Directly relevant to a limited number of students

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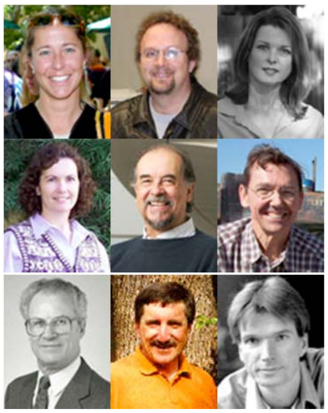
Challenge: Institutional Knowledge



- 9 Faculty members in Stanford EES
- 4 Faculty members involved with remediation research
- 0 Faculty members focusing on GSR

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Challenges: Institutional Knowledge

- 0 classes available on GSR
  - Too new & niche for classes?
  - Topic for professionals, not students?
- Piecemeal approach
  - CEE 270 – Engineering science
  - CEE 226 – Quantifying environmental impacts
  - CEE 277C – Environmental governance
  - Disadvantage: consumes many credits

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Opportunity: Independent Learning

- Student-led learning
  - Collaborative learning through literature
  - Students teaching students
- Professional mentorship
  - Example: Chris Glenn (Treadwell & Rollo) visits Stanford in February
  - Conference and workshop participation

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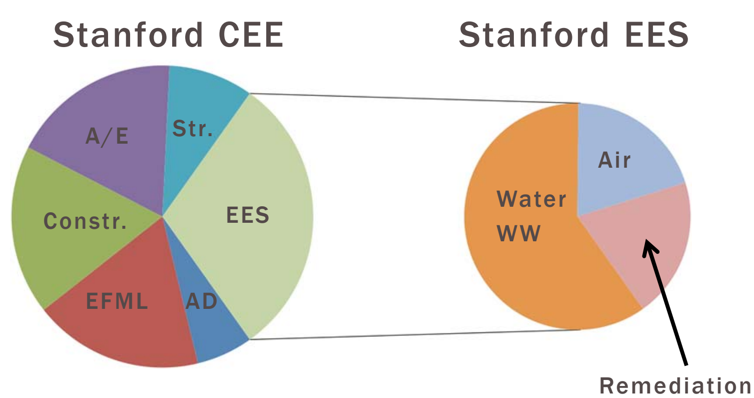
Challenges: Expanding Membership Base



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Opportunity: Engaged Membership

- Outcome: Small numbers of highly engaged students
  - High engaged to unengaged ratio
  - Advantageous in completing projects
  - Camaraderie!
- Students from non-traditional backgrounds
  - Recruiting is difficult
  - Mostly word-of-mouth

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Other Challenges

- Active recruitment and leadership
- Sustainability of chapter
- Outreach to other disciplines

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Suggestions to Assist Future Chapters

- Creation of a "Reading List" to bring new chapters up to speed
- Matching of chapters to local SURF professionals
- Communicate the potential benefits of SURF membership to potential founders: learning, knowledge creation, professional development

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Prospective Activities

- SURF at Stanford: A Focus on Deliverables
  - Bi-monthly seminars
  - Student-proposed course
  - Student design competition
  - Field trips

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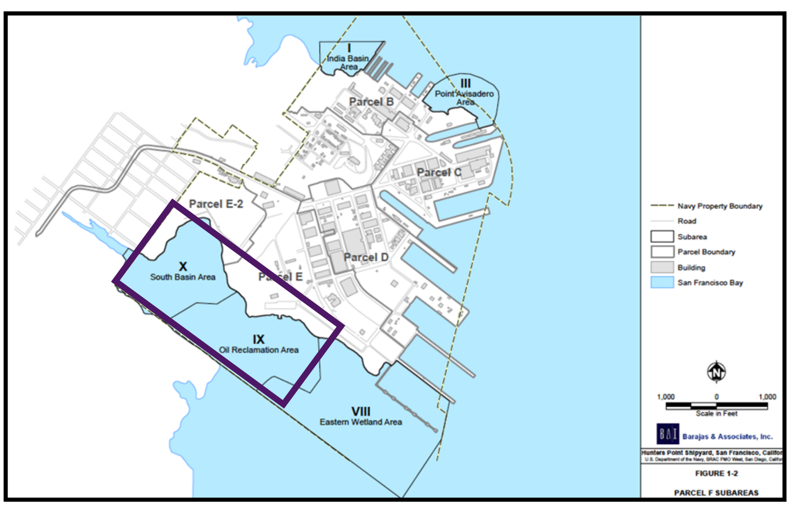
Example of a Deliverable:

Life Cycle Analysis of Activated Carbon and Dredging for PCB Remediation at Hunters Point Shipyard

Jay Thompson, Diana Lin,
Wakuna Galega, Niveen Ismail, Adrian LeCesne,
Momoko Otsuka

2008 Feasibility Study

- Prepared for US Navy for Parcel F
- PCB "Do not exceed" goal is 1.24 ppm



Source: Barajas & Associates, Inc. , "Feasibility Study Report for parcel F Hunters Point Shipyard San Francisco, California", 2008

Study Objective

- Quantify and compare:
  - Environmental impacts of
  1. traditional dredge and fill technology and
  2. activated carbon (AC) amendment

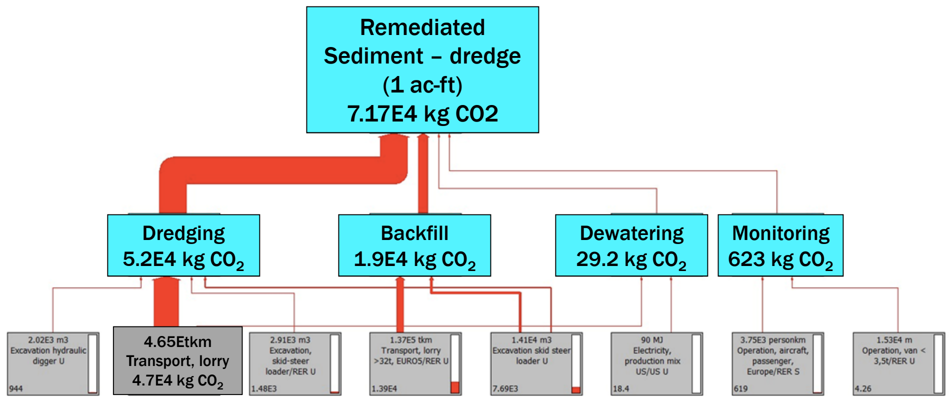
  for PCB remediation of Hunters Point Shipyard

Study Scope

- Scope
  - Raw material acquisition & manufacture
  - On-site activities
  - Disposal
  - Long term monitoring
- Functional Unit:
  - Acre-foot of bioactive sediment with an initial PCB concentration of 2 ppm treated to meet remediation goals of a maximum PCB concentration of 1.24 ppm
  - Area of sediment multiplied by the depth of the bioactive layer (estimated as 1 foot).

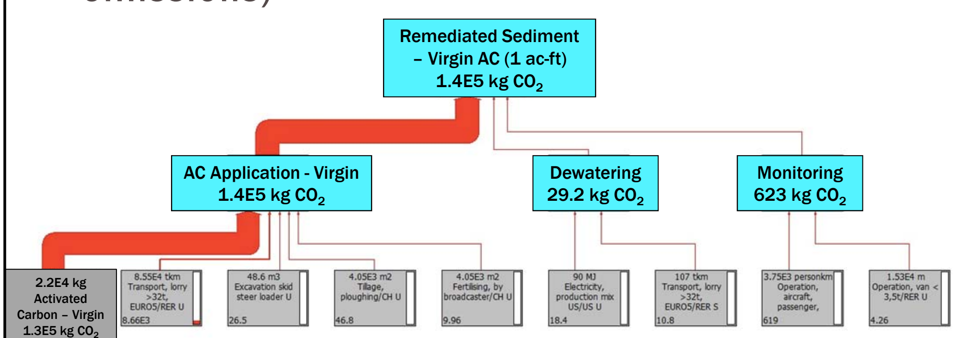
LCA – Major Impacts for Dredge Option

- Dredge & Fill = Transportation (85% total GHG emissions)



