

9th Annual Salt Lake County

Watershed Symposium

November 18-19, 2015

**The Ever-changing Climate of
Watershed Management**

Utah Cultural Celebration Center
West Valley City, Utah



Watershed Planning & Restoration Program
Salt Lake County Government Center
2001 South State Street, Suite N3-120 | Salt Lake City UT 84190
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Welcome

Nine years and counting! As the annual host of the Watershed Symposium, Salt Lake County welcomes its community of water stewards and environmental advocates.

The goal of the Watershed Symposium is to encourage a comprehensive review of the current state of our watershed, while creating a successful networking event for a broad array of stakeholders. As always, speakers and sessions cover a wide range of watershed issues, from general interest to technical. And, we're trying some new things this year. Shorter "power" sessions allowed us to offer more talks in only two concurrent breakouts. Which means more focused presentations with less deciding on which session to attend. Also, we'll be giving out Symposium "Best of" awards at the end of Day 2, so please cast your votes for:

Most Creative Session Title—the Wordsmith Award

Best Science—the Sulu Award

Most Engaging Presentation—the Tony Award

Best Group Presentation—the Go Team Award

Best Information Table—the Wiki Award

Best Poster—the Billboard Award

This free, two-day conference is made possible through collaboration with numerous individuals and agencies. We want to thank all of the presenters for their willingness to share their time and expertise—this event would not be possible without them.

We also thank Salt Lake County Mayor Ben McAdams and the Salt Lake County Council for their continued support in helping to make this annual conference a reality.

Enjoy!

Salt Lake County

Watershed Planning & Restoration Program



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We love feedback.

Available at 2015watershedsymposium.eventbrite.com.

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Schedule

WEDNESDAY, November 18		Utah Cultural Celebration Center
8:30-9:20	Check-in/Registration	
9:20-10:10	Welcome & Opening Comments —Deputy Mayor Lori Bays Salt Lake County (Great Hall) Keynote The Solution to Utah’s Water Problems: The Four Water Freedoms Dan McCool University of Utah Film Desert Water: Climate Change and the Future of Great Salt Lake	
10:20 - 11:55	Panel Discussion: Managing Watersheds In Times Of Climate Uncertainty (Great Hall) I Opening Remarks (30 min) Bob Bonar Snowbird Resort Robert Davies Utah Climate Center Joan Degiorgio The Nature Conservancy Break (10 min) Dan McCool University of Utah W. Paul Miller NOAA—Colorado Basin River Forecast Center Discussion and Q&A (55 min) Moderator Laura Briefer Salt Lake City Public Utilities	
Room	Plaza A/B (lower level)	Room 104/105
12:10 - 12:35	The Future Of Utah’s Water Supply In A Warming Climate I Brian McInerney National Weather Service	Are Utah’s Landscapes Worth The Water? I Larry Rupp Utah StateUniversity, Center for Water Efficient Landscaping
12:35-1:35	Lunch (Great Hall)	
1:35 - 2:00	What Is Going To Happen To Great Salt Lake? I Jeff DenBlyker CH2M Laura Vernon Utah Div. of Forestry, Fire, State Lands	Go With The Flow: Using Free Play In Watershed Education I Anne Terry, Annie Young, Corinne Gentry, Marina Astin Tracy Aviary
2:15-2:40	Gray Meets Green: Planning Multi-Purpose Water Reuse Facilities I Joe Donaldson Ecology & Environment, Inc.	Revitalizing Red Butte Creek At The UofU I Robin Rothfeder, Sarah Hinners University of Utah, City and Metropolitan Planning
2:55-3:20	A Survey Of Water Feats And Follies Across The American West I Gordon Rowe Utah Rivers Council	Understanding The Present And Charting The Future Of Utah Lake I Hilary Arens Utah Division of Water Quality
3:35-4:00	The Power Of Information In Water Conservation II Todd Marti, Matt Olsen Jordan Valley Water Conservancy District	Water And Nutrients In The Urban Center And Surrounding Wildlands II Samantha Weintraub, Yusef Jameel, Gabriel Brown University of Utah, Global Change & Sustainability Ctr.

THURSDAY, November 19		Utah Cultural Celebration Center
8:30-9:20	Check-in/Registration	
9:20-10:00	Opening Comments (Great Hall) Keynote Jurisdictional Jealousies: Why We Can't Get Anything Done Pat Shea University of Utah Film Desert Water: A New Water Ethic	
Room	Plaza A/B (lower level)	Room 104/105
10:10 - 10:35	Six Years Later: Updating The Water Quality Stewardship Plan I Marian Hubbard-Rice Salt Lake County Watershed Karen Nichols HDR Engineering	Assessing & Managing Farmington Bay Impounded Wetlands II Theron Miller Jordan River/Farmington Bay WQ Council Heidi Hoven Institute for Watershed Sciences
10:50 - 11:15	I Looked Over Jordan And What Did I See? I Laura Vernon Utah Div. of Forestry, Fire, State Lands Kelly Gillman, Susie Petheram CRSA	Shell Shocked: Utah's Unique Native Freshwater Mollusks On The Brink I David Richards OreoHelix Consulting Theron Miller Jordan River/Farmington Bay WQ Council
11:30 - 11:55	The Nature In The City Riparian Restoration Master Plan III Soren Simonsen Community Studio & Impact Hub Salt Lake Ray Wheeler Earth Restoration Network	Uncertainty In Future Water Quality And Quantity In The Jordan River III Ramesh Goel, Steve Burian, Sarah Hinners University of Utah; Carl Adams Div. of Water Quality
12:10 - 12:35	Rainwater Harvesting Strategies for Abundance I Shaun Daniel University of Utah Taft Nicholson Ctr. Nich Schou Utah Rivers Council	Don't Drink The Water? Testing Water Quality For Science And Outreach I Maura Hahnenberger Salt Lake Community College Brian Greene Utah State Univ. Water Quality Extension
12:35-1:35	Lunch (Great Hall)	
1:35 - 2:00	Focusing On What's Important: Prioritizing and Implementing TMDLs II Carl Adams Utah Division of Water Quality	Fecal Contamination And Source Identification In Summit County I Lucy Parham SWCA Environmental Consultants
2:15-2:40	West Jordan Big Bend Phased Restoration Plan II Eric McCulley River Restoration Christopher Sands BIO-WEST	Detecting Harmful Algal Blooms: A Different Shade of Green I Ben Holcomb Utah Division of Water Quality
2:55-3:20	Lock 'em Out Or Let 'em In? The Future Of Recreation In The Watershed I Reid Persing SWCA Environmental Consultants Alex Schmidt Save Our Canyons	One Goal Many Paths: A Multi-Disciplined Approach To Water Conservation I Stephanie Duer Salt Lake City Public Utilities
3:35-4:00	Closing Comments (Great Hall) Symposium "Best of" Awards (don't forget to vote!)	

Posters on display in Room 101/102

Session Level:
I Introductory/All
II Intermediate
III Advanced

Hosted by the Salt Lake County Watershed Planning & Restoration Program watershed.slc.org



Updated November 16, 2015 (subject to change)

Welcome & Opening Comments

Lori Bays, Deputy Mayor/Chief Administrative Officer
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Marian Hubbard-Rice, Watershed Section Manager
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Keynotes

The Solution to Utah's Water Problems: The Four Water Freedoms

Dan McCool, Professor
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A focus on four conservation initiatives will be presented: 1) replacing the property tax with water fees; 2) a water fixture replacement program similar to the very successful program in Denver; 3) a turf replacement program similar to successful programs in Los Angeles and Las Vegas; and 4) the rain barrel program. Each of these initiatives is based on individual choice—users can choose to participate or not. The sharp contrast will be drawn between these “freedom-enhancing options” and the water districts’ approach of collecting more taxes to build big projects.

Jurisdictional Jealousies: Why We Can't Get Anything Done

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Film Shorts

Desert Water: Climate Change and the Future of Great Salt Lake

Great Salt Lake is a Utah icon, as famous as great skiing or the Mormon Tabernacle Choir. But climate change and a growing population threaten its future. We need to ensure a healthy future for this world-famous ecosystem, used by hunters, bird-watchers, local families, tourists and the minerals and brine shrimp industries, which contribute over \$1.3 billion dollars to Utah's economy. This film discusses new ideas for guaranteeing water inflows into the Great Salt Lake.

Desert Water: A New Water Ethic

As we move into the future, will there be enough water for families, industry, wildlife and the beautiful environments that make Utah special? This film explores three ways in which a new water ethic can ensure a prosperous economic future, preserve healthy lakes and rivers for wildlife and recreation, and save taxpayer dollars.

*Both films are based on the book **Desert Water: The Future of Utah's Water Resources**, edited by Hal Crimmel (Weber State University) and published by the University of Utah Press, 2014. The films are available on YouTube.*

Plenary Session

Panel Discussion: Managing Watersheds In Times Of Climate Uncertainty

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Moderator

Laura Briefer, Deputy Director
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Climate change is one of the most pressing issues affecting watersheds to this day. With recent droughts and floods, climate change has become an even more salient issue. The aim of the plenary session is to discuss uncertainties as well as the emergent challenges and solutions of the effects of climate change on the watershed. Panel members represent policy, science, meteorology, advocacy, and industry disciplines. Issues to be discussed include the effects of ecosystem services on the watershed, water resources, water quality, flooding, policy, recreation, planning, and the economy.

