Santa Cruz Water Supply Strategies and Ideas submitted by July 28th

We have compiled the submissions from our initial call for strategies and ideas to address our water supply issues in Santa Cruz. We received over 80 separate ideas from over 50 different participants. Please take some time to look through these to get a feel for how well our community has responded to our request.

To further the discussions about these ideas we will host a Convention Event at the Santa Cruz Civic Auditorium on **Thursday, 16th October, from 11am to 9pm**. Participants will have an opportunity to present their ideas to and interact with WSAC members, citizens, elected and appointed officials and invited guests. In preparation for this Event, the WSAC now invites you to submit or update your submission in order to support this next level of analysis of solutions to deliver a safe, adequate, reliable, affordable and environmentally sustainable water supply for Santa Cruz. Please visit www.santacruzwatersupply.com for more information.

Recognizing that these submissions may require substantial time and effort on your part, we respectfully suggest that you consider collaborating with other applicants who have suggestions similar to yours. Such "joint proposals" could make the process more efficient and effective for everyone. In order to enable you to evaluate opportunities to collaborate, we have provided you with a summary list of the submissions (with page numbers for reference) followed by the actual submissions. Please take a look at these materials and feel free to reach out to and team with other applicants.

Submissions Overview				
Pg. #	**Focus Area**	**Name**	**Contact info (email, phone, addr.)**	**Solution(s)**
1-3	Demand	Bill Smallman	www.scwatersolutions.com	Conservation Savings Accts
4-6	Demand	Desal Alternatives (SCDA)	longinotti@baymoon.com	Water Neutral Development
4-6	Demand	SCDA	longinotti@baymoon.com	Progressive Water Rates
4-6	Demand	SCDA	longinotti@baymoon.com	Building Code Adoption
4-6	Demand	SCDA	longinotti@baymoon.com	Appropriate landscaping
4-6	Demand	SCDA	longinotti@baymoon.com	Cconservation behavior
4-6	Demand	SCDA	longinotti@baymoon.com	CCC restoration projects
7-9	Demand	Dominique Gomez, WaterSmart	dgomez@watersmartsoftware.com	Smart metering and feedback
10-11	Demand	Ellen Farmer	ellen.farmer@yahoo.com	Subsidize gray-water systems
12	Demand	Golden Love	goldenlove@lovesgardens.com	Appropriate landscaping
13	Demand	Bobby Markowitz	info@earthcraftdesign.com	Appropriate landscaping
14-15	Demand	Sarah Mansergh	semmansergh@hotmail.com	Appropriate landscaping
16-17	Demand	James Workman, AquaJust	jworkman@smart-markets.com	Water Trade system
18-19	Demand	Jeffrey Langholz, WaterCity	jlangholz@miis.edu	conservation measures
20-21	Demand	Joanna Nelson	joannanelsonchaver@gmail.com	Composting Toilets
22	Demand	Peter Scott	drip@ucsc.edu	Composting Toilets
23	Demand	Kar Fraser	karfraser@cruzio.com	Education and conservation
24	Demand	Ken Baurmeister	geoken007@yahoo.com	Free parking
25-26	Demand	Paul Gratz	ppauljg45@pacbell.com	Conservation behavior
27	Demand	Robert Singleton, Civinomics	robert@civinomics.com	capacity estimation
28-49	Demand	Sam Burkhardt	831-212-7019	Hot-water recirc

Pg. #	Focus Area	Name	Contact info (email, phone, addr.)	Solution(s)
28-49	Demand	Sam Burkhardt	831-212-7019	Ultra-efficient toilets
50-51	Demand	Sue Holt	suholt@cabrillo.edu	Conservation behavior
52-53	Demand	Scott McGilvray	scottm@wateraware.com	MCP implementation
52-53	Storage	Scott McGilvray	scottm@wateraware.com	Quarry storage
52-53	Storage	Scott McGilvray	scottm@wateraware.com	Stormwater capture
54-56	Storage	Bill Malone	billmalone@pacbell.net	Enhance storage
54-56	Storage	Bill Malone	billmalone@pacbell.net	Stormwater capture
54-56	Storage	Bill Malone	billmalone@pacbell.net	Water Exchange
1-3	Storage	Bill Smallman	www.scwatersolutions.com	Stormwater treatment;
1-3	Storage	Bill Smallman	www.scwatersolutions.com	Reservoirs
57	Storage	Dick Erlin	bompaerlin@aol.com	Enhance storage
58-79	Storage	Jerry Paul	jpaul@ix.netcom.com	capture and storage
58-79	Storage	Jerry Paul	jpaul@ix.netcom.com	Regional sharing:
80-81	Storage	JoeBen Bevirt	joeben@northcoastfarms.com	Liddell Quarry
82-83	Storage	John McGuire	johnandcarol@att.net	increased SLR diversions
84-85	Storage	John Ricker	john.ricker@santacruzcounty.us	Water Exchange
86-87	Storage	Piret Harmon, Scotts Valley WD	pharmon@svwd.org	Off-stream storage; recharge
88	Storage	Randa Solick	rsolick@gmail.com	Lochquifer
89	Storage	Richard Luthy	luthy@stanford.edu	Stormwater capture
89	Storage	Richard Luthy	luthy@stanford.edu	SLR diversions;
89	Storage	Richard Luthy	luthy@stanford.edu	groundwater storage
90-91	Storage	SCWD	hluckenback@cityofsantacruz.com	Zayante Dam

Pg. #	Focus Area	Name	Contact info (email, phone, addr.)	Solution(s)
92-96	Storage	Terry McKinney	tmckinneyus@yahoo.com	flows
92-96	Storage	Terry McKinney	tmckinneyus@yahoo.com	Branciforte creeks
97-101	Storage	Wison (Bill) Fieberling	249 3rd Ave, Santa Cruz CA 95062	Off-stream storage
102-103	Supply	Annaliese Ramsay, Trevi Systems	aramsay@trevisystems.com	Desal
1-3	Supply	Bill Smallman	www.scwatersolutions.com	DPR;
104	Supply	Bud Miller	bmiller@cityofsantacruz.com	Re-use
105-106	Supply	Candace Brown	clbrown23@gmail.com	Wave energy for Desal
107-108	Supply	Dana Ripley, Ripley Pacific	dana@ripleypacific.com	IDPR / Irrigation
109-111	Supply	Dave Martin	c.dave.marting@gmail.com	Dual-plumbing / re-use
112	Supply	David Laughlin	dlaughlin@ebold.com	Majors Creek
58-79	Supply	Jerry Paul	jpaul@ix.netcom.com	DPR with detainment tubs
20-21	Supply	Joanna Nelson	joannanelsonchaver@gmail.com	restoration
113-114	Supply	John McGuire	johnandcarol@att.net	(I)DPR;
113-114	Supply	John McGuire	johnandcarol@att.net	purchases;
115	Supply	Kathy Haber	dannynor@cruzio.com	fields
116	Supply	Mark Agnello	iggysc@cruzio.com	Desal
117-119	Supply	Paul Gratz	ppauljg45@pacbell.com	courses
120	Supply	Paul Lillie	paulilie@netscape.net	Ship desal
121-128	Supply	Porifera	erik.desormeaux@poriferanano.com	Desal (FO)
129-132	Supply	Ric Davidge, Aqueous	pm@cyalaska.com	Desal/WWT (Aqueous)
133	Supply	Russ Weisz	russweisz@baymoon.com	Recycled Water-multi uses
52-53	Supply	Scott McGilvray	scottm@wateraware.com	Pasatiempo

Pg. #	Focus Area	Name	Contact info (email, phone, addr.)	Solution(s)
52-53	Supply	Scott McGilvray	scottm@wateraware.com	Upgrade WWTF
52-53	Supply	Scott McGilvray	scottm@wateraware.com	Pipelines
134-135	Supply	SCWD	hluckenback@cityofsantacruz.com	DPR
136-137	Supply	SCWD	hluckenback@cityofsantacruz.com	IDPR
138-139	Supply	SCWD	hluckenback@cityofsantacruz.com	IDPR / Groundwater recharge
140-141	Supply	SCWD	hluckenback@cityofsantacruz.com	IDPR / regional irrigation
92-96	Supply	Terry McKinney	tmckinneyus@yahoo.com	Improve SLR lagoon
92-96	Supply	Terry McKinney	tmckinneyus@yahoo.com	Wells
92-96	Supply	Terry McKinney	tmckinneyus@yahoo.com	IDPR / Irrigation
92-96	Supply	Terry McKinney	tmckinneyus@yahoo.com	Upgrade / augment WWTF
1-3	Administration	Bill Smallman	www.scwatersolutions.com	Consolidate mgt;
142-143	Administration	Paul Gratz	ppauljg45@pacbell.com	Regional management
144	Administration	John Corgiat	jcorgiat@hotmail.com	Meter Mobile Homes
145	Comment	Linda Sorauf	linda_sorauf@yahoo.com	Look at recycled water
146	Comment	Michael Veglia	msvphoto@pacbell.net	Fix rates
147	Comment	Patti Shimokawa	pshimokawa@gmail.com	Emphasize conservation
148-149	Comment	Peter Haworth	pete.haworth40@gmail.com	n/a
150	Comment	Rainbow Mitchell-Fox	rrepstein@live.com	Review rates
151	Comment	James Cook	jcookster999@hotmail.com	Fix rates
152	Comment	William Epstein	hawkland@pacbell.net	Affordability
153	Supply	Matthew Orbach	redmattsc@gmail.com	Desal as an option

Bill Smallman, P.E.
11765 Edgewood Drive
Felton, CA 95018
www.SC WaterSolutions.com

July 23, 2014

Santa Cruz Water Supply Advisory Committee
212 Locust Street
Santa Cruz, CA 95060

RE: Preliminary Outline of Water Solutions for Santa Cruz County.

The attached 2-page outline includes conceptual plans for the entire County, including the City of Santa Cruz. The details of my plans which specifically benefit the City are more detailed, and the others left blank in order to fit in the 2-page minimum.

I will always be available for presentations and answering any questions. I am also working on a short film which describes my plan in detail. More detail can also be found on www.SCWaterSolutions.com. I sincerely look forward to participating with you on this extremely important task.

I'm a licensed Civil Engineer with over 25 years in water resource related infrastructure improvement projects. I also have served on the Lompico County Water District Board since January, 2009 to present.

Sincerely,

Bill Smallman

Bill Smallman, P.E.

Water Solutions for Santa Cruz County

By Bill Smallman, P.E. www.SCwatersolutions.com

1. **Create County Wide Water Authority:** This would be a Special District Board with a Director elected that resides, and may also serve each major water agency.
   A. **Reason for need:** Santa Cruz County unfortunately has numerous water agencies concerned only with their own situation, which makes construction of larger water improvements which benefit the entire County difficult, if not impossible, to achieve. This Water Authority would provide means to ultimately construct and control those larger improvements for a safe and sustainable water supply.
   B. **List of Main Priorities:**
      1. **Create Computerized Model**- This would use fixed, engineered and real time variables in a sophisticated model with the goal of preventing any devastating effects from a drought. This model, in order to work long term, would have incorporate, a fixed maximum of allowable water service connections.
      2. **Groundwater Replenishment-** They would be responsible to maintain ground water levels all over the County, and, in particular maintaining the level 10 feet above mean sea level along the coast.
      3. **Recycled Water-** They would be in charge of distributing 100% of recycled water from both Watsonville's and Santa Cruz's Waste Water Treatment Plants.
      4. **Emergency Intertie to Deep Water Desal**- They would be in charge of paying for and distributing this water during an extreme drought.
      5. **Additional Water Sources and Storage**- This includes storm water collection, reservoirs, and treatment facilities described below and on the above website.
      6. **Merge Water Agencies-** Aside from the major Water Districts and the City Water Departments, there are also numerous small agencies which need to participate in these improvements.
      7. **Interties-** Distribute water between agencies through metered interties.
2. **Recycle**
   A. **Main Features:**
      1. **Build Advanced Recycle Treatment Plant, ATP**- This would be built on the same lot of the proposed Desal plant. A large pipeline would divert the 8.4 million gallons per day from the sewer plant down Delaware Ave to the ATP. The ATP would be capable to either create purified, (drinking water quality), water or standard, (irrigation quality), water. The purified water could, in the future, be connected directly into the distribution system after further testing and regulation modification from the Department of Health, CDPH, this is called Direct Potable Reuse, (DPReuse). The initial system is using what is called Indirect Potable Reuse, (IDPReuse), and benefits mainly restoring the ground water basin mainly for SqCWD.
      2. **Build Distribution Pipelines/Utility Corridor/Bike Path:** This would involve removing and salvaging the RR tracks and installing an 18" Purified Recycle and an 18" Standard Recycle pipeline from the plant to the PVRMA plant in

Watsonville. The purified recycle pipeline would be connected to a six mile pipeline connected to Deep Water Desal in Moss Landing, DWDesal. Other utilities, gas, electric, broadband would also be installed. The surface would be restored as a bike path using solar panel paving blocks, (a new product), that would provide energy + has LED lighting. Service branches for the standard recycled water line installed.

3. **Build Injection Wells:** Every ½ mile install injection wells, (40 each), to restore groundwater basin and create saltwater intrusion barrier.

B. Environmental Impact: The above improvements would have enormous ***positive environmental impacts***, including:

1. Eliminates daily pollution of millions of gallons of secondary treated sewer water into the Bay.
2. Provides a central located, 25 mile bike path taking cars off the road.
3. Provides Green Energy with solar panel paving blocks.
4. Restores the ground water basin- a key aspect to restore fish habitats.

C. Cost: The ATP will cost around 60 million, (an identical plant was built in San Jose for 57 million). The distribution pipeline cost varies with cooperation with SCCRTC and the other utility and solar energy interests. For budget figure, use 40 million. Add additional 10 million for injection wells, service connections and the emergency connection to DWDesal.

D. Effectiveness: For 15 million dollars less than the proposed Desal, this system could be pumping over 3 times the water into the ground water basin. It uses about 1/3 the energy to create purified recycle, and 1/5 the energy to create standard recycle. The standard recycle services with significantly reduce demand of existing wells. The pipelines allow a connection to DWDesal, which would be invaluable during an extreme drought. The pipelines provide a means to distribute all of this water in various areas in need. For example, if the basin is full, the water could be used on expanded agriculture areas in the County, or after the CDPH approves DPReuse, it can be pumped into the City's distribution system.

3. Storm Aquarries (Blank- benefits mostly SLVWD and SVWD, see website for more details).

4. Conservation Savings Accounts: These accounts would show up on water customer invoices. They would accrue money either from an applied percentage of water use, or and approved grant. The customer can use this money to install a water conservation improvement on their residence, (i.e. grey water, drought resistant landscaping, etc. etc.). This is a high incentive program. This is particularly beneficial on homes that are not connected to the sewage system, because that water can get recycled per step #2.

5. Reservoirs: Build four, 4, additional reservoirs in the County so that there would be one in each Supervisorial District. They would all function, and similar in size to District #5's Loch Lomond. During wet years they would all be open to public recreational use. During droughts the water would be used. The amount of water in the reservoir determines the period of drought that can be endured and be a key variable in the model described in Step #1.

6. Water Skate Parks: (Blank-benefits mostly SqCWD, Watsonville and PVRMA, see website for more details).

Santa Cruz Desal Alternatives

Submissions for the Strategies & Ideas Convention

1. Water Neutral Development
Adopt a water-demand offset program whereby developers pay into a water conservation fund to completely offset the increased water demand of the new construction.
Effectiveness
The Soquel Creek Water District has found this to be an effective tool to accommodate growth while reducing the impact of growth on the water security of existing customers.
Environmental Impact
Compared to developing new water supplies, conservation has a lower environmental impact.
Practicability
For over ten years the Soquel Creek District has administered the program at a low cost.

2. Price Water to Encourage Conservation
The City already has tiered pricing for single-family customers in order to encourage conservation. There are measures that could enhance the incentive to conserve: shift more of the monthly charge from fixed rate to volumetric rate; extend tiered pricing to other customer groups; implement significant price surcharges for landscape accounts that exceed their water budget. The marginal cost of new water supplies (or new conservation investments) should be charged to the highest tiers.

Effectiveness
There are studies that demonstrate a significant causal effect of water pricing on conservation behavior.
Environmental Impact
Compared to developing new water supplies, conservation has a lower environmental impact.
Practicability
An article in the American Water Works Association[1] states that

> "When excess water consumption is priced to capture the costs associated with overuse, the rates more closely respect each customers' proportionality requirement by ensuring that those customers who stay within reasonable use of water don't pay for costs generated by those whose use is excessive."

3. Building Code Revisions
Maddaus and Associates has calculated that the City's recent adoption of the latest California Building Code will achieve water savings equivalent to the entire list of

[1] Hildebrand et al, "Water conservation made legal: Water budgets and California law"

conservation measures in the Draft Master Conservation Plan. This proposal is for the City to adopt building code measures that *go beyond* current California code. Examples of possible measures listed in Maddaus (May, 2013):

a) #17, Require .25 gal/flush urinals in new development
b) #18, Require fixture replacement by a certain deadline.
c) #20A require hot water on demand in new development
d) 23B Require efficient dishwashers in new development
e) 36B Require plumbing for gray water in new development

Effectiveness
Building code requirements have proven to save water.
Environmental Impact
Compared to developing new water supplies, conservation has a lower environmental impact.
Practicability
Requiring water conservation in new construction saves on future building retrofit costs.

4. Campaign for climate-appropriate landscaping
We can reduce our normal year water use and increase our resilience in drought years by transforming our landscapes so that they need less water. The City can catalyze this transformation through supporting a variety of community efforts such as the Native Garden Tour; Monterey Bay Friendly Landscape; etc. The City could provide a rebate for customers who achieve a "Water-Friendly Landscape" rating.
Effectiveness
According to estimates by Maddaus, the new landscape water conservation ordinance affecting new landscape installations will save a significant amount of water compared to existing landscapes. Hence transforming existing landscapes towards the standards of the ordinance could yield significant savings.
Environmental Impact
Compared to developing new water supplies, conservation has a lower environmental impact.
Practicability
By partnering with community groups, the money spent can facilitate volunteer efforts.

5. Behavior Change
Most measures in the Draft Master Conservation Plan have to do with improvements in fixtures and appliances, with a few measures having to do with behavior change. This proposal is for the City to organize the community to respond to the need for conservation, especially in dry years that do not require curtailment. Potential measures include:
Information and Feedback: Change the customer bills so that quantity of water is in gallons instead of ccf. Adopt "Water-Smart" type billing feedback, and include information about meeting targets for fish habitat and Loch Lomond levels. In local media publish information about the goals v. actual water consumption, reservoir

levels, and stream flow targets. Investigate feasibility of inside-house meter readings.
Community Commitment Campaign
Work with community groups to generate participation in water use commitments during dry years that do not require curtailment.

Effectiveness
The Soquel Creek Water District and East Bay MUD have experienced a 5% savings by customers who have Water Smart billing. This confirms the recommendations of social psychologist, Doug MacKenzie-Mohr in *Fostering Sustainable Behavior.*
Environmental Impact
Compared to developing new water supplies, conservation has a lower environmental impact.
Practicability
By partnering with community groups, the money spent can facilitate volunteer efforts.

6. California Conservation Corps, Santa Cruz
The California Conservation Corps contracts with local government agencies to carry out habitat restoration and conservation projects. Projects could include the watershed restoration work envisioned in the City's *Habitat Conservation Plan;* storm water infiltration projects; riverbank cleanup; partnering with schools to do habitat restoration, and water conservation education.

Effectiveness
Water quality issues have forced the City to make large investments in upgrading water treatment. This measure contributes to water quality and habitat by reducing sediment runoff into streams and river; preventing human waste flow into the river; and increasing aquifer recharge through storm water infiltration.
Environmental Impact
In addition to promoting lower water use, this proposal contributes to the goal of the Water Supply Advisory Committee to recommend measures for a *safe* and *environmentally sustainable* water supply.
Practicability
This project addresses the great need for watershed restoration by offering employment and character development to area youth.

WaterSmart SOFTWARE
20 California Street, Suite 200
San Francisco, CA 94111
415.366.8622
WaterSmartSoftware.com

City of Santa Cruz
Water Supply Advisory Committee
santacruzwatersupply@gmail.com

July 28, 2014

Dear Committee Members,

Thank you for the opportunity to submit ideas and strategies to address Santa Cruz' pressing water supply concerns. WaterSmart Software is happy to submit a short description of the work that we have done to help reduce discretionary water consumption by residential customers served by our utility partners. We briefly discuss the effectiveness, environmental impact, and practicality of our solution, but we would welcome questions or the opportunity to provide more detail at a later date.

Background

WaterSmart currently works with over twenty water utilities across four states to engage residential customers on their water use, driving conservation and customer engagement. As part of the Water Insight program, WaterSmart sends customized Home Water Reports to residential water users, hosts an interactive Customer Portal where residents can learn more about their water use and ways to save, and provides utility staff with a Utility Dashboard to track program outcomes and gain insights on customers and their water use.

WaterSmart delivers Home Water Reports to residential households by both print and email. WaterSmart Home Water Reports are branded for the water utility, displaying utility logo and contact information, and provide social comparisons on water use as well as targeted recommendations and messages. Exhibit A shows an example Home Water Report.

WaterSmart's Customer Portal allows residential customers to find more information about their water use and recommendations to reduce, as well as provide "self service" updates and feedback on their patterns and demographics to make recommendations and analytics more accurate. The Utility Dashboard provides a Utility Staff with standardized reports, insights on each residential customer, and the ability to update customer information or track interactions.

Effectiveness

WaterSmart solutions are proven to improve water-use efficiency by up to 5% within 6 months. A third party evaluation of WaterSmart's work with East Bay

Municipal Utility District is available on the website of the California Water Foundation (which funded the third party audit) here. The evaluation found that the cost per acre foot conserved ranged from $250-590, which compares very favorably with many other municipal conservation programs. The evaluation also found improved customer satisfaction and increase participation and engagement in other utility programs.

Environmental Impact

WaterSmart's program uses behavioral insights to encourage behavior change among residential users. WaterSmart's program does not require any type of capital infrastructure, thus greatly reducing the environmental impact of the program. WaterSmart may also be more environmentally friendly than many rebate or direct-install programs which require the installation of new fixtures or appliances which, though more water efficient, rely on energy-intensive manufacturing processes and may include a lot of embedded energy. In addition, the recycling of outdated fixtures remains a challenge in many areas. WaterSmart actively reduces its environmental impact by encouraging all residential water customers to switch to paperless Home Water Reports by providing their email address through the Customer Portal. For Home Water Reports that are sent by mail WaterSmart uses a vendor that prints on recycled content and FSC-certified paper and envelopes.

Practicability

WaterSmart's solution is delivered as Software-as-a-Service (SaaS) and does not have to integrate with client IT systems, making program launch fast and straightforward (typically six weeks from contract signing). WaterSmart currently serves Santa Cruz's neighboring utilities of Soquel Creek, City of Palo Alto, City of Mountain View, City of Morgan Hill, as well as 20 other utilities in California, Colorado, Utah and Texas. WaterSmart's cost effectiveness, quick implementation, and multiple benefits (to customer satisfaction, utility data analytic capability, water conservation) make it an extremely practical solution to help reduce water use in Santa Cruz.

Thank you for your consideration! If there is any other information I can provide do not hesitate to reach out.

Sincerely,

Dominique Gómez
Director of Market Development
719.659.2865
dgomez@watersmartsoftware.com

Example Home Water Report

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

City-Subsidized Grey Water Systems

Ellen Farmer <ellen.farmer@yahoo.com> Mon, Jul 28, 2014 at 1:07 PM
Reply-To: Ellen Farmer <ellen.farmer@yahoo.com>
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>
Cc: Coleen Douglas <cdouglas25@gmail.com>

Dear Members of the Water Supply Advisory Committee,

As city residents, we would like our city water department to focus on the big picture of water use and conservation. As in the past, the city is capable of sponsoring programs like the low-flush toilet discount to residents. This type of individualized solution impacts overall water usage and the city's perceived need to manufacture water.

What we would like to see projected, analyzed, and penciled out is individual grey water systems for yard care in all commercial and home sites throughout the city. In our home, our biggest water uses besides the two toilets we have are showers and watering our garden and landscape. We have been investigating transferring water from each of our showers to grey water use in different parts of our yard where we currently do not have drip irrigation. It surprised us to learn that we can use shower and washing machine water on our landscape, even with shampoo and detergent in it (non-toxic and biodegradable varieties would be selected, of course). As soon as we learned about this, we wondered why we needed to continue to feed our plants precious drinking water.