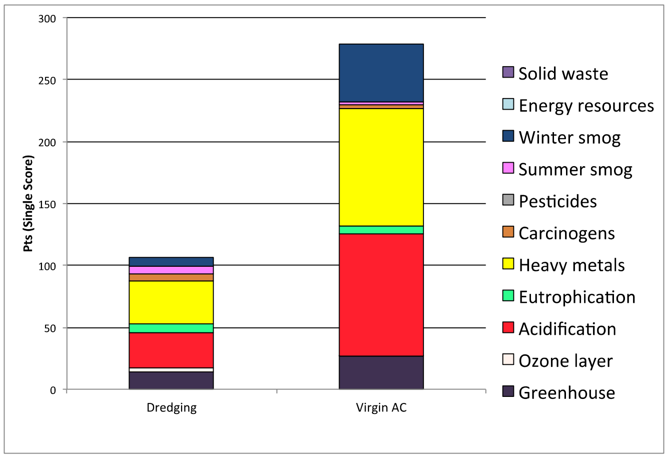
LCA – Major Impacts for AC Option

- Virgin AC = Production (93% total GHG emissions)



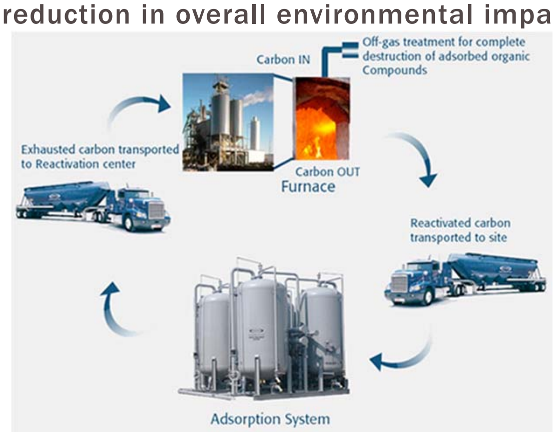
Environmental Impacts Comparison

- Virgin AC amendment has 2.6x greater environmental impact than dredging



Another Option: Recycled AC

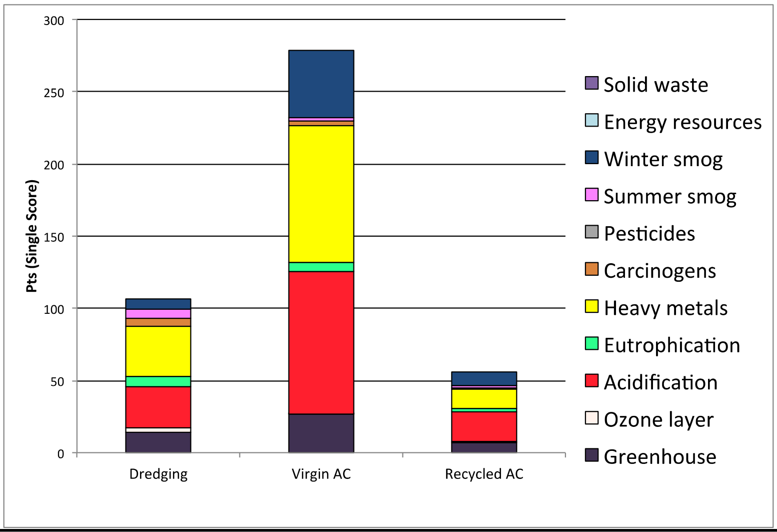
- Potential Impact on Cost:
  - cost reduction of $1.8 million ($2.90/lb vs $1.80/lb)
- Potential Impact on Environmental Impact:
  - 80% reduction in overall environmental impact



Source: http://www.calgoncarbon.com/carbon_reactivation/process.html

Environmental Impact Revisited

- Recycled AC has lowest environmental impact (~50% less than dredging & ~80% less than virgin AC)



Project Uncertainties

- Energy input for AC manufacturing
- Transportation distances
  - Parcel E-2 cleared for on-site disposal – less transportation needed
  - Dredge sediment does not meet Class II standards – more transportation needed
  - Availability of backfill sediment from Oakland harbor
- Overall remediation success

Project Recommendations

- Replace Virgin AC with Recycled AC
  - Reduction of cost by 20%
  - Reduction of environmental impacts by 80%
- Analyze impacts of using coconut shell-based AC
- Dredge and Fill if Recycled AC not Available
- Follow-up on 2008 Feasibility Study
  - Parcel E-2 for on-site dredge disposal
  - Backfill from closer location
  - Change transportation mode (i.e. barge, rail)

Additional Information

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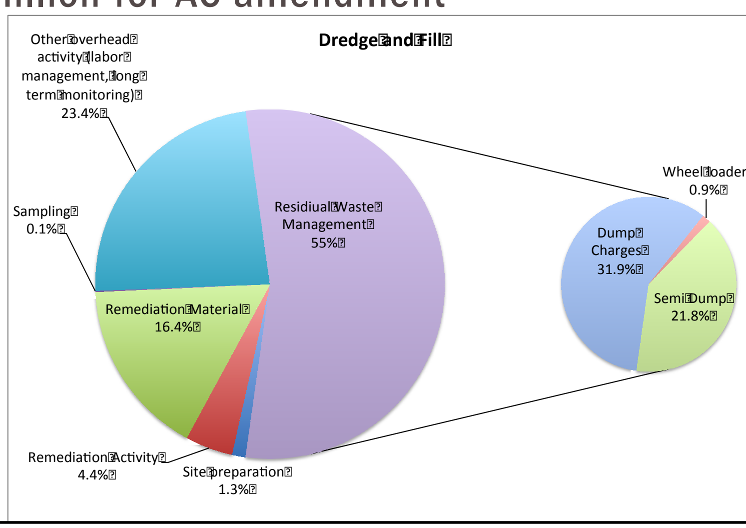
Normalized Cost (Cost per 33 acres)		
Cost Description	**Dredging Subtotal**	**AC Amendment Subtotal**
Aquadam installation and pumping (South Basin, 2000 ft)	$10,402	$10,402
Aquadam installation and pumping (Yosemit Creek, 150 ft)	$1,742	$1,742
Excavation and backfill		
Excavator (150,520 yd^3) + crane mats	$26,273	
Backfill (37,037 BCY + 185,195 yd^3 Unclassified fill)	$155,146	
Dewatering Pad	$15,389	
Thin layer backfill of AC, no excavation, with tiller mixing		
Activated carbon cost		$141,524
Broadcast carbon twice using tractor spreader (2 x 33 acre; $105/acre)		$211
Soil tilling twice usign D3 doser with tiller attachment (2 x 40 hr @ $200/hr)		$484
Decontamination	$33	$33
Confirmation sampling	$1,020	$895
Residual waste management (for dredging: 35,480 yd^3 disposed at Altamont Landfill)	$516,896	$674
Professional labor management (@33% of capital costs)	$171,949	$50,955
Design cost(@12% of capital costs)		$18,529
Long-term monitoring		
Annual monitoring first 4 years	$16,467	$16,467
Monitoring every 5 years and 5-yr review for years 5-30	$32,993	$32,993
Total Cost per acre	**$948,310**	**$274,910**
Total (for 33 acres)	**$31,294,228.00**	**$9,072,041.00**

LCCA Charts

- $31.3 million for dredge and fill versus $9.1 million for AC amendment



LCCA Charts

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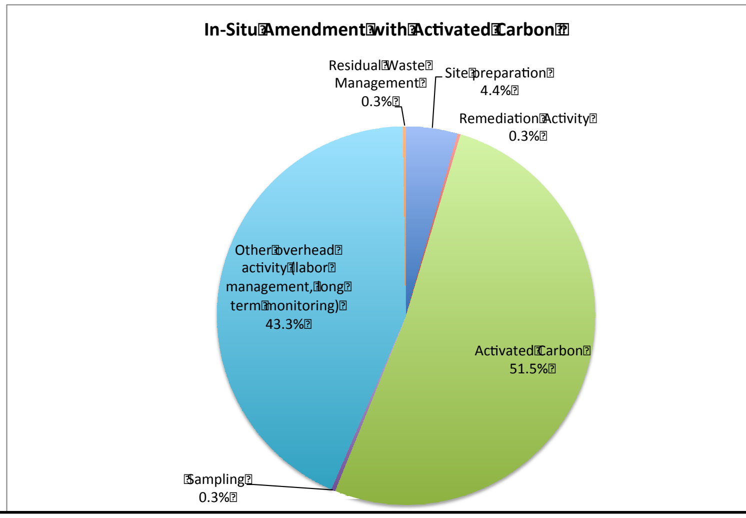