Level: Introductory/All

Breakout Sessions (listed alphabetically by title)

A Survey Of Water Feats And Follies Across The American West

Gordon Rowe
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Amid the fourth year of drought, western communities are adapting to water shortages in a number of ways. From drought shaming, to rate increases, we will explore what Utah and our neighbors are doing (or not doing) to adapt to the new reality of warmer temperatures and lower flows. From the foothills of the Sandia Mountains in New Mexico to the alpine meadows of the Rocky Mountains, to Los Angeles's suburbs, local municipalities are learning to do more with less in innovative ways. 2015 was marked by

advances in the public's consciousness about the value of water and its limited supply. A number of municipalities implemented bold new programs to conserve water across all sectors. Yet stark differences remain between the have and the have-nots in the liquid realm. As California prepares to embrace a statewide water affordability mandate, other western communities still incentivize their residents to waste water. In this presentation we will look at how Utah can learn from the mistakes and successes of our neighboring states to ensure a sustainable water future. From unused agricultural water still diverted through forgotten irrigation canals, to strategic water pricing structures, to innovative new public education campaigns, Utah has a lot of exciting opportunities to further expand our water conservation efforts.

Level: Introductory/All

Are Utah's Landscapes Worth The Water?

Larry Rupp, Extension Landscape Horticulturist
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As a result of the current drought, landscape irrigation is being vilified as a waste of scarce water. Many cities have taken steps to reduce landscape water use, but nowhere has this effort been greater than in California where a 2015 executive order calls for sudden and dramatic changes in landscape design and irrigation. Such action disregards many of the benefits of landscaping and fails to consider effective strategies that do not sacrifice landscapes as crucial urban green infrastructure. While drought-stricken regions are calling for landscape removal, other regions are calling for additional green infrastructure to improve urban environments. Green infrastructure calls for the increased use of plants and landscaping to enhance and sustain urban environments. In contrast, extreme water conservation measures call for reduced plants and landscaping to conserve water. Both of these movements have some merit, especially in extremely dry or wet environments. But, in the vast majority of environments that fall between the extremes, landscape removal and green infrastructure are incompatible. Utah stands to benefit from a more nuanced and pro-active approach to water conservation that addresses quality of life issues and incorporates green infrastructure concepts. The U.S. West has widely varying geography and water conservation programs must vary accordingly. While Las Vegas has a growing season of 280 days, an average high temperature in July of 104°F, and 4.2 inches of precipitation, Salt Lake City has a growing season of 200 days, an average high temperature in July of 90°F, and 16.1 inches of precipitation. Clearly these environmental differences should not be ignored in the development of water conservation programs. Multiple studies have shown that diverse urban landscapes provide measureable benefits including fixing CO₂, improving air and water quality, moderating temperatures, reducing erosion, enhancing water infiltration, improving soils, mitigating sound pollution, supplementing economic growth, providing psychological and social benefits, providing safer recreation, enhancing quality of life, creating default urban ecosystems, reducing waste water management costs, and enhancing property values. Currently, urban landscaping uses roughly 7% of all developed water supplies in Utah. While a small percentage, it is increasing with population growth and urban sprawl. Using landscape water efficiently will reduce urban competition for water that supports agricultural, industrial, and recreational contributions to Utah's economy. It also allows urban, landscape-dependent industries to continue. Many Utahns live in Utah because of the life style. They like the mountains, the desert, the arts and many other elements that add to quality of life. Landscaping is part of that quality. If urban irrigation water is used efficiently and the more valuable elements of landscapes are strategically prioritized for watering in times of drought, then Utah's urban landscapes are worth the water. **Additional authors from Utah State University's Center for Water Efficient Landscaping:** Kelly Kopp, extension water conservation and turfgrass specialist, directs the Utah Water Check program and conducts research on landscape irrigation.

Joanna Endter-Wada, environmental sociologist in the College of Natural Resources and director of the Urban Water Conservation Research Lab. Roger Kjelgren, woody plant physiologist, conducts research on water use by woody plants both in real time and through tree-ring analysis of tree responses to historical drought. Paul Johnson, turfgrass scientist and the head of the Plants, Soils, and Climate Department, conducts research on drought tolerant turfgrass varieties.

Level: Introductory/All

Assessing And Managing Farmington Bay Impounded Wetlands

Theron Miller, Research Scientist

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Heidi Hoven, Wetlands Scientist

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Great Salt Lake wetlands are a critical component of the Western Hemispheric Shorebird Reserve system. An estimated five to seven million waterfowl and shorebirds utilize this vital resource each year and Farmington Bay impounded wetlands comprise approximately 40% of this vital resource. In recent years, there has been elevated concern that some of these impoundments are exhibiting signs of stressed or degraded condition. These symptoms included occasional surface mats of filamentous algae or duckweed and earlier senescence than ponds located in Bear River Bay. We have spent 11 years identifying and testing candidate metrics that are sensitive to potential environmental stressors and which are closely linked or represent a direct measure of Clean Water Act beneficial use support status. Beneficial uses include: support for waterfowl and shorebirds and other water oriented wildlife and the aquatic live in their food chain. Indeed, these ponds are managed for the purpose of growing sego pond weed or widgeon grass, both characterized as submerged aquatic vegetation (SAV). Together, with the macroinvertebrates that inhabit this underwater forest, these aquatic habitats are a key feature of the beneficial uses for these wetlands. Sensitive metrics which we have identified and tested include: Percent cover surface mat, measures of biofilm on SAV, percent cover algae on SAV, Percent forageable SAV, branch density, tuber biomass, drupelet biomass. Further, through years of research, we have found these metrics to vary seasonally and annually. Therefore, we also present various pond management strategies that have been found to significantly influence the condition of these impoundments.

Level: Intermediate

Detecting Harmful Algal Blooms: A Different Shade of Green

Ben Holcomb, Biological Assessment Program Coordinator

Division of Water Quality

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Globally, harmful algal blooms (HABs) are occurring at an increasing rate. Along coastal North America, HABs have increased 30 fold since the 1960s. Similar or higher rates are likely in North America's inland waters. These blooms not only have ecological consequences, such as disrupting fisheries, but human health and welfare consequences as well, like recreation and drinking water. Recent examples include the loss of drinking water to half a million people along Lake Erie to a couple dead dogs in Utah Lake. As a result, Utah Division of Water Quality (DWQ) and Utah Department of Health (DOH) have partnered to produce HAB guidance documents, coordination and action plans to inform and protect the public from these events. This session will provide the 1. 'HABs 101': learning to identify HABs broadly and common

taxa found in Utah, 2. an overview of action plan guidelines to protect the public, and 3. agency plans for communication, coordination, and outreach activities.

Level: Introductory/All

Don't Drink The Water? Testing Water Quality For Science And Outreach

Maura Hahnenberger, Assistant Professor

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Brian T. Greene, Program Coordinator

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Water monitoring in the field with students and citizens engages and educates in a meaningful and long lasting way. This presentation will highlights two outreach programs focused on participatory water science, Utah Water Watch and iUtah WaterGirls. Utah Water Watch is the statewide volunteer water quality monitoring program in Utah. It started in 2012 and seeks to engage the public with monitoring lakes and streams. We will highlight some of the data collected by volunteers, discuss the successes of the program, and present results from a recent program evaluation that document participant knowledge gains and changed behaviors due to participating in Utah Water Watch. iUtah WaterGirls is a field experience program for middle school students to monitor water quality in the canyons in the Salt Lake Valley. We will explore the motivation for and effectiveness of scientific field experiences in engaging students in place-based learning and for increasing interest of girls in STEM careers. The objective of this presentation is to share the value of citizen science and water outreach for both students, citizens, and scientists.

Level: Introductory/All

Fecal Contamination And Source Identification In Summit County

Lucy Parham, Water Resource Specialist

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The Utah Department of Environmental Quality's 2014 Rockport Reservoir and Echo Reservoir Total Maximum Daily Loads conducted in Summit County, Utah, identifies septic systems as contributing approximately 2%–15% of nutrients to surface waters in the Rockport Reservoir and the Echo Reservoir watersheds. As a result, a septic assessment was performed prioritizing housing subdivisions in the two watersheds for targeted implementation of sewerage or septic upgrades to follow best management practices (BMPs). The assessment relied on three prioritization criteria (septic age, proximity to stream, and landscape position with respect to irrigation), and identified over 100 septic systems as "very high priority" and several subdivisions as "critical." This initial septic assessment coupled with on-the-ground observations and reports of potential septic contamination prompted the Summit County Health Department to build on the initial septic assessment to identify subdivisions specifically in the Snyderville Basin that are at the highest risk for causing surface water contamination from septic systems. Contamination of surface waters by septic effluent can have significant implications for both the ecological functioning of the stream as well as human health risk. The objectives of this assessment were 1) to conduct a prioritization analysis of subdivisions in the Snyderville Basin to determine those areas at highest risk for septic failure and subsequent contamination of surface water and 2) to conduct surface water sampling and use microbial source tracking methods to confirm fecal source identification as human or non-human. This presentation will present the methodology and findings of the septic

prioritization analysis and provide an introductory level overview of microbial source tracking and how this technology is best used in watershed studies.

Level: Introductory/All

Focusing On What's Important: Prioritizing and Implementing TMDLs

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For the past 15 years development of Total Maximum Daily Load studies (TMDLs) at the national level have been driven by lawsuits, court orders, and consent decrees. As a result over 65,000 TMDLs have been produced nationally with little to show in terms of improved water quality, especially with regard to voluntary control of non-point sources of pollution. Utah however is an exception due to our commitment to put TMDLs into action on the ground. The trade-off though has been a fewer number of TMDLs developed overall. Given our limited resources we must prioritize where we can achieve the greatest environmental benefit while addressing our most pressing water quality concerns. By factoring in a wide array of variables such as recovery potential, designated beneficial uses, and level of threat to human health and the environment, the Division of Water Quality has identified a short list of impaired waters to develop TMDLs on within the next six years. Carl Adams, Manager of the Watershed Protection program for DWQ will present this list of priority TMDLs and engage attendees in a discussion of how together, we can collectively ensure these and already existing TMDLs, are best attained through voluntary best management practices and regulatory point source limits.