Experienced and trained landscapers in Santa Cruz stand ready to set up these systems. Working with local plumbers, they can retrofit a home's shower and washing machine outflow in an efficient timeframe. The cost is slightly prohibitive (we were quoted $700 per shower), so we would like the city to create discounts for homeowners and landlords. This not only supports local small businesses but allows people to make the choice to participate in conservation efforts and become more involved in water use issues. Empowering citizens to make a difference that has a positive effect on the entire community feels right to us.

As rate-payers, we would prefer to reduce the amount of water we are using by having it do double-duty in the shower and in the landscape. Even though our costs won't go down that much, they certainly won't rise as they would paying for a desal plant.

Thanks for your consideration of this idea.

Warmly,
Ellen Farmer and Coleen Douglas
621 Fairmount Ave
Santa Cruz, CA 95062
831-426-5755

Collaborative Ventures
831-750-9799
ellen.farmer@yahoo.com

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Strategies and Ideas Convention ideas

Golden Love <goldenlove@lovesgardens.com> Mon, Jul 28, 2014 at 6:25 PM
To: santacruzwatersupply@gmail.com

1. **Offer a free checkout of drip systems and training on how to use irrigation controllers**. We are finding many systems have leaks and are overwatering plants and most people struggle with programming their irrigation controllers. Many people have no idea on how much time to water plants. In some cases, we have reduced water use as much as 70% after a landscape review and repair.
2. **Offer free greywater and rainwater evaluations for every property that receives City water.** Implementation of alternatives could save as much as 70% on water bills during the highest demand times. The goal being Water Neutral--zero municipal water used for irrigation.
3. **Offer rebates to convert lawn and shrub spray irrigation heads, including drip micro-spray heads, to drip tubing.** Drip emitters have been found to reduce water lost to evaporation and run off.
4. **Coordinate an Annual Water Wise Landscape Tour with Ecology Action's "Sustainable Landscape Recognition" program.** Use these models to inspire and educate and involve people in the transformation of their landscapes.

Thanks,

Golden

Golden Love
Love's Gardens

CA Licensed Contractor C27 363672

Certified Arborist WE 3535A

Pest Control License 35988

Certified Greywater Installer

American Rainwater Catchment Systems Association Accredited Professional

Certified Permaculture Designer

127 National St.
Santa Cruz, CA 95060-6516
Phone (831) 471-9100
goldenlove@lovesgardens.com
www.lovesgardens.com

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water supply advisory committee

Bobby Markowitz <info@earthcraftdesign.com> Sun, Jul 27, 2014 at 2:46 PM
To: santacruzwatersupply@gmail.com

Hello, my name is Bobby Markowitz, local Licensed Landscape Architect specializing in rainwater harvesting systems for 15 years. I teach rainwater harvesting and usage at Cabrillo College Extension and have spoken at Landscape Architecture, Architecture, and Civil Engineering conferences (in addition to numerous community gatherings) promoting alternatives and ideas regarding water usage. I have gone to oversees conferences in Australia and Singapore to investigate systems where rainwater harvesting is very successful and is in common use. In California, I have designed rainwater systems for commercial, institutional, as well as many residential projects.

At the forum, I would like to present ideas, show drawings and photos of these successful rainwater (and greywater) projects so the community becomes more aware of the possibilities, and that people are/have been doing this. I specialize in NetZero water usage for landscape irrigation and recently have also designed rainwater systems for domestic use (non-potable for toilets and washing machines--which use about 50% of the potable, treated municipal water that a residence consumes). There are ways to save and use **millions of gallons of water** that currently goes down the drain (or into the street thus polluting our Bay)...this can be achieved with education, leading to behavior modification - the same process as we accomplished regarding recycling.

I feel the information that I will present will be of great value to many citizens.

thank you for your consideration.

Bobby Markowitz

Landscape Architect #3309

websites: info@earthcraftdesign.comm

www.ecologicalconcerns.com

Hello WSAC SIC members,

I am submitting a water supply strategy that does not seem to be fully addressed in other proposals put forward through this process. I would like to introduce you to the Monterey Bay Friendly Landscaping program that is rolling out this summer in Santa Cruz, Monterey and San Benito Counties. The program is designed to certify both business and residential properties that modify their landscapes to include the 10 Monterey Bay Friendly Landscaping requirements (see attached checklist).

This program encourages the modification of landscaping to address two major concerns that the City of Santa Cruz is currently grappling with-water supply and urban pollution. Cowell's Beach is listed as the dirtiest beach in California based on weekly water quality test results: (http://www.healthebay.org/sites/default/files/pdf/BRC_2014_WEB_.pdf#page=11). At the same time the San Lorenzo River (SLR) is listed as an impaired water body based on high bacteria loads, nitrate levels, sedimentation and pesticides (http://www.swrcb.ca.gov/centralcoast/water_issues/programs/tmdl/303d_and_tmdl_projects.shtml. Modern urban design has created a community landscape that includes many underutilized lawn spaces and a reliance on high water use plantings. At the same time our designs for stormwater conveyance have concentrated water and redirected it to runoff into our ocean and river systems, carrying pollutants and sediment with it.

By combining efforts we can decrease demand for water in the most critical times of year (summer), increase our water supply by increasing infiltration (raising the water table under the SLR) as well as better source water quality by reducing pesticide, bacteria and sedimentation loads into the river. Combining these efforts also opens up access to additional funding sources through Low Impact Development (LID) grant cycles as well as water supply solution grant cycles.

To date Soquel Creek Water District, the City of Santa Cruz Public Works Department, the Monterey Peninsula Water Management District, the City of Salinas, the Scotts Valley Water District, the City of Pacific Grove, the City of Monterey, the Monterey Regional Water Pollution District, the City of Watsonville and the Regional Water Quality Control Boards as well as multiple environmental and landscaping organizations have participated in the stakeholder meetings and have committed to certifying over 100 existing and new landscapes. The Water Department can capitalize on this existing program to help implement some of their conservation ideas presented in the Master Conservation Plan and expand on those ideas.

Thank you for your consideration,
Sarah Mansergh
semmansergh@hotmail.com

10 Monterey Bay Friendly Landscaping Requirements

Implement these practices to receive your Monterey Bay Friendly Landscape Yard Art Sign and Discount Card

1	**Use Mulch and Compost to Create Healthy, Permeable Soil** Cover soil with a 2-4 inches of recycled green waste mulch Amend soil with 1" of organic compost at planting time
2	**Space Plants Appropriately and Practice Natural Pruning to Minimize Green Waste** Plants that have been sheared, boxed or topped should be restored to their natural shape or replaced with plants that will fit into the space when they are fully grown.
3	**Don't Plant a Pest** Remove invasive plant species. See a list at: www.cal-ipc.org
4	**Grow Drought Tolerant and California Native Plants** Plant low-water plants that thrive in summer-dry climates in at least 75% of your total landscaped area. Consider watring thirsty plants like vegetables, fruit trees, and flowers with greywater or rainwater.
5	**Lose Your Non-Functional Lawn** A lawn that is only planted for looks is non-functional and is the biggest water user in the landscape! Limit functional turf areas where people play to no more than 25% of your total landscaped area.
6	**Practice Weather-Based Irrigation Scheduling** Install a rain sensor on your irrigation controller and program a weather-based irrigation schedule OR Install an EPA WaterSense labeled Weather-Based Irrigation Controller.
7	**Replace Spray Irrigation with Subsurface Drip Irrigation** In all non-turf areas and areas less than 8' wide
8	**Remove Sprinklers near Sidewalks and Driveways** Sprinklers must be set back 24" away from non-permeable surfaces, unless run-off drains into a landscaped or permeable area.
9	**When it Rains....Slow it, Spread it, Sink it!** • Harvest rainwater in a cistern or rain barrels. • Replace pavement with permeable pavers. • Direct downspouts into the landscape, or install a rain garden, swale or dry creek bed.
10	**Use Ecological Landscape Maintenance Methods** Implement a Monterey Bay Friendly Landscaping maintenance agreement with your landscape maintenance professional. Download a template at www.green-gardener.org

Ecology Action

Learn more at www.green-gardener.org

Water Boards

AquaJust

27 July 2014

SANTA CRUZ STRATEGIC PLAN: ONLINE CONSERVATION EXCHANGE

Water scarcity escalates risk, conflict and uncertainty. To restore stability, Santa Cruz could pilot a voluntary and transparent approach to monetize water conservation. It's called AquaJust™.

Right now, most homes and businesses (and even some water utilities) don't know how much water they use, leak or waste. They take the resource for granted. Turn the tap, and water gushes out, making it seem abundant, clean, and cheap. Water officials and conscientious users may know better. But both face three painful paradoxes:

- First, is the paradox of *value*: water is priceless in use, but worthless in exchange; there is no way to profit from the water saved, or ensure it stays in reservoir, aquifer, or stream.
- Second, the paradox of *efficiency*: individuals who install water saving devices (HET, drip irrigation, etc.) leave more water for more people to consume more often, hardening demand while encouraging more water waste throughout the expanding system.
- Last is the paradox of *monopoly*: a water utility institution in which revenues are tied to volumetric use is punished – both politically and economically – if it unilaterally imposes rations, restrictions, or rate hikes, while it is rewarded if people waste water.

To resolve these, AquaJust provides an online platform to track and trade the water people save. It gives every family or firm new options and strong incentives: earn EcoShares™ for saved water, or buy shares from others who do. In this way even a thirsty user can be certified and recognized as 'water neutral' – by erasing a water footprint through EcoShare trade with the community – or even restore more water to the river than you individually require.

How does it work? Simple. Users choose to offset part or all of their water demand, and select how much to invest in a 100-gallon unit, or EcoShare. AquaJust matches bids to those in the watershed who save that amount below their SmarThreshold™ of historic mean usage. That's it. As a trusted broker, we accurately track, aggregate, transfer, verify, and certify water offsets and water neutrality down to the exact gallon.

Every gallon saved has value, and is accounted for. In a single instant transaction, AquaJust relieves Santa Cruz households and businesses of the pain and anxiety of water stress. No legal hassle. No energy costs. No construction. No impact forms. No physical reallocation of flows. The only thing transferred is the clear and precise value of saved water. With a few clicks you insulate Santa Cruz homes or brands from environmental risk, reputational risk, operational risk, and regulatory risk of water scarcity, and open up potential for upside benefits.

If you are committed to affordable, carbon-free water, reducing demand through AquaJust will measurably support this goal. A successful pilot across just 300 metered units can reduce demand by 3 million gallons (9.25 acre feet) save 19,000 kWh of electricity, offset 20,000 pounds of carbon dioxide (1,200 gallons of gas). You can scale up benefits by number of meters.

While such benefits are considerable, effective, and pragmatic, AquaJust isn't for everyone. Some seek the prestige of a supply-side dam or desalination plant, ignoring how the cheapest, cleanest, fastest and fairest way to produce more water comes from reducing water demand. Others prefer unilateral and vertically applied rules, fines, rations and restrictions, which in the past have resulted in perverse incentives and unintended consequences, like waste and inequality.

Most people prefer AquaJust's quiet, horizontal and judicious pull of voluntary incentives. They would rather define water use on their own time and terms. And AquaJust can quickly integrate our software with Santa Cruz's metering hardware to unlock equitable local system that lets all users – large and small, rich and poor, thirsty and spartan – collaborate as part of the solution.

At this point you may wonder, "So what's in it for AquaJust?" Like eBay, our platform earns a commission on EcoShare transactions, with vested interests in fair, smooth, and local efficiency.

So because AquaJust is relatively novel, and because Santa Cruz also embraces the wisdom of crowds through this offering, we can offer your utility, families and firms a special package of exclusive benefits. For testing our system, we can provide end users with access to free software, free recognition, free membership, free certification, and free water use analytics. A bonus: EcoShares are tax-deductible, so water offsets may be written off as a charitable donation.

To explore this opportunity, please contact me, or my team members, who will work closely with Santa Cruz's water utility to set up a custom-tailored voluntary solution that could remove the pain, risk and anxiety of water stress for all your citizens, for good.

Thank you, and I look forward to hearing from you soon.

Warm regards,

Jamie Workman

James Workman
Founder, AquaJust
jworkman@smart-markets.com;
jamesgworkman@gmail.com

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water idea submission

Langholz, Jeffrey <jlangholz@miis.edu> Sun, Jul 27, 2014 at 11:07 PM
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>

Dear Santa Cruz Water Supply Advisory Committee Members,

We are pleased to submit an idea for improving the reliability of Santa Cruz's water supply. Our idea entails the City of Santa Cruz and other water users pilot testing a new approach focusing on both supply augmentation and demand reduction.

We recently launched a new social venture called WaterCity. The company's mission is to make water conservation easy and affordable for the public. In May 2014, we outcompeted 23 other startups to win the $50,000 first prize at the annual Monterey Bay Startup Competition. Earlier this month (July 9), we also took top honors at the Santa Cruz New Tech Meetup. At both events, a panel of judges and more than 200 audience members enthusiastically endorsed our market-based solution to the water crisis.

Our unique approach can help governments, businesses, schools, and residential customers realize significant water savings. For each customer, we design a water conservation "system" unique to their situation, based on more than two dozen factors. Their system may include a combination of rainwater harvesting, greywater recycling, atmospheric water generators, and other water conservation infrastructure. After designing the system, we obtain the necessary permits from relevant agencies then install the system at the property.

We do all of this for free. The property owner incurs zero upfront or recurring costs. We even provide 15 years of free maintenance and repairs.

If our business model sounds familiar, that's because it comes from SolarCity (www.solarcity.com). SolarCity recently revolutionized the solar energy industry, making it easy and profitable to go solar by removing upfront costs and other barriers. We are doing the same, but for water. We would be happy to provide more details on how it all works.

Our approach offers several advantages, including:

- **Effectiveness:** Unlike strategies focused on either supply augmentation or demand reduction, our approach covers *both* aspects. We augment supply through rainwater harvesting and reduce demand through greywater recycling (among other things, such as potential fog collection and atmospheric water generation). Our strategy also operates on a larger *scale* than most others. Granted, replacing showerheads, toilets, and other infrastructure is important. But it offers limited impacts compared to large scale rainwater harvesting and greywater recycling.

- **Environmental Impacts**: By producing water on-site at individual properties, we reduce the city's *greenhouse gas emissions* attributable to pumping and piping water through centralized distribution systems. This has huge implications for climate change and the city's commitment to addressing it. Our approach also helps reduce *stormwater runoff* into the Monterey Bay National Marine Sanctuary, by capturing and reusing rainwater before it hits the streets. Finally, by augmenting the water supply, our approach can help maintain sufficient flows in local waterways that are *critical habitat* for steelhead and coho.

- **Practicality.** Our proposed approach is extremely practical. *The main advantage is that it induces large-scale water conservation and supply augmentation at zero cost to the public. We pay for everything*. Such savings are important at any time, but especially during the current era of tight budgets among households, businesses, and government agencies. On a deeper level, our approach also promotes *citizen empowerment* with respect to an important natural resource. We democratize water, giving people greater control over this precious natural resource. Finally, our approach is *politically feasible*. With abundant rainwater and graywater flowing, Santa Cruz can continue to irrigate its outdoor spaces, keeping the city beautiful for tourists and residents alike. We can have guilt-free greenery and less need for enforcement of unpopular water restrictions.

Thank you for considering our idea. We look forward to discussing this with you. Please give us a call anytime.

Sincerely,

Jeff Langholz & Maeve Murphy

831-277-7221

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Improving Santa Cruz's water supply

Joanna Nelson <joannanelsonchaver@gmail.com> Mon, Jul 28, 2014 at 4:13 PM
To: santacruzwatersupply@gmail.com

To the WSAC -- thank you for serving on this important committee!

I currently work as a postdoctoral fellow in a position held jointly between Stanford University and the Nature Conservancy; I am an ecologist; I work on the benefits of terrestrial conservation, restoration, and best-management practices for both freshwater quality and quantity.

1) Evaluate/model a conservation prioritization scheme that quantifies the effect of forest conservation, native-ecosystem conservation/restoration, and agricultural best-management practices on water flows. Mature forests help regulate flows, especially in the dry season (I would be happy to provide scientific references for this from my current literature review).

Effectiveness: the presence of redwood forest catalyzing fog drip can be an important contribution to streamflow in Central California coastal watersheds. Forests effectively maintain and improve water quality -- especially for nutrient and sediment retention – and consistent flow. Forests provide multiple benefits, of course, including support of biodiversity and recreation.

Environmental impact: Beneficial, incorporating the value of natural capital to water provision and human well-being.

Practicability: City, county, and federal agencies, with NGOs and consulting groups, currently have the capacity and knowledge to conduct these assessments.

2) Stop using water for sanitation, or greatly cut down on its use. Rationale: There is no substitute for water when it comes to drinking water or irrigation. There may be substitutes for water in certain industrial sectors, with new technology and innovation. With current technologies, we can safely treat, dispose of, and/or repurpose human waste without using water – certainly not potable water! – as the primary vehicle for sanitation.

I understand quite clearly that some institutions, like hospitals and nursing homes, need water for safe operation and limiting the spread of disease.

Effectiveness: We jump a big hurdle in water conservation if we cut out water use in the sector of sanitation, a decrease in demand.

Environmental impacts: We would decrease freshwater, high nutrient flows to the ocean (decreasing the coastal problem of eutrophication).

Practicability: New policies and coordination of policies would have to be established for composting toilets to be used in residences, schools, universities, and other public buildings; there are major PR problems with composting toilets (but they

don't smell and aren't disease vectors); it seems highly practical to me to use resources on newer, more innovative technologies (no-water toilets) than to expand and replace aging sewage infrastructure. What would we do with the compost? We're an agricultural county, and topsoil is being lost everywhere; also there are prototyped no-water toilets (LooWatt, for example) that propose gathering the waste and creating a methane digester.

Thank you very much,

Joanna Nelson

Postdoctoral ecologist/NatureNet Science Fellow

Santa Cruz resident

joannanelsonchaver@gmail.com

cell: 831-454-6893

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

a suggestion: Composting toilets

Peter Scott <drip@ucsc.edu> Mon, Jul 28, 2014 at 8:20 PM
To: santacruzwatersupply@gmail.com
Cc: Rick Longinotti <longinotti@baymoon.com>

Dear people,

I hope you will consider possible installations of composting toilets in institutional and commercial venues, as a strategy for conserving water.

Possible venues would include the UCSC and Cabrillo College campuses, the Civic Auditorium, the Kaiser Arena, the County Government Center, and State Parks.

A review of six existing composting toilet installations in the U. S. is here: http://sirius.ucsc.edu/users/drip/toilet_review/
I would be willing to present a slide show on this topic.

-- Peter Scott

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water conservation ideas

karfraser@cruzio.com <karfraser@cruzio.com> Mon, Jul 21, 2014 at 6:10 PM
To: santacruzwatersupply@gmail.com

Ideas for Water Conservation for the Santa Cruz area:

1. Get baseline water use data for individual farms and industries and set up reward systems for those that reduce water use.

2. Offer educational resources about water saving on farms and in industry--furrow diking to avoid runoff, leveling of land, efficient irrigation scheduling, water reuse, etc.

3. Identify and implement water re-use opportunities for the City. For example, the wastewater generated by reverse-osmosis at the Water Store--how can this be harvested and used?

4. Create a water conservation assembly or curriculum for K-12 schools in the county. (I became a water conservationist at age 7 when people came to my classroom and told us all about saving water.)

5. Provide water saving tips to be advertised on buses and other public places.

6. Have fees or higher water rates for people who want to have a private lawn or a private pool, or offer incentives for low-water landscaping.

7. Allow and subsidize composting toilets.

8. Encourage and/or subsidize laundry-to-landscape home greywater systems. (I'd way rather money was spent incentivising water reuse/conservation than spent building a plant to convert saltwater to freshwater.)

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

saving water

ken baurmeister <geoken007@yahoo.com> Mon, Jul 21, 2014 at 12:37 PM
Reply-To: ken baurmeister <geoken007@yahoo.com>
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>

Proposal for water-saving:

Anybody in the county that can prove a 20% reduction of water usage with a water bill can get free parking meter tokens and a voucher for free parking on the wharf.

This way we reward conservation and get locals to spend money in town and on the wharf in the summer.

Ken Baurmeister

Boulder Creek

geoken007@yahoo.com

STRATEGIES AND IDEAS FOR IMPROVING THE RELIABILITY OF SANTA CRUZ'S WATER SUPPLY

Submitted to WSAC by Paul Gratz - July 28, 2014

Maximum Application of the WaterSmart Conservation and Customer Engagement Program

WaterSmart (http://www.watersmartsoftware.com/) creates a multi-channel platform around behavior change -- the behavior being to use less water and be more aware of it. WaterSmart accomplishes this by making aggregate private usage of water something of a public event: Information about your consumption and that of your neighbors is shared openly as norms (without disclosing identities). This creates a social context around the data, so it's not just *how much* water people use, but how a customer compares to others just like themselves. This social norm becomes a motivator and yardstick for changing residential, commercial and public institutional behavior.

Multi-channel refers to the multitude of ways that consumers can receive messages about their comparative water use. Bits of data include things like house occupancy (highly correlated with usage), lawn footage (irrigation) appliance flow rates, house construction date, swimming pool size, hot tub(s), current and past actual water consumption, and so on.

What each participating utility ratepayer receives out of this assemblage is a *home water report*, consisting largely of comparative bar charts. Reports are distributed periodically throughout the water service area, by Web or other means (currently optimized for smartphones and tablets), monthly or bimonthly, depending on the billing period.

For example, the approximate 10,000 East Bay MUD households (modest size homes in a mild weather zone) participating showed **water savings of 4.6 - 6.6%** simply in response to getting bimonthly "Home Water Reports" -- indicating whether their usage was "great", "ok", or "take action" in comparison to similar households, like those that PG&E provides.

Also, it resulted in an **increased use of water audits and rebate programs**. The effect was greatest among high water users. Compelling results?

Program cost were estimated to be $250-590/AF, depending on the particulars. Targeting this peer competition/re-norming strategy toward certain household types would make it cheaper per AF of savings as well as less expensive and more environmentally-friendly than many kinds of new water supply sources for urban areas.

While water bills today typically have information about water use, it's often not provided in a way that is empowering to the average user. WaterSmart reports are highly visual, easy–to-understand, and provide consumers with context about how their use fits into a broader neighborhood bench marking picture.

Some of the other communities that have either piloted or instituted the WaterSmart program include South Coast Water District, Palo Alto, Davis, Newport Beach, Irvine Ranch, Sacramento, Roseville, and the Soquel Creek Water District.

Why is the City of Santa Cruz lagging behind as opposed to being an empowering conservation efficient model community?

Related

CBS - Software Helps Californians Compare Their Water Use Against Neighbors
Water districts across the Bay Area are trying different ways to get people to conserve. On the ConsumerWatch Julie Watts reports some are now turning to peer pressure -- and it's working. (7/11/14)
http://sanfrancisco.cbslocal.com/video/10358646-software-helps-californians-compare-their-water-use-against-neighbors/

WSJ - New Technology Tools Aim to Reduce Water Use. Utilities Say People Cut Back Consumption If They See How Much They Use Compared With Others

http://www.watersmartsoftware.com/assets/new-technology-tools-aim-to-reduce-water-use-WSJ-WSS.pdf

Conservation Capacity Assessment
Idea for WSAC 7/28/14

The Water Solutions Advisory Committee should conduct a randomized survey of primary ratepayers at owned homes to assess the community's collective capacity for further conservation. The survey will serve to 1) Educate primary ratepayers about the extent and severity of the current drought and historical circumstances, 2) Provide an overview of the current conservation programs and rebates being offered by the city, and 3) Enroll these ratepayers (and their respective households) in these conservation programs/sign them up for rebates. Each household should be given the option to sign up for a free water evaluation to be performed at a later date by city staff, sign up for conservation rebates on site (rain barrels, lawn removal subsidies, low flow toilets upgrade rebates, etc.), enroll in the city's now much touted "water school", and join a sort of loosely organized "conservation corps" of volunteers who can conduct further surveys should they prove to be an effective means of reducing water use and public education.

According to the 2010 United States Census, Santa Cruz has roughly 23,300 housing units, and a homeownership rate of 44 percent.[1] Thus the city has roughly 10,120 owned home units, which includes both single family and multifamily units. A survey of 570 of these units (with proportional representation of single family versus multifamily homes) would yield a confidence interval of +/-4%, which is fairly accurate. Therefore the data would provide a good overview of existing conservation and awareness from which future decisions could be made, while at the same time making genuine progress towards conserving water and educating the public.