Transportation of Dredged Sediment

- On-site disposal at Parcel E-2
  - 66% reduction of environmental impacts due to transportation
  - 55% reduction in overall cost
    - Elimination of transportation and disposal fees
- Transportation of dredged sediments to Class I landfill
  - Transport to Kettleman City, CA (206 miles)
  - 3x cost and environmental impact increase

Attachment 6
Redefining Remediation Goals with Long-Term Monitoring Data

Redefining Remediation Goals with Long-term Monitoring Data

James R. Hunt
UC Berkeley

with assistance from Steven Gladding and Arthur Wiedmer

and support from
UC Berkeley Superfund Research Program
Advanced Simulation Capabilities for Environmental Management (ASCEM) at Lawrence Berkeley Nat. Lab.
UC Berkeley Center for Information Technology Research in the Interest of Society (CITRIS)

1

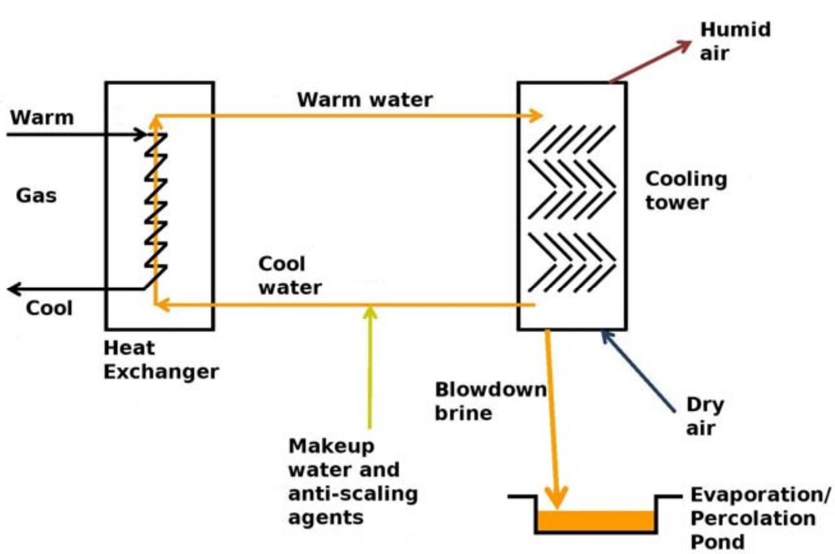
Messages

- Environmental monitoring data can be valuable if mined
- Subsurface remediation programs have unique temporal and spatial coverage
- Even if all sites are different, generalization (scaling) across sites is needed
- Example 1: Learning lessons for Cr(VI) remediation
  - Hinkley Gas Compressor Station
  - Topock Gas Compressor Station
- Example 2: Lost in data
  - Department of Energy Nuclear Fuel Production Facility at Savannah River Site

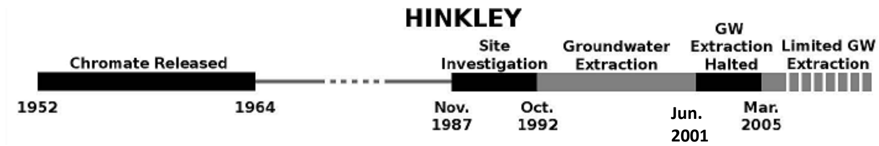
2

Example 1: Pacific Gas & Electric Companies natural gas compressor stations in Southeastern California

Pumping Natural Gas Requires Cooling, Evaporative Cooling Systems Produce Brines



Timeline of investigations at the Hinkley natural gas compressor station



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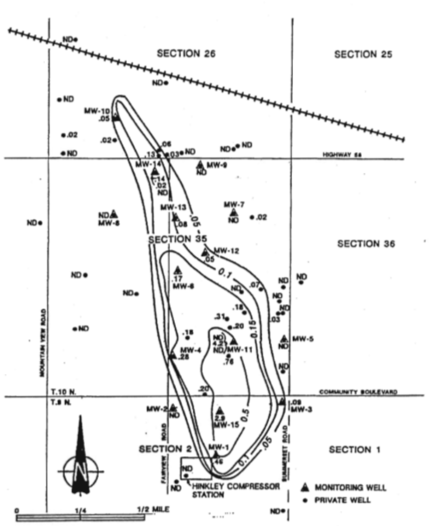
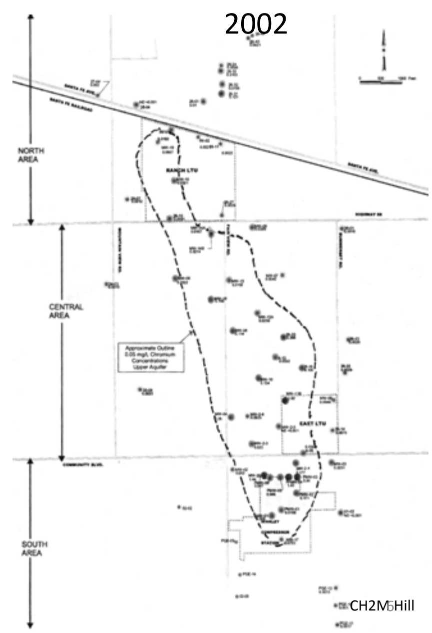
Hinkley chromium plume at 50 μg/L in 1988 and 2002

1988

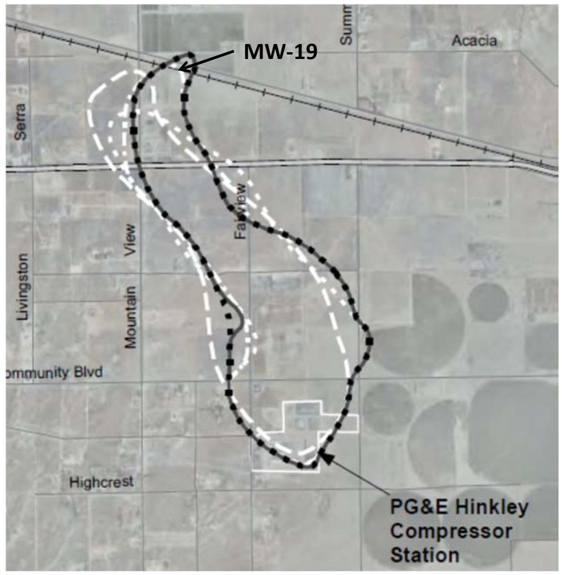


2002



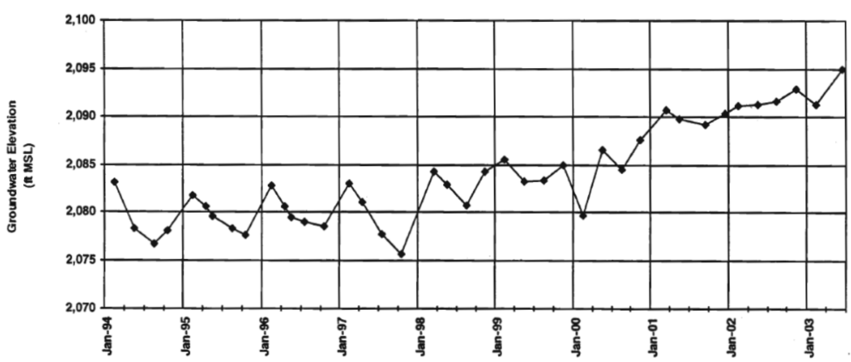
CH2M Hill

Hinkley chromium plume at 50 μg/L in 2011



RWQCB (2012) Draft EIR 7

Groundwater elevation at MW-19, Hinkley, CA shows active groundwater withdrawal and recharge