Level: Intermediate

Go With The Flow: Using Free Play In Watershed Education

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Tracy Aviary inspires curiosity and caring for birds and nature through education and conservation, but it doesn't end at the Aviary's gate! Through new Nature in the City programs, Tracy Aviary educators are connecting people to urban watersheds in parks and public lands, throughout Salt Lake City. As educators we have so much knowledge and so many facts to impart to participants, making it easy to fall into lectures or facilitator-focused activities. Recently, education started turning to hands-on and inquiry-based science lessons. Tracy Aviary's educators take that idea even further, by using free play in nature to guide science, specifically environmental, education. Research is increasingly revealing the value of free play outdoors, not only on physical health but also on mental health and school performance. Join Tracy Aviary educators in exploring the role of free play in environmental education, as well as the challenges and successes of this new programming.

Level: Introductory/All

Gray Meets Green: Planning Multi-Purpose Water Reuse Facilities

Joe Donaldson, Landscape Architect/ Environmental Planner
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In arid areas, every drop of water counts. As the population of the Salt Lake Valley and surrounding region grows, it is unlikely that development of new sources of water will sustain the current levels of aquifer withdrawals and water use. Clearly, using and reusing the water we already have more efficiently will help. Recharge and reuse of treated wastewater, if done properly, can contribute substantially to sustaining our water supply. However, effective reuse of municipal wastewater does not need to be viewed as a single-purpose, utilitarian operation. Wastewater reuse in combination with aquifer recharge can provide multiple benefits to communities and the environment, thus helping dilute costs by spreading these to a wider range of purposes. This presentation will focus on how several communities near Phoenix, Arizona have planned, designed, and now are operating multi-purpose groundwater recharge facilities that reuse or store the majority of their treated (reclaimed) wastewater while providing a variety of other beneficial uses, including recreation, wildlife habitat, community open space, environmental education, and serving as community gathering areas. These facilities epitomize the concepts of multiple use and sustainable design by contributing to improving community ecological health and quality of life while providing essential services for wastewater reuse and water supply. The presentation will highlight one facility, located in Gilbert, Arizona, by describing its background, planning, design, and operation, and briefly discuss several others that demonstrate a range of creative applications in the Phoenix area. For each of these multi-purpose projects, collaborative planning and design involving water resource engineers, landscape architects, park maintenance personnel, biologists, and municipal government officials was key to their success. Outreach to the public, schools, and community organizations throughout the planning and design process helped ensure these facilities would be welcomed and early and ongoing communications with agencies ensured they would meet regulatory and permitting requirements. Challenges and lessons learned will be presented along with successes and benefits. Given the challenges this region faces in meeting its current and future water supply needs, it is hoped this presentation will inspire some locally appropriate and creative solutions and that multi-purpose groundwater recharge and wastewater reuse facilities will be an integral part of these solutions. Learning Objectives: 1) Understand the context, purpose, and importance of water reuse and opportunities for integrating treated wastewater and groundwater recharge in community water reuse programs; 2) Gain an awareness of how arid region communities have planned, designed, and are operating multi-purpose groundwater recharge facilities; and 3) Understand the value of collaborative planning and design, community outreach, and agency coordination in developing and operating multi-purpose recharge facilities.

Level: Introductory/All

I Looked Over Jordan And What Did I See? Jordan River Comprehensive Management Plan

Laura Vernon, Planner / Forest Legacy Coordinator
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The Jordan River is valuable ecosystem of state-wide importance. The State of Utah, through the Equal Footing doctrine, has fee title ownership of the banks and bed of Jordan River. The Utah Department

of Natural Resources Division of Forestry, Fire & State Lands (FFSL) has direct management jurisdiction over lands between the banks (i.e., ordinary high water marks) as identified at statehood and is currently developing a management plan that will deliver consistent, transparent, and long-term guidance for this state sovereign land. FFSL recognizes the importance of the Jordan River ecosystem and its natural, cultural, recreational, and aesthetic amenities, including those resource values and uses that extend beyond its banks and affect or are affected by actions on sovereign lands. Creating a document that guides sustainable management in the context of multiple-use of the Jordan River will ensure that the ecological health (e.g., water quality, bank stability, riparian zones, aquatic organisms, wildlife, and wetlands), scenic attributes, and recreation opportunities (e.g., bird watching, biking, and boating) will be maintained into the future. FFSL is coordinating with stakeholders to ensure that planning for and management of this resource is based on a holistic view and ensures long-term sustainability. The planning process includes components such as, a review of existing information and research, public engagement, establishing management goals and objectives, and identifying best management practices. This session summarizes information gathered to date, presents an on-line data gathering tool, and outlines upcoming tasks for plan completion in Fall 2016.

Level: Introductory/All

Lock 'Em Out Or Let 'Em In? The Future Of Recreation In The Watershed

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Towering above the capital city and the State of Utah's population center, the Central Wasatch Mountains are an iconic symbol of life in Utah. The mountains provide benefits that are not found in any other major American city and are foundational to the quality of life in the Salt Lake Valley. World-class scenery, hiking, skiing, wildlife viewing, biking, and so many more recreational opportunities are located within 30 minutes of the homes and jobs of local residents. The mountains are also an economic engine, hosting a world-renowned tourism industry and making the region desirable for companies looking to attract highly-skilled workers. Most importantly, the mountains literally make life in the Salt Lake Valley possible by providing drinking water for more than 600,000 residents. However, with great promise comes great responsibility. The Central Wasatch Mountains present an incredible challenge for land and resource managers, politicians, and community leaders charged with stewardship of this landscape. Communities along the Central Wasatch Mountains are poised to be among the fastest growing areas in the United States in coming decades and recreational use of the mountains and corresponding watersheds is forecast to increase dramatically. Management decisions in the Central Wasatch have the potential to affect the way the region develops and grows, and ultimately, the fabric of the community left to future generations. How should we protect our precious water resources and avoid loving the mountains to death? How should we balance protection and recreational access? Where and how should we invest in the mountains? How do we communicate and involve the public in planning for this irreplaceable resource? In this session we present interesting results and observations from the recently completed Central Wasatch Visitor Use Survey, a year-long collaboration between the U.S. Forest Service Salt Lake Ranger District, Save Our Canyons, Salt Lake City, and Utah State University. We also explore the foundations of environmental values in the modern American public and their importance in achieving landscape protection, discuss strategies to manage recreation employed in other protected western landscapes, and ponder potential future management strategies for the Central Wasatch.

Level: Introductory/All

One Goal Many Paths: A Multidisciplined Approach To Water Conservation

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Since writing its first water conservation master plan in 1999, SLCDPU has seen the relationship between water conservation and watershed protection. In these two robust programs, SLCDPU gives vision and voice to its long-standing environmental ethos. Through parallel, shared, and even divergent programming, SLCDPU guides the community to see how watershed protection and water conservation are two approaches to a single goal: develop and sustain a long term supply of high quality drinking water for our community now and into the future. Water conservation is an integral component of SLCDPU's overall water management strategy. Through water conservation planning and programs, SLCDPU shares with the community information regarding water sources, supply levels, and the role of individuals, businesses, and the community in sustaining those supplies for household, economic, recreational, and aesthetic uses. Through over thirty-six ongoing program initiatives, SLCDPU educates, informs, motivates, and moves the community to take action to reduce water use in order to achieve its long term water conservation goals, which in term is helping to secure our water resources for now and into the future. This presentation will highlight key initiatives within the 2014 Water Conservation Master Plan Program Practices of Outreach, Economics, Utility, Law and Policy, Research, and Metrics. Specifically, the presentation will focus on the following program initiatives: slcgardenwise and Demonstration gardens as tools for education and community engagement; tiered rate structures and bill messages to convey use, cost, and value; automated metering technologies to facilitate use and billing information; outcome-based landscape ordinances; Commercial/Institutional Analytics tool; and baseline assessments of water use at school facilities. The presentation of these initiatives will provide a basis for a discussion of the role of conservation in long range water planning and management. It is this balanced approached—education and outreach, policy, price signals, water use analytics, and meaningful baselines and benchmarks—that has helped SLCDPU lead its community to a consistent trend of water use reduction over the last 15 years, a reduction trend of over 20 percent since the year 2000.