This sort of survey can be done fairly cheaply as well, and would likely cost less than $10,000, using preferred local vendors. Should the survey prove successful, further iterations can be managed at an even cheaper rate by leveraging volunteers to reduce costs. The results of the survey will no doubt be helpful from an education standpoint alone, but could also lead to a truly unified community effort to conserve more water, further proving that Santa Cruz can be a model for other California Cities.

Please consider this idea, and feel free to contact me with any questions you may have.

Sincerely,
Robert Singleton,
Santa Cruz Resident
(707) 569-4546
robert@civinomics.com

---

[1] http://quickfacts.census.gov/qfd/states/06/0669112.html

Burkhardt Construction
Plumbing and Electrical
120 Seaview Ave.
Santa Cruz, CA 95062
License # 672860
831-212-7019
A Licensed General, Electrical, and Plumbing Contractor

Saturday, July 26, 2014

To:
Santa Cruz Water Supply Advisory Committee

Re: Proposal for water conservation program:

An average home has 125 feet of ¾ pipe. 125 feet of ¾ pipe holds 3.14 gallons of hot water. If hot water is used 10 times per day, 31 gallons of water is wasted running the faucets and shower to get hot water. In a year this equals 11,461 gallons of potable water down the drain per home.

A simple solution to this problem is the installation of hot water recirculating systems that provide nearly instant hot water. The yearly operating cost of such a system is a few dollars a year. The simplest hardware system is about $200 and the best is from $500 to $800 depending on features. Installation time for the simplest system is a couple of hours and does not take the skill level of a professional plumber. I am enclosing some literature on these systems for your information.

In 1992 a new standard was put into effect for water saving toilets. Prior to that an average toilet used about 3.5 gallons per flush. The new standard was 1.6 gallons per flush which saved about 50% over the 3.5 gallon toilets. The new standard is 1.25 gallons per flush, and that is what the code requires today, but there are toilets available now that use .8 of a gallon for a single flush toilet and dual flush models that use .5 gallon for liquid and .9 gallon for solids with an average of of .65 gallons per flush, which is a substantial saving.

I am proposing a non-profit organization that will train economically disadvantaged" youth to install these products in the homes of people who live in our community.

Niagara Conservation, a leading manufacturer of water and energy saving products has launched a program called Niagara Green Cities which allows utility customers to have their toilets and faucet heads upgraded to ultra high efficiency fixtures with no cost to the utility. The customers will pay a small monthly fee, included on their utility bills, which is less than the money they save on their water bills. The program will be administered through Niagara Conservation, who will administer the program, including management, installation, reporting, customer service and marketing services. The high utility fixtures will be installed by a State Licensed Plumbing Contractor who is a Certified Green Plumber. (see attached Green Plumber Information). I happen to be both.

My salary will be pid for in part by grant money and I will be an employee of the non-profit. I would expect to administer this program. I have experience administering youth work programs and grant writing as well as being a licensed professional plumber. There will also be money provided by Niagara for installing the the toilets, shower heads and aerators and additional money will be from the installation of hot water recirculation systems. More than likely, there will also be money available from the Work4Youth program which is a 501c3 non profit. The Work4Youth program is a partnership between local businesses, the Workforce Investment Board and the Santa Cruz Office of Education.

I am attaching some information on another youth work program I tried to establish in Santa Cruz County. That proposal is entitled the "Community Home Maintenance Project".

The benefits of this proposal are obvious. Saving hundreds of thousands of gallons of fresh water while providing vocational training to economically disadvantaged youth.

In your request for proposals, you asked for not more than a 2 page narrative about ideas. In all humility, I know you will call me back for more information, so I am enclosing it here. I am not an egotist, I just know my concept is exceptional. It is workable and cost effective. I am seeking an opportunity to create a demonstration program that once proved successful, can be replicated in other communities.

I am always available to discuss my ideas further.

Thank you for your consideration.

Sincerely,

Sam Burkhardt

My name is Sam Burkhardt and I am a Licensed General, Electrical and Plumbing Contractor, with a Bachelor's degree in Social Work. I am working in conjunction with the Santa Cruz County Office of Education to create a youth work project in Santa Cruz County. The project will train "economically disadvantaged" and "at risk" young people to provide **FREE** labor to perform home repairs, yard work assistance, handicapped accessibility services, and house painting for low-income elderly disabled people and nonprofit social service organizations in Santa Cruz County. We will call this the **Community Home Maintenance Project.**

Santa Cruz County Office of Education's

Community Home Maintenance Project

Goals

1. Provide on the job employment training for economically disadvantaged and "at risk" young people.

2. Provide charitable services in the form of home repairs, building maintenance and handicapped accessibility for low-income elderly and disabled individuals and nonprofit social service organizations.

Non-profit description

Typical nonprofit social services organizations are group foster homes, residential care facilities for the developmentally disabled, childcare centers, senior centers, teen centers, organizations serving the disabled and homeless, organizations, that provide housing for low income people, and organizations that promote animal welfare.

Services Performed for Low Income Elderly Disabled People and Non-Profit Social Service Organizations

1. **Major house cleaning**
   a. Washing floors, walls, kitchens and bathrooms
   b. Vacuum cleaning and rug shampooing
   c. Window washing

2. **Yard improvement**
   a. Hauling away debris
   b. Weeding
   d. Pruning
   E. Cutting overgrown lawns

My ultimate goal

3. **Painting**
   Exterior and interior house painting

4. **Minor carpentry**
   a. Adjusting doors, windows and cabinets that operate improperly
   b. Repair broken steps or handrails.
   c. Repair broken furniture
   d. Repair floors under toilets and around bathtubs and showers
   e. Replace windows or doors that are broken or inoperable
   f. Repair or install door weather stripping

5. **Minor electrical**
   Repair or replace broken electrical fixtures, lamps, receptacles, and switches. Install security lighting such as motion sensors.

6. **Minor plumbing**
   a. Repair leaking faucets, toilets, water heaters, sinks, hose bibs, etc.
   b. Unclog drains
   c. Repair toilets that work poorly and install new water efficient toilets
   d. Install water conservation aerators and showerheads

7. **Miscellaneous**
   a. Replace broken glass
   b. Putty windows
   c. Repair door locks and installs additional devices to promote security.
   d. Tile repairs in tubs, showers or countertops
   e. Drywall repairs

8. **Handicapped accessibility**
   a. Grab bars
   b. Hand held showers
   c. Motion activated lighting
   d. Wheelchair ramps
   e. Install handicapped doorknobs
   f. Install handicapped plumbing fixtures
   g. Widen doorways and modifying cabinets
   h. Install handicapped toilets

The Santa Cruz County Office of Education will provide the salaries, vehicles, tools, and associated operational costs for the students and project.

Funds for Materials

The homeowner or non-profit organization will be expected to pay for materials used on their jobs. In the event an individual's resources are inadequate to provide for all materials needed for their job, we hope to establish a revolving fund to be available for seniors and disabled individuals without adequate financial sources to provide for these expenses. The money will be paid back in installments to keep the funds available for other participants in need. We desire to set up a checking account in a local financial institution that will be funded from community donations. We will solicit funds from local churches, individuals, businesses and philanthropic organizations as long as the need exists. Although the labor to our clients is free, we will suggest that they anonymously donate whatever they can afford to be added to the pot to help provide materials for others in need. It is our desire that no one be turned away for lack of money.

Obtaining Referrals

We anticipate getting client referrals form the Santa Cruz Volunteer Center's "Helping Hands" Program, the California Grey Bears "Brown Bag Lunch Program", Community Bridges "Meals on Wheels Program", Santa Cruz County's "Multipurpose Senior Services Program", Santa Cruz County's "Senior Network Services" program, Shared Adventures and the Central Coast Council for Independent Living. All are nonprofit organizations that assist seniors or disabled persons.

Documentation of Results

We will obtain the services of Community Television of Santa Cruz County; a non-profit community based and oriented Video Production Company that will produce a mini documentary, which will document the success of the project. We will interview the elderly project participants and ask them to talk a little about themselves and what the improvements to their homes will mean for them in terms of safety, security and comfort in their final years. We will interview the youth workers before they start working in the project and ask them what they hope to gain from being participants. We will interview them again after 6 weeks and finally after three months. The video will show the jobsites before, during and after completion of various projects. We will ask both the elderly and youth participants to offer suggestions on how they believe the project can be improved.

Our Philosophy

We believe that putting money into work training programs is a better investment that putting it into Prisons. In California, it costs about $47,000 a year to incarcerate a single inmate. The recidivism rate is 67% after three years of non-incarceration.

It is our belief that enabling young people to contribute to society in meaningful ways, in this case, helping low income elderly disabled people and nonprofit social service organizations, will change their hearts and attitudes, while giving them a sense of

self pride and accomplishment while teaching them valuable construction skills and work ethic.

The goal of this project is to demonstrate that this concept is a viable alternative to traditional crime and violence prevention programs. This program is more cost effective, the attitudinal changes to the individual are everlasting, the benefits to the community are more significant and the costs to society are far less than investing in the criminal justice and prison systems.

Lastly, in a day when fewer and fewer young people have the opportunity to attend college or vocational school, we believe a youth service program that guarantees a vocational or college education for those who participate is the best way to promote good citizenship and a strong, vibrant society. We hope the success of this project will enable the concept to be replicated in other communities. We are actively seeking funding sources to make it an ongoing permanent program in Santa Cruz County.

IAPMO.org

Accredited Green Plumber Search

Class Schedule

Registration

GreenPlumbers USA

Green Plumbers Inspector Training

Train Online

Any time, anywhere. Earn your certification at your own pace. Begin your Enrollment Here.
For updates contact Green Plumbers and IAPMO at 1-877-427-6601 ext. 3005 or email at sol.alba@greenplumberstraining.org

Contract Green Plumbers to Train Your Group

If you have a group of plumbers, we can bring Green Plumbers to you. Choose the dates, times and location for the training, saving on travel and time away from work! For more information, contact Green Plumbers and IAPMO at (877) 427-6601, ext. 3005.

Disciplines and Topics Covered

Caring for Our Water
- Global Water
- How We Got Here
- Water Efficient Products
- New Technology
- Reducing Household Water Use
- Intro to Water Audits

Climate Care
- The Greenhouse Gases
- The Water/Energy Nexus
- Energy Consumption
- Energy Efficient Equipment
- Greenhouse Gas Abatement
- Water Heating Equipment
- Efficient Hot Water Delivery
- Emerging Technology

Water Efficient Technology
- Potential Hazards
- Rainwater Capture
- Graywater Reuse
- Calculating Condensate
- On Site Wastewater Treatment
- Reclaimed/Recycled Water
- Water Treatment

Solar Hot Water
- Does It Work?
- Site Survey
- Sizing
- Classic Solar Thermal
- New Solar Technologies
- Design Strategies
- Retrofitting
- Utility Rebates/Tax Credits

Inspection Report Service
- The Inspection Report Tool Kit
- Water and Energy Related Audits
- Commercial/Industrial/Residential Buildings
- Review of Water/Energy Efficient Products
- Creating a Master Plan for the Future

what a Green Plumber has learned about water.

ACT
D'MAND Kontrols® Systems
Advanced Conservation Technology Inc.

"Designed for Today... Dedicated to the Future®"

Shopping Cart | Checkout

Over 108,349,200 gallons of water saved since 1991!!

Home | D'MAND Kontrols® Systems | Benefits | Plumbing Solutions | D'MAND® Products | Installation | D'MAND® Resources | About Us

- Mission Statement
- Media Coverage
- Press Releases
- Articles
- Recognition
- Success Story
- D'MAND® System International Markets
- DOE Emerging Technologies
- What's New?
- Water Regulations
- Articles by Larry
- Testimonials
- Contact Us
- Videos
- Information Videos
- ETS 2010 - IAPMO
- How it Works
- Marketing Videos
- International
- Training Videos
- Installation Videos

Mission Statement

Advanced Conservation Technology, Inc., (dba ACT, Inc.) D'MAND Kontrols® Systems, is the environmental leader in conservation products specializing in Water & Energy. We are an "environmental enterprise" whose operations are focused on benefiting and protecting the environment. It is our mission to develop, manufacture and sell technologically advanced products of high quality that help to conserve our natural resources and promote ecological sustainability. We believe that minimizing the depletion of precious natural resources will ultimately help contribute to the quality of life for future generations. ACT, Inc. D'MAND Kontrols® Systems are made in the United States, developed by Americans with American technology. **Advanced Conservation Technology—**

Designed for today...

Dedicated to the future®

Best hot water recirculating system for retrofit.

Testimonials

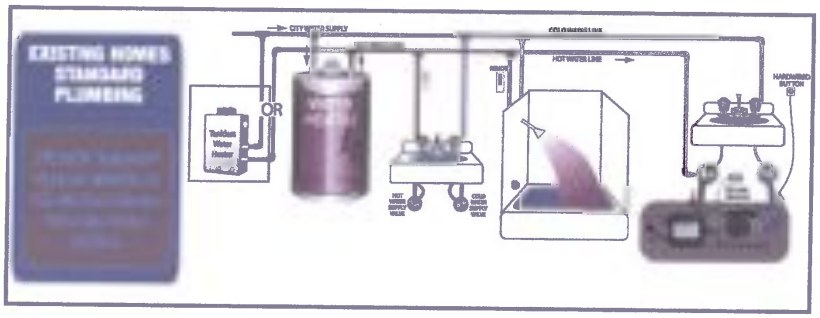
Greatest thing since sliced bread.
Richard — Franklin, NC

Great invention!
Marilyn — Amarillo, TX

About Us | Blog | Products | Benefits | In the News | Privacy Policy | Contact Us

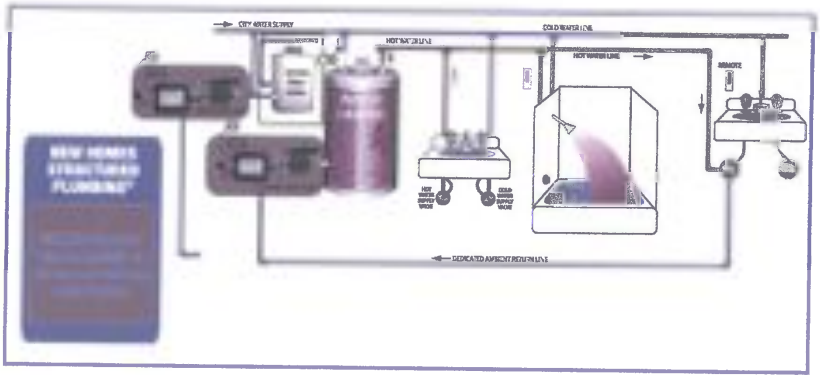
Intertek · GREEN · IAPMO · WaterMark Australia · CE · NOM · Dept of Energy Certificate of Recognition · GSA Advantage! · GREEN

How it Works



At the push of a button, the ACT, Inc. Hot Water D'MAND Kontrols® System circulate the ambient temperature water in the hot water lines (water that is normally lost down the drain) back to the water heater. This occurs up to 80% faster than just letting the water run down the drain—the usual scenario. Depending on the plumbing layout, the route and time can vary. The D'MAND Kontrols® System move the water rapidly, so that the hot water arrives at the fixtures before the heat is lost through the pipe.

As the ambient temperature water in the cold water line travels towards the water heater, the D'MAND Kontrols® System fill the hot water line with hot water. When the hot water reaches the D'MAND Kontrols® System, a thermal sensor (thermister) senses a temperature rise and quickly shuts the pump off. The sophisticated electronic circuitry that does this is attached to the high-performance pump housing.



This results in getting hot water to the fixtures three to four times faster (on average), greater convenience in not having to wait, a savings in water and energy, and a reduction in sewage costs! As a by-product of these savings, a cumulative

How it Works
Activating the System
D'MAND® Activation Sensors
Water Heating
Bathroom Plumbing
Kitchen Plumbing
Plumbing Layouts
Applications
Components & Specifications
Rebates

Testimonials

Hardest part of installation was for this 82 year old geezer to get under the sink cabinet.
Charles — San Antonio, TX

Beautiful - no more wasted water.
Arthur — Brick, NJ

Only used it for one day so far and am very satisfied.
Diana — Wilmington, DE

Excellent Unit - very efficient!
Julian — Whittier, CA

Outstanding unit, your company does good work!
Richard — N. Charleston, SC

Intertek Dept of Energy Certificate of Recognition

ACT

"Designed for Today... Dedicated to the Future®"

Over 108,349,200 gallons of water saved since 1991!!

Mission Statement
Media Coverage
Press Releases
Articles
Recognition
Success Story
D'MAND® System International Markets
DOE Emerging Technologies
What's New?
Water Regulations
Articles by Larry
Testimonials
Contact Us
Videos
Information Videos
ETS 2010 - IAPMO
How it Works
Marketing Videos
International
Training Videos
Installation Videos

About Us

Vision

While delivering comfort and convenience, Advanced Conservation Technology (ACT, Inc.) is a global partner in conservation. From humble beginnings, the leadership team of Act, Inc. has led the charge forward to demonstrate the critical link between water and energy consumption. What started off as a solution to provide hot water when demanded, has become a way forward in our world of ever dwindling resources.

Through innovative thinking and tireless research, ACT Inc. has developed a patented process to provide consumers an exclusive solution to their wait for hot water. Precision controls perform the task while not wasting precious energy due to outdated technology that constantly recirculates hot water and prematurely wears out our expensive plumbing systems.

As a result, ACT, Inc. has been awarded a coveted certificate of recognition by the United States Department of Energy for demonstrating the ability to save both water and energy.

About Our Product

Advanced Conservation Technology (ACT, Inc.) manufactures Hot Water Recirculation Systems that deliver hot water on demand, reduce water waste, and conserve energy. ACT, Inc.'s recirculating hot water pumps send cold water in the plumbing back to the hot water heater, via the cold water, or dedicated return line, while simultaneously bringing hot water to all fixtures on the line, in a matter of seconds. Unlike other hot water recirculation pumps, the ACT, Inc. D'MAND Kontrols® pump does not allow hot water into the cold water line, and delivers hot water to the furthest fixtures on user-demand, rather than relying on a timer activated system.

Because ACT, Inc. utilizes electronic control recirculation systems, we save the user money, whereas other pumps that utilize timer based recirculation systems cost the user hundreds of dollars in energy expenses every year. The ACT, Inc. D'MAND Kontrols® recirculation system saves water by reducing the user's wait time for hot water and thus reduces the water wasted down the drain. ACT, Inc.'s hot water recirculation systems reduce energy use by diminishing the amount of unused water wasted down a drain, thus cutting on sewage and treatment costs. The average home only uses hot water for less than 1 hour a day, so why waste money waiting for it or recirculating hot water when no one is using it?

Invest in the Future®

Testimonials

We love our system and have recommended it to everyone!
Ann — Las Cruces, NM

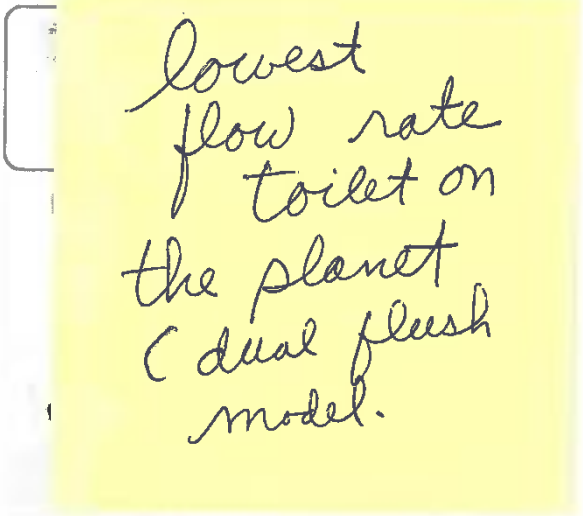
It's great - saves time and money and

Intertek · GREEN · IAPMO · WaterMark Australia · CE · NOM · Dept of Energy Certificate of Recognition · GSA Advantage! · GREEN

NIAGARA CONSERVATION

Stealth® UHET® Dual Flush Toilet-Elongated

MODEL # N7717EB-DF, N7714T-DF



lowest flow rate toilet on the planet (dual flush model.

Product Overview

Innovative and stylish, Niagara's Stealth UHET Dual Flush delivers two efficient flush options – 0.95 GPF full flush for solid waste and 0.5 GPF reduced flush for liquid waste With its quiet flush, low-profile body and breakthrough patented hydraulic technology, the Stealth has revolutionized the toilet market. It is offered in both round and elongated modelsand adaptable to fit a standard 12" roughing installation. The Stealth easily replaces your existing toilet, offering superior performance and lowering water usage and utility bills like no other toilet can.

- Ultra-High-Efficiency Flush
- Two efficient flush options – 0.95 GPF full and 0.5 GPF half
- Quiet 0.65 Average Flush
- Miso Flush Rating: 400g at 0.5 GPF / 800g at 0.95 GPF
- Extremely quiet flush
- EPA WaterSense labeled
- White vitrous china, Elongated front, 12" rough-in
- One flush thoroughly evacuates the bowl every time—no double flushing

Details

Bowl Shape: Elongated
Rough-In: 12"
Bowl Rim Height: 17"
Efficiency Standard: Ultra-High-Efficiency

Product Dimensions: 28.875" x 31.5" (732 mm x 800 mm)
Trapway: Fully glazed 2" (51 mm) trapway
Water Surface Area: 8" x 6"(203 mm x 152 mm)
Valve/Flush Lever: Polished chrome top-mount flush actuator
Flush Technology: Patented Stealth® flush chamber and air transfer system
MaP Performance (Miso Rating): 400g at 0.5 GPF / 800g at 0.95 GPF
Color: White
Finish/Glaze: Vitreous China – White Finish

4200 Diplomacy Road I Fort Worth, Texas 76155
Email: info@niagaraconservation.com I Toll-Free: (800) 831-8383

BURKHARDT CONSTRUCTION

What I do now.

A Santa Cruz General, Electrical & Plumbing Contractor

My name is **Sam Burkhardt** and I'd lile to introduce you to my business, Burkhardt Construction and myself. I am a licensed and insured General, Electrical and Plumbing contractor (3 separate licenses), and have been licensed for over 18 years. I have been involved in the construction trades for 39 years and have lived in Santa Cruz for 30.

Services I provide for residential repairs and remodeling, include:

- **Complete plumbing and electrical wiring repair.**
- **Bathroom and kitchen remodeling.**
- **Run new gas and water lines.**
- **Install water heaters, toilets, faucets and shower valves.**
- **Run new circuits and install electrical panels.**
- **Troubleshoot electrical problems.**
- **Install ceiling, exhaust and whole house fans.**
- **Drywall and tile work.**
- **Install windows, doors, and skylights.**
- **Decks and retaining walls.**

I would appreciate your consideration when you find yourself in need of any of the services I can provide. I'm competitively priced, conscientious, do quality work, and am determined to make my clients happy. I will be glad to provide you with many references upon request. Please visit my website for additional information.

Thank you for your time!

"Sam has done work for us for over 10 years, on both my residence and rental properties we own. He has always been reliable, honest and reasonably priced. He has done all types of building and repair work for us, from rewiring an entire house to repairing a dripping faucet. He is licensed as both an electrician and a plumber, which is an uncommon and very useful combination. Sam has also been dependably available to deal with emergencies, and has even shown up on a holiday to fix our water heater and restore hot water service. I wholeheartedly recommend Sam for repairs and building, particularly plumbing and electrical work."
Carlos, Santa Cruz

"This man is incredible!!! He did the work for 1/10 of the cost from another plumbing company and was very efficient and happy to help. Best Customer Service skills I have experienced in a long time!"
Suzanne, Aptos

"Sam Provided excellent service on my bathroom. I had been given an $800 estimate to fix the hot and cold-water spigots. Sam charged me $50 for labor and $30 for materials and fixed the problem. So glad neighbors recommended Sam."
Marge, Santa Cruz

HONESTY
INTEGRITY

831-212-7019

www.BurkhardtConstruction.net

"Sam has done a number of projects for me over the past 10 years, ranging from major remodels to plumbing and electrical changes and emergencies. I keep calling Sam back to handle my construction, plumbing and electrical projects because I know he will give me a fair price for excellent workmanship. I was very pleased with the master bedroom remodel he did at my Corralitos house, which added a skylight, fireplace and redwood deck and staircase. I spent many happy nights in that room. When I recently moved to a new home in Scotts Valley, I called Sam to connect my new gas stove to replace the worn out electrical model. I can't count the times Sam has responded quickly to my various plumbing and electrical emergencies. This is very important to me since I am totally clueless in both these areas."
Christina Shaw, Scotts Valley

PayPal

831-212-7019

NIAGARA CONSERVATION

FOR IMMEDIATE RELEASE
CONTACT: Maureen Brennan
312-946-6075

NIAGARA CONSERVATION® LAUNCHES GROUNDBREAKING GREEN CITY PROGRAM TO SAVE BILLIONS OF GALLONS OF WATER

Green City Provides Utility Customers with Water, Money Saving Program

Fort Worth, TX – October 2, 2012 – Niagara Conservation, a leading manufacturer of water and energy-saving products, recently launched an innovative program for utilities and their customers designed to provide maximum water and energy savings. The turnkey Niagara Green City program allows water utilities to offer their customers the opportunity to upgrade to the ultra-high-efficiency plumbing fixtures included in Niagara's Stealth® System, with no-cost to the utility.