CH2M Hill

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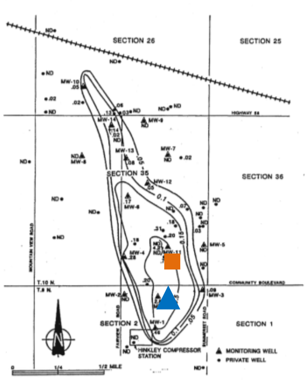
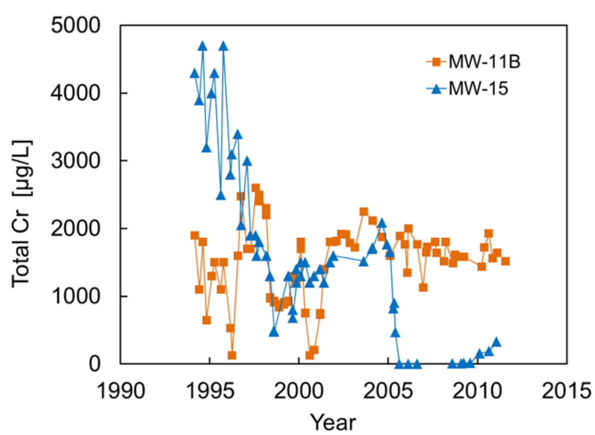
Subsurface Remediation Sites are Data Rich.
At Hinkley: > 240 Wells and > 6000 Cr measurements

TABLE G-1
Groundwater Chromium Sampling Results for GMP Wells 2001 through December 2011
Fourth Quarter 2011 Groundwater Monitoring Report and Domestic Well Sampling Results
Pacific Gas and Electric Company Compressor Station, Hinkley, California

Well ID	Sample Date	Total Dissolved Chromium (ug/L) SW6010/6020	Hexavalent Chromium (µg/L) SW7199/218.6	Hexavalent Chromium (µg/L) SW7196A/3600	Data Source
MW-10	12/13/2011	36.8 J	**43.8**	NA	CH2M
	12/13/2011*	46.9 J	**43.8**	NA	CH2M
No. of Samples:	42				
MW-11A	04/14/2008	**15.5**	**4.80**	NA	ARCADIS
	08/16/2010	**1.40**	ND (0.2)	NA	CH2M
	02/01/2011	ND (1.0)	ND (0.2)	NA	CH2M
No. of Samples:	3				
MW-11B	03/07/2001	**750**	NA	**753**	ALISTO
	03/07/2001*	**730**	NA	**738**	ALISTO
	05/22/2001	**1400**	**1350**	**1310**	ALISTO
	05/22/2001*	**1400**	**1470**	**1320**	ALISTO
	09/26/2001	**1800**	**1700**	**1700**	ALISTO
	09/26/2001*	**1800**	**1600**	**1700**	ALISTO
	12/05/2001	**1800**	**1600**	**1800**	ALISTO
	12/05/2001*	**1800**	**2100**	**1600**	ALISTO
	02/11/2002	**1820**	NA	**1840**	CH2M
	05/20/2002	**1920**	NA	**1950**	CH2M
	08/21/2002	**1910**	NA	**1900**	CH2M
	11/11/2002	**1790**	NA	1790 J	CH2M

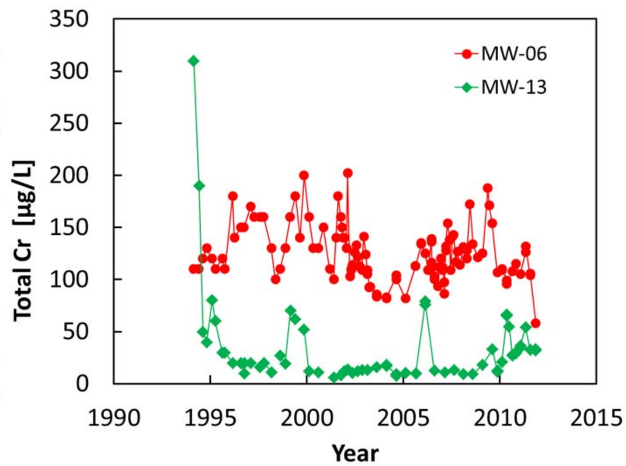
Near Hinkley Source, Cr is Variable in Groundwater





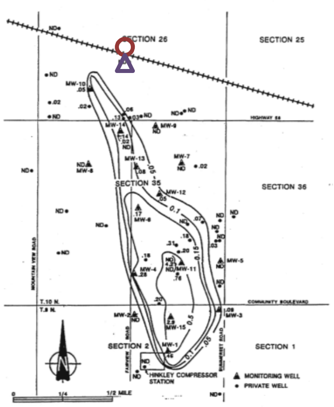
CH2M 4th Q Monitoring Report, 2011

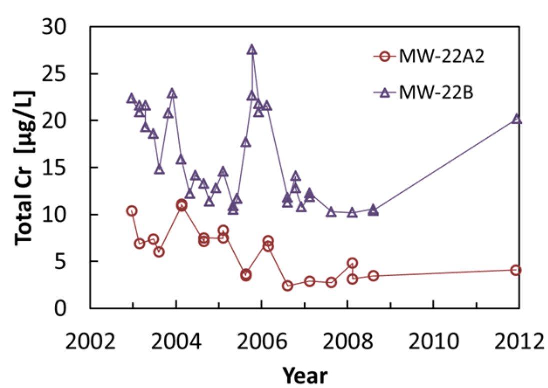
Down Gradient, Cr is Persistent



CH2M 4th Q Monitoring Report, 2011

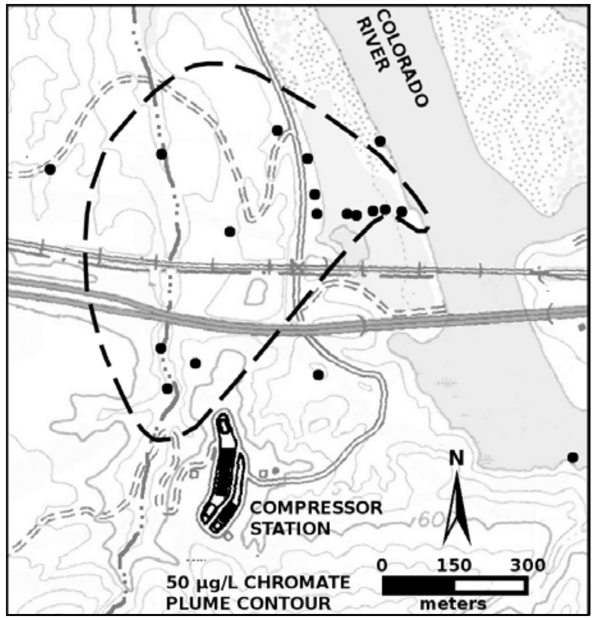
Some Evidence of Upper Aquifer Stratification





CH2M 4th Q Monitoring Report, 2011

Topock Compressor Station had similar operational history on brine disposal



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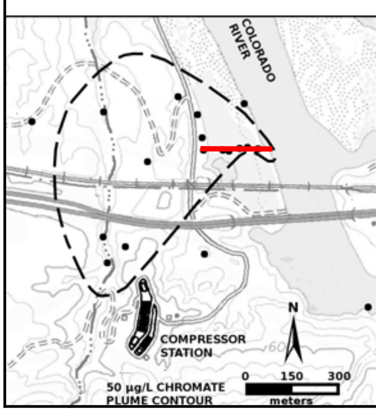
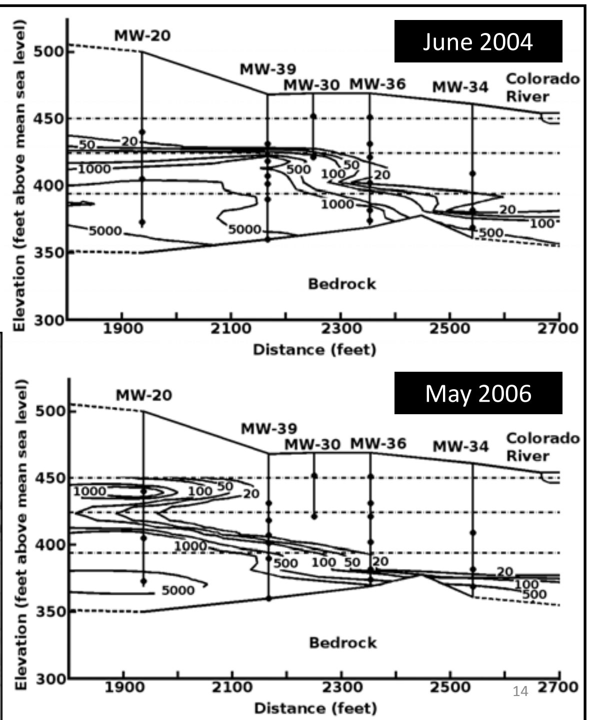
Topock Vertical Cross Sections Show Stratification