Level: Introductory/All

Rainwater Harvesting Strategies For Abundance

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As one of the driest states in the nation and one of the heaviest users of water per capita, Utah is concerned about impending water scarcity—especially as climate change and population growth are expected to compound these challenges. How do we ensure enough water for all? Often the choice is posed as one between personal sacrifice or major new infrastructure investment. Few people realize that Utah is already proposing some of the largest river diversions in the nation. This session will suggest, instead, that rainwater harvesting strategies, when integrated into the design of present and future properties, can offer a solution to many of Utah's water woes. Drawing on ecological design—and the principles of permaculture, in particular—Utahns can better fit themselves to place, making wise and fair use of available resources while rejuvenating the land. Participants will learn about a number

of rainwater harvesting solutions that can be implemented at home, or scaled up for businesses and institutions. “Passive” strategies like swales, berms-and-basins, and curb cuts will be explored, in addition to more “active” strategies like rain barrels and cisterns. One case study is found in RainHarvest, a program launched this past summer in which several nonprofits and six Utah municipalities partnered to distribute 2,200 rain barrels to Utah residents. Participants will hear the lessons learned from RainHarvest as implemented in Murray, Sandy, Salt Lake County, Park City, Summit County, and Ogden. Because no single strategy offers a universal solution, “stacking functions” will be emphasized in this workshop, highlighting the exciting opportunity to use our creativity to adapt and retrofit existing structures and yards to provide multiple benefits simultaneously, such as irrigation, microclimate regulation, beauty, food, and habitat. Participants will leave empowered with the knowledge that starting to harvest the rain at home or at the neighborhood level will make a difference. All told, implementation of rainwater harvesting strategies and community-based water conservation programs like RainHarvest has positive effects throughout the watershed, helping Utahns reduce demand on municipal systems, improving water quality of local rivers and lakes, and starting thousands of families down a lifelong path of water stewardship. In this way, we can move from scarcity to water abundance.

Level: Introductory/All

Revitalizing Red Butte Creek At The University Of Utah

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This session will provide an introduction to and overview of the Red Butte Creek (RBC) Strategic Vision. The Strategic Vision is a sustainability, environmental stewardship, and ecological planning initiative at the University of Utah. It was produced by a Steering Committee of campus faculty and administrators, with input from a diverse group of stakeholders including campus facilities, planning, and landscape maintenance staff; Research Park administrators; neighboring community members and community council representatives; Salt Lake City and Salt Lake County municipal employees; additional faculty across campus; and students and student groups including Friends of Red Butte Creek. Learning outcomes for the session will address the need, purpose, goals and objectives, public engagement process, and implementation strategies for the Strategic Vision. The project focuses on the portion of RBC running through campus and Research Park, but seeks to leverage assets and create benefits along the riparian corridor and throughout the watershed. The theme for the Vision is revitalization: from a neglected, degraded, and under-utilized space, to a healthy, beautiful, and valued corridor that connects the Wasatch Foothills to Salt Lake City and creates a vibrant campus at the urban-wildland interface. The goals and objectives for the Strategic Vision reflect the University of Utah’s three-part mission to promote teaching, research, and public life. Campus plans and design standards will make enforceable policy commitments that support environmental restoration, improve watershed management, and facilitate interdisciplinary inquiry. The University community will have state of the art facilities for place-based, hands-on learning and environmental education. Research Park, Fort Douglas, Salt Lake City and County, and other partners will help to build capacity, engage the community, and implement a plan with broad public support. Implementing the RBC Strategic Vision will mean changing the face and function of the creek and its watershed, especially the built environment on campus. Native flora and fauna will stabilize the stream bank, provide critical habitat, and improve water quality through nutrient uptake and cycling.

Bioswales and other stormwater management practices will become part of the watershed, protecting and restoring the riparian environment by controlling and treating urban runoff. Paths, benches, and bridges will integrate RBC into campus life, in place of the current fences and walls. These changes will require the University of Utah to reimagine its relationship with RBC. Today, the creek serves as receiving waters for urban drainage, and its unstable banks are a hazard instead of an asset. Through restoration and revitalization, we will create a unique campus amenity that promotes health, advances knowledge, and provides sense of place. Our hope is that this Watershed Symposium session will help to create excitement about the project, and to identify future partners and collaborators.

Level: Introductory/All

Shell Shocked: Utah's Unique Native Freshwater Mollusks On The Brink

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North America supports the richest diversity of freshwater mollusks on the planet with over 700 species of snails and 300 species of freshwater mussels described so far. They serve vital functions in freshwater ecosystems, are excellent indicators of water quality, and are increasingly recognized as important ecosystem providers. Unfortunately, freshwater mollusks are one of the most disproportionately imperiled species groups on earth. 55% of North American mussels are extinct or imperiled compared with 7% of bird and mammal species. Future extinction rates for North American freshwater fauna are projected to be five times higher than those for terrestrial fauna. 74% of the freshwater snail taxa in N.A. are imperiled and thus have the dubious distinction of having the highest modern extinction rate yet observed, at > 9000 times background rates. This alarming decline is almost entirely due to human economic activities. The greatest diversity of freshwater mollusks occurs in the southeast USA, whereas in the western half of N.A. the molluskan fauna is relatively depauperate. However, unbeknownst to most citizens and water quality managers, the area consisting of Great Basin, Snake River Basin and Bonneville Basins, including the Great Salt Lake area, is a freshwater mollusk hotspot. There are at least seventy freshwater mollusk taxa reported from UT, the majority of which are found only in our area, and their taxonomy, life history, ecology, distribution, and status, are poorly known to all but a few concerned scientists. We, and a handful of others have been studying these amazing creatures for several years and are sad to report that unless measures are taken to clean and protect our waters, Utah's native freshwater mollusks will silently disappear into the desert dust. In this session we will briefly discuss the freshwater molluskan fauna of our area, the threats to their continued existence, and suggest ways to hopefully preserve Utah's unique freshwater molluskan heritage.

Level: Introductory/All

Six Years Later: Updating The Water Quality Stewardship Plan

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Since the late 1970s, Salt Lake County has provided planning and implementation to protect and improve the water quality of the county's surface waters. Salt Lake County's goals are to protect, maintain, and restore the chemical, physical, and biological integrity of the 300 miles of surface waters within the county. As part of its continuing area-wide (that is, county-wide) water quality planning, Salt Lake County is completing the 2015 Integrated Watershed Plan (2015 Plan) to update its 2009 Salt Lake Countywide Water Quality Stewardship Plan (2009 Plan). The 2015 Plan doesn't reiterate all of the baseline information in the 2009 Plan, but rather updates information where needed and builds on the framework of goals and policies laid out in 2009. The 2015 Plan includes a 6-year program evaluation to review program efforts since adoption of the 2009 Plan. It analyzes current land-use projections, population projections, and monitoring data that have been gathered since the 2009 Plan was issued to provide an updated picture of current watershed conditions. In addition, this document reports on three focused planning elements: an instream flow analysis for Little Cottonwood Creek, a feasibility study to retrofit debris basins, and a west-side stream plan. With this new analysis, Salt Lake County has updated the goals, objectives, and implementation plans in the 2009 Plan to continue guiding water quality stewardship and integrated watershed management in the county through 2040 and beyond.

Level: Introductory/All

The Future Of Utah's Water Supply In A Warming Climate

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As global temperatures continue to climb, the future of Utah's snowpack and resultant water supply is in flux. Currently, the fraction of snow/rainfall is evolving to more of a rain driven hydrology. Research has shown that areas of the Wasatch Mountains which contain over 90% snowpack, can expect 50% or less in 20 years, with rainfall dominating the hydrology by 2070.

Level: Introductory/All

The Nature In The City Riparian Restoration Master Plan

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This session will be a follow-up of a proposed field trip to various restoration sites on the Jordan River in mid-October or early November. It will introduce conference attendees to the "Nature in the City" master plan to restore wildlife habitat, native plants, stream bank, river-adjacent wetlands, and wildlife habitat, especially for migratory birds, within a series of 17 connected "nature parks" running the length of the Jordan River across Salt Lake City.

Level: Advanced

The Power Of Information In Water Conservation

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Currently, most Utahns receive a monthly water bill that tells them they used X number of units of water, and compares their water use in the current month to the last 12 months. It is almost impossible for water users to know if they are conserving or wasting water, especially during the summer while irrigating outdoors. If Utah is truly serious about convincing home owners and businesses to utilize water more efficiently, water suppliers must provide much more detailed water use information, including showing how water is being used and where savings can be achieved. Jordan Valley Water Conservancy District is embarking on a \$2.8 million dollar project (partially funded by a Bureau of Reclamation WaterSMART Grant) to install an AMI (Advanced Metering Infrastructure) system with new "smart" meters at 8,500 retail connections in Murray and Sandy. These smart meters will transmit hourly data back to the District's headquarters. With this data, the District will implement social norming, which is basically a comparison of an individual's water use compared to a similar cohort. The data will also enable the District to prepare customized suggestions for conservation, and even help customers find and repair leaks. The data will be made available to customers through a customer web portal, bi-yearly water use reports, and a new and improved monthly bill. These various communications channels will allow the District to share hourly, daily, weekly, and monthly water use with customers. With this new data, customers will be empowered to ramp up conservation efforts by having the necessary information to make good decisions. Attendees of this presentation will learn about the following topics: 1) What is a "smart" meter and what is AMI?, 2) What information can be shared with customers to help achieve conservation goals?, and 3) How is Jordan Valley Water implementing AMI?

Level: Intermediate

Uncertainty In Future Water Quality And Quantity In The Jordan River

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The Jordan River originates from the Utah Lake and terminates in Great Salt Lake wetlands after meandering through different counties in Utah. Recently, several reaches, primarily in the lower Jordan River, have been designated impaired for dissolved oxygen (DO), E. coli and temperature. DO, E. coli and temperature are common water quality indicators but the underlying reasons to affect these indicators include organic carbon and nutrients. The Utah Division of Water Quality (UDWQ) has done a commendable job in engaging the research community and fill in the necessary data gaps that existed during phase I TMDL efforts. Nevertheless, very little attention has been given to the uncertainty associated with future water quality and quantity of The Jordan River. This workshop will provide a comprehensive view of key areas of uncertainty in projecting water quality in the Jordan River. The workshop will include a review of ongoing observation and modeling studies and presentation of emerging integrated observation and modeling approaches to assess uncertainty and incorporate into water quality projections. The targeted audience includes water quality managers, stakeholders (i.e. WWTPs and storm water managers), community members, academicians, students and consulting people. At the end of this session, attendees will be able to learn: 1) What is the importance of The Jordan River and why its water quality is impaired?; 2) How extreme wet and dry conditions impact water quality and quantity in the Jordan River; 3) What modeling practices can best predict water quality and quantity in the Jordan River and what data needs will help predict climate change based water quality and quantity in The Jordan River; and 4.) How community members and stakeholders can help improve water quality in The Jordan River?