Niagara Conservation's will be leveraging its partnership with Green *Plumbers* USA, an innovative organization with an accredited plumber training program, to ensure the upgrades are installed by certified Green *Plumber* Contractors. Participating utility customers will have the Niagara Stealth System upgrade installed at their home or business. The Stealth System is composed of the ultra high- efficiency Stealth toilet, a low-flow Bi-Max showerhead and three low-flow faucet aerators, which help to reduce water usage and utility bills. In fact, if 25,000 homes are retrofitted with Niagara Conservation's Stealth System, the savings for the city is estimated at one billion gallons of water per year.

Green City, Green Savings

To participate in the Niagara Green City program, utilities need only to agree to provide access to its customers through bill inserts and the utility's website. Niagara will administer the program, handling management, installation, reporting, customer service and marketing services. Customers can sign up through their utilities, and Niagara will schedule a time for installation, using a certified Green *Plumber* contractor from the local community. Following the

installation, customers pay their local utilities a monthly charge amounting to less than their water and utility savings. For example, the charge added is typically $5 per month for an average home, but the estimated savings amounts to $20 per month. Niagara Conservation also includes a 10-year warranty on all products installed, providing program participants with added peace-of-mind.

In addition to the benefits for the utility customers, Niagara's Green City program also offers benefits to the participating city or municipality. The water savings created from the program means a decrease in the demand for water storage, sewerage treatment and/or lift station capacity. Additionally, the plant capacity needed for water desalination is reduced and there is less need for the participating city to purchase costly imported water. Energy usage is also decreased during peak demand times because less water is utilized, which means less energy is needed to heat that water.

"We're extremely proud of the Niagara Green City program, as it allows us to work with utilities across the country and help them achieve their conservation goals without exhausting their financial resources," states Carl Wehmeyer, Niagara Conservation's Executive Vice President. "At Niagara, we're constantly striving to create innovative, water-saving technologies that will help conserve water and money. Niagara Green City allows us to safeguard resources on a large scale by installing environmentally friendly products into homes and businesses throughout entire communities, which is vital in this time of water crisis."

Start Saving with The Stealth System

For utilities that participate in the program, Niagara will provide the best water-saving technology available on the market: The Stealth System. The water savings achieved by the Stealth System are double those of other water conservation devices, as the Stealth System can save consumers up to 40,000 gallons of water and as much as $600 per year.

NIAGARA GREEN CITY PROGRAM LAUNCHES – PAGE THREE

For more information about the Niagara Green City program or Niagara's water and energy efficient products, please visit www.niagaraconservation.com.

About Niagara Conservation

With a history of nearly 40 years of quality and innovation, Niagara Conservation has earned a reputation as the premier manufacturer of high-efficiency water and energy conservation products. Niagara is the leading developer of conservation solutions for plumbing professionals, utility companies, government leaders, energy management officials and environmentally conscious consumers. Founder and President William Cutler established Niagara in 1977, and the company is still family owned and headquartered in Fort Worth, Texas, with satellite offices around the world.

For more information about the Stealth system and Niagara's other water-saving and energy-saving products, visit www.NiagaraConservation.com, or call 800-831-8383. For media inquiries, contact Maureen Brennan at 312-946-6075.

###

NIAGARA Green City™
WATER SAVING PROGRAM FOR SUSTAINABLE COMMUNITIES

Program Details

Niagara Green City is a direct installation water conservation program featuring the Niagara Stealth System of water-conserving fixtures and the Niagara Smart Pay™ financing system. Under the voluntary participation program, for a modest monthly fee, customers can purchase and have installed a Stealth System which includes a Niagara Stealth Ultra High Efficiency 0.8 gpf Toilet (UHET); a 1.5 gpm or less Niagara showerhead, bathroom faucet aerators for single or dual sinks and a 1.5 gpm kitchen flip aerator.

Families can save on average 30,000 gallons

of water in a single year with the Stealth System

Sign Up Now

The water savings with these ultra high efficient bathroom and kitchen aerators with a single system in a home with 3 people could save in excess of 30,000 gallons of water in a single year. This reduction in water consumption alone will in some homes save the resident enough money to more than offset the cost. The savings experienced in not having to heat the water saved at the showerhead and faucets can actually exceed the reduction in water and sewer costs. Imagine how this kind of savings would impact a 100 unit apartment complex or a 5,000 home community.

Program Features

Professional Installation

Trained and certified in the latest water and energy efficiency technologies, local Green Plumbers will provide upfront inspection, installation of new products, and remove and recycle old fixtures.

Clear Reporting

The NIAGARATRAC™ web-based data management tool provides secure comprehensive management of client information and real-time installation tracking with easy accessibility for your authorized staff members.

Turnkey Program

Niagara Green City is easy to scale, as we provide all retrofit program management, installation coordination, financing, marketing, and customer service.

Connect with Niagara Green City:

NIAGARA Green City™
WATER SAVING PROGRAM FOR SUSTAINABLE COMMUNITIES

What Is It

Niagara Green City is a water and energy conservation program brought to you by Niagara Conservation and Green Plumbers USA. The program saves water because new ultra efficient fixtures are installed including Niagara's 0.8 GPF Stealth toilet, a Bi-Max showerhead that allows the user to select either a 1 or 1.5 GPM flow rate, a 1.5 GPM swivel kitchen aerator, and two 1 GPM bathroom aerators. The program reduces energy demand because with less water being used in showers and sinks, the need for energy to heat the water also shrinks.

Niagara Green City helps the utility promote the program to single family residents and owners of multi-family dwellings. Niagara Green City then administrates the installation and billing process with those individuals who opt to participate. With no upfront costs and savings that exceed the monthly costs paid by the residents, the program provides an easy way for both the city and the end-users to achieve their conservation goals.

- Niagara Conservation manufactures EPA WaterSense labeled high-efficiency toilets, showerheads, and aerators and has extensive experience in working with utilities.

Green Plumbers USA is a five-time WaterSmart Innovations partner and an internationally recognized trade association and training organization.

Connect with Niagara Green City:

NIAGARA Green City™
WATER SAVING PROGRAM FOR SUSTAINABLE COMMUNITIES

What Are The Benefits

Benefits for Utilities & Cities	Benefits for Consumers	Benefits for Plumbers
Meet conservation mandates in a cost effective manner	Savings that significantly exceed the cost	Source of new business opportunities
Reduced water use and demand on treatment facilities	Access to the best conservation technology with no upfront cost	Access to advanced conservation training through Green Plumber USA
Save energy used in transport and treatment of water	Products are installed by qualified professional plumber	Access to ultra high-efficient conservation products
Lead and inspire in the conservation movement		

Instant Hot Water Recirculating System

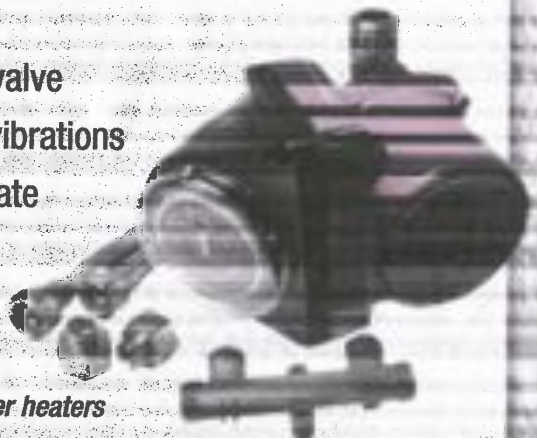
The Watts Instant Hot Water Recirculating System brings convenience and savings to your home, giving you hot water instantly at every faucet or shower when you need it.

This unique product connects easily to existing plumbing. It saves up to 15,000 gallons of water per year and up to 10% of your water bill.

inexpensive hot water recirculation system for retrofit.

Features:

- Easy to install in under one hour
- 24-hour programmable timer activates pump when you need it
- Maintenance free
- Pump mounts directly onto a water heater with 3/4" connections
- Can be used with all types of pipe
- 10' power cord
- 1/2" thermal bypass valve
- Extremely quiet - no vibrations
- Cost 5¢ a day to operate



**Do not use with tankless water heaters*

Saves Water

WATTS

How much water is wasted waiting for water to warm up?

An average home has 125 feet of 3/4" pipe. 125 feet of 3/4" pipe holds 3.14 gallons of water. If hot water is used 10 times per day, 31 gallons of water is wasted running the faucets/ shower to get hot water. In a year, this equals to 11,461 gallons of water. 25.2 million homes waste approximately 300 billion gallons of water annually.

How does the Instant Hot Water Recirculating System work?

A pump with a built-in timer is installed on the hot water line from the water heater (*Fig. 1*). A patented sensor valve (*Fig. 2*) opens when the water on the hot water side cools and pushes the cool water back to the water heater. As the temperature in the hot water line hits 98°, the valve closes.

Some homes are designed with multiple hot water loops, one per floor, etc. If one section of the house does not receive hot water, you will need to purchase a Watts Sensor Valve Kit (*Fig. 3*) for each loop. For best results, the valve should be located at the faucet furthest from the water heater in each loop.

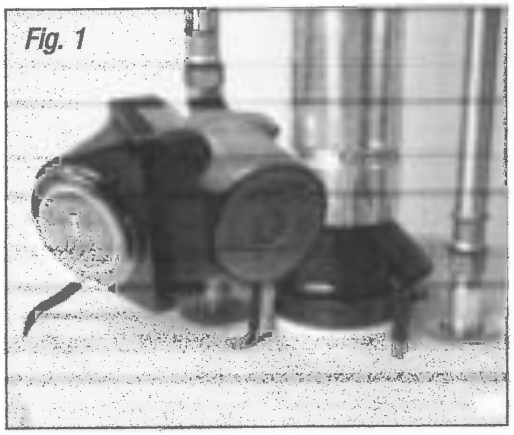


Fig. 1

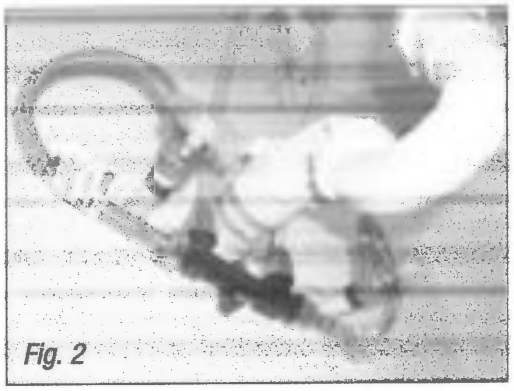


Fig. 2

Instant Hot Water Recirculating System

Watts Ordering Code #: 0955800
Model Description: 500800 Recirculating System
Cube (ea): .27
Weight (ea, lbs.): 7.0
UPC: 098268253764
Master Pack: 1

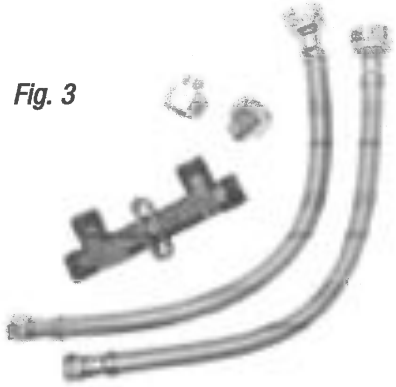


Fig. 3

Instant Hot Water Recirculating System Sensor Valve Kit

Watts Ordering Code #: 0955801
Model Description: 596816 Sensor Valve Kit
Cube (ea): .13
Weight (ea, lbs.): 0.7
UPC: 098268256987
Master Pack: 5
Master Pack ITF: 20098268256981

Water Conservation Response to Rate Increases

by Sue Holt

suholt@cabrillo.edu

Submission Overview for the WSAC Strategies and Ideas Convention

July 28, 2014

Proposal: 1) that the City Water Department engage in either

a) a formal statistical estimation of the price elasticity of water demand

b) or, at a minimum, a sensitivity analysis using a range of peer-reviewed values of elasticity in the short and long run; and

2) that the City use these findings to create more precise and accurate estimates of water demand and GPCD.

Scientists who study resource use know that new conservation is equivalent to additional supply because it allows existing supply to serve more uses. It's common for textbooks to say that the cheapest new water source or power plant is often the one that is no longer needed because of conservation (e.g., Tietenberg, T., Environmental Economics and Policy, 5th ed, Pearson Addison Wesley, 2007, pp. 151, 173-4).

Historically, the City of Santa Cruz Water Department has estimated water demand independent of any dampening effects due to projected rate increases. The Water Conservation Master Plan currently being developed also excludes consideration of any rate increases over the next decades. But research has shown that city customers are quite responsive to rate changes. Residences that used twice the average amount in the mid-1990s (40 CCF bi-monthly) reduced their water use by 2.6% to 5.2% for each 10% increase in rates in the short run. [Nataraj, Shanthi. "Do Residential Water Consumers React to Price Increases? Evidence from a Natural Experiment in Santa Cruz." *Agricultural and Resource Economics Update* 10(3) (2007):9-11. http://giannini.ucop.edu/media/are-update/files/articles/v10n3_3.pdf]

For other communities, peer-reviewed studies that measure rate responsiveness (price elasticity) show values of roughly 3-4% less usage for each 10% increase in rates in the short run, and eventual values of 6% less in the long run. These measures are independent of the influence of weather and climate, income levels, and housing characteristics. These measures show the quantifiable effectiveness of rate increases as a means of holding down water demand and GPCD.

Whereas formal conservation programs that depend on new technologies and appliances may have slow penetration rates through the housing stock, rate changes can have both immediate and long-term effects. At their own discretion, customers shift their water use away from lower-priority applications. For some this means shorter showers. For others it means less frequent flushing in order to free some water for their favorite water-intensive plants. Some customers become better educated about water conservation because their lack of knowledge has become

costly. All of this can happen in the short-run, without any formal conservation program appliance replacements. Indeed, outdoor use is much more variable and also much more flexible than indoor water use because it is less subject to the effects of equipment saturation and more subject to a variety of behavioral and landscape adjustments. To the extent that the City relies on strictly formal conservation programs, it underestimates the willingness of customers to adapt to increased water scarcity.

When we recognize and utilize the inherently conserving effects of rate increases, we make more water naturally available to the environment, including the protection of fisheries.

Unlike other strategies, there is no additional cost associated with the pricing strategy, given that rate increases are necessary for other reasons. Rate increases are in the approval process, satisfying practicality criteria.

The Water Department has stated that they expect GPCD and gross demand to rebound because they have in the past after recessions and droughts. However, those periods were characterized by older technologies, very low water rates, infrequent billing, smaller population levels, and less concern about climate change. It is not clearly the case that a rebound, much less a full rebound, will occur in the present circumstances.

It is reasonable to expect that some of the decrease in GPCD we have witnessed is due to recent rate increases as well as the shift to monthly billing. The City's tendency to overlook the impacts of rate changes and billing frequency contributes to its typical overestimation of demand.

When rates rise consistently over several years, social norms tend to follow. Consider how rising gasoline prices and fears of shortages helped create the disparaging term "gas guzzler."

Now water rates are scheduled to increase over the next five years by 61%. Whatever alternatives the City considers to create a better fit between water supply and demand, the failure to consider rate responsiveness will increase both the uncertainty and the bias in its demand estimates.

Therefore I suggest

1) that the City Water Department engage in either
   a) a formal statistical estimation of the price elasticity of water demand
   b) or, at a minimum, a sensitivity analysis using a range of peer-reviewed values of elasticity in the short and long run; and
2) that the City use these findings to create more precise and accurate estimates of water demand and GPCD.

To: Water Supply Advisory Commissiion, Attention Sarah Mahsergh					**Page 1.**
From: Scott McGilvray, Live Oak Resident					
Re: Suggested water supply sources					
Project #	**Item**	**Description**	**Benefits**	**Costs**	**Comments**
1	**Pasatiempo Golf Course**	Conversion to 30 m gallons of recycled water each year	Reduce Santa Cruz Potable water demand 30 Million gallons per year	Most costs to be paid by user.	Bureacratic obstacles. $5 Million intertie and pipe line to Scotts Valley. Guarantee required from SC of Potable water to SV.
2	**Utilize former Quarries for Raw Water Storage**	Examples: Hansen Quarry, and/or Eastern Cemex quarry	Resolve Santa Cruz problem of additional storage need of raw water. Hansen Quarry close to SV and SC water treament plants Cemex Quarry next to Lidell Springs, existing pipeline	**Cemex Quarry:** $6 million for 650 Milliion g $15 Milliion for 1.3 Billion g $30 Million for 2.6 Billion g **Hansen:** Under review	Watch out for "no-growth" interests to find environmental objections. Note: The holes are already dug!
3	**Water Transfers**	Capture San Lorenzo winter flow, send to SV, SqCWD or storage	Average water/year 700 Million gallons to 1 Billion plus. Water exists, as do water rights viz a viz fish	$90 Million or less, depends on storage option	Aquifer storage may be less expensive than in lieu recharge option.
4	**Upgrade Water Treatment Plant Flexibility**	Add 2nd pipeline to Loch Lomond. ……. Obtain permission to take water direct from Felton diversion	Fill Loch Lomond in dry years. Up to 1 Billion gallons/year …… Simultaneously supply Graham Hill treatment plant and re-fill LL. …… …….	2nd pipeline may be $10 million. ……. ……. Felton diversion less than $1 Million.	Felton diversion permit application filed 10 years ago. Bureaucratic tie up prevents processing. …….. ……
			P		
5	**Upgrade Water Treatment plant processes**	Use better settling agent	Treats and reduces effective water turbidity, and lowers required amount of chlorine. Quantity of benefit under study	Some tests in process, cost unknown to me	Allows more water use from San Lorenzo river intake at Tait St.

From: Scott McGilvray, Live Oak Resident					**Page 2.**
Re: Some suggested water alternative sources					
	Item	**Description**	**Benefits**	**Costs**	**Comments**
6	**Recycled Water trunk line**	Install on RR right of way Santa Cruz to Watsonville	Access to Recycled water facillitated. …….	$100,000 to $500,000/mile = $8.5 million	Needs contractor ball park estimate to counter fear of $1 Million per mile. ($34 Million)
7	**Raw Water trunk line**	Install on RR right of way Santa Cruz to Watsonville	Access to raw water for agencies.	$100,000 to $500,000/mile = $8.5 million. …… Should be less if done at same time as Recycled pipeline.	Needs contractor ball park estimate to counter fear of $1 Million per mile. ($34 Million)
8	**Enlarge Tertiary Water Treatment capacity at Neary Lagoon waste water treatment plant**	Presently 100,000 g/day …… Enlarge to 10x	Increase supply of tertiary water to 1 million g/day = 365 m gallons/year ……. Waste Water resource is 3 Billion gallons per year.	Unknown to me. Monterey built 25 mg/day facility for $70 million. 20 years ago.	Surplus water not needed for parks, golf courses, could be used by Pajaro Valley basin (overdrawing aquifer 1Billion Gal/year)
9	**Water Conservation**	Santa Cruz Master Conservation plan =	500 millon gallons/year attainable with current technology.	Not to exceed $21 Million, could be much less.	No conservation effect studied for tiered rates to commercial and irrigation users.
10	**Regional water issue requires regional solution**	San Lorenzo River and Neary Lagoon Waste Water treatment plant are sources of water supply	SqCWD needs water from Santa Cruz… Scotts Valley needs Santa Cruz water San LorenzoValley needs Santa Cruz water	zero	requires broader view.
11	**Regional Desalination Plant per scwd2**	Build per 2013 proposal	900 million gallons/year	$130 Million, plus financing costs. …….. High operating costs due to energy intensivenss.	Energy intensive …….. 10x... Coastal commission permit required

Three Year Reserve of Water for Fish, Drought Relief and Aquifer Recharge

What is the Goal?

A three year reserve supply of water for fish flows, water for Santa Cruz customers during droughts, and water for Soquel Creek Water District aquifer recharge.

By judicious capture and management of excess San Lorenzo River runoff coupled with adequate storage, we could provide:

1) A sustainable supply of water providing fish flows that exceed Department of Fish and Wildlife requirements
2) A sufficient, sustainable supply of water for Santa Cruz customers during drought periods
3) A sustainable supply of water to help Soquel Creek Water District recharge their aquifers.

Where do We Get the Water?

A review of the Water Department's graph of annual runoff from the San Lorenzo River over the last 93 years shows that the average annual runoff is about 30,000 mgy (million gallons a year). Over the last several years Water Department has used only about 2,000 mgy from the San Lorenzo River.

That means on average about 15 times more water (28,000 mgy) gets flushed to the sea. If we save some of that we would easily solve the water problems listed above. Of course, some of the river flow is necessary for the fish and environment.

Also noteworthy, on average, we have twice as many "wet" years as "critical dry" years. During wet years, average annual runoff is about 66,000 mgy. We could achieve the desired water savings by just capturing some of the excess runoff in these extremely high runoff years.

Where to Store the Water?

Several smaller storage options are preferable to one big solution. This approach has several advantages:

1) Provide redundancy of storage - in case of any one failure
2) Can be phased in – don't have to build them all at once
3) Build them a little larger than currently needed – for climate change and the unexpected
4) Don't have to operate all of them all of the time.

Suggested storage options: Enlarge capacity of Loch Lomond reservoir; Build new dams, for example: Zayante Creek, Waterman Gap; Use abandoned quarries; Groundwater recharge as storage; Water swaps with neighboring water agencies.

How much more water could we store in Loch Lomond reservoir if the dam was 5 feet higher? Or 10 feet higher?

The capacity of the reservoirs would depend on how much water we want to store to meet the three goal listed above.

We could also have an agreement with Soquel Creek Water District that not only do we supply them water to recharge their aquifer but also for them to store some water for us in a dire emergency.

We can help them recharge their aquifer to the point where during extreme low rain years they could ship some of their groundwater to us to help us deal with a drought. This should be a very rare occurrence if we build sufficient reservoir capacity.

What about Water Rights?

The State Water Resources Control Board should be encouraging this plan because it helps solve three problems: maintaining sufficient water flow for the fish and the environment, provide water for Santa Cruz during drought years, and it is a regional approach to help solve regional problems of a neighboring water district.

Water rights have been concern with dams. However, with the current heightened concerns about the drought in California, the State Water Resources Control Board should be more receptive to building a new dam and/or enlarging an existing dam. In fact, several new and/or enlarged dams are currently being proposed, including Shasta dam. Also, saving water for the environment and for fish flows would be a plus for a dam.

It has been said that it takes 20 years to get water rights changes. In this current State-wide drought emergency environment, the regulators will act faster. They will appreciate that we are trying to solve our water problems locally and we are not seeking to pump in outside water.

Also, very importantly, the City has declared that it has a water emergency. In emergency situations, the State Water Resources Control Board will consider water rights changes more expeditiously.

Climate Change Impacts

This plan can be designed to cope with the future consequences of climate change.

Climate change will probably cause less rain to fall. The rain may be of shorter duration and heaver. The summers will be warmer. The amount of water for fish flows will need to be increased.

People's needs? Residential indoor water use probably won't increase much – we aren't going to flush more often nor wash more clothes more often. However, outdoor water use will increase due to the warmer weather.

Fortunately, the San Lorenzo River has plenty of excess annual runoff. Today's annual runoff of 30,000 mgy is about 15 times more than we use. If climate change cuts that to, say, 20,000 mgy, there is still plenty of supply for this plan: at about 10 times more water than we may use.

Similarly, for wet years, cutting today's average annual wet year runoff of about 66,000 mgy down to, say, 44,000 mgy would still be plenty for this proposal.

To plan for climate change we will need more storage capacity than we require today. More and/or larger reservoirs. When we build the reservoirs, we must build them larger then we currently need so we have the additional capacity to deal with future consequences of climate change.

What are the Benefits?