Contours in µg/L





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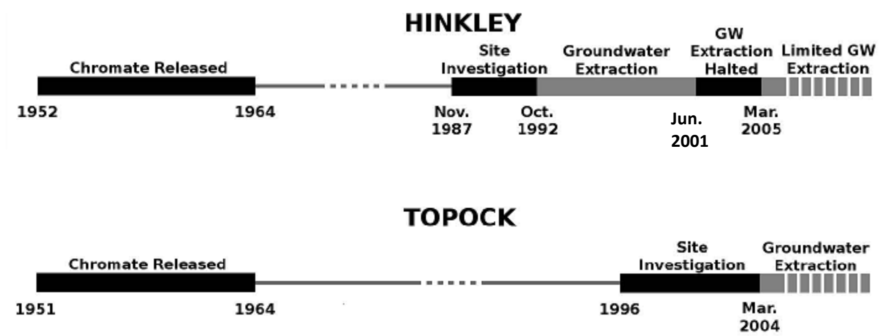
Timelines of Operations and Investigations at the Natural Gas Compressor Stations



Were any lessons learned and shared between these remediations?

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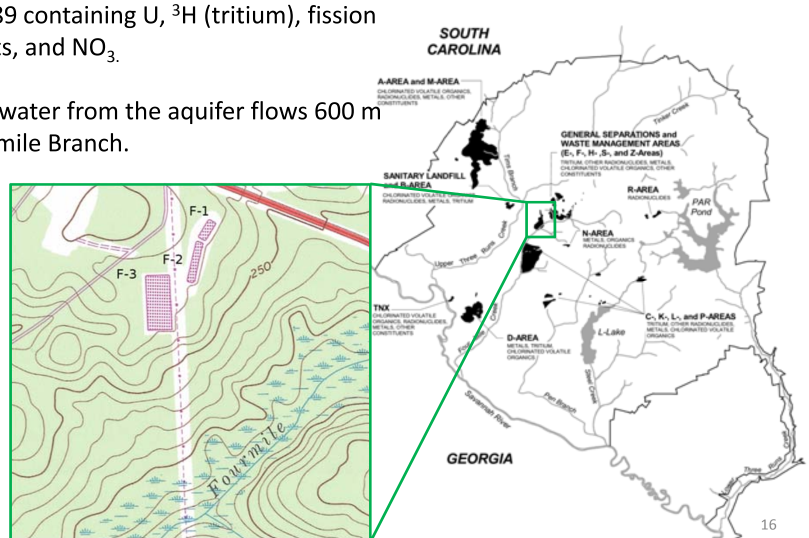
Example 2. Department of Energy Savannah River Site: F-Area Seepage Basins

Seepage basins received $7x10^6 m^3$ of low level acidic (pH~3) waste between 1954 and 1989 containing U, ^3H (tritium), fission products, and NO_3.

Groundwater from the aquifer flows 600 m to Fourmile Branch.



16

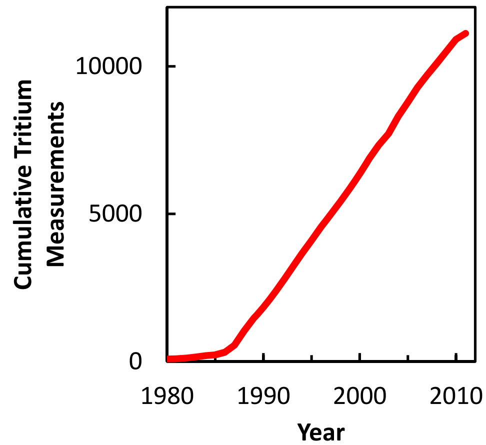
Tritium and Nitrate as Tracers and Contaminants

Tritium is a great tracer:

- Known decay rate
- Non adsorptive
- Good monitoring data
- 360 wells

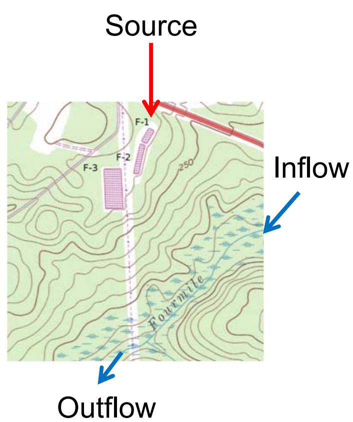
Nitrate as check

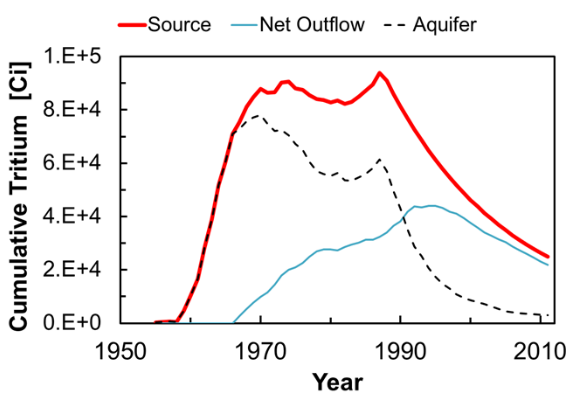
- Conservative
- High concentrations
- Good monitoring data



17

Aquifer Inventory of Tritium = Source – Net Outflow





18

Monitoring Well Data within Aquifer Provides Additional Check of Tritium Inventory

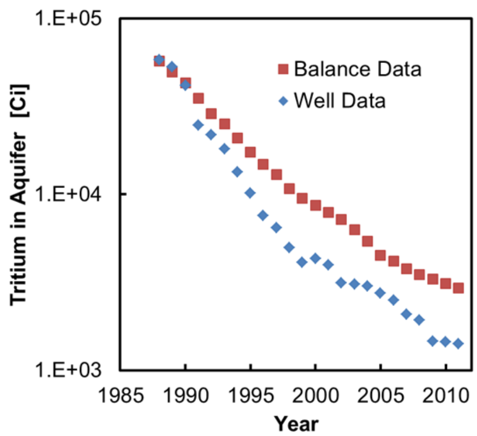
Tritium in aquifer decays exponentially through radioactive decay, k_T, and flushing, $1/\theta$

$$T(t) = T_o \exp[-(k_T + 1/\theta)\, t]$$

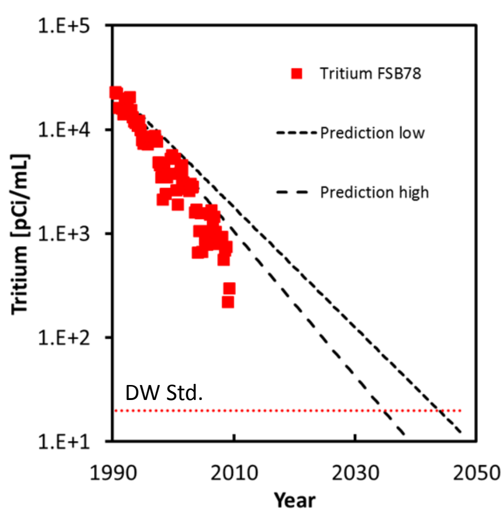
with:

$k_T = 0.056\ yr^{-1}$

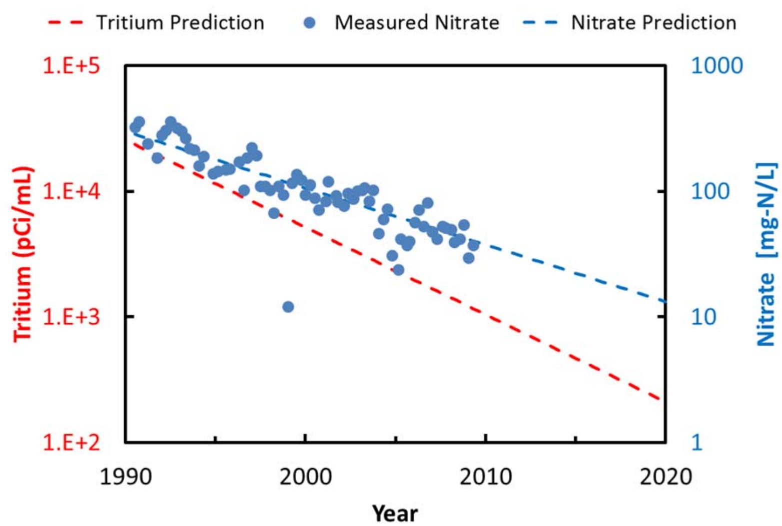
$1/\theta = 0.077 – 0.104\ yr^{-1}$



Flushing Model Provides Conservative Estimate for Observations at Well FSB 78

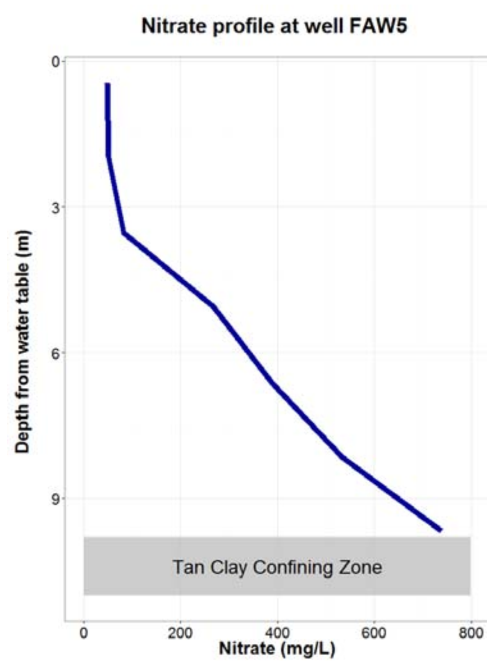


Flushing Model Provides Reasonable Estimate to Nitrate at Well FSB 78



Known issues that compromise modeling:

- Monitoring wells only partially screened in upper aquifer
- Limited data in Well FAW 5 suggest density stratification
- Some contamination in lower aquifers



Messages

- Environmental monitoring data are valuable
- Visualization of spatial and temporal data is challenging
- Even if all sites are different, generalization (scaling) is needed across sites
- Example 1 (Compressor Stations):
  - Source terms are as important as plume chasing
  - Remediation is an integrated system
- Example 2 (Savannah River Site):
  - When lost in data, it is hard to find simple models

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Attachment 7
Breakout Session Reports

Academic Outreach Initiative

Academic Outreach Initiative

Team Members:
- Lead – Pamela Dugan & Mike Miller
- Michelle Crimi
- Keith Aragona
- Scott McDonough
- Brandt Butler
- Dan Watts

- Board Liaison - XXX

Objectives:
Promote academic involvement in SURF:
- Recruit/advertise to academic community
- Support SURF student chapters
- Develop student chapter design competition
- SURF-sponsored student paper and poster presentations
- Collaboration on academic research programs related to sustainable remediation

Accomplishments:
- Six student chapters
- Others in process
- Battelle Conference SURF student paper competition
- Student/professor attendance and participation at meetings

Next Steps:
- SURF mentors for student chapters: guidelines & recruiting
- Continued development of student design competition
- More outreach to academic institutions
- Webinar series for student chapters
- Newsletter for students

Upcoming Meetings/Presentations:
- Battelle 2013 Biosymposium: SURF student paper award
- Student/faculty presentations at each SURF meeting

Help Needed:
- **Help Needed: Board**
  - XXXX
- Help Needed: Membership
  - XXXX

Academic Outreach Initiative
Breakout Session 1

Mike Miller (Co-Chair, Academic Outreach Initiative) led this breakout session and stated that the primary purpose of the session was to obtain feedback from SURF members about the roles and responsibilities of a SURF Mentor for SURF student chapters. The Academic Outreach Initiative will use the information gathered in this breakout session to develop a plan to support and nurture SURF student chapters through a SURF Mentor Program.

Mike provided a brief background for those participants unfamiliar with SURF student chapters. The first student chapter was established in 2010, with additional student chapters forming across the country. Although a formal process exists for establishing a SURF student chapter, ongoing support from SURF occurs on an informal and ad-hoc basis. The idea of creating a volunteer SURF mentor position was generated as a way to establish a more formal "bridge" between SURF and its student chapters. One or more SURF members would be assigned to each student chapter to serve as a liaison between the two groups and a point of continuity when students graduate.

Participants brainstormed about the following topics related to the SURF mentor and the proposed program:

- Number of SURF Mentors per Student Chapter
  Participants seemed to agree that it was a good idea to have more than one mentor per student chapter. The volunteer position of a SURF mentor could be shared between two SURF members or one mentor could develop a "support group" as backup.

- Roles
  - Act as a conduit between SURF and student chapter.
  - Serve as a technical resource in the field of sustainable remediation.

- Responsibilities
  - Provide peer review of student projects and/or research.
  - Provide support to student chapter so that there is continuity when students graduate.
  - Communicate SURF activities and efforts to student chapter and vice versa.
  - Educate students about the framework, tools, and metrics associated with sustainable remediation.
  - Provide opportunities for summer internships, job networking, pilot studies, presentations, and publications.
  - Make link between students and related organizations in the nearby community and, in turn, link these organizations with SURF.
  - Provide students with opportunities for *active* participation in SURF's technical initiatives.

- Set aside time with student chapter members for open dialog.
    - Provide students with real-world examples of sustainable remediation (e.g., consideration of billability, budgets).
    - Leverage SURF membership to coordinate site visits, presentations at student chapter meetings, and informal dialog through Skype.
    - Advise students regarding career development.

- Guidelines for Engagement
    - Check in every other week with students or once a month depending on frequency of student chapter meetings and need.
    - Allow all students to contact mentor directly via email (vs. having one point of contact within the student chapter).

- Qualifications
    - Be a SURF member.
    - Have a familiarity about the program, professors, and departments at the university associated with the student chapter.
    - Ideally, live geographically close to the university associated with the student chapter to facilitate face-to-face interaction.
    - Ideally, be an alumnus of the university associated with the student chapter.

- Other Ideas
    - Provide a mechanism to allow SURF student chapter members to provide feedback about their mentor.
    - Request student chapters to produce an activity report at a specific frequency for submission to SURF via the SURF mentor to help facilitate communication.
    - Create a newsletter for student chapters describing SURF activities and student projects and efforts in the field.
    - Develop a mechanism (e.g., certificate) to recognize students participating in SURF so that they can distinguish themselves from others to potential employers.
    - Develop a one-hour teaching module on sustainable remediation and integrate into course curricula at universities associated with SURF student chapters.

The following action items were mentioned during the breakout session:

- Create a new page on the SURF website entitled “Career Opportunities” and encourage SURF members to post relevant career opportunities. (Kathy Adams to communicate this idea to Maile Smith, webmaster)
- Reach out to student chapter faculty advisors to obtain input as to amount of hours spent mentoring per month. (Mike Miller to work with committee to obtain input)

Academic Outreach Initiative
Breakout Session 2

Mike Miller (Co-Chair, Academic Outreach Initiative) led this breakout session about the SURF Student Chapter Design Competition. The primary purpose of the breakout session was to obtain feedback from SURF members about the design submittal requirements, judging criteria, role of SURF Mentor to the student teams, and competition guidelines.