Level: Advanced

Understanding The Present And Charting The Future Of Utah Lake

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Utah Lake is a highly productive lake associated the growth of nuisance phytoplankton and periphyton, low dissolved oxygen, elevated pH, and the potential for cyanotoxins from blue-green algae. Utah Lake was listed on Utah's 2004 §303(d) list for exceedances of the state criteria for total dissolved solids (TDS) concentrations and exceedances of the pollution indicator value for total phosphorus. A TMDL study was initiated in 2004 that produced a validation and evaluation report, but the TMDL study was subsequently suspended to evaluate the effects of invasive carp removal by the Division of Wildlife Resources and to better understand the relationship between measured total phosphorus concentrations and observed impairments to the lake's designated beneficial uses. DWQ has spent the last 10 years focused on data collection on the lake and its tributaries to evaluate the water quality effects on beneficial uses, trends and linkages to the management goals of Utah Lake. This presentation will detail DWQ's 2015-2019 path forward to evaluate the impairment on Utah Lake, develop tools to make water quality related decisions, and incorporate the work of stakeholders and partners to improve the health and function of Utah Lake. The key questions DWQ will answer in the next 5 years include: 1) What are the current water quality concerns on Utah Lake? Does the current data reflect the historic impairments, or are there new water quality impairments? If so, what trends do the water quality parameters indicate? If not, should the water body be delisted from the current TDS and phosphorus listing?; 2) What are the connections amongst the water quality parameters and the effects on aquatic life? Have water quality changes coincided with changes in fish populations, macroinvertebrate populations, phytoplankton and zooplankton abundance and species?; 3) Are the current uses of Utah Lake reflected in the current beneficial use of a 2B waterbody? Does the recreational use survey support upgrading Utah Lake from a 2B to a 2A?; 4) What influence of the load do the different pollutants, both point and nonpoint source, have in driving the productivity of the Lake? Extensive modeling will be used to answer this question. Also, how is the

nutrient loading different by season and by hydrological condition?; and 5) What effects do nutrients have on the water quality in Utah Lake? What are the current sources of nutrients, and the future expected sources, and what would changes in the nutrients have in affecting water quality conditions of the lake?

Level: Introductory/All

Water And Nutrients In The Urban Center And Surrounding Wildlands

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Local freshwaters are a critical and scarce resource, yet they face myriad threats and challenges in both natural and human-engineered contexts. At the University of Utah, members of the SPATIAL Group (Spatial and Temporal Isotope Analytics Lab) utilize measurements of aquatic stable isotopes, as well as nutrient concentrations and other geochemical tracers, to investigate spatial and temporal trends in water quality and sources across the Salt Lake Valley (SLV). These studies are revealing new information and surprises about the cycling of water and nutrients between the valley and the adjacent mountain wildlands. SLV watersheds carry natural precipitation, and perhaps water from 'unnatural' sources such as the tailpipes of our cars, from their pristine Wasatch Mountain headwaters through an increasingly urbanized landscape. Although flows vary dramatically within and between years, our studies suggest a relatively constant source of water to mountain streams – groundwater, recharged by snowmelt. However, aquatic stable isotopes highlight a dramatic change as streams reach the urban environment, where storm water inputs become a substantial source of water and a force for erosion. Water quality, i.e. degree of nutrient pollution, is also highly sensitive to urbanization and land-use. Stream nitrate concentrations, a key water quality component, are low in Red Butte, City Creek, and Upper Emigration Canyons, but increase in Lower Emigration, Big, and Little Cottonwood Canyons. In the Jordan River, nitrate concentrations reach their peak, especially where wastewater treatment plants discharge into the river. Leaky sewer pipes and stormwater runoff also add diffuse nutrient inputs to urbanized streams. Understanding stream dynamics is important, but so too is the study of waters directly utilized by people. Over the last 3 years, intensive surveys of SLV tap waters have revealed notable spatial and temporal variation, which can be linked to different water management practices and sources across the urban area. Some water districts switch water sources seasonally, while others do not; these patterns are clearly reflected in the isotopic chemistry of domestic tap waters. Based on water isotopes, we observed 1) significant positive correlation between population size of a water district and isotopic range, reflecting increased use of diverse, non-local water sources in districts with high water demand, and 2) that tap water isotope values match montane, as opposed to valley, precipitation, highlighting the importance of the mountain snowpack as source water for SLV taps. Over the entire urban area, we've observed a coherent signal of increased evaporation of tap water sources, which we hypothesize is due to below-average precipitation and above-average temperatures in recent years. Together, this work sheds light on how land-use change and management, as well as climate, can impact water sources and quality across our local mountain-to-urban landscape.

Level: Intermediate

West Jordan Big Bend Phased Restoration Plan

Eric McCulley, Watershed Scientist

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Christopher Sands, Principal, Senior Planner and Landscape Architect

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Habitat improvements are a key goal of the West Jordan Big Bend Restoration Project and phasing the project's construction will reduce potential impacts to the site's current wildlife population. Phasing the project will limit the amount of area that will be disturbed at any one time. Portions of the site will be left undisturbed during the initial phases of construction to provide habitat. This applies particularly to habitat for migratory song birds. In a recent report, Tracy Aviary recommended a phased approach for removal of the site's invasive Russian olives, which currently serve as habitat for migratory and other bird species. Russian olive will be left on portions of the site that are not part of the initial phases. As native plants that will provide suitable habitat mature, the remainder of the Russian olives will be removed and replaced with the appropriate native species. Costs for irrigation will also be reduced as there will not be a scenario where the entire site needs to be irrigated for vegetation establishment. However, this approach may result in additional regular maintenance of the site to prevent Russian olives (and other invasive species) from re-establishing in areas where they have been removed.

Level: Intermediate

What Is Going To Happen To Great Salt Lake?

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Is Great Salt Lake drying up? How might forecasted population and economic growth in Northern Utah change water levels in the lake? How might an extended drought affect the lake? What does that mean to Great Salt Lake's natural resources, the economic and ecological benefits that are derived from them, and the people who live near its shores? These are all questions the State of Utah has been grappling with that this project hopes to help begin to answer. A recurring challenge for State regulatory and resource agencies is defining and understanding how variable precipitation and water management in Great Salt Lake's watershed can influence the lake's water levels and salinity and subsequently the resources the lake supports. State agencies have not had an effective tool at their disposal that integrates available information to better understand these issues and support sustainable management of Great Salt Lake resources—until now. The purpose of the Great Salt Lake IWRM model project is to provide state agencies and stakeholders with a tool that: 1) Describes how changes in water management and availability in Great Salt Lake and its watershed could impact the lake's water levels and salinity; 2) Could be used to evaluate potential impacts to and changes in the lake's resources; and 3) Will serve as a foundation for addressing future management challenges. This tool will allow State agencies to understand the lake's drivers of change, understand the potential changes and risks Great Salt Lake and its resources may encounter, incorporate these findings into planning efforts, and sustainably manage the lake's economic and ecological resources. This session will provide an overview of the need for and purpose of this tool, a description of our approach for model development, and a preview of the model's structure.

Level: Introductory/All

Posters

Mill Creek Watershed Restoration Overview

Paul Cowley, Project Lead
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Contributors: US Forest Service, US Fish and Wildlife Service, National Forest Foundation, Salt Lake County, Trout Unlimited, Utah Division of Wildlife Resources, Utah Anglers Coalition, Pacific Corp, and Stonefly Society

The poster will present an overview of the watershed restoration effort occurring in Mill Creek on the Uinta-Wasatch-Cache National Forest that is part of the US Forest Service process used to improve entire watersheds. This watershed restoration effort includes several projects that have been implemented with various partnerships and funding sources. Types of projects include replacement of non-native with native fish, culvert replacement to improve fish and debris passage, riparian vegetation improvements, and removal of unneeded infrastructures like bridges or dams. Locations of specific projects and before and after photos of completed projects will be shown.

Salt Lake County 2015 Integrated Watershed Plan

Karen Nichols, Water Resource Engineer
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HDR Personnel: Rosemary Fasselin, Sue Lee, Matt Cooper, Maggie Nichols, Steve Thurin, Bill Pope, Carrie Ulrich, Mike Perkins

Since the late 1970s, Salt Lake County has provided planning and implementation to protect and improve the water quality of the county's surface waters. Salt Lake County's goals are to protect, maintain, and restore the chemical, physical, and biological integrity of the 300 miles of surface waters within the county. As part of its continuing area-wide (that is, county-wide) water quality planning, Salt Lake County is completing the 2015 Integrated Watershed Plan (2015 Plan) to update its 2009 Salt Lake Countywide Water Quality Stewardship Plan (2009 Plan). The 2015 Plan doesn't reiterate all of the baseline information in the 2009 Plan, but rather updates information where needed and builds on the framework of goals and policies laid out in 2009. The 2015 Plan includes a 6-year program evaluation to review program efforts since adoption of the 2009 Plan. It analyzes current land-use projections, population projections, and monitoring data that have been gathered since the 2009 Plan was issued to provide an updated picture of current watershed conditions. In addition, this document reports on three focused planning elements: an instream flow analysis for Little Cottonwood Creek, a feasibility study to retrofit debris basins, and a west-side stream plan. With this new analysis, Salt Lake County has updated the goals, objectives, and implementation plans in the 2009 Plan to continue guiding water quality stewardship and integrated watershed management in the county through 2040 and beyond. (5 posters)

Seven Canyons Trust | 100 Years of Daylighting

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Contributors: Seven Canyons Trust

The poster will include information about the Seven Canyons Trust and their mission to daylight and rehabilitate the seven canyon creeks, restoring beauty and health to the hydrology. Topics will include mission, study area, vision, and spotlight areas.