We are fortunate to live in Santa Cruz County with redwood rain forests, where we get many times more rainwater on average then we use. We have plenty of water available to us in a river that flows through our town. We just have to manage it better.

Several storage projects provide redundancy. Several storage projects provide operational flexibility. Several storage projects are less costly, both in cost to build and in annual operating costs. Several storage projects would have less negative impact on the environment.

No Greenhouse gasses emissions. Enhanced, sustainable fish flows.

Practically: Low cost compared to other projects, when cost to build and cost to operate are calculated over a 30+ year life span.

This plan has considerable resiliency with plenty of water supply, several storage options, operational flexibility and the ability to solve several water problems.

Other

Water officials have dismissed another dam or a taller Loch Lomond dam for a variety of reasons. One of their reasons they say is that Environmentalists will not allow another dam to be built. Environmentalists have a choice: a highly environmentally damaging desalination plant or dams which have different and lesser environmental impacts. Dams would be far less costly both in dollars and long-term environmental damage.

As a strong Environmentalist, I would much prefer to have dams with their associated costs and environmental drawbacks to a desalination plant with its massive environmental costs and environmental drawbacks.

I was surprised to find out that Los Angeles County has 14 dams in their County. They currently have a three-year supply of water available in these dams. They are doing something right.

Santa Cruz does not have a water SUPPLY problem we have a water STORAGE problem.

Summary

The point I'm trying to make is that there is a very large amount of water runoff from the San Lorenzo River during normal years and especially in wet years. And if we have places to store some of that excess water we could probably solve the problems of providing an adequate, sustainable water supply for fish flows, a sustainable supply of water for Santa Cruz's periodic drought years and provide water to help our neighbors in Soquel Creek Water District with their need to resupply their groundwater basin.

Do the cheap things first. Learn as you go. Remember: it IS going to rain.

Bill Malone billmalone@pacbell.net

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Water Supply

BompaErlin@aol.com <BompaErlin@aol.com> Wed, Jul 16, 2014 at 3:57 PM
To: santacruzwatersupply@gmail.com
Cc: citycouncil@cityofsantacruz.com, lrobinson@cityofsantacruz.com

I am certain I speak for many when I state: The water problem in Santa Cruz is *not* a matter of *supply*, it is a matter of STORAGE. Adequate storage would allow us to ride out the dry years with the wet ones, recharge our aquifers and probably help Soquel in the bargain.

Would building reservoirs be easy, absolutely not. Would it be cheap, of course not. But our rainfall averaged out year in and year out is more than adequate for our needs if we would just use our heads. Whether it's the dam in Zayante or using abandoned quarries or all of the above, once in place maintenance would be nil and the supply of water assured, to say nothing of the potential recreational benefits.

Or, we can continue trying to promote an ugly, grossly innefficient and very expensive new de-sal toy that will only get more costly as time goes on, while pushing the citizenry to use less and less water while jacking up the rates to balance the loss of revenue - the perfect catch-22 business model.

For once, let's take the long view. Let's bite the bullet and do the right thing - even tho it may be the hard thing. Let's not think band aid, but let's fix this thing once and for all. We need STORAGE and we should get on it without further delay.

Dick Erlin
Santa Cruz

To: Water Supply Advisory Committee (WSAC)
City of Santa Cruz
212 Locust St.
Santa Cruz, CA 95060

attn.: Sarah Mansergh

From: Jerome E. Paul

Re: Water supply ideas: 2-page overviews solicited by WSAC

Thank you for the invitation to share some fruits of my research and analysis, some 1100 hours of work to date. I offer 41 strategies and ideas, culled down from about 71 total. As per your request, these items are presented as overviews only; much of my bibliographic information, calculations, expert endorsements, etc. are not included. A table of contents can be found on the following page.

It is helpful to examine the strategies and ideas in the order presented, because many of the latter items use concepts defined and explored in the earlier items. To the extent that you are already familiar with each element of these earlier items, I beg your pardon and indulgence.

As a longtime Santa Cruz resident and an engineer by training, I became concerned and involved in serious study of mid- Santa Cruz County water matters over two years ago. For granting me substantial, frank and helpful private interviews--usually repeatedly--I am indebted to many highly knowledgeable people, including past and present heads of water departments and districts for the County, SCWD, SqCWD, SLVWD, consultants, board members and the people who do the work and know where the facts are buried such as the engineers responsible for Loch Lomond and the Graham Hill Water Treatment Plant, those responsible to negotiate with regulators, Engineers for Water Alternatives, elected officials and many more. Because I came to this study to understand desal, many examples are compared to desal. I hold no prejudice for or against desal, but do have a strong preference for objective scientific evaluation.

Although I hold no PE license, I hold a Master of Science degree in Electrical Engineering and have a considerable education in business. After a career contributing to the designs of over 200 products, technology transfer for governmental agencies, and serving as a Silicon Valley executive in charge of corporate strategy, I bring an uncommon perspective to addressing our water source problems.

I look forward to receiving your comments and answering your questions during the coming months.

Sincerely,

Jerry Paul

jpaul@ix.netcom.com
831-457-0910

Table of Contents

1. Top-Down (Strategy)

[S24] List *all* potential water sources, storage, and places of use, to identify all possible Alternatives involving those three elements. Identify scope, objectives, stakeholders, knowledge base, principles and parameters. Identify the most successful people in the field and try to emulate them. The above tasks help us stand on the shoulders of giants and make sure we have not overlooked valuable elements.

2. Science First (Strategy)

[S21] Divide the problem into two aspects: the aspect governed by the laws of nature; and the aspect governed by the laws of humans. In other words, first imagine that all of mid-County were one big, unified water district, and in that frame, derive and study the possible solutions allowed by the laws of physics, engineering and the life sciences. Once the best science-based solutions become apparent, then imagine how the human laws, rules, regulations, procedures, political considerations and economics might be configured to achieve the best outcome. This "science-first" chronological order is important because it encourages virtually all physical options to be considered openly before the voters as mandated by the WSAC charter. No options are pre-empted. "Science-first" also gives the human laws more of a chance to bend and change as reasonably suggested by the objective science.

3. What Does It Take? (Strategy)

[S3] In the past two years of this endeavor to find suitable water supply options, I have encountered over a score of options which were thrown out because of a "fatal flaw" which proved not to be fatal in actuality. How did I determine whether a flaw was indeed "fatal"? Simply by asking the time-honored business question: "What does it take?" (to make this so-called flaw workable). Note that "It can't be done" is not an answer.

By repeatedly asking this magic question and digging deep for answers, my conferees and I were able to come up with numerous possible solutions to our regional water problems. (One notable example is "What does it take to acquire new water rights within about 3 years instead of some 20 years?") I invite everyone involved to get into the habit of asking "What does it take?" It is a profound game-changer, as you'll see throughout this document.

4. Include the Neighbors (Strategy)

[S20 et al.] There are many huge reasons for each entity to solve the problem regionally instead of going it alone. The various neighbors (including the County and state) are positioned to provide considerable resources, including such things as collective political clout, expertise, a reservoir, a stream, diversion facilities, public relations help, lots of cash, pipelines, co-signing to get better terms on bonds, and aquifer debt. Aquifer DEBT? Yes, their vast underground spaces which used to contain water and now don't, constitute what is called aquifer debt. However, these very same empty spaces also can be thought of as vast water STORAGE sites--clean, covered, already up and running, and much bigger than Loch Lomond. In general each neighbor has some things the other neighbor needs. I believe that in this situation, the whole is much greater than the sum of its parts—a "positive-sum game". Which is why a solution which includes the neighbors is likely to be a better deal, more robust and lasting.

Henceforth in this document, I mostly will address my analysis to the combined area covered by the Santa Cruz Water Department (SCWD) and the Soquel Creek Water District (SqCWD). This covers the coastal communities extending from just south of Davenport southeastward to La Selva Beach. In a few cases I will include several communities upstream from SCWD as well.

5. Heuristics – Water Quantities

As the chart below shows, SCWD and SqCWD together usually divert only 6% of the water in their streams. The rest just flows into the ocean.

Average Annual Stream Flow

AFY = acre-feet per year. Scale: one horizontal inch = 27,500 AFY

- **How much surface water is there, total?**

Total of SCWD and SqCWD combined
190,000 AFY
(100%)

- **What are the main potential sources?**

San Lorenzo River	Soquel Creek	North Coast, Aptos Creek, Other
95,000 AFY (50%)	**31,300 AFY** (16%)	**63,700 AFY** (34%)

- **How much gets diverted from streams for human use?**

diverted by **SCWD** ←**11,500 AFY** (6%)

Not diverted, just flows out to sea
178,500 AFY
(94%)

diverted by **SqCWD** **0 AFY**→ (0%)

Key point: We divert only 1/16th of what there is.

- **How big? Desal's annual production capacity, and our storage site capacities:**

Desal annual production capacity
←**2790 AFY**
(1.5%)

Loch Lom-ond	Purisima Aquifer	Santa Margarita Aq.	Lompico Aq.
8k AF	**30k AF**	**15k AF**	**10k AF**

Loch Lomond is SCWD's 8400 AF reservoir filled via its 9 Sq. mi. watershed and by a pipeline from Felton Diversion. It is rarely drawn below 30%. The Purisima Aquifer is under the SqCWD areas of Rio Del Mar, Aptos, Capitola, and Soquel, and the SCWD area of Live Oak, where it is at the earth's surface; it goes increasingly deep underground as it approaches Rio Del Mar. The part of the Santa Margarita Aquifer most conducive to water storage is around Scotts Valley, although the aquifer stretches to Ben Lomond and Santa Cruz as well.

- **How big is our combined storage capacity?**
  (Desal normal-year production shown for comparison.)

Desal normal year's production
←**1500 AFY**
(0.8%)

Combined Storage Capacity
63,000 AF
(33%)

Key point: The storage capacity of mid-County is roughly 42 times the normal-year output of the proposed desalination plant. I say "roughly" because even the best hydrologists have a tough time accurately determining the sizes of underground formations which can't be seen directly.

Here is a memory aid: Think "6"
The Loch is almost 6 times as big as the normal-year desal plant output (1500 AF), and
The available aquifer storage space ("debt") is more than 6 times as big as the Loch.

1500 AFY = 929 gallons per minute (GPM) = 489 million gallons per year (MGY)
= 2.07 cubic feet per second (CFS) = 1.34 million gallons per day (MGD).
See the appendix for a full conversion chart.

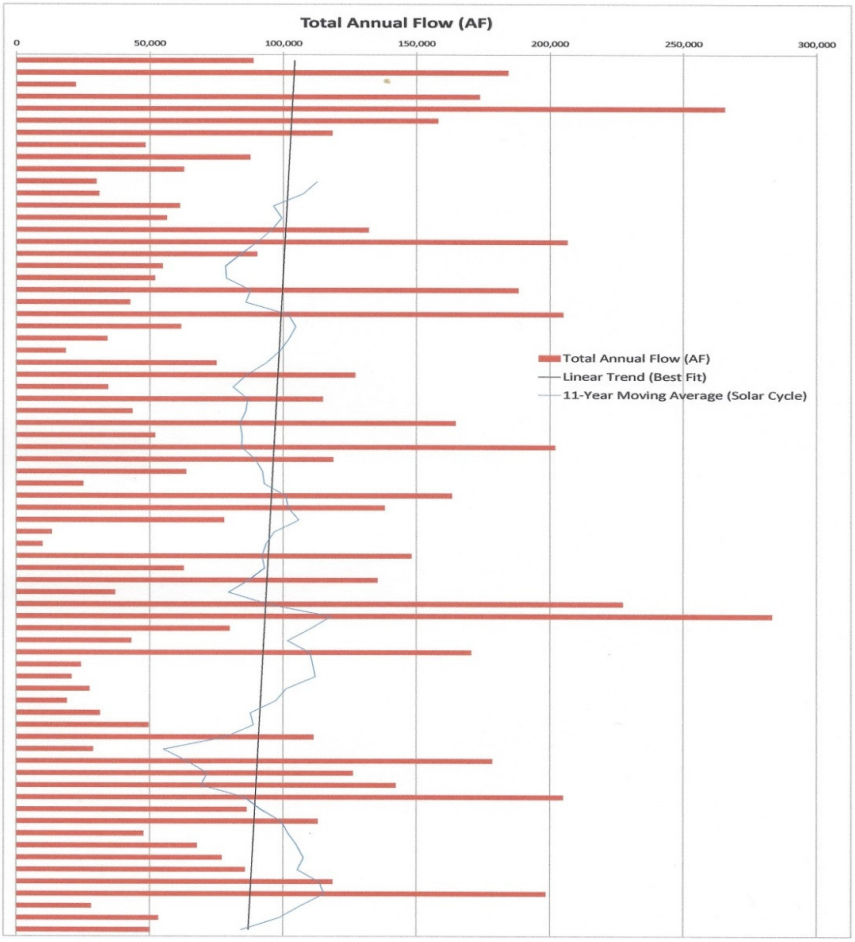
A **tertiary wastewater (sewage) treatment** plan being considered can yield a pure water output volume of no more than about half of that of the secondarily-treated sewage. In the case of Santa Cruz, the pure water output thus would be limited to about 6000 AFY, which is equal to 3.2% of the 190,000 AFY above.

Key point: as the chart of 71 years of rainfall shows below, San Lorenzo River flow for the wettest year is about 29 times more than for the driest year. It probably will take much more than 1500 AFY to even out our supply. BTW, in this graph median is about 81% of mean.

Felton Flows

Annual Natural Flows Approaching Felton Diversion in the San Lorenzo River, Santa Cruz County, California

Flow Year	Year Type	Total Annual Flow (mg)	Total Annual Flow (AF)
1937	N	28,941	88,790
1938	W	60,089	184,354
1939	C	7,239	22,210
1940	W	56,595	173,633
1941	W	86,520	265,445
1942	W	51,511	158,035
1943	N	38,601	118,429
1944	D	15,744	48,301
1945	N	28,567	87,644
1946	N	20,462	62,779
1947	D	9,754	29,924
1948	D	10,102	30,993
1949	N	19,929	61,141
1950	N	18,354	56,310
1951	W	43,016	131,973
1952	W	67,336	206,588
1953	N	29,415	90,246
1954	N	17,854	54,776
1955	N	16,906	51,867
1956	W	61,339	188,187
1957	D	13,882	42,589
1958	W	66,824	205,016
1959	N	20,101	61,670
1960	D	11,130	34,146
1961	C	6,014	18,451
1962	N	24,467	75,066
1963	W	41,400	127,017
1964	D	11,224	34,435
1965	N	37,453	114,907
1966	D	14,192	43,541
1967	W	53,650	164,598
1968	N	16,948	51,996
1969	W	65,841	202,000
1970	W	38,712	118,770
1971	N	20,745	63,647
1972	C	8,157	25,025
1973	W	53,225	163,294
1974	W	45,015	138,107
1975	N	25,400	77,928
1976	C	4,320	13,253
1977	C	3,188	9,781
1978	W	48,271	148,096
1979	N	20,457	62,762
1980	W	44,153	135,462
1981	D	12,080	37,063
1982	W	74,132	227,436
1983	W	92,358	283,353
1984	N	26,056	79,941
1985	D	14,049	43,101
1986	W	55,589	170,547
1987	C	7,902	24,244
1988	C	6,770	20,771
1989	C	8,929	27,394
1990	C	6,192	18,996
1991	D	10,214	31,338
1992	D	16,165	49,594
1993	N	36,325	111,445
1994	C	9,387	28,798
1995	W	58,153	178,415
1996	W	41,129	126,184
1997	W	46,387	142,315
1998	W	66,799	204,940
1999	N	28,161	86,399
2000	N	36,851	113,058
2001	D	15,546	47,696
2002	N	22,078	67,736
2003	N	25,117	77,059
2004	N	27,968	85,806
2005	W	38,644	118,560
2006	W	64,689	198,465
2007	C	9,149	28,069
2008	N	17,353	53,240
2009	D	16,326	50,087



6. Heuristics – Energy/Elevation

A key issue in the water supply problem is the cost of energy—both the financial cost and the cost to the environment--the "carbon footprint" which gives rise to global climate change, a matter of great concern to our citizenry. Let's consider the relation between energy and elevation (as in lifting water uphill). When SCWD replenishes Loch Lomond Reservoir with water from Felton Diversion on the San Lorenzo River, the water is typically lifted a little over 300'. Almost every other project being considered lifts water by a few hundred feet at most. After all, Loch Lomond Reservoir tops off at 577' elevation above sea level, Scotts Valley Skypark area is at 520' elevation and the highest identified percolation site into the Purisima Aquifer I am aware of is at some 600' elevation. Projects which use membranes/reverse-osmosis to purify surface water or secondarily-treated wastewater (sewage) tend to consume energy corresponding to lifting water by some 1000' to 3000'. To desalinate any amount of seawater, the energy it requires would equal the energy required to lift that same amount of water over 4800 feet straight up. So for example, by simply comparing the elevation differences, you can see that desalination requires16 times more energy than the aforementioned 300' lift to the Loch.

Once water has been purified, **distributing** it consumes energy typically corresponding to elevating the water by at least 200'. This is because, as water is about to enter your house, it generally is at a pressure of no more than 85 PSI, the pressure delivered by a 200' high column of water. (Rule of thumb: about 1 PSI for every 2.3 feet of height.) An important principle is that ***we can reduce this distribution-energy expenditure to the extent that we acquire and treat the water at higher elevations.***

Here is a list of the elevations of various places in mid-County, as well as energy expenditures expressed in terms of elevation lifts. These elevations were used to determine the nature and the site locations for projects mentioned later in this document, notably the Lochquifer Alternative, the Cross-County (Raw Water) Pipeline, and Water Looping.

Approx. Elevation (')	**Place**
725	Graham Hill Pipeline highest pt.
600	Purisima Aquifer top percolation access point
577	Loch Lomond Res. when full
520	Scotts Valley Skypark
>520	Hansen Quarry
>400	Olympia Quarry
~400	Pasatiempo
320	Graham Hill WT Plant
240	Felton Diversion
~40	Tait Street Diversion
	Process
4800	Seawater desalination
1000 to 3000	RO on fresh water or tertiary-treating wastewater
>200	Pressurize for distribution

7. Heuristics – Costs, Lifetimes

a. Operating Lifetime

If project A costs $100M to build and Project B costs $150M, generally folks would favor Project A. Often what is forgotten is to factor in the operating lifetimes of the two Projects, or treating operating lifetime only as an afterthought. For instance, a reverse-osmosis project might declare a 30 year lifetime (desal is a case in point). Pipelines and dams, on the other hand, tend to last some 100 years, thus giving us 3.3 times more water for the money. Similarly, a polyethylene rain catchment tank might last only 15 years. Let's pull the issue of operating lifespans up front and realize that more lifespan equals more water. Incidentally, I think that the desal dEIR handled the issue fairly in the end. It just seems that some expensive but long-lived alternative projects are vulnerable to elimination at an early decision stage partly because their operating lifetimes are not fully valued.

b. Cost to whom?

When a purchase is being contemplated it is quite natural for the Water Department, say, to hold as important the cost to the Water Department. Or for the City government to hold as important the cost to the City government. However, what really matters—and what voters may hinge their votes upon—is the total cost to

the *community*, not just to the organizations which serve it. For instance, interest costs on a bond may borne by the Water Department and passed along to the City, and passed along again to the ratepayers. But it does not end there. At that point many ratepayers will be pressed to run up their charge card balances, HELOC lines of credit, etc. as a result. Furthermore, that money will not be spent on other items, including at local businesses. Hopefully our next dEIR economic impact analysis will start early, and will thoroughly address the question, "Cost to whom?"

c. Bonds

A bond is a useful tool. It's a way to buy something big. It's a way to get a benefit to happen sooner. It's a way to have future generations pay their share of the capital cost of facilities they will be using. And It's a possible way to get the best price, especially if the bond interest rate is lower than the rate of inflation.

If a project will cost, say, $130M to design and build, and we only have, say, $30M in liquid assets to use as a down payment, we'll need to get a loan for the $100M balance. A straight, simple, home-mortgage-type 30-year fixed rate loan at 3 and 1/8 percent interest, for instance, would incur interest charges of about $50M. In other words, interest charges may raise the "all-in" cost by an amount equal to half of the principal. Of course I have little idea of what the actual rate, term, or closing costs might be arrived at in the future when the actual financing happens for a project we are contemplating. But I do know that it may be significant, and I believe that to be fair and open with the voters, our best guesses about interest costs ought to be disclosed to voters more prominently than in the past. It is a legitimate and real part of what the voters will have to pay, and I believe it should be part of the answer to their question, "What will it cost, all in?".

In the case of the desalination project, perhaps we'd be talking $130M to build, plus some $50M in financing costs, plus of course the yet-to-be-decided energy mitigation sub-project costs—for a total in the general neighborhood of $190M.

Fully recognizing bond interest has another effect as well. It tends to make us thoroughly consider whether we might rather choose a less expensive alternative project, one which might be paid for mostly by the, say, $30M we might already have in liquid assets.

d. Multiplier effect

The bond market is international. One consequence of this is the great likelihood that almost all of the bond interest we pay will leave the County on a one-way trip and be gone forever. The economic impact of interest payments, therefor, is very different from payments we might make to our project's local construction company, whose owners and workers will receive our money and turn around and spend much of it *locally*. And when that money is spent at local establishments, those who own and work at those establishments turn around and spend some part of it at more local establishments. In this way, $100M spent locally could have a much greater net positive effect on the local economy, perhaps up to $300M. Economists call this the "multiplier effect". It happens because the economy of a county is not like the economy of a family: when the family spends, the money is gone, whereas in a larger economy, one person's expenditure is another person's income, and so we "float each other's boats" as the water project's money circulates and recirculates.

In a nutshell: The economic multiplier for local labor is somewhere between 1.00 and 3, whereas for bond interest, it is perhaps 0.01. Let's consider trying hard to buy local and to minimize the use of bonds, especially if we are being conscious about section b above, "Cost to whom?". Are there local lenders who will agree not to sell our bond to anyone outside the County?

8. Observations & Approaches

a. Purisima Urgency

[S43] Regard degradation of the Purisima Aquifer with a *sense of urgency*, to be fixed in 7 years, not in 23 years (20 years after a leisurely project start). Note that the permanently lost region of the Purisima will be getting larger *for the entire 23 years*—as will the water banking capacity loss. Furthermore, every well lost is a water source for which a replacement will need to be found. Do not let agencies and committees take too much precious time. Do not be fooled by the gradual nature of the process into thinking that the matter is not dire and urgent. Do not let it be someone else's problem. Expedite the recharge by promoting the aquifer as a water bank essential for drought protection for all—which it is.

[S23] Let SCWD store water in SqCWD's aquifer this winter, using in-lieu recharge, Beltz well injection, and/or Beltz well cessation, etc. Jointly commission a hydrological study as to how much of the stored water is returnable under the various hydrological scenarios, to convince SCWD as to the degree and likelihood of water being returned to SCWD, and to define the resulting contractual terms. Pursue the necessary water rights acquisition, be it of the emergency, temporary or permanent variety.

b. Concurrent Alternatives

[S14] Don't stop at one alternative; combine them, let them run concurrently, cherry-pick the best aspects of each. Having more than one source provides a fail-safe.

c. Catchment cost

I was trying to solve the problem of retaining water acquired in rainy winters and used in dry summers. Then I realized that a tank which is completely filled and completely drained, say, 10 times per year has a capital cost ten times less on a per gallon basis. So the trick of making tanks cost-effective is to find applications for them which re-use them multiple times per year. Looking at USGS hydrographs, I generally see two to five big storms per year. If you can choose a tank to be of a size which you can empty fairly completely before each next storm, you have multiplied its per-gallon value by the annual number of storms. Furthermore, if you can find an application which enables the tank to be fully cycled more than once per storm, you probably have a big winner. The hydrographs of San Lorenzo River water at Felton show a peak at each storm and a tail which lasts for about two to three weeks thereafter. I can provide information on cost comparisons of different catchment options if desired.

d. Pipeline is cheap

[S13] I constructed a table which contained the respective approximate costs to construct a number of subsystems, each having a capacity of 2790 AFY. The list included a dam, a conventional water treatment plant, a riverwater diversion, etc. One thing that struck me was that pipeline was cheap, relatively speaking, especially when one is considering spending over $100M for a project. I was told that although cost would increase with an increasing incidence of pumpstations, bridges, urban density, elevation change, etc., the base cost was only about $1M per mile, and that increasing pipe diameter did not increase the cost by much. Pipelines for water transfers and other purposes would not be prohibitively expensive. This concept helped drive me to come up with the ideas of the Cross-County (Raw Water) Pipeline, Detention Tub String, Lochquifer Alternative, and Water Looping, among others.

e. The 4 terms of Loch use

[S15] Raw water storage occurs for at least four different purposes, covering four respective lengths of time:

- Short term--minutes, hours or days—to smooth out the peaks and valleys in consumption rates, or to cover for temporary cessations in supply from other sources, etc.;
- Winter-to-summer--to cover two problems:
    1) to store water acquired throughout our rainy winters and dispense it throughout our dry summers until the rains begin again;
    2) to cover the phenomena that summer peak demand is roughly twice as big as winter demand.