Mike provided a brief background for those participants unfamiliar with the planned SURF Student Chapter Design Competition. A sustainable remediation design problem would be developed and submitted to interested SURF student chapter teams. Student teams would develop a solution and document accordingly. The goal is to announce the competition in Fall 2013 and have the students begin working on the solution in January 2014. Mike said that the following four groups of volunteers will be needed for this effort: (1) Competition Design Team, (2) Site Problem Design Team, (3) University Mentors, and (4) SURF Mentors.

Participants brainstormed about the following topics related to the competition:

- Design Submittal Requirements
    - Use of EPA Guidance
      One participant suggested using the EPA guidance for developing a feasibility study. Other participants seemed to agree. The guidance would be provided to student teams and they would be required to produce a deliverable that addresses particular relevant sections. The Site Problem Design Team would ensure that a limited focus and limited level of detail are maintained when selecting relevant sections.

    - Site Selection Considerations
      One participant expressed his preference for a specific site location so that sustainability elements (e.g., transport to an off-site landfill) can be considered quantitatively. After some discussion, participants seemed to agree that a specific location of a hypothetical site (vs. an actual remediation site) would be appropriate.

    - Inclusion of Tools
      Participants discussed the advantages and disadvantages of requiring a specific tool to be used to solve the design problem. After the discussion, the group agreed that the Site Problem Design Team would include a *limited* amount of publicly available tools familiar to the competition judges. Then, student teams would need to assess the site problem and decide which tool to use.

- Judging Criteria
  Participants seemed to agree that social questions should be embedded in the design problem and student teams should be given points for considering all elements of the

triple bottom line. In addition, participants seemed to agree that the University Mentor should encourage student teams to work with departments outside of their expertise to solve the problem.

- SURF Mentor Role
  After some discussion, participants seemed to agree that transparency and open communication were of primary importance when considering the role of the SURF Mentor. The role of the SURF Mentor in the competition is to support the student teams by answering questions about competition rules/procedures. When asked a question about the design problem, SURF Mentors *direct* the student team toward the resources to solve the problem (vs. provide the answer). For example, for an engineering question, the SURF Mentor would say "I can't answer that, but did you check with your engineering department?" Before providing an answer to a question, the SURF Mentor should ask him/herself "Is my answer influencing the student beyond what answer they would be able to obtain on their own?"

- Competition Guidelines
  During the breakout session, participants recommended the following approach for the competition:
    - Numbers are assigned to student teams to preserve anonymity.
    - Student teams receive the design problem information at the same time via email, followed by a 10-day Q&A period.
    - SURF Mentors support all student teams via an electronic bulletin board and biweekly conference calls.
        - Student teams post questions on the electronic bulletin board and a SURF Mentor replies. Other SURF Mentors add or clarify the answer as necessary. The questions and replies would be available to all student teams participating in the competition.
        - Biweekly conference calls with all student teams and SURF Mentors would allow for more informal interaction.
        - When answering questions, SURF Mentors

After this meeting and based on the results of this discussion, the Academic Outreach Initiative members will develop numeric scoring criteria for the competition.

Government Outreach Initiative

GO SRI

Team Members:

- Leads – Buddy Bealer & Stephanie Fiorenza
- Keith Aragona, Charles Blanchard, Brandt Butler, Angela Fisher, Nicholas Garson, Karin Holand, Melissa Koberle-Harclerode, Marianna Horinko, Jason McNew, Kathryn Moxley, Leah Pabst, Olivia Skance, Dave Woodward
- Board Liaison – Buddy Bealer

Objectives:

- Complete standardized presentations (525: 5 words, 5 minutes, 25 minutes, 2.5 hours)
- Identify priority stakeholders and develop engagement teams with specific strategy and plan (engagement plan)
- Begin implementation of plans using standardized materials
- Develop methods to encourage and promote regulatory participation and membership in SURF

Accomplishments:

- Draft Strategy and Plan out for review
- Draft One Page Summary (with definition)
- Draft Summary Presentation Slide Pack

Next Steps:

- Review and complete presentation packages
- Identify targeted geographic areas and team leads to develop engagement plan

Upcoming Meetings/Presentations:

- Calls every two weeks

Help Needed:

- **Help Needed: Board**
  - Continue support
- Help Needed: Membership
  - More volunteers to review and update strategy, plan, and implementation efforts (engagement plans)

Completed by: Buddy Bealer
Date: 3-15-2013

Sustainable Remediation Resource Index

Sustainable Remediation Resource Index Initiative
Breakout Session 1

In this breakout session, participants brainstormed about the value of the proposed index and commented on its potential use. Mary Kean (Co-Chair, Sustainable Remediation Resource Index Initiative) led the discussion.

- Use students to help develop it. Make it workable, usable, and concise.
- Go with the Excel sheet, especially considering the level of effort associated with two-page summary.
- Need to keep updated, which will be very difficult.
- Obtain help from professional members of SURF as well as students. Prioritize Excel sheet and ensure that the top priority tools are up to date.
- Need to provide something different because lists of tools already exist.
- Make it fact-based, and list the capabilities of each tool.
- Make it searchable.
- Need to define audience (e.g., novice or experienced remediation practitioner).
- Develop a hybrid of two-page summary and Excel sheet that uses macros and is able to be downloaded.
- Create a folder structure with categories, if possible.
- Need to focus on key audience.

Mary asked breakout participants to vote for one of the proposed four deliverables. Results are as follows:

Proposed Deliverable	Number of Votes
PDF summary	0
Excel sheet	8
White paper	1
Searchable database	6

Based on this voting, Mary asked participants for funding source ideas for a searchable database. Participants replied as follows:

- One participant believed that the U.S. Environmental Protection Agency (EPA) would not be willing to fund the effort due to timing and budget constraints.
- One participant recommended partnering with computer programming students at a university. Mary reminded participants that the content of the database needs to be developed as well as the structure.
- A few participants expressed concern about discussing funding options and suggested that the initiative focus only on the Excel sheet.
- One participant recommended starting with the Excel sheet and expanding the scope (e.g., to include case studies) at a later date if necessary or desired.

- One participant suggested creating a five- to 10-minute survey via SurveyMonkey and asking SURF members to rank the categories on the Excel table.

Maile Smith (Co-Chair, Communications Committee) said that additions to the Excel table could be added using a form on the SURF website. She offered to design a “Submit a Resource” page in which SURF members would add information to form fields and the information would automatically update a master table. Mary expressed her concern that new information would need to be verified before it is posted.

Mary asked participants if they would use the Excel table and if they knew of any other similar resource containing the same information. Participants replied as follows:

- One participant said he would use it and he is not aware of other similar resources.
- One participant expressed his belief in the value of a resource index, but challenged participants to define the goal for providing this service.
- Three participants said they would use the Excel table provided it was simple and easy to navigate. One participant suggested the table reflect the media that the tool addresses.
- One participant said she would use the Excel table if it contained non-EPA resources. She commented that a lot of the information contained in the current Excel table is available on www.clu-in.org (CLU-IN) and questioned why people would go to SURF for this information. Mary responded that CLU-IN is not being updated regularly. The participant recommended reaching out to non-EPA resources, as well as international resources, and including them in the existing table.
- One participant suggested linking case studies to the tools listed in the Excel table at a later time.
- One participant asked Mary to define the intended audience for the resource and asked participants what additional value the Excel table brings beyond the information included in CLU-IN.

The breakout session ended and continued the following day of the meeting.

Sustainable Remediation Resource Index Initiative
Breakout Session 2

In this breakout session, participants continued their discussion from Day 1 regarding the value of the proposed index and its potential use. Mary Kean (Co-Chair, Sustainable Remediation Resource Index Initiative) led the discussion.

User-Driven Resource Option

One participant said that it was not necessary to choose between including tools or case studies in the resource index if the end product was designed to be user-driven. Users would rate and comment on existing resources, eliminating the burden of monitoring and validating by SURF. The end product would have interactive features and use templates so that information was consistent.