Spatio-temporal Variation In The Tap Water Isotope Ratios Of Salt Lake City: A Novel Indicator Of Urban Water System Structure And Dynamics

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Public water supply systems are the life-blood of urban areas. How we use urban water systems affects more than human health and well-being. Our water use can alter a city's energy balance, including how much solar energy is absorbed as heat or reflected back into space. The severity of these effects, and the need to better understand connections between climate, water extraction, water use, and water use impacts, is strongest in areas of climatic aridity and substantial land-use change, such as the rapidly urbanizing areas of Utah. We have gathered and analyzed stable water isotope data from a series of semi-annual hydrological surveys (spring and fall, 2013, 2014 and 2015) in urban tap water sampled across the Salt Lake Valley. Our study has led to four major findings thus far: 1) Clear and substantial variation in tap water isotopic composition in space and time that can be linked to different water sources and management practices within the urban area, 2) There is a strong correlation between the range of observed isotope values and the population of water districts, reflecting use of water from multiple local and non-local sources in districts with high water demand, 3) Water isotopes reflect significant and variable loss of water due to evaporation of surface water resources and 4) Overall, tap water contains lower concentrations of the heavy H and O isotopes than does precipitation within the basin, reflecting the connection between city water supplies and mountain water sources. Our results highlight the utility of isotopic data as an indicator of heterogeneities within urban water systems, management practices and their variation across a major metropolitan area, and effects of climate variability on urban water supplies.

Understanding Nutrient Dynamics in the Jordan River, Utah

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In the growing urbanization era, anthropological changes like hydraulic modification, wastewater treatment plant effluent discharge etc. have caused a variety of ailments to urban rivers that include

organic matter and nutrient enrichment, loss of biodiversity, and chronically low dissolved oxygen concentrations. Utah's Jordan River is no exception; where nitrogen contamination, persistently low oxygen concentration and high organic matter are some of the current major issues. The purpose of this research is to look into the nitrogen and oxygen dynamics at selected sites along the Jordan River and wetlands associated with Great Salt Lake. To demonstrate the nitrogen dynamics, sediment nutrient flux experiment was performed at downstream of the Red Butte Creek discharge and South Davis South wastewater effluent discharge point along Jordan River, State Canal and wetland sites Unit 1 and Unit 2. The daily changes in nutrient concentrations of water with and without in contact to the underlying sediment were measured using 10 inch x 10 inch acrylic chambers twice over the course of Summer, 2015. At most of the sites, the sediment was a sink for nitrate as a consequence of denitrification, whereas water column was the nitrate source due to nitrification. At Legacy Nature Preserve, water column illustrated a decrease in ammonia, whereas sediment was noticed to be a source of ammonia as decomposition likely outperformed nitrification. These sediment nutrient flux is compared with the Sediment oxygen demand (SOD) which accounts for the depletion of dissolved oxygen due to the decomposition of settled organic matter (OM). The potential denitrification rate, measured using isotopic nitrogen source, strongly indicate that Jordan River sediment is very active in nitrate reduction. Results from serum bottle nitrification experiments illustrates the potential rate of ammonia oxidation. Both nitrate reduction and ammonia oxidation rate obtained at Legacy Nature Preserve site was higher than other sites. The potential nitrification rate observed at this site was 0.468 mg-N14/gm-VS/day, whereas denitrification rate was 1.35 mg-N15/gm-VS/day. Variation in nitrification and denitrification rates was also supported by the molecular analysis-qPCR on amoA and nirS gene. The T-RFLP experiment on ammonia mono-oxygenase revealed the presence of several nitrifying species in the Jordan River sediment. Comparing the potential rates of denitrification and nitrification with the insitu nitrogen flux, and sediment oxygen demand at different locations along the Jordan River provides a great insight of the nutrient dynamics along the river. Results from these study can serve as essential additions in the continuing efforts of improvising the Jordan River TMDL and management practices.

Speaker Bios

Carl Adams has worked for the State of Utah's Division of Water Quality for the last 15 years, first in developing TMDLs in the Uinta and Colorado River Basins and more recently as manager of the Watershed Protection Section. During this time Carl has had the pleasure of working with a diverse group of resource professionals, elected officials and passionate stakeholders towards improving water quality in Utah's streams, lakes and reservoirs. In his spare time, Carl enjoys playing the drums and touring the scenic byways of the West via motorbike.

Hilary Arens is the watershed coordinator for Utah Lake and the Jordan River basins for the Utah Division of Water Quality. Over the years, she has worked in watershed management in VT, CO and AK, and as a volunteer with water groups in VT, OR and UT. Hilary received her B.A. in Biology from Colby College (in Maine) and her M.S. in Watershed Science from Colorado State University. An avid boater, skier and cyclist, she and her husband enjoy bringing their toddler twins on adventures where few toddlers go.

Marina Astin is an educator at Tracy Aviary. She graduated from Brigham Young University with a B.S. in Biology and a minor in Environmental Science. As an intern at Tracy Aviary she was introduced to environmental education. Marina works with Tracy Aviary's Nature in the City program, providing fun, educational activities to get families outdoors exploring nature. She has especially loved getting to explore Salt Lake's river and streams.

Mike Barber is a professor and chair of civil Engineering at the University of Utah.

Lori Bays first joined Mayor McAdams' team as director of the Human Services Department in 2013, and was promoted to Deputy Mayor and Chief Administrative Officer in September 2015. Lori has more than 16 years of experience in local government and Health and Human Services. Prior to joining Salt Lake County, Lori was a Health

and Human Services Agency Executive for San Diego County. Before that, she served as Director of the Office of Public Guardian for the State of Utah. Earlier in her career, Lori worked for a non-profit serving at-risk youth. She holds a master's degree in Clinical Psychology and is a licensed therapist.

Bob Bonar is the president and chief executive officer of Snowbird Ski & Summer Resort. Mr. Bonar's purview includes 1,800 employees within mountain operations, sales and marketing, human resources, retail, food and beverage, and lodging. He also serves on the boards of the Utah Ski and Snowboard Association, Wasatch Adaptive Sports, Utah Sports Commission, and the Cottonwood Canyons Foundation. Mr. Bonar began as an employee and ski patroller at Alta Lodge before moving to Snowbird when the resort opened in 1971. While at Snowbird, he has held several positions, including director of ski patrol and mountain operations.

Gabriel Bowen is an associate professor of geology and geophysics and member of the Global Change and Sustainability Center at the University of Utah, where he leads the Spatio-temporal Isotope Analytics Lab (SPATIAL) and serves as co-director of the SIRFER stable isotope facility. His research uses spatially and temporally resolved geochemical data to study Earth systems processes, ranging from coupled carbon and water cycle change in geologic history to the movements of modern and near-modern humans. He has coauthored more than 100 peer reviewed papers and book chapters, and his work has been supported by grants from the National Science Foundation, other U.S. government agencies, and private foundations. In addition to fundamental research, he has been active in developing cyberinformatics tools and training programs supporting the use of large-scale environmental geochemistry data across a broad range of scientific disciplines.

Laura Briefer is deputy director for Salt Lake City Department of Public Utilities (SLCDPU), a municipal water supplier responsible for the provision of drinking water to more than 349,000 people in the Salt Lake Valley of Utah. SLCDPU also manages wastewater and stormwater for Salt Lake City. Ms. Briefer has worked at SLCDPU for seven years, and has 20 years experience in natural resource and environmental professions in the public and private sectors. She has a degree in Environmental Studies from the University of California at Santa Barbara, and a Master of Public Administration from the University of Utah.

Steve Burian is an associate professor in Civil Engineering and director of sustainability center at the University of Utah.

Shaun Daniel recently graduated from the University of Utah's Environmental Humanities program (M.S., 2015), where his master's project proposed rainwater harvest for stream and species conservation at the U's Taft-Nicholson Center, located in the Greater Yellowstone. He holds a permaculture design certificate from Occidental Arts and Ecology Center and has provided community organizing and communications support for organizations focused on sustainability. He is currently developing a design portfolio to establish an ecological design and consulting business. Recent projects include establishing the Off Broadway Community Garden in downtown Salt Lake and initiating food production and composting systems at the Taft-Nicholson Center as an assistant instructor this year. As part of his efforts for a more just, joyful, and regenerative future, Shaun likes playing music, cooking, hiking, and exploring Utah with his wife Teresa.

Robert Davies is a physicist and educator. Rob is an Associate of the Utah Climate Center and teaches physics and climate at Utah State University, where he is adjunct professor in the department of Plants, Soils and Climate. His work for the past seven years has focused on communicating climate change and sustainability science to a wide variety of audiences.

Joan Degiorgio has been working in the field of natural resources planning for over 30 years. These years have included planning positions with the State of Utah, U.S. Forest Service, private consulting, and the Utah Mitigation Commission. She is a Utah native raised on a farm in Weber County, with a law degree from the University of Utah. She has also been an adjunct professor at the University of Utah teaching a public land and planning course. For the past 12 years she has been working for the Nature Conservancy responsible for identifying and managing projects in Northern Utah that preserve sensitive landscapes and species. These include the Uinta Basin and Bear River where she has assembled a team of public and private partners to develop and implement science-driven landscape plans that include a climate change element.