- Several years—to protect the community against droughts, which have occurred sporadically, but on an average interval of 6.5 years.
- Long term—to anticipate global climate change.

Right now, the Loch is being used to deal with the problems of all 4 lengths of term. This is highly infeasible, as it creates conflicts in Loch management policy. For instance, using the Loch effectively for the winter/summer problem leaves the Loch relatively empty by the end of the dry season each year, whereas the Loch almost always needs to be left as *full* as possible if it is to be used for longer-term protection against drought and/or climate change. The Loch is "serving two masters". It is clear that the long-term storage job needs to be assigned to a different reservoir than the one doing the winter/summer job. For this reason, it is a very attractive idea to try to use our vast aquifers to perform most of the long-term jobs of drought protection and climate change mitigation, and largely relieve the Loch of those duties.

f. Dealing with Turbidity

[S12] It has been said that even though we divert only about one-sixteenth of our surface water on average, we cannot divert much more because the remainder is "too turbid". What is usually meant by this is that the water is above 30 NTU (nephelometric turbidity units, a measure of the abundance of particles suspended in the water) and therefor the water cannot be taken by the Tait Street Diversion facilities and treated by the Graham Hill Water Treatment Plant (GHWTP). In practice "too turbid" often implies that the water also contains unacceptable levels of toxins, notably septic system runoff (fecal coliform bacteria, etc.). This turbidity also limits the environmental desirability of pumping much more water up to the Loch—not to mention that the sandiness beats up the pumps.

So, "what does it take" to make use of this turbid water? One or more of the following:

1) One solution is to use only the cleanest of the remaining water and no more. That appears to be able to buy us a few thousand AFY, particularly if we include diversions from Soquel Creek and Zayante Creek.
2) Another solution may be to de-turbidify the water *before* storing it in the Loch (or elsewhere). Proven technology has existed for many years for this—and for much more severe cases than this. Rotating devices, sand filters, diatoms, zeolites, membranes, UV, ozone… Note that this solution involves pre-treating the water, not to potable standard, but rather to "Loch standard", which has the advantage that our pre-treated water will be diluted in the Loch and detained there while biota further degrade many of the undesirable elements.
3) Use diversion devices which leave much of the turbidity behind in the first place. Such devices include properly configured casing path wells, infiltration galleries and Ranney collectors. Water enters Ranney collectors after being filtered down through the river bed, giving Ranney collectors the ability to deliver water in the 4 NTU range in our case, I'm told. This is discussed in greater detail in the sections regarding Ranney collectors and the Lochquifer Alternative.

g. First payback is precious

[S31] One of the biggest concerns about water swaps expressed to me by senior Santa Cruz water officials was their lack of confidence that if they "loaned" water to SqCWD or to some other entity, they might not get it all back and the deal would constitute a net loss of water.

At first blush, that sounds serious, especially during a drought. But when you are in a drought and you want water back, it is the *first* water which comes back that is the most precious. By far. Certainly more precious than the water you originally loaned to them. The *first* water returned comes at the most critical time, keeps you out of curtailments, curtailment-related rate increases, business/ag shutdowns, embarrassments, killing off our plants, terrible publicity, losing elections, etc.. In contrast, the last few gallons won't even make the papers. The last bits mostly will be seen as just a small number on some balance sheet somewhere.

The real risk is not that repayment might be short, but rather it is the risk you take in *failing* to set up a water swap deal—and then having no recourse during a severe drought.

So the real goal is not a 100% guarantee that 100% of the water will be returned. Contract for 100%, privately think 80%, and still sleep well at night.

9. Consider the Temporary

[S18] Sometimes something temporary will suffice nicely, especially if a short time-period is part of the larger plan. Examples include short-lifetime or low-reliability equipment; leasing instead of buying, e.g., land;

a. Tide-over Projects

[S34] The state "owns" virtually all of the surface water; to divert some water for our use we must obtain water rights from the California State Water Resources Control Board. A big reason why so many alternative water supply solutions were eliminated from consideration in the past is that they required some adjustment in water rights, and that such adjustment was said to be likely to take some 20 years and stir up a number of adverse side-effects. Many water officials agreed that several alternative water supply projects were quite attractive IF we could just get over the water rights hump.

Applying the "What does it take?" strategy, I naturally concluded that we possibly could choose such alternatives if we either endured the 20 year timespan or somehow compressed it into a shorter timespan—or both. I discuss how to compress the timespan in Section 10, which has to do with regulators.

We would need to adopt some water supply options which would tide us over until the water rights arrived—hence the names "tide-over options" and "tide-over period". Examples of tide-over options include conservation measures, projects that succeed in getting temporary or even emergency water rights, projects which bring water from far-off places using ships, and projects which do not take surface water, such as seawater desalination, tertiary wastewater treatment, or wellwater (provided that the wellwater is used only by the local water district, or by the owner of the land the well is on, who is not allowed to sell the water). Another example is engaging a portable piece of equipment rather than upgrading an entire expensive plant in a way which may become unnecessary upon the end of the tide-over period.

Some tide-over projects may themselves require water rights, but may receive them in three years or less if there are no objections, especially objections from regulators. Section 16 "Upgrade Existing Intertie" (between SCWD and SqCWD) may be such a tide-over project. Another example may be noninvasive diversion of turbid winter stormwater using, say, a Ranney collector.

Bottom line: tide-over projects appear to be our ticket to succeeding with our best and most cost-effective major projects.

b. During Recharge Only

Some project alternatives, notably Lochquifer and the Cross-County (Raw Water) Pipeline, have the potential to recharge all three local aquifers at an astounding rate (in as little as 7 years for the Purisima Aquifer). Once the aquifers are recharged and we're all snug and drought-proof, some of the facilities won't be needed very much or very often. So it might be just fine—even preferable—to opt for equipment which may have a relatively short lifespan or perhaps relatively low reliability. This is especially true if multiple units of that equipment are used: if one unit goes down, the other units still carry the load and the project as a whole still succeeds. Servicing the failed unit might not even be necessary.

c. Diversion Systems

[S18b] Such is the case with several types of river water diversion equipment: casing path wells, infiltration galleries, and notably Ranney collectors.
Ranney collectors have a lot of advantages:

no dam
no impingement (the fish don't crash into them);
no entrainment (the fish can't go up the pipe, which holds potential harm);
they filter out turbidity (matter suspended in the water)(a big deal) without the need for us to change any filters or rid ourselves of the filtered-out goop (the river bed itself filters water as it descends to a perforated pipe beneath); and
they come at reasonable cost (according to the Tait St. Sanding Study).

Ranney collectors may be just the ticket. Additional study needs to be done to determine "what it takes" to make them successful in the situations in which they might be used.

d. Pond Buy/Sell/Lease

A settling pond de-turbidify river water may no longer be necessary after aquifers are recharged. Thus the land may be leased instead of purchased, saving bond interest expense. If the pond will be an enhancement to property value, it may be purchased and re-sold at a profit.

e. Deepwater Desal: Ships

[S35, P21] Deepwater Desal at Moss Landing has claimed that its water will cost some $1650 per AF at their fence, which is many times the going rate for water. In order to bring its water to Santa Cruz, a pipeline costing some $32 M also would be needed. They told the SqCWD Board in a board meeting that DD's business is primarily about their data center at Moss Landing, and that they don't need our desalinated water business. It is looking like it will take them about as long or longer to get their operation running as it will take us to get ours running.

Sounds like 4 strikes to me. Nevertheless, there is a tiny chance we might be faced with using them as a tide-over project [see section 9a above].

If we find ourselves in a dire situation, instead of buying a Deepwater Desal equity share, a lifetime commitment or the like, we might consider offering to buy just some water--and only for as long as our tide-over period lasts. And instead of getting involved in paying for an expensive pipeline which we are not likely to continue using, perhaps we should look into more radical but temporary means of delivery, such as shipping the water using leased ships, barges, and/or huge plastic bags (in the ocean, bags of fresh water float).

10. Regulatory Buy-Ins First

a. 3 years instead of 20

In a SqCWD board meeting, their water rights attorney Peter Theil [sp?] said that water rights acquisition, if uncontested, now takes only three years, often less. This is in part because of how the California State Water Resources Control Board no longer advertises the existence of new applications until they are in a mature stage, where they are less likely to attract viable challengers. Since then, the drought has caused the Board to have more clout, resources and streamlined procedures as well. These events, together with growing momentum for legislative changes at the state level, strongly suggest that water rights acquisition can be a speedier process than assumed heretofore, and allow us to consider realistically projects which require water rights acquisition.

Let's do a little **critical-path analysis**.

6. It seems that many of the proposed water-transfer projects would solve our problems handsomely.
5. To implement any of these projects, we would need to get the water rights in a timely way (the state "owns" all of the surface water and a state board issues rights to that water).
4. To obtain a water right in some 3 years instead of some 20 years, our application must be uncontested.

3. This means dealing effectively with state and federal fisheries regulatory agencies, who have been principal contesters historically. Getting their broad, genuine and unqualified support right from the beginning is on our critical path.
2. To obtain said fisheries support, we must ask "What does it take?" and do what it actually takes, including learning what they want in detail and agreeing to provide much of it.
1. In order to accomplish step 2, we must do a number of things here at step 1:

b. Provide alternatives

[S21] First build sound documents describing alternatives, then approach decision-makers for tweaks and buy-in.

c. Measures to stay close

[S5] Stay close to regulators, ask about their dreams, and what they would do if they were you.

[S22] Define and budget for projects and mitigations which are aimed primarily at getting stake-holder buy-ins. E.g., fisheries regulators "dream" projects, environmental regulators "dream" projects, recreational Loch users mitigations/compensations, research to prove contested claims, voter seminars, etc.

[S4] Identify the winners who received timely regulatory approvals, learn what they did, and do similarly.

[S3] Ask "What does it take?"

[S6] Go for a conditional close with each regulator. This is a questioning technique which develops a complete list of what it takes for them to say "yes", eliminates all extraneous issues, and actually gets them to say "yes, if these [X] conditions are met". Then, when the [X] conditions are actually met in real life, we can go back and remind them that they have already agreed to the proposition.

d. Capitalize on crises

[S1] Use the threats/crises of local fish extinctions, aquifer saline incursion, and hexavalent chromium, etc. to obtain emergency and/or temporary water rights.

[S2] Use an emergency water transfer project as a means to form relationships with regulators and facilitate formal and informal discussions regarding projects involving permanent water rights acquisitions.

e. Provide incentives

The biggest incentive is likely to be the quick and complete recharge of the aquifers, as proposed by such plans as Lochquifer and the Cross-County (Raw Water) Pipeline. When the aquifers are recharged, they seep water into the streams—cold water, the kind fish need and love—and so the stream levels ("base flows") rise. This greatly benefits migration, feeding, protection from predators, etc.

[S11] Wherever possible, give water to fish explicitly when and where they need it most, using stream augmentation (see Section 17 - Cross-County Raw Water Pipeline) or water looping if necessary. (see Sections 18 and 19 regarding Water Looping)

[S44] Water Looping: If fisheries regulators say that they need more water (base flow, bypass, etc.) in a particular stream throughout a particular range of elevation at a particular time of year or set of conditions, consider water looping: pump water from the bottom of the range to the top of the range to significantly enhance the stream flow in that range of the stream for a few days or weeks of the year. Greatly boosts the stream flow for a time, at the cost of a little energy. At the end of the designated time period, the extra water stored in the stream and pipe could be used for human or fish benefit, just as if it had come from a reservoir.

Fix the lagoon: The alluvium of the San Lorenzo River (south of Highway 1) tends to be too hot, polluted and shallow for the fish which live there. Finish the present study, use some Tate Street raw well water, provide some shade, manage the sand bar better, etc. (see Section 23.)

Find solutions to the North Coast conflicts with regulators.

[S32] When the Loch and aquifers are full, consider using the proposed Felton de-turbidification pre-treatment infrastructure (a new settling pond) to *clean the river itself*, as an inducement to fisheries regulators and to give Tait Street/GHWTP a head start on treatment of water from the river.

f. Conditional water rights formulae

Most water rights diversion formulae are blunt, simple and fixed. The formula might, for instance, demand that from May through October a fixed amount of flow be left behind for fish habitat, e.g., "20 CFS bypass". The fixed number does not depend upon whether it is a wet year or a dry year, whether it is hot or cold, whether fish migration is completing nicely or seriously threatened, or upon the value of any other parameter. It is clear that by taking a closer look at these fixed formulae, more water might be able to be diverted without harm to fish habitat—in fact, it could benefit fish habitat.

[S41] "AC plus DC": Let things vary more often. For example, let the bypass flow requirement vary from day to day in the following way: instead of a straight 10 CFS bypass amount, let it be 12 CFS on even-numbered days and 6 CFS on odd-numbered days. The benefits include that fish often get 12, not just 10 CFS, and diversion gets an extra 1 CFS on the average. Of course, this technique may be appropriate in only certain seasons of the year, and only at certain elevations.

[S8] Propose *conditional* water rights formulae, depending on:

- rainfall amount and recency,
- hydrographic waveform characteristics,
- contract timeout,
- actual real-time data regarding flows and migration, etc.

[S10] Get stormwater rights to:

- all but leading faces of hydrograph peaks, or
- after each time a flow peak exceeds a threshold, or
- for even-numbered peaks of the season, or
- for all but the first peak of the season, etc.

[S11] For each diversion site, divide its hydrograph into pixels. Ask biologists and regulators for a "hydrograph pixel sequence", i.e., where the respondent replaces the pixels of a hydrograph one at a time, in order of fish needs; then we ask for rights to divert the last pixel, then the second-last pixel, etc.

Occasionally give up for the season: For instance, if the fish fail to migrate, it might not be necessary to keep providing until the end of the season the big bypass flows intended to support such migration.

If the science is sound, perhaps it is time to put such criteria into the water rights formulae.

g. Choose applicant

[S40] Run more than one water rights application at a time and see which wins. E.g., have SqCWD apply for Soquel Creek rights while SCWD/SVWD applies for Felton rights.

[S9] SCWD officials have expressed fears that an application for water rights at, say, Felton Diversion may give rise to the regulators making adverse re-evaluations of all *other* water rights and fisheries issues faced by SCWD. To leave SCWD rights undisturbed if possible; it occurs to me that SqCWD, not SCWD, might be the best entity to apply for new water rights, so as not to awaken the sleeping giants regarding SCWD. After all, SqCWD has a huge threatened aquifer to recharge, and precious little stream with which to do it. What does it take to overcome the legal problem that SqCWD is not in the San Lorenzo River basin? Is there a way to make it look like a qualifying water storage/swap deal?

11. Multipurpose Settling Pond

Winter stormwater is the class which regulators are most willing to part with and let us divert. The trouble is that this water is the most turbid. There are types of diversion devices, notably Ranney collectors, which remove most of the turbidity. However, if we want to make use of our *existing* diversion facilities at Felton and/or Tait Street, some serious turbidity removal scheme is called for.

Normally, some kind of settling pond would be constructed, with concrete walls and moving devices to sweep away the settled sediment. I propose a lower-cost settling pond which takes advantage of existing flat land near Felton Diversion, does not need to operate during the warmer part of each year, might be free of the need to dispose of the collected sediment, and might make enough of a profit to pay for a substantial share of the project.

Imagine laying large drain pipe (at least 6' diameter) on the top of the ground in the form of a rectangle the size of a football field or city block. Put a little dirt over it to form a berm and stabilize it. Cover or coat the entire area with some waterproof material (rubber sheet, aquaclude clay, etc.). In the bottom of it run some permeable pipe covered with graded rock and sand. You now have a large settling pond. There are two modes of operation, both using agar and/or an organic flocculent. One mode is that turbid water enters at one end and by the time it meanders to exit at the other end, it is much cleaner. The other mode has the water exiting downward, through the sediment previously deposited, and into the perforated pipes. So sediment is used to filter out more sediment. This might be called an infiltration gallery, a Ranney field, or another name which escapes me at the moment.

Whatever sediment that settles can just stay there. As more sediment piles up, the surface water level does too, and the pressure increases as a result, so as to help push the water through the increasing stack of sediment. After a while (a few years?) another story of drain pipe may be mounted on top of the first. One of the reasons for the drain pipe is to conduct floodwater around and past the site, to keep the structure intact and do serious flood control.

In some number of years when our aquifers have been recharged, the structure may have reached some three stories in height. At that point instead of being vulnerable, hardly-insurable flood plain, the top surface may have become buildable, or could be made so. A place with a much better view and a very good drainage system underneath. It might be sold at a substantial profit, which might pay for a large share of the entire enterprise. An alternative is to lease the land very cheaply, seeing as how the owner knows that he will get better land back at the end. One caveat: the site must be located so that it does not violate laws against constricting the river valley—or else it must get regulatory permission to become an exception.

12. Lochquifer Alternative

Divert SLR winter water to Loch Lomond and dispense it from the Loch throughout the year to water districts dependent upon wells, so wells rest and allow aquifers to recharge quickly.

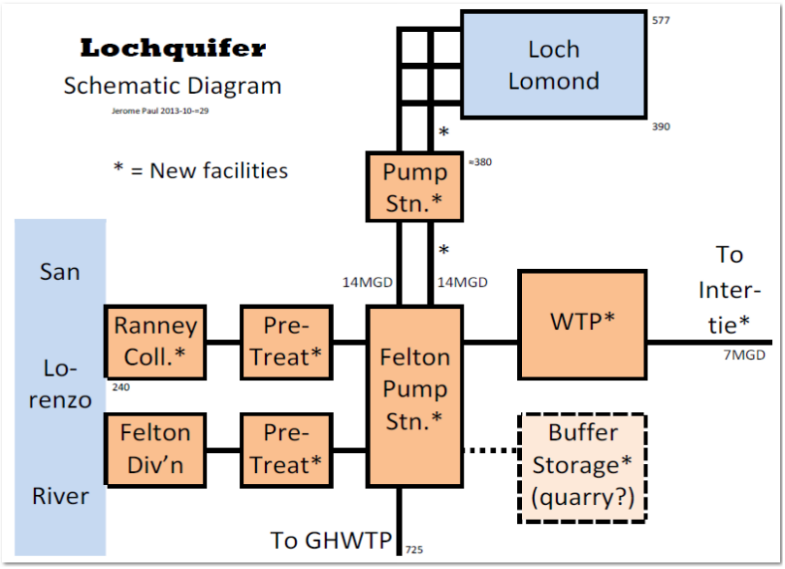
Benefits: [E = Effectiveness, I = Environmental Impact, P = Practicability]

- **E** Provides an extra 4700 AFY most years, over 3 times SqCWD's 1500 AFY target
- **E** Recharges aquifers 2 to 3 times faster: Purisima in as little as 7 years, Santa Margarita in as little as 4 years
- **E** Creates a vast water bank 6 times bigger than the Loch, to protect against long-term droughts.
- **E** Benefits all of mid-County.
- **E** Gives full yield even in most dry years, because winter storm water usually is still abundant.
- **I** Increases fish populations: cool water seeps from recharged aquifers into habitat base flows.
- **I** Increases dry-season flows at Tait Street Diversion, easier to meet bypass requirements.
- **I** Uses water which is not needed by fish habitat.
- **IP** Fisheries' approvals may be quick as a result, speeding water rights approval.
- **I** Good carbon footprint: Uses only about the same amount of energy per gallon as SCWD's current facilities. Also, hydroelectricity can be generated in the gravity feed to customers.
- **P** Operating cost per gallon is comparable to SCWD's current operating cost per gallon.
- **P** Low capital cost per AF of capacity, potentially 6 times lower than that of desal plant.
- **P** High yield on capital cost, because of long project operating lifetime. Potential profit on pond.

Summary: Increase Felton diversions and pre-treat water to a standard suitable for storage in Loch Lomond. Increase Loch pipeline capacity to about 28 mgd by upgrading existing aging 14 mgd pipeline and adding a second one. Quarry storage of stormwater surges probably will be unnecessary. Transfer to Felton some of the County's reserved 17,000 AFY Zayante Creek water right and/or obtain San Lorenzo River stormwater rights at Felton Diversion.

For water diversions use Ranney collectors predominantly, as they filter out most turbidity before it even enters their system, and because they are very friendly to fish. To pre-treat conventional (non-Ranney) Felton diversions for turbidity, build a low-cost settling pond nearby using large drain pipes to define its periphery and provide floodwater bypass routes. Years later when sediment has filled it up and aquifers are recharged, sell it as buildable land. (At that point, most of the Ranney collectors could be rested as well, except in drought-recovery years.)

Build an 8 mgd conventional water treatment plant to treat Loch water all year for the benefit of SqCWD, SCWD, SVWD and other water districts--which would rest their wells substantially and thus let all of the region's aquifers recharge at the highest possible rates. Locate the treatment plant at about the same elevation as the Loch so getting water from the Loch takes little energy, and so most customers can be fed via gravity only, without needing electric pumps. Such a good site for the plant might be in the Scotts Valley area, perhaps in a corner of one of the quarry properties.



EP ANNUAL WATER BALANCE SHEET

for the Lochquifer Alternative in an Average Year, stated in acre-feet per year (AFY)

INFLOWS

AFY	Source	Comments
1932	Rain	from 9 square mile watershed above the Loch, rough estimate
6000	Diversions	from San Lorenzo River at Felton and from Zayante Creek; this is the proposed rate of diversion, not the increase in the rate over the historical rate.
7932	TOTAL	5600 of this goes into Loch; the balance of
		2332 of this goes to water districts when diverted in the wet third of the year

OUTFLOWS

AFY	Destination	Comments
2332	WDs; wet	goes directly to water districts when diverted in the wet third of the year; its purpose is to rest wells, to let aquifers recharge quickly.
3494	WDs; dry	goes from Loch to water districts, mostly in the dry 2/3 of the year; its purpose is also to rest wells, to let aquifers recharge quickly.
		5826 AFY is the total amount provided to WDs for resting wells.*
675	Evap.	The Loch typically loses some 675 AFY to evaporation.
0	SLVWD	San Lorenzo Valley Water District has not been exercizing their 320 AFY right,but may begin to do so as a matter of degree sometime in the future.
145	Newell Cr.	Fisheries regulators rules require 0.2 CFS to be let out of the Loch at all times;this may be increased to 1.0 CFS, where it has been historically.
1286	SCWD	Santa Cruz Water Department's approximate annual average Loch water use
7932	**TOTAL**	**5600** AFY is the total amount coming from the Loch; it is the sum of all Outflows items with the exception of the first item. This number was chosen so that a full Loch would be drawn down to a level no lower than 1/3 of capacity.

EP NOTE: Even in most dry years, no WDs need to "repay" SCWD with their aquifer water; SCWD will merely use a larger share from the new treatment plant and the rested wells will resume pumping somewhat.

* The approximate amounts of new water which would be required to rest wells *completely*:

4100	SqCWD
1400	SVWD
450	SCWD
5950	TOTAL

P....**Cost Guesstimates ($M)**

12	Ranney collectors
15	Pre-treatment at Felton
8	Pump station on old pipeline
12	New pipeline and pump, 6 miles
35	New water treatment plant (add $20M if membranes are required)
15	Studies, engineering & permits
88	TOTAL (for planning purposes only)

Further study:

What does it take to use Ranney collectors in the site areas contemplated for new diversions?
What are the details of the optimal pre-treatment to meet Loch standard?
How much sludge will the existing Felton Diversion & its new settling pond remove? (nil for Ranney diversions)
What does it take to get regulators' early endorsements so water rights can be obtained in about three years?
What are the most important details regarding the new treatment plant; will it require membranes?
What does it take to make a profit from the settling pond?

13. Upgrade Existing SCWD-SqCWD Intertie

[P2] Expand existing 6" SCWD/SqCWD intertie now by increasing pipe diameter to 18" for a short distance; get emergency or temporary permit; install a bi-directional variable-speed low-pressure inline pump to control water transfer capacity of at least 2000 AFY; capture an extra 300 to 500 AFY this winter. Re-apply for rights each winter during tide-over.