Need for Case Studies

Another participant recalled SURF's international meeting in December 2012. The most significant need mentioned to gain acceptance of sustainable remediation was the need for case studies. He suggested developing a standard format for case studies so that SURF members could submit them in a consistent format. SURF would store them, but not evaluate them. Participants generated the following ideas associated with a case study template:

- Include tools used for the sustainability assessment.
- Develop a standardized form on the website in which SURF members could contribute.
- Use the NICOLE template as the starting point.
- Design template around the triple bottom line.

New Technical Initiative

Participants seemed to agree that the effort proposed, development of a case study template and a user-driven case study repository, should be considered a new technical initiative for SURF. Mary suggested conducting a survey of SURF members to gauge their energy and interest in this new proposed effort.

Maile Smith (Co-Chair, Communications Committee) provided her thoughts about how the effort could be streamlined. She recommended a process whereby members would enter information into a form field, similar to the SURF meeting registration process. When a member answers a question, the information would automatically populate an Excel spreadsheet. Conceptually, it would be possible to attach files, but SURF may not want to be a storage facility. One participant said that he would prefer a Power Point format but acknowledged that a strict format (regardless of the end product software) would help distill information. Mary said that the members of the new technical initiative would have to determine the end product desired. One participant suggested including a simple sentence with contact information should anyone desire additional detail.

One participant said that the case study template should be generic so that problem owners can share information without confidentiality concerns. One participant of the Groundwater Conservation and Reuse Initiative said that their members discussed the need for a case study template and recommended communication between initiatives.

Participants and Board members agreed that this new technical initiative would need to be proposed to the Board following the usual process. Participants seemed to agree to wait to "kick off" this initiative for at least six months due to limited resources and the abundance of ongoing technical initiatives at the current time. Participants agreed that it seemed reasonable to begin the process of completing the Technical Initiative form and submitting it to the Board before the next SURF meeting In July 2013.

The following individuals offered to work on the new initiative: Buddy Bealer (Shell), Elisabeth Hawley (ARCADIS), Karin Holland (Haley & Aldrich), Maile Smith (Northgate Environmental Management), and Dave Clark (BNSF Railway).

Resource Index Wrap-Up

One participant asked for the background of this initiative. Mary said that that Illinois Institute of Technology developed a draft resource index. With little guidance, the students developed the index as best as they could. The resulting index included some resources that were not applicable to sustainable remediation and the deliverable lacked senior review. The two SURF members leading the initiative passed the torch to its current leaders before leaving the organization. The current initiative leaders refocused the template and re-developed the index of resources.

At the end of the two breakout sessions, consensus was reached to stop the Sustainable Remediation Resource Index initiative. In addition, participants agreed that the hard work performed to date by initiative members should be preserved. Participants acknowledged the leaders of the initiative, Mary Kean (Sustainable Silicon Valley) and Pamela Dugan (Carus Corporation) and commended them for their work.

- Mary will forward the original deliverable from IIT, albeit in very draft form, to the Board along with a summary of the history of the initiative.
- Maile will include appropriate links from current initiative work products on SURF website.

Sustainable Remediation Rating and Certification System

SR Rating & Certification System

Team Members:

- Lead – Dick Raymond & Diana Hasegan
- K. Beil, D. Ellis, K. Holland, R. Kuhns, D. Taege, K. Tipton, S. McDonough, J. Flattery, C. Glenn, R. Sirabian, M. Miller, H. Philip, D. Shea, S. Pan, A. Fisher, R. Britt, R. Ampil, K. Mancini, B. Kelley, L. Larsen-Hallock
- Board Liaison – Paul Favara

Objectives:

- Phase I Objective Research existing sustainability site rating and professional certification systems and develop a whitepaper discussing those systems as well as the business case for establishing and applying such a system applicable to sustainable remediation.
- Phase II Objective Develop a sustainable remediation site rating and professional certification system.
- Phase III Objective Implement the sustainable remediation site rating and professional certification system.

Accomplishments:

- Completed survey & reported results

Assigned White Paper sections to team.

Next Steps:

- Complete White Paper Draft
- Initiate work on Phase II Objective

Upcoming Meetings/Presentations:

- Monthly committee meeting

Help Needed:

- **Help Needed: Board**
  Continued support and encouragement
- Help Needed: Membership
  - Review draft of White Paper

SR Rating Tool TI

SURF 22

Berkeley, CA

February 25, 2013

Key Topics

- Review and summarize the SR Rating Tool Survey
- Complete/finalize the White Paper on "Review of Publically Available Sustainability Rating Systems"
- Where do we go after the White Paper
  - Develop our rating tool and go it alone
  - Incorporate a rating tool into another system such as Envision

SR Tool Survey

- # of responses by group
- Summary of responses
  - Overall
  - By group

White Paper Sections

- Introduction
- Benefits of the SR Rating Tool
- SURF Rating System Survey Review
- Listing of identified sustainability rating systems and their elements
- Summary of rating system characteristics/elements
- Conclusions

Benefits of a Rating Tool

- While ensuring that the proposed remedial action is protective of human health and the environment, the SR Rating Tool is intended to assist the Site Owner in choosing between alternatives that will achieve the most environmental, social, and economic benefits. In this manner, the Site Owner will participate in a process that selects a remediation program that was developed through consensus that supports the community's quality of life while based on sound scientific and economic principles.

Identified Rating Systems

Americas	**U.K. and Europe**	**Rest of the World**
Envision (U.S.)	ENVEST	Green Star (Australia)
LEED (U.S. & Canada)	Office Scorer	BEAM (Hong Kong)
U.S. DOE Design Guide (U.S.)	Sustainability Checklists (e.g. SEEDA. BRE)	LEED (China and India)
WBDG (Whole Building Design Guide) (U.S.)	Environmental Impact Assessment (EIA)	Greenmark (Singapore)
HOK Sustainable Design Guide (U.S.)	Strategic Environmental Assessment (SEA)	GBTool (South Africa)
BREEAM Canada (Canada)	BREEAM (inc Eco-homes)	
Green Globes (U.S. & Canada)		

Additional Rating Systems

- Sites – USEPA
- PEARL – Middle East
- STAR – University Campus
- Land Code – Land not develped – Yale Univ.
- Maile Smith has list of other systems.

Volunteers For Each Section

– Introduction – L. Larsen-Hallock
– SURF Rating System Survey Review – D. Hasegan & M. Miller
– Benefits of the SR Rating Tool – D. Raymond
– Listing of identified sustainability rating systems and their elements – K. Mancini
– Summary of rating system characteristics/elements – R. Britt
– Conclusions & Path Forward – D. Raymond & D. Hasegan

Deadlines for Completing Paper

- Draft Completion
- Review Process Completion
  - Technical review
  - Board review
- Editorial Review
- Final Review -- SURF 23

Next Step – General Concept

- If decision is made to move forward
  - Develop tool
  - Determine if the tool will be a "stand alone" or incorporated within another tool such as Envision

Research Initiative

Research Initiative

Team Members:
- Lead – Stew Abrams
- TBD

- Board Liaison – Stew Abrams

Objectives:
- Make SURF relevant to remediation research
- Provide some funding for research
- Identify research needs
- Expand relationships with research universities
  - Focus on student chapters
- SURF leveraging multiple entities
- Self-Funding – bring parties together
- Voice of support for other researchers

Accomplishments:
- Two brainstorms
  - SURF 20 (July 2012)
  - Yesterday
- High level legal review

Next Steps:
- Higher level legal review
- Development of "Charter"
- Survey of SURF membership of research needs
  - Who are the potential funders
- Board review & resolution
- Schedule & Tinmesframe

Upcoming Meetings/Presentations:
- TBD – probably once a month

Help Needed:
- **Help Needed: Board**
  - Board Resolution (based upon charter)
- Help Needed: Membership
  - Co-chair
  - Committee members

SURF Committees and Initiatives

Overview and Objectives

SR Research Support

- Objectives
  - SURF to become involved and influence remediation research
- Establish a research function
  - Focused on sustainability
- Develop the following:
  - One-page "White Paper"
  - Identify potential funders
  - Develop criteria for research

SR Research Support

SURF 22 Breakout Objectives:

- Firmly establish committee members
- Divide up responsibilities
- Establish timeframes and milestones

SURF