Jeff DenBleyker has been a project manager and water resources engineer at CH2M in Salt Lake City since 1996. He has led a wide variety of permitting, investigation, and design projects covering water quality, hydrology, ecotoxicology, the assessment and restoration of streams and wetlands, and constructed treatment wetlands.

Jeff's focus is helping form solutions that integrate science with the people and uses that are affected. Jeff led the State's effort to develop site-specific numeric criteria for selenium for GSL, has been involved with efforts to develop nutrient water quality standards for GSL, and is the State's project manager the GSL Integrated Water Resources Management Model.

Joe Donaldson has over two decades of experience in environmental planning, design, compliance, and permitting for projects throughout the U.S. His expertise encompasses water resources planning; ecological restoration; visual resource assessment; community planning; and public involvement. His project work has included flood control planning; multi-purpose groundwater recharge facilities; new and refurbished reservoir developments; stream corridor management plans; wildlife refuge planning; bank stabilization; and recreation and open space projects for streams, wetlands, and flood plain areas. His experience includes work for a wide variety of clients, including flood control agencies, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Park Service, BLM, U.S. Forest Service, utility companies; private energy and transmission developers; and various state and municipal government agencies.

Stephanie Duer has been with Salt Lake City Department of Public Utilities since 2001, when she was hired to create and manage a water conservation program for one of the most populated, industrialized, and commercialized areas in Utah. She has since written and implement three conservation master plans, which she refers to as her "job description." She holds degrees in political theory and U.S. history, and earned a secondary education credential, all from San Jose State University. She is currently finishing a Masters in Professional Communications/Writing from Westminster College.

Corinne Gentry works as an educator at Tracy Aviary, primarily facilitating family programming for Nature in the City. Her enthusiasm for environmental education (EE) stems from a childhood spent outdoors; this passion evolved throughout college and in her elementary school teaching experience, where she successfully advocated for the inclusion of free play into her school's programming and developed an EE curriculum for teacher use. She has a BA in English with an emphasis in ecological creative literature and is currently earning her Utah EE certification.

Kelly Gillman has been with CRSA for thirteen years and is a senior principal with the firm. Kelly leads the CRSA Site Studio which houses the landscape architecture, urban, municipal, and campus planning, and public outreach disciplines. Kelly is professionally accomplished in developing graphic communications and outreach materials, applying this experience to projects with institutional agencies and local municipalities. Most recently Kelly has provided campus planning, site design, and urban planning services to Salt Lake Community College, Utah State University, and the University of Idaho. He is also currently providing public outreach and analysis services to the State of Utah's Division of Fire, Forestry, and State Lands as part of the development of a Comprehensive Management for the Jordan River. Kelly is a graduate of the Landscape Architecture and Environmental Planning program at Utah State University, and serves as the Utah Chapter trustee for the American Society of Landscape Architects.

Ramesh Goel is an associate professor of environmental engineering at the University of Utah. He studies water quality in urban environments. He also studies nutrients dynamics, recovery and removal in municipal wastewater treatment plants.

Brian Greene is a stream ecologist who works for USU Water Quality Extension. He enjoys sharing his passion about aquatic environments with the general public and engaging the public to actively participate in the scientific process via citizen science.

Maura Hahnenberger is currently an assistant professor in the Geosciences Department at Salt Lake Community College. Her teaching responsibilities include lower division meteorology and geography courses, with both in-person and online settings. She received her Ph.D. in the Department of Atmospheric Sciences at the University of Utah studying dust storms in the eastern Great Basin of Utah, and was a 2-year NSF GK-12 Fellow serving as a "scientist in the classroom" at local elementary and middle schools. She is the founder of WaterGirls, which aims to inspire women and girls and increase their interest and confidence in pursuing STEM disciplines.

Sarah Hinners is a landscape and urban ecologist and associate professor in City and Metropolitan Planning at the University of Utah. As a scientist in a planning department, she works on bridging the gap between science and academic research and real-world applications. Her research interests focus on the ecological, economic and social

roles and value of green infrastructure in cities across scales and along the full gradient from “pristine” to highly urbanized ecosystems. She collaborates with scientists, engineers, planners and stakeholders to better understand the way humans and landscape interact to produce “human habitat”, of which cities are perhaps the ultimate example. She is currently working on mechanisms that facilitate inclusion of ecosystem service values and natural resource data in urban scenario planning calculations. She is also the Acting Director of the Ecological Planning Center and involved in the EPSCoR iUTAH project, which looks at biophysical and socio-ecological dimensions of water in three northern Utah watersheds along a gradient of urbanization.

Ben Holcomb is the Utah Division of Water Quality coordinator for the biological assessment and harmful algal bloom programs. He’s worked at DWQ for seven years and past work includes salmon, water quality, and tribal sovereignty in the Pacific NW.

Heidi Hoven received a Ph.D. in the Natural Resources Program in 1998 and an M.S. in Botany in 1992, at the University of New Hampshire, and a B.S. in Natural Resources at the University of Rhode Island, 1986. Her focus is on wetlands ecology and plant ecophysiology and she has applied these disciplines towards wetland assessment, restoration, and conservation planning for wetlands of Great Salt Lake. She founded the Institute for Watershed Sciences in 2006 and is director of its Wetland Research Program. Dr. Hoven is an adjunct and visiting research professor at Weber State University.

Marian Hubbard-Rice joined the Salt Lake County Engineering Division, Watershed Planning and & Restoration Program in 2007 as a Watershed Scientist and Planner. She has a Bachelor of Science Degree in Biology from Portland State University, a MPA in Natural Resource Management from University of Utah, and currently working on a Ph.D. at University of Utah. Marian’s core responsibilities include, but not limited to, collaboration with agencies, local stakeholders, and the general public; writing, updating and implementing the Salt Lake Countywide Water Quality Stewardship Plan (WaQSP); performing ecosystem restoration; and water quality monitoring in the Jordan River Watershed. Prior to the County, Marian worked in the Portland, Oregon Metro area in environmental management. After which she moved to Utah to work with the U.S. Forest Service performing ecosystem restoration in the beautiful Strawberry River Watershed.

Yusuf Jameel is a Ph.D. student studying urban and natural waterways at the Department of Geology and Geophysics, University of Utah. He is currently working on understanding spatio-temporal variations in Salt Lake Valley tap water isotopes, in order to examine connections between climate, human water consumption and local hydrologic systems. He is also working on quantifying the inorganic carbon budget of the major rivers in the Great Salt Lake basin. He seeks to understand the variation in inorganic carbon loads among and within rivers, based upon varying degrees of urbanization and diverse land cover types.

Todd Marti is an engineer at the Jordan Valley Water Conservancy District, where he has worked for 8 years. Since 2013, he has been the project manager for AMI implementation at the District. He received a B.S. in Civil Engineering from the University of Utah in 2005, a M.S. in Civil Engineering from the University of New Mexico in 2007, and a Master of Public Administration degree from the University of Utah in 2012. He earned his Professional Engineer’s license in 2010. He is married with two rambunctious boys who love terrorizing his clean house. His license plate frame reads “I’d rather be kayaking”; which is true.

Dan McCool’s research focuses on water resources and river restoration, Indian water rights, Indian voting rights, and public lands policy. His recent books include: *River Republic: The Fall and Rise of America’s Rivers* (Columbia University Press 2012); and *Native Waters: Contemporary Indian Water Settlements and the Second Treaty Era* (University of Arizona Press 2002). He directed the Environmental and Sustainability Studies program for 12 years.

Eric McCulley has experience planning, implementing, and following up on numerous stream and wetland ecological restoration and mitigation projects. His experience ranges from assessment of the ecological integrity of wetlands and streams to migratory bird inventory to riparian habitat evaluation. He has provided guidance to decision makers and their staff on optimizing use of project funds for maximum ecological and societal benefit on several large projects in the Intermountain West. His project work has focused on mapping of hydrology, soils and vegetation; analysis of data on water, plants and birds; monitoring for adaptive management of open spaces, ranches and nature preserves; and restoring wildlife, stream and wetland habitats.

Brian McInerney is the senior hydrologist at the National Weather Service Forecast Office in Salt Lake City, Utah. He has held this job for the past 26 years and resides in Park City, Utah.

Theron Miller is yet another well seasoned veteran with vast experience conducting aquatic ecological studies. He earned his B.S., M.S. and Ph.D. degrees from Utah State University and University of Alberta. Theron was a fishery biologist with U.S. Bureau of Reclamation, a research associate in Limnology at UNLV, an aquatic toxicologist with U.S. EPA, and a scientist with Utah DWQ. He is currently the lead ecologist with JRFBWQC, not to mention he also likes studying freshwater mollusks.

W. Paul Miller works for the Colorado Basin River Forecast Center as a senior hydrologist in Salt Lake City, UT. He is the climate focal point and water supply focal point for the Great Basin. Prior to joining the CBRFC in November 2012, he worked for the Bureau of Reclamation in Boulder City, NV for 7 years. He received his B.S. in Environmental Hydrology and Water Resources from the University of Arizona in 2003, his M.S. in Environmental Engineering from the University of Notre Dame in 2005, and his Ph.D. in Civil Engineering from the University of Nevada, Las Vegas in 2010. His dissertation was titled, "Assessment of Impacts to Hydroclimatology and River Operations due to Climate Change over the Colorado River Basin." Paul previously worked for the USDA's Southwest Watershed Research Center in Tucson, AZ and the U.S. Army Corps of Engineers in Vicksburg, MS. He has taught introductory hydrology and fluid mechanics courses at UNLV.