Benefits:

- Low-cost intertie of considerable capacity
- Could be used almost immediately for water-swap protections.
- Relatively easy water transfer rights acquisition
- Tide-over: helps both SCWD and SqCWD both get water until a big project begins production.
- Removes the expensive multi-agency intertie from the critical path of water transfer solutions.

Summary: An expanded connection between SqCWD and SCWD, distinct from the multi-agency intertie, is already in the works but possibly on hold. However, the job in the works specifies only a 12" pipe, I believe; whereas a larger pipe, say 18", will save energy and increase capacity. Also, the job in the works specifies no pump, which means that water transfer differential pressures must originate deep inside the two respective systems and would need to be well-coordinated, and would risk the possibility that a transfer would cause some distribution customers to be at inappropriate pressures during transfers. In contrast, a low-pressure pump would handle generating the small differential pressure locally, keeping the pressure effects from spreading too widely to customers. Also, an inline pump would probably be much cheaper, quicker and easier to install than adding an entire pump station would be.

In short, if you're going to do the planning, get the authorizations and dig the trench, why not put into it the thing which will serve you the best? Also, in this era of saline incursion, drought and curtailment, why not start getting a few hundred acre-feet transferred THIS winter?

Further study:

- Should the intertie capacity be set at SqCWD's stated need of 1500 AFY, or at SCWD's drought need which may be up to 6000 AFY, or at SqCWD's present return pumping capacity which is ___ AFY?
- What is the revised project cost, including the in-line pump?
- What would it take for Scotts Valley water District to forego temporarily some of its right to transferred water during the tide-over period, so as to save the Purisima?

14. Cross-County (Raw Water) Pipeline

[P7] Conveys raw water, in both directions, between Loch Lomond and Soquel Creek. Can include diversions from any or all of the streams in between, and can augment any of the streams when needed for fish habitat. Stores winter water in Loch Lomond, then distributes Loch Lomond water throughout the year to the participating well-dependent water districts.

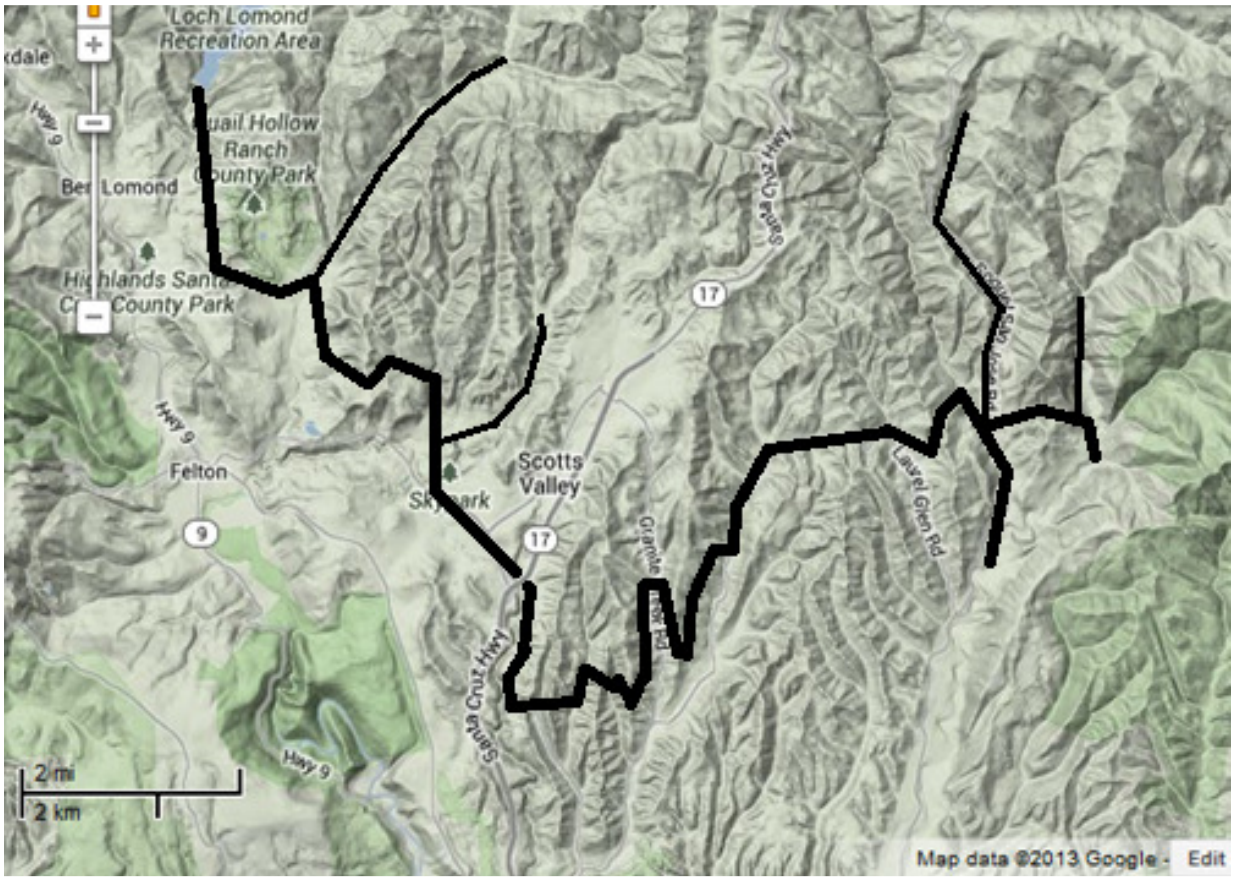
Benefits: **[E = Effectiveness, I = Environmental Impact, P = Practicability]**

E Provides massive flexibility of an inter-agency intertie at the raw-water level.
E Allows water to be transferred without first having to treat it very much.
P Allows water treatment facilities to be located in any district along the pipeline.
E Fills aquifers quickly, heads off ocean saline incursion into the Purisima Aquifer.
EIP Saves energy: water treated at the pipeline's elevation would go *downhill* to reach most users, and could even generate some hydroelectricity in so doing.
E Uses very little pumping energy because pipeline stays roughly level at roughly 500' elevation.
EI Apportions diversions among a number of streams to increase yields and lessen impacts.
I Assertively supports fish habitat: can augment almost every mid-County stream exactly when needed, at effective elevations, and at considerable volumes.
I Increases fish populations: cool water seeps from recharged aquifers into habitat base flows.
IP Water rights may be granted quickly because of considerable fish habitat benefits.
EP Can be used independently or in conjunction with a Lochquifer-type project for larger capacity.
P Might take advantage of SqCWD's 5,000 AFY reserve water right on Soquel Creek, and/or
P Might take advantage of County's 17,000 AFY reserve water right on Zayante Creek.
P Avoids CalTrans approval delays by crossing under Highway 17 with Glen Canyon Road.
P Cost guesstimate for planning purposes: $35M to $80M

Summary: The Cross-County Pipeline Alternative is similar in concept to the Lochquifer Alternative, but with several additional features. Both Alternatives divert water from streams during rainy months of each year and store the water in Loch Lomond. Both Alternatives distribute Loch Lomond water throughout the year to the participating water agencies which depend upon wells, so as to greatly reduce well use and thus allow rainfall to quickly recharge the aquifers—which then will become vast water banks for use during droughts, and will provide enhanced cool base flows for fish habitat. Additional capabilities of the Cross-County pipeline include:

1. **P** the ability to **divert water** from virtually every stream in mid-County. One object of this capability would be to reduce the total impact of diversion by making an inconsequential diversion from each of many streams rather than problematic diversions from just a few streams. Conventional wisdom says that it is better to divert water at lower elevations so the fish have use of it along the length of the stream. However, diversions under the Cross-County Pipeline Alternative would be almost entirely in the rainy season when water for fish is abundant; furthermore, diverting at higher elevations most likely will yield better water quality for humans.
2. **P** the ability to **exchange raw water** between agencies at any time. Water would no longer have to be treated to a potable standard before it can be transferred. When Graham Hill Water Treatment Plant is at or near full capacity and thus is unable to transfer water—which is the case throughout much of the year--the Cross-County Pipeline could accomplish the transfer.
3. **I** the ability to **augment**, or provide extra water to, virtually every stream in mid-County, to target specific fish habitats *when* and *where* the extra water is needed most to grow fish populations, in the judgment of specialists in fisheries matters. The map below shows examples of several small-diameter spurs leading uphill from the main pipeline to stream-augmentation sites. (1 cfs augmentation for two dry months per year is 120 AFY.) The flexibility of the augmentation infrastructure would facilitate original research in which the parameters could be controlled. This augmentation would be a significant move to intelligently *help* fish, as opposed to merely trying not to hurt them so badly.

The pipeline runs some 7.3 miles "as the crow flies" and some 12 to 17 miles as constructed.



Map of the Cross-County Pipeline Option number 1, some 16 miles of main, plus a few miles of small-diameter spurs for stream augmentation. –J.Paul

Lower-elevation routing options exist to the south, from Highway 17 to Soquel Creek. They may incur lower capital cost because of smoother terrain, but may consume more energy by dropping to low elevations. The main point in saving pumping energy is: all points where water enters or exits should be at similar elevations.

Stream augmentation of Carbonera and Branciforte Creeks may be relatively pointless from a fisheries standpoint unless environmental modifications are made to a drainage channel which they share for roughly their last mile before flowing into the San Lorenzo River. The entirely concrete channel probably does not now support anadromous species, and would need to be converted into suitable habitat.

To sum up, the Cross-County pipeline is a direct solution to the reality that most of mid-County's water sources are to the northwest, whereas the most dire need is to the southeast.

Further study:

- What treatment, if any, would Loch water need in order to be used for stream augmentation?
- What is the best pipeline route so as to minimize the sum of capital, finance and operating costs?
- Would it be better to locate the Soquel end of the pipeline at a lower elevation, on the theory that most water would be travelling from northwest to southeast?
- Is it better to locate treatment facilities in Scotts Valley, Soquel or both?
- At what cost level would the drainage channel modification be effective for fish habitat purposes?
- What do fisheries regulators have to say about the plan?

15. Water Looping

[S44] If fish biologists and fisheries regulators say that they need more water in a particular stream throughout a particular range of elevation at a particular time of year or set of conditions, consider water looping: pumping water from the bottom of the range to the top of the range to significantly enhance the stream flow in that range of the stream for a few weeks out of the year. This costs a little energy, but it may cause a huge boom in fish populations, especially in dry years by, for instance, by making fish migration possible, or by turning a string of puddles into a viable stream (and so fish can feed), or by deepening the water, which cools it, provides fish with more protection from predators, and enables fish to better jump hurdles. (I've been told that our salmon can only jump about as high out of the water as is the depth of the water they are jumping from.)

The most energy-efficient water-looping applications are for:
long stream sections which have only a small elevation difference between the high and low ends;
where major habitat benefits can be achieved by running the system only a few days or weeks per year;
where the stream has low flow volume (which is the case for every stream in a major drought); and
where large-diameter (i.e., low resistance) raw water pipeline runs parallel to the stream,
or might be installed for reasons which might have to do with some other project.

Here is an example of how it would work: at first, pump 10% of stream flow from the bottom of the selected section of stream through a pipeline to the top of said section; when that water returns to the bottom of the section, begin pumping 20% of the initial stream flow; when that returns, pump 40%; when that returns, pump 80%, etc. The net effect is to roughly double or quadruple the stream flow for a short time, at the cost of a little energy. At the end of the designated time period, the extra water stored in the stream and pipe could be released for human diversion or for fish benefit, just as if it had come from a reservoir.

16. Water Looping SLR Canyon

[S44] Anadromous fish migration up through the San Lorenzo River canyon from Tait Street Diversion to southern Felton reportedly has been a life-threatening problem for them. It takes a certain large flow volume for the fish to surmount the vertical barriers. Seeing as how a powerful pump already exists at Tait Street Diversion, capable of the 270 foot lift to Graham Hill Water Treatment Plant (GHWTP) at least, water looping may not only be feasible, but may also turn out to be a local species-saver.

A pipeline from Tate Street to Felton already exists as well, but it goes up Graham Hill Road to an elevation of some 725 feet, which would require lots more energy to operate than would a new pipeline along the river itself. (Tate Street is at about 70' elevation and Felton is at 240'). Use of the existing pipeline would turn a 170' lift into a 655' lift. Water coming from Loch Lomond to GHWTP goes through this unnecessarily high pipeline as well. When the pipeline was built, the state parks would not give permission to run it along the railroad right-of-way. But now, we can help the park save its fish and make a better carbon footprint. Fortunately, our local man John Laird is in charge of the state parks, is familiar with our water supply dilemma in detail, and has a dedication to environmental causes.

The new Tate St.-Felton pipeline would run about 4-miles. Its primary purpose might not be for water looping, but rather to replace the aging, energy-wasting Graham Hill Road pipeline, which carries water from the Loch and/or Felton Diversion over the 725' elevation point to GHWTP.

I would guess that the cost of the pipeline would fall between $2M and $6M because no pump station is required, the railroad right-of-way would make for easy trenching, and the pipeline might piggyback on some of the railroad bridges over the river.

17. Detention Tub String

[P16] **No water rights acquisition is necessary to do a wastewater recycling project. However, California Department of Public Health CDPH-requires that tertiary-treated wastewater not be treated as potable at least until it has been subjected to a two-month detention in an aquifer. A Detention Tub String simulates such detention by creating a completely sealed aquifer-type environment. For example, detainment cavity could be constructed under a plot of land, perhaps agricultural land, parkland, parking lot, sports field, etc. For 2-month detentions it would be cycled 6 times per year. Most tubs would cycle more often and would be strung in sets along a pipeline in order to be located conveniently.**

Benefits:

- No water rights acquisition is necessary
- Abundant potable water (up to some **6,000 AFY** of Santa Cruz tertiary-treated wastewater could become available).
- Speediest recharge of the Purisima Aquifer known to this author.
- Reduces sewage pollution of the ocean.

Summary: A Detention Tub may be constructed by removing some one to four stories of earth from several acres of farm land, lining the excavation with impermeable material, and then replacing the earth. Happily, most detentions would be shorter than two months: e.g., if the distance from an injection well to the nearest production well is, say 30 days, a Detention Tub could be set to cycle its water in 31 days (the remainder) and supply its output to the injection well. This detention tub would cycle 12 times a year. Detention Tubs could run at high or low speed to accommodate the actual results of water testing. Several tubs in widely separated locations could be strung together as a "bucket brigade" at 20 days each, for instance. They could be filled with existing dirt, water, and/or probiotics, so long as they are completely encased, including on their tops and bottoms. Use of the potable water enables participating water districts to shut down their wells, enabling extremely speedy aquifer recharge, possibly in as soon as seven years.

Sewage ("wastewater") is viewed by many as an unwarranted pollution of the ocean. However, tertiary-treated wastewater is not considered potable, both legally and actually, as it is said to contain unacceptable levels of prions, pharmaceuticals and other impurities. One method currently being used—notably by Orange County, California—is to detain tertiary-treated water underground for at least 2 months, allowing anaerobic bacteria and filtering action to degrade or remove the undesirable impurities. So far our mid-county community has failed to find a 2-month detention site: (a) because the distances between local production wells were judged to be too small to achieve the required detention duration, and (b) because it was only recently that the required detention duration was reduced from six months to two months.

However, the site or sites for detention:

- could be located in fairly remote places because pipeline is relatively cheap—in fact, the sites could be a "string of pearls" along a pipeline already needed to convey water from the water source to the users;
- need not be located in the aquifer whose recharge is the project's primary purpose; and
- could be entirely constructed, as opposed to natural.

Locate or construct a shallow aquaclude or aquatard layer and wall it off with impervious material such as clay, to make it into a confined space for underground water detention. E.g., consider agricultural land under which such a detention area (reservoir) is excavated and lined with clay aquaclude and then refilled with the excavated dirt. A percolation facility is installed just inside one end and shallow production wells or Ranney collectors are installed just inside the opposite end. To give an idea of size requirements, 9 acres x 30-foot deep = 270 AF, which at a 2-month detention time (6 cycles per year) yields **1620 AFY** for the case where the reservoir contains no dirt, just water and probiotics**;** the actual yield per acre would depend upon the amount and porosity of the dirt or other materials added into the space. To minimize the amount of excavation, the reservoir might be filled with extremely wet earth, covered with a buoyant layer, which in turn would be

topped with the original layer of farmable soil. The use of the land might be cheap, as it would allow the owner to continue to use the land for agricultural purposes as well. Another advantage to the farmer is that the land may be made more level and/or erosion-resistant in the process.

Other facilities in the project would include a tertiary wastewater treatment plant (studied by others and thus not covered here), a pipeline to the injection/percolation site, some modest water treatment for water exiting the site, and a pipeline to the desired potable water distribution system.

Further study:

- What are the results of past research on this topic?
- How much does large-scale excavation cost?
- Where are there plots of land suitable for such arrangements?

18. Weir Systems

Fish are often in dire need of slightly deeper water than they have. A weir could raise the water depth by a few feet in a local area of river, and store a bit of water in so doing. If weirs were under a biologist's computer-control, fish populations might skyrocket.

19. Stream Relocation for Dams

Two streams coming from side-by-side canyons often join together at a lower elevation. One canyon could be used as an off-stream reservoir if its stream were rerouted into the other canyon.

20. SLR Alluvial Plain Wells

The desal dEIR says that Carollo Engineers in about 2001reported well opportunities in the San Lorenzo River alluvial plane, yielding up to some 800 AFY, if I recall correctly. This water had problems, most importantly that it was not available year-around. Recharging aquifers does not have to happen year-around to be effective. Nor does using the cool well water to help the dire plight of fish in the hot alluvial lagoon.

21. Private Pumpers

Legislative changes may revolutionize this arena. Promote a regional Groundwater Management/Reclamation District to incentivize conservation among private well owners, and to gain their financial participation in groundwater recharge projects.

22. Suggested Action Items

a. Get regulators' support for water rights acquisition
b. Upgrade existing 6" SCWD-SqCWD intertie to 18", with bi-directional inline pump
c. Study aquifers, create models
d. Study settling pond
e. Ranney collector study: What does it take to make them work at the various sites?
f. Get expert 10% design and cost estimate for Lochquifer Alternative
g. Get expert 10% design and cost estimate for Cross-County (Raw Water) Pipeline
h. Get estimate and permission for Felton-Tate St. railroad ROW pipeline
i. Get expert "What does it take?"analysis of Detention Tub String viability and cost, for use in both post-tertiary wastewater treatment and in Scotts Valley quarry percolation pre-treatment.

Can the Liddell Quarry be repurposed as a water reservoir for the City of Santa Cruz?

Quarrying limestone and production of lime began on Liddell Creek the 1850s and continued until the 1870s. When the Davenport Cement Plant had depleted its limestone deposits in San Vincente Canyon in the 1960s, it began quarrying on Limestone Hill above Liddell Creek. The site was quarried from 1970 until 2008. This quarrying resulted in a 70 acre 400 foot deep hole. In 2012, I purchased the quarry property from Cemex with the goal of building a home on the land adjacent to the quarry. Cemex retains the responsibility of remediating the quarry which involves stabilizing the slopes, replacing the top soil that was removed, and then revegetating. The pictures below show the quarry site in 1967 and in 2007.

In 1916, the City of Santa Cruz purchased the water rights to a Liddell Creek spring that emanates from beneath where the quarry sits (designated by the blue circle on the image above). The City installed a water pipeline from the spring to the North Coast Pipeline. This spring has been providing high quality water to the City for nearly 100 years. The full capacity of the pipeline is frequently not fully utilized.

The quarry floor covers approximately 25 acres at an elevation of 750 feet above sea level. The lowest elevation of the rim is 830 feet. The quarry in its current form can hold approximately 2,000 acre feet (650 million gallons).

Approximately 500,000 cubic yards of material need to be moved as part of the quarry remediation. If this material were used to construct a dam as shown by the blue line in the image above, the resulting reservoir would cover approximately 50 acres, have a depth of 230 feet, and have a volume of roughly 8,000 acre feet (2.6 billion gallons).

To convert the quarry into a reservoir, the sides of the quarry which are currently ragged and stepped would need to be smoothed and then the quarry would need to be lined with a polypropylene or high density polyethylene liner. The cost estimate for smoothing the sidewalls is approximately $4 per square foot of sidewall area, or $2 million for the 2,000 acre foot option and $6 million for the 8,000 acre foot option. The cost of the liner is $0.50 to $0.70 per square foot. Installation is 10-50% of the liner cost. I expect that the installed cost will be $1 per square foot (high end) as the quarry walls are steep. The 2,000 acre foot option will have an installed liner cost of about $1.2 million. The 8,000 acre foot option will have an installed liner cost of $2.5 million. The liners are guaranteed for 20 - 40 years if uncovered. I would like to add Geocell filled with soil on top of the liner so that plants can grow as the water level recedes. This will add additional cost.

I estimate that the total cost of the 2,000 acre foot option will be in the neighborhood of $5 million.

I estimate the total cost of the 8,000 acre foot option to be in the neighborhood of $20 million.

It is possible that some of the construction costs can be covered by Cemex in lieu of remediation. Additionally, because the quarry has not yet been remediated, it provides an ecologically low impact site for a reservoir.

Due to it's location in EvapoTranspiration zone 1 (33" per year), shape, and depth, a Liddell Reservoir would have a 2% evaporation loss relative to it's volume (150 acre feet of yearly loss for 8000 acre feet of storage). Loch Lomond is located in EvapoTranspiration zone 3 (46" per year) and has a surface area of 175 acres and a storage volume of 9,200 acre feet (700 acre feet of yearly loss) or approximately 8% annual evaporation loss.

Yes, the proposed reuse of the Liddell Quarry can provide an economically, environmentally, and aesthetically attractive water storage option for the City of Santa Cruz.

Thank you for your consideration,

JoeBen Bevirt

From: John McGuire
johnandcarol@att.net

Water Supply Alternatives

1. Water reclamation:

Water reclamation is a tried and true alternative. Orange County has been doing it for about 40 years. Reclaimed water can be used as a hydraulic barrier to seawater intrusion thus allowing greater pumping from the inland basin. Reclaimed water can, and should be used to supply the two golf courses, which use about 2mgd between them. When the golf courses are not in need of irrigation, the 2mgd can go to groundwater storage through percolation basins or direct injection. Also cemeteries and parks can use the reclaimed water. Costs are associated with treatment, solids disposal and distribution piping. While initial piping may be costly, the long-term cost is minimal. If groundwater recharge were used, private wells in proximity to recharge wells would have to be abandoned and municipal water supplied.

2.Purchase water:

Purchase of out-of-county water. It may be possible that the Santa Clara Valley Water District and the San Jose Water Company which operate Lexington Reservoir and Lake Elsman, respectively, have excess water in winter and, in the case of SCVWD in Fall when they ready the reservoir for winter floods. Pumping of excess water could discharge to the headwater of Soquel Creek at Summit Road for improved fish habitat and diversion downstream for recharge or treated direct use by Soquel Creek Water District. This new water could be shared with Santa Cruz.

3.Waste water treatment for semi direct use:

This is a proven method of providing potable water for public consumption. Except the public seems to consider it the least safe method. By providing discharge of treated wastewater to San Lorenzo River, up stream of the City in-takes at Tait Street, thus blending with the River, the stigma is reduced. However, the reclaimed water should be safe for all purposes. The additional treatment at the existing water treatment plant will provide a double safe potable water.

4. Increase surface diversions:

The San Lorenzo River and North Coast streams (except for Liddell Spring) are somewhat flashy and turbidity increases quickly rendering their waters difficult to treat. Constructing side stream facilities to reduce turbidity may allow using existing surface sources for longer periods. While high flows are beneficial to fish movement, the higher flowing turbid water is generally far beyond fish needs and thus available to the community. Two such side stream methods are a slow sand filter and a Ranney Collector. The Ranney collector is a system of horizontal wells adjacent to a stream emanating from

a single caisson. The Soquel Creek Water District could also use this system on Soquel Creek if water rights could be secured. Fish are not affected by this system because channel flows are high and intake pressure at the stream bank is low.

5. Desal:

Desal can provide our water needs but must be combined with environmental and cost tradeoffs. Regards the environment: intakes must be below the ocean floor to eliminate any chance for fish harm and treatment site must be located to eliminate neighborhood issues. Regards costs: cost must be borne by new development and power must be derived from solar energy.

6. Do nothing:

Do nothing, implies conservation would continue and a policy of neutral water growth would handle future development for a short period. Customers would probably volunteer to remove turf and opt for no water using hardscapes and parks and golf courses might find ways to tap into reclaimed water sources. A moratorium on new water demand would have to be considered.