Brian Nicholson is a project manager and regulatory specialist in SWCA's Salt Lake City office. He has more than 15 years of experience working in streams and wetlands in the Intermountain West, Alaska, and Hawai'i. He is proficient in all aspects of Section 404 of the Clean Water Act from jurisdictional determinations to permitting to mitigation design and presents regularly on this topic. He has practical experience assessing ecological condition of wetlands using field-based and GIS-based methods. He recently wrote a whitepaper for Salt Lake City outlining the mitigation banking process and assessing the potential to develop a mitigation bank for internal municipal and outside use. His training in watershed science and sociology allows for interdisciplinary analysis of biophysical processes and human dimension issues.

Matt Olsen is the communications department manager for Jordan Valley Water Conservancy District, with responsibilities that include managing public outreach, conservation, customer service, and analysis services for the organization. Throughout his career, he has developed multiple technology and analytical solutions for enhancing organizational decision-making, messaging, and operations and was the leader in developing the Star Wars club at the District. He has a Bachelor of Science in Information Systems from the University of Utah and a Master of Business Administration from Western Governors University.

Lucy Parham is a water resources specialist and currently manages study design, data collection, analysis, and reporting for various watershed studies in Utah and Wyoming for SWCA Environmental Consultants. She has over five years of experience in the natural resources field and has worked both professionally and academically on a variety of projects that include water quality and quantity investigations, nonpoint source identification, microbial source tracking, BMP implementation, watershed management and planning, and long-term environmental monitoring of hydrological ecosystem services. Her academic and professional career has afforded her ample opportunity to develop and demonstrate scientific proficiency and perhaps more importantly, effectively communicate findings to various audiences.

Reid Persing focuses his practice on environmental law and policy, federal land management and decision making, and complex natural resource issues in western landscapes. Raised by parents who loved the National Parks and American West, he moved to Utah in 2005 for "one more year of skiing before graduate school" and immediately fell in love with the Central Wasatch Mountains. He is an avid resort and backcountry snowboarder, mountain biker, fly fisherman, trail runner, and enthusiast of all things outdoors. In his career Reid has performed planning work in seven western states, all five Utah National Forests, and had the privilege of working extensively in the National Parks. Reid also served as the lead consultant for the recreational planning recreation stakeholder engagement conducted through the ongoing Mountain Accord process. He is on the board of directors for the Utah Avalanche Center and Team Utah Snowboarding.

David Richards is an evolutionary ecologist focusing his research on freshwater mollusks, biodiversity, food webs, metapopulation viability, and all things too cool to be ignored. He has conducted scientific research on aquatic ecosystems from Alaska to Panama, from the Columbia River to the Colorado River, from tiny freshwater springs to the Great Salt Lake. And he has only just begun.

Robin Rothfeder is a Ph.D. student in the City and Metropolitan Planning Department at the University of Utah. He is the department's first ecological planning fellow and is the project manager for the University's Red Butte Creek Revitalization initiative. He also holds an M.S. in Environmental Humanities, from the University of Utah, and a double major B.S. in Environmental Sciences and Environmental Economics & Policy, from UC Berkeley. Robin's current research covers two areas: 1) the foundations, processes, and best practices in the emerging field of Ecological Planning, and 2) water resources planning, policy, and management in the western United States. In addition, his work along Red Butte Creek aims to create a one-of-a-kind ecological, recreational, and educational amenity at the University of Utah. Off campus, Robin is an outdoor enthusiast, an avid sports fan, and a certified yoga instructor.

Gordon Rowe grew up in Albuquerque, New Mexico and is an avid outdoorsman. Gordon works to analyze water finance policy inside Utah, oversee water supply research projects, draft materials for public distribution and oversee interns among other projects at our organization. Gordon is a graduate in Environmental and Sustainable Studies at the University of Utah. In his free time, Gordon can be found skiing, mountain biking, climbing, and kayaking throughout Utah.

Larry Rupp is an extension landscape horticulturist and professor of Landscape Horticulture in the Plants, Soils, and Climate Department and the Center for Water Efficient Landscaping at Utah State University. His research focuses on selection and propagation of native plants for use in water conserving landscapes as primarily funded by the USDA Specialty Crops Block Grant program through the Utah Department of Agriculture and Food. The CWEL is a research and outreach center established in 1999 to promote water conservation through environmentally, socially, and economically sound landscape management practices. It is unique among water conservation by focusing only on the issue of efficient landscape water use. Its major programs include outreach education, the Water Check program, WaterMAPS, development of water efficient landscape plants, and in-depth research on water use by plants in the landscape. The members of the Center include Dr. Joanna Endter-Wada (Environmental Sociology), Diana Glenn (Urban Water Conservation), Dr. Paul Johnson (Turfgrass Science), Dr. Roger Kjelgren (Woody Plant Physiology), Dr. Kelly Kopp (Extension Water Conservation), Dr. Larry Rupp (Extension Landscape Horticulture), and Adrea Wheaton (Program Coordinator).

Christopher Sands received his Masters Degree in Landscape Architecture and Environmental Planning (LAEP) from Utah State University and his Bachelor of Landscape Architecture degree from the University of Georgia. He is a licensed landscape architect and a certified planner at BIO-WEST, Inc., in Logan, Utah. BIO-WEST is a 50-person, multi-disciplinary environmental consulting firm providing context sensitive environmental services since 1976. BIO-WEST's corporate offices are located in Logan, with satellite offices Salt Lake City, Utah and in Austin and Houston, Texas.

Alex Schmidt has been a friend of Save Our Canyons since his mother bought him a Save Our Canyons t-shirt in 2003. In 2010 he received his A.S. from Salt Lake Community College and has since completed a Certificate of Excellence from the Non-profit Academy of Excellence through the University of Utah. Having the Wasatch Mountains in such close proximity, with ease of access to recreation, natural spaces, and quiet solitude in the mountains and foothills of this incredible area has shaped the way that he has come to better understand himself and the world around him. He is currently acting as full-time campaigns coordinator for Save Our Canyons.

Nick Schou is the conservation director for Utah Rivers Council and leads the organization's water conservation initiatives. Nick has a M.S. in Environmental Humanities from the University of Utah, a B.A. in History from Westminster College and spent 5 years working for the U.S. Fish and Wildlife Service to restore endangered native fish species of the Colorado River. Nick is an avid outdoorsman who drags his family on all manner of outdoor excursions throughout the West.

Pat Shea is a Salt Lake Native. He is a conservation biologist who also practices law (one call, is not all). He served in the Clinton Administration as the National Director of the Bureau of Land Management. He tends to be attracted to controversy, of which there is an abundance in Salt Lake County and the State of Utah. Dilworth Elementary School; Hillside Junior High School; Highland High School; Stanford University; Oxford University; Harvard University; Van Cott Bagley, Partner; Patrick A. Shea, PC; Counsel Senate Foreign Relations Committee; Director of Bureau of Land Management, Department of Interior; Associate Research Professor of Biology, University of Utah.

Søren Simonsen is an architect and urban planner, who served for two terms as a Salt Lake City Council member and is currently the president of Community Studio planning firm and executive director of Impact Hub Salt Lake, and a member of the Salt Lake City RDA board.

Anne Terry is senior educator at Tracy Aviary. She got her start in environmental education by volunteering at a zoo in Texas at the age of thirteen and quickly realized it was the field for her. She has a B.S. in Biology from the University of Texas. An internship with the City of Austin Watershed Protection Department introduced her to watershed education, and in her three years at Tracy Aviary, she has enjoyed finding new ways to connect people to their watersheds. She loves bike commuting (and all sustainable transportation), yoga, and of course, birding.

Laura Vernon is a planner and the Forest Legacy Coordinator for the Utah Division of Forestry, Fire & State Lands. Over the last 15 years, Laura has worked with federal, state, and local governments and industry leaders on contemporary planning and environmental policy issues in the West. Her education and professional experience focuses on land use planning, public involvement, socioeconomic analysis, project management, and technical writing. Laura received her Master of Public Administration from the University of Utah in 2003. Having served as the project manager for the Great Salt Lake Management Plan, she is currently overseeing completion of the Jordan River Comprehensive Management Plan.

Samantha Weintraub is postdoctoral research associate at the University of Utah. Her research seeks to uncover how biotic and abiotic variables interact with human activities to regulate key ecosystem processes and services, such as carbon sequestration, water quality, and trace gas emissions. In particular, she is fascinated by the nitrogen cycle, and uses stable isotopes to track flows of nitrogen, both naturally occurring and from anthropogenic pollution, through plants, soils, and hydrologic systems. She works in diverse landscapes, from tropical rainforests to the Andes and Wasatch mountains, and draws on a broad suite of biogeochemical tools in her research adventures.

Ray Wheeler is a writer, photographer, outdoor adventure travel explorer, planner and environmental activist. He is a principal co-author of BLM and Forest Service wilderness proposals for Utah and a framer of the America's Redrock Wilderness Act, and principle architect of the "Nature in the City" riparian restoration plan for the Jordan River in Salt Lake City.

Annie Young is an educator at Tracy Aviary. Having studied at the University of Portland, she received her B.A. in International Languages and Culture focusing on Spanish, along with double minors in Biology and Chemistry. She found her passion for environmental education through an internship at Tracy Aviary focusing on education about watersheds, riparian habitats, and water conservation. In her free time Annie enjoys creating ceramic pottery, hiking and any activity that includes coffee.

Notes