John McGuire
Member
Engineers for Water Alternatives
415 National Street
Santa Cruz, CA 95060
johnandcarol@att.net

DRAFT: July 28, 2014

Water Exchange Evaluation:
Potential Yields and Costs under Various Infrastructure Upgrade Scenarios

The Santa Cruz Regional Water Exchange Project Proposes to transfer excess available surface water from the San Lorenzo River during the winter months of November through April. Water would be transferred to the surrounding groundwater agencies to supply their demands, allowing them to reduce pumping from their overdrafted groundwater basins, helping those basins to recover. As basin recovery occurs, increased groundwater levels will increase stream baseflow and available fish habitat, and during dry summers water could be provided back to the City of Santa Cruz to help meet their demands while leaving more flow in the streams for fish. The City of Santa Cruz would also benefit indirectly from some increase in San Lorenzo River flow and increase in groundwater levels in the western Purisima basin, which the City shares with the Soquel District.

The timing and amount of water delivered back to the City will depend on the condition of the groundwater basins, pumping capabilities of the groundwater agencies, and policies for basin management established by the governing boards. With current infrastructure and the addition of a pump station at 41st Avenue, Soquel could pump 1.44 mgd to the City, or 172.8 million gallons (530 acre-feet) over a 4 month period. This would be dependent on assurance that the additional withdrawal for that period would not have an adverse impact on seawater intrusion. This assurance could be provided by better knowledge of the location of the seawater interface, groundwater modelling, and/or an increase in basin storage resulting from prior deliveries and in-lieu recharge. Additional delivery to Santa Cruz from Soquel would require an increase in intertie and pumping capacity and additional wells. Delivery of water from Scotts Valley to Santa Cruz would require construction of an intertie and additional wells to be able to deliver 1 mgd, (700 gpm) 120 million gallons (370 acre-feet) in a 4 month period.

As originally conceived, winter water would first be provided to the Scotts Valley area (Scotts Valley and San Lorenzo Valley Water Districts), which is within the San Lorenzo Watershed, and would eventually lead to increased baseflow in Bean Creek and the lower San Lorenzo River. Any available water in excess of Scotts Valley demand would be provided to Soquel Water District. The eventual priority and timing of deliveries is a matter subject to negotiation and agreement among the water agencies.

The City of Santa Cruz utilizes the Confluence model to model its operations, taking into account the variation in demand, the availability of water from its various sources, and the capacity of its infrastructure to pump and treat the water. Confluence has been used to model various water transfer scenarios to calculate the expected yield during the range of historical hydrologic conditions. All model runs took into account the need protect fish habitat throughout the City operations and utilized the flow bypass requirements that are currently under consideration in the City's Draft Habitat Conservation Strategy. Under those conditions, it should be noted that the City utilizes the Tait Street Diversion significantly more than they have historically used it, leaving less water available for transfer to neighboring agencies. The total amount potentially transferred in a day is also limited to the actual daily demand of the groundwater agencies.

Winter flow in the San Lorenzo River is frequently subject to higher sediment load, higher turbidity, and increased organic and potential pathogen load, requiring considerable treatment to meet State Public Health requirements. Depending on the amount of water transferred, pumping more winter water from Tait Street, with treatment at the City's Graham Hill Treatment Plant, will require upgrade of diversion and treatment facilities and increased operation costs. Kennedy/Jenks Consultants has prepared an analysis of the improvements needed under the various scenarios and a planning level estimate of the capital and operational costs of those improvements.

The following scenarios have been evaluated:

0. Use of current water rights, current Tait Street Diversion capacity (7.8 mgd), current Graham Hill Treatment Plant capacity (10 mgd), and existing interties between Santa Cruz and Soquel to transfer water to Service Area 1and 2 of the Soquel Water District. This assumes a capacity of 1.48 mgd, based on hydraulic capacity of those interties.
1. Utilize current water rights and diversion/treatment infrastructure, with new interties to Scotts Valley (1-2 mgd capacity) and to Soquel (1.5-3.5 mgd capacity). This would also require some upgrades to the Tait Street intake to better handle the increased sediment load from increased winter use.
2. Increase Treatment Plant Capacity to 16 mgd. This would require replacement of the pre-treatment solids settling and filtration components and oxidation/disinfection components at the Treatment Plant.

3. Increase Treatment Plant capacity to 16 mgd as in Scenario 2 and double diversion capacity at Tait Street to 14 mgd by constructing an additional new diversion works and upgrading pumps.
4. Increase Treatment Plant capacity to 16 mgd as in Scenario 2 and upgrade treatment process to treat turbid source water up to 200 NTU, by upgrading the solids handling process. This allows more days of diversion during the winter.
5. Increase Treatment Plant Capacity to 16 mgd and turbidity treatment to 200 NTU per Scenario 4 and Tait Street diversion capacity to 14 mgd per scenario 3.

The following table presents the results of the yield and cost analysis of the various scenarios.

	Scenario	SqCWD Average Yield MG(AF)	SVWD Average Yield MG(AF)	Total Potential Yield MG(AF)	Capital Cost $M[4]	Annual Cost $M[4]	Production Cost/AF $/AF[4]
0	Current Tait/GHTP Infrastructure/ Water Rights/ Connections, 1.48 mgd to SqCWD SA1 and SA2[1]	145 (445)	0	145 (445)	5.8	0.1	1,020
1	Current Infrastructure/Rights[2,3] New interties (SV: 1-2mgd; SqCWD: 1.5-3.5 mgd)	39 (120)	106 (325)	145 (445)	26.95	1.90	4,260
2	Increase GHWTP Capacity from 10 mgd to 16 mgd[2,3]	95 (292)	108 (331)	204 (623)	77.53	5.24	8,420
3	Increase GHWTP Capacity and Increase Tait Capacity from 7.8 to 14 mgd[3,5]	333 (1,022)	154 (473)	488 (1495)	90.61	6.40	4,280
4	Increase GHWTP Capacity and Turbidity Treatment from 15 to 200 NTU (Tait at 7.8 mgd)[2,3]	136 (417)	124 (381)	260 (798)	85.73	5.91	7,410
5	Increase GHWTP Capacity, Increase Tait Capacity, Increase Turbidity Treatment[6]	384 (1,178)	174 (534)	558 (1,712)	91.68	6.68	3,900

Sources/Notes

[1] Kennedy/Jenks, Draft Technical Memo No. 3 Surface Water Transfer Alternatives, July 10, 2014

[2] Fiske, Phase 2 Water Transfer Analysis: Task 1 Results (Second Revision), May 22, 2013

[3] Fiske, Water Transfer Phase 2 Summary, June 27, 2013

[4] Kennedy/Jenks, Water Transfer Infrastructure Summary Report, October 25, 2013; costs are costs of production and do not include additional costs of delivery to customers.

[5] Fiske, Phase 2 Water Transfer Project Draft Task 3 Technical Memorandum: Potential Transfers with Unlimited Tait Street Capacity, June 20, 2013

[6] Fiske, Supplemental Analysis of Water Transfer Volumes, July 24, 2013

[7] Fiske, Water Transfer Project: Long-Term Analysis Scenario 2 (REVISED), June 22, 2012

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Strategy for improving the supply reliability

Piret Harmon <PHarmon@svwd.org> Thu, Jul 24, 2014 at 5:44 PM
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>

Groundwater Recharge/ Water Banking at Hanson Quarry

To utilize the inactive Hanson Quarry that provides optimal geological conditions to effectively recharge the Lompico Aquifer in Santa Margarita Groundwater Basin which has a great storage potential for long term water supply and drought protection.

The quarry is located in Santa Cruz County between Scotts Valley and Felton, off Mount Hermon Rd. It sits on top of the Santa Margarita Groundwater Basin that covers about 30 square miles in the Santa Cruz Mountains. The estimated cumulative decline in the basin is 12,000-15,000 AF, mainly contributed to high production levels in 1980s and 90s. The total pumping from the basin has decreased about 35% from historical highs and the groundwater levels have been relatively stable for the last 5 years.

Santa Margarita Basin with its favorable geological conditions could serve as a regional groundwater recharge and water banking site. An portfolio of the various source water supplies for recharge includes recycled water, surface water, storm water.

Scotts Valley Water District (SVWD) submitted an grant application for DWR Prop 84 Drought Funding for the project that would conduct feasibility and pilot study at Hanson Quarry to further evaluate the site and its capability for recharge. This project proposes to drill an injection /aquifer storage and recover (ASR) well and a new monitoring well that would be used to inject advanced treated water or for surface water injection and recovery. It will evaluate the source water and treated water quality to advanced treated recycled water recharge at the site. Included in the project is the assessment of San Lorenzo Valley Water District (SLVWD) water rights/contract options for Lock Lomond water and facilities need to deliver Loch Lomond water to Hanson Quarry under three surface water diversion/ conveyance/ treatment alternatives.

This project has the expected outcomes of directly increasing groundwater in storage and resulting in water supply reliability improvements for the region. Secondary long-term benefits are to increase summer base flow in San Lorenzo River and tributaries to improve conditions for Coho salmon and other anadromous fish.

Based on the findings and recommendations from the feasibility and pilot study, the site could serve as a surface water banking storage for other region’s water purveyors including Santa Cruz.

Piret Harmon

General Manager

Scotts Valley Water District

Main 831-438-2363 ext 202

Direct 831-600-1902

pharmon@svwd.org

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

PLease evaluate this

Randa Solick <rsolick@gmail.com> Thu, Jul 31, 2014 at 11:04 AM
To: santacruzwatersupply@gmail.com

Sorry this is a few days late, I just got back into town, and hope you can still consider it.

I support the 'Lochquifer' plan submitted a few months ago in the Sentinel, by Steve Newman; it seems to be the way to start on more storage. "To capture more winter water, the Lochquifer Plan would send half of Loch Lomond's water to Soquel every year - twice the amount of water that the district would have received from the desal plant. This way the Loch becomes half-empty and can collect and store a big amount of new water each winter. (Assuming rain, of course). Using all this extra water will require building some new infrastructure: pipelines and a treatment plant... The extra water gained after drawing the Loch down would be sent to the Soquel Creek Water District customers so they wouldn't need to pump so much from their wells. With so much less pumping from the aquifers, Soquel's aquifers could be fully restored in as soon as seven year. (He doesn't say where he gets that figure from.) In another ffour years or so, the Lochquifer plan could do the same for Scotts Valley's threatened aquifer... When completely restored, the aquifers will become a 'reservoir' over five times the size of Loch Lomond!... becoming water banks, quickly assuming the job of long-term drought protection for the participating water districts. During extended drought years, the needed water would be pumped from the aquifers. This is regional water sharing..."

Which is exactly waht we need - regional water sharing ideas. THank you, Randa Solick

Richard Luthy <luthy@stanford.edu>
to: SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Sarah,

An important opportunity is working collaboratively, with a regional approach and not just think narrowly of the water supply for the City of Santa Cruz by itself. Cites working together can provide regional benefits.

One opportunity would be the beneficial use of stormwater to replenish groundwater. The current stormwater management plan addresses the need for nonpoint pollution control but is silent on the co-benefits that could be achieved with stormwater capture.

Stormwater capture, treatment and recharge could reduce pollution to the coast and replenish groundwater at the same time.

Also, the transfer of excess high-winter flows from the San Lorenzo River to adjacent groundwater basins could help aquifers in the county to be replenished. Later, water could be transferred back to the City as water supply in dry years.

Watsonville (and perhaps other places closer to Santa Cruz) has places potentially where stormwater runoff could be recharged and stored as part of aquifer storage and recovery for water supply. I don't think the geology is very good for that within the City of Santa Cruz itself. The San Lorenzo River is sometimes very rapidly flowing in winter storms, so any new project would have to consider how to capture more of that runoff with an improved diversion structure.

I think the runoff in the San Lorenzo River would be free of chemical contaminants, because it doesn't drain an urban landscape. So the main treatment needed would be settling and filtration to remove suspended solids.

My main message is that "regional solutions can provide local benefits."

Of course this requires cooperation among agencies, but we all see that business as usual isn't going to work in the future. I copied Mary Bannister on the email, she is GM of Pajaro Valley Water Management Agency.

Best wishes, Dick Luthy

City of Santa Cruz Water Department
July 28, 2014

Proposal for Indirect Potable Reuse (IPR)/North Coast Agricultural Use

Concept

This alternative proposes using recycled water for agricultural irrigation through an exchange in which the City would provide recycled water to North Coast growers in all years, and in return, the City would obtain access to the grower's coastal groundwater basin to use as a reserve supply in drought years. Several major issues emerged with this recycled water concept during previous evaluations including: (1) uncertainty about the amount of groundwater available in a multi-year drought; (2) unwillingness of State Parks (the major landowner) to permit groundwater pumping for the water exchange; and (3) opposition by local organic growers (Gary Fiske & Associates, 2003).

Characteristics

Effectiveness. What is the project's effect on supply and/or demand

The exchange of recycled water for agriculture groundwater is assumed to provide up to approximately 1,200 AFY of water per year. However, because the State Parks, the major landowner in the North Coast area groundwater basin, appears unwilling, at least historically, to consider the groundwater exchange project, and local growers are unwilling to use recycled water, this alternative project has not been considered to be viable nor to provide potable water to meet the supplemental potable water supply objectives of the City and the District.

Environmental Impact. Provide a brief consideration of expected impacts.

Environmental impacts of this project would be associated with construction and therefore be temporary impacts. That said, additional piping up the coast may reveal impacts that are typically not found with the boundaries of the urban environment; those that are archaeological or historical in nature. These would be revealed in the environmental review process.

Practicability. How practicable is the project to construct and operate with regards to cost, reliability, and community considerations.

The conceptual level project capital cost of approximately $98 million was estimated during the scwd2 desalination project evaluation and was assumed to be shared by the City and District. Similar to the agreement for cost sharing of a regional desalination project, the City is assumed to pay 59-percent of the project capital cost ($58 million) and the District is assumed to pay 41-percent ($40 million).

The capital cost of the recycled water treatment facility ($30 million) is less than the regional desalination treatment facility because the overall recovery of the recycled water plant would be higher, only a part of the effluent would require reverse osmosis desalting and the materials of construction do not need to resist the corrosivity of seawater. However, the cost of the recycled water conveyance system and the groundwater facilities would be significant.

The average annual operating costs include treatment and pumping of the recycled water up to the large irrigation customers on the North Coast, and treatment and pumping of groundwater back to the City and District. The operating costs are lower than a desalination facility because the overall recovery of the recycled water plant would be higher, and the energy for treatment would be lower.

Terry McKinney
833 Pinecone Drive, Scotts Valley, CA 95066
(831) 461-0405

Dear Water Supply Advisory Committee Members,

I am submitting these recommended projects for your consideration as a member of the public and not as a representative of the city. As an industry advisor, mentor/coach for the American Water Works Association for the San Jose State University Student Chapter, I have multiple student volunteers (ten or more) that will be assisting me with the next phase of this process which will be to help research, develop and better define the scope of work for these projects. I think this will be an exceptional learning opportunity for these students (some of which are graduate students) who are very interested in Water Policy and Environmental Engineering

Project #1: San Lorenzo River Lagoon reclamation

At the heart of many of the discussions with the CA Department of Fish and Wildlife is how to address the adverse conditions to fish habitat in the San Lorenzo Lagoon caused by numerous human impacts on the river. I cannot see any water supply project moving forward without first addressing this issue and completing our Habitat Conservation Plan for fisheries. One strategy has been to add more water to the lagoon with the hope that fish migrate upstream, but this strategy obviously puts a strain on our already stressed water supply. While allocating some additional water to fish is necessary, I believe that this amount of water can be minimized though some of the ideas listed below.

The basic concept behind this project is to actively manage the water conditions of the lagoon similar to what would be accomplished in a commercial fish farm or hatchery. Fish would not be confined to a specific location, but multiple locations would be created to give optimal habitat and the fish would be allowed to freely move between the locations. The question which would need further investigation would be how many locations and how large. Water temperature, Dissolved Oxygen and water level would be monitored and treated to provide optimum levels. This would be accomplished through the following engineered processes targeting just the areas in the San Lorenzo Lagoon with the greatest depths of water:

- Seasonal diffused aeration (Solarbee aeration units, Wastewater treatment ceramic membrane technology)
- Seasonal Shading (Most likely shade cloth, but trees or solar panels should be considered)
- Cooling towers to lower river water temperatures
- Pumping excess water to the WWTP similar to the procedure currently used for Neary's Lagoon
- Installation of solar panels to power the equipment
- River augmentation with advanced tertiary reclaimed wastewater

° Effectiveness: Current tolling agreements with the CA Department of Fish and Wildlife require substantial water release past the Tait Street intake to maintain hydrologic connectivity with the goal of improving fish movement and food transport. This practice accomplishes little and essentially wastes water for a worthy cause. Water quality for endangered species in the San Lorenzo River Lagoon is however the most important long term goal that must be addressed. Addressing lagoon water quality more directly through a more aggressively engineered approach should allow the city to reduce its water release requirements and provide a better fish habitat. Water supply would be increased based on the decrease in fish releases negotiated with the California Department of Fish and Wildlife. Temperature control with cooling tower technology will be the key to the success of this project. Cost of this project is unknown at this time and would need to be determined once the scope of work is better defined. I would anticipate a 1-2 cubic feet per second increase in water supply (1 cfs @ 24 Hours = 235.8 Million Gallons per Year MGY).

- Environmental Impact: This project would greatly improve the water quality of the lagoon, but would obviously have visual impacts depending on how shading was provided and whether or not solar power was utilized for the equipment. This project may be highly controversial due to its potentially large footprint on a natural waterway. I personally believe that the benefits would outweigh the costs and negative impacts.
- Practicability: Overcoming the political gridlock regarding a solution for the lagoon conditions may be something that cannot be overcome with this proposed project. From a technical perspective fish farming and fish hatchery technology already exists. I believe that it is feasible to transfer this technology to an open lagoon environment, to my knowledge it has never been attempted before. Diffused aeration is commonly used in the wastewater treatment field and is also transferable. Cooling towers are commonly used for various industries and would only need to be a simple "swamp cooler" technology.

Project #2: River/creek bank filtration with Ranney Collectors

The City of Santa Cruz has two raw water mains. One runs basically North/South from the Loch Lomond Reservoir to the Graham Hill Water Treatment Plant and the other East/West from our Coastal Sources to the treatment plant. Each of these raw water pipelines traverse creeks which could have Ranney Collectors installed so that water could be diverted from the creeks during the rainy season. A link to the Ranney Collector website is located at the end of this letter. Possible sites to target would be Baldwin Creek, Wilder Creek, Moore Creek, Meder Creek, Yellow Bank Creek, Powder Mill Creek, Eagle Creek and Zayante Creek. Another location for Ranney collectors would be near the San Lorenzo River Lagoon. Currently the Boardwalk and nearby businesses pump water from their basements when the lagoon depth is too high. Capturing this water with a Ranney collector would add another tool for managing the lagoon and create a new water supply.

- Effectiveness: Ranney collectors are a proven technology for high turbidity water diversion from rivers and streams. They receive log removal credit from the California Department of Public Health. I would anticipate 200 to 500 gpm during rain events. (200 gallons per minute for six months = 52.5 MGY, for each site. Therefore, if we had 5 sites we would collect 263 million gallons per year during rain events). Each Ranney collector would cost about 5 million dollars a piece.
- Environmental Impact: Minimal. The Ranney Collector is installed outside the creek bank alongside and tunneled underneath the river or creek. Many of these creeks are dry during the summer and thus are not associated with fish migrations. Creeks within the State Park land would require state approval which would be difficult to achieve. These creeks may need to be removed from consideration, but I believe that it is worthwhile to pursue these creeks with the goal of diverting excess water only. Electrical power would need to be brought to each site which would have some aesthetic/visual impacts
- Practicability: Diversions on the above creeks which are Coho habitat and/or on State Parks property would be impossible due to environmental regulations. However, Ranney Collectors withdraw water from below the creek and have little impact on the habitat above. In the case with the San Lorenzo River, there is a clay layer between the river water and the sub-surface water which further reduces the impact of the Ranney Collector. Such a geological layer may exist elsewhere. They have been studied by the city and have been found to be applicable for use on the San Lorenzo River. I am confident that an expanded study to these locations would receive the same results.

Project #3 Reinitiate water rights on Carbonera and Branciforte Creeks

The City has abandoned diversion dams and water rights on Carbonera and Branciforte creeks. While the current structures create barriers to fish migration, they could be retrofitted with fish ladders and have Ranney Collectors installed for water diversion. A small filtration plant would be required at each location for water to be delivered directly into the distribution system.

- Effectiveness: Ranney collectors are a proven technology for high turbidity water diversion from rivers and streams. They receive log removal credit from the California Department of Public Health. I would anticipate 300 -700 gpm throughout the winter for both creek diversions. (For 300 gpm = 158 MGY, two sites would produce 316 MGY) Each Ranney collector would cost about 5 million dollars a piece. Each membrane treatment plant would be about 1-2 million dollars a piece.
- Environmental Impact: Minimal. A Ranney Collector is installed alongside and underneath the river or creek. The diversion dams are already currently in existence so environmental impacts due to construction would be minimal. The dam on Carbonera Creek does not pose a barrier to fish passage andwill blend nicely with a Ranney Collector. The Branciforte diversion dam is proposed to be removed as part of the city's draft HCP. Use of Ranney Collectors are not dependent on a diversion dam, but their effectiveness is increased with one. I believe that a modified demolition of the Branciforte dam will achieve the desired fish passage and still be an effective support element of a Ranney Collector. Electrical power would need to be brought to each site which would have some aesthetic/visual impacts
- Practicability: Ranney Collectors have been studied by the city and have been found to be applicable for use on the San Lorenzo River. I am confident that an expanded study to these locations would receive the same results. Estimated cost for a Ranney Collector is about 5 million per collector.

Project #4: More wells located along raw water mains:

The raw water mains mentioned above also traverse several aquifers which could be tapped into as an additional water source in the manner as proposed with Project 2. The capacity of each well would probably be small, but a large number of the wells at various locations could be drilled. Upper aquifers that are under the influence of surface water would be targeted. Ground water would help dilute lake water and help lower DBP precursors. Potential well site would be at Bay Street Reservoir where an active spring exists, along Hwy 1 near the city landfill, in the Rollingwoods area, Felton Fair shopping Center and Newell Creek Road area. The combination of wells and creek water should allow the GHWTP to not have to rely on Loch Lomond water during he winter months as is currently required. Not drawing from Loch Lomond opens up the opportunity for more pumping to the lake from the Felton Diversion Dam.

- Effectiveness: Wells are used throughout the county. The expectations for well sustainable yields need to be reduced. I believe that well projects have been discarded in the past because the expectations were for them to produce 500 gpm or above which is not realistic for our county. If we lower our projections to 100 gpm (53 MGY), I believe that this becomes a viable option even though the cost per gallon would be extremely high relative to a normal well. If six 100 gpm wells were drilled, then an additional 600 gpm (318 MGY) of water would be added to our supply.

- Environmental Impact: Potential impact to local aquifers which could be managed by not running the wells during the winter allowing for recharge which is the current city practice. If higher aquifers are targeted that are under the influence of surface water, the impact would be less because there would not be many other users for this aquifer. Water treatment would not be required because it would be treated by the GHWTP.
- Practicability: Very practical, but will have a higher cost per gallon than a normal well. This option would probably raise some protests from neighboring water agencies. Each well would be approximately 1 million dollars each.

Project # 5: Drill wells near DBP "hotspots" in the distribution system to help lower DBP levels:

The GHWTP produces on average about 35parts per billion tri halo methanes which can grow in the distribution system to the high 70s ppb in certain areas of our system due to excessive water age in our storage tanks or "dead end" lines that have low water consumption. Ground water has a very small potential for producing disinfection biproducts and so utilizing ground water in small amount in specific areas can have a great impact on meeting regulations. Having some small 50 gpm wells located at these sites would introduce non- DBP forming water into the system and diluting the higher DBP water into acceptable ranges. Wells could also be co-located with our water storages tanks so that ground water would comprise most of the water in the storage tanks and thus water age in the tanks becomes less of an issue. Storage levels could be maintained at higher levels with non-DBP forming water inside them.

- Effectiveness: Wells are used throughout the county. The expectations for well sustainable yields need to be reduced. I believe that well projects have been discarded in the past because the expectation were for them to produce 500 gpm or above which is not realistic for our county. For this well project, only small producing wells would be required, probably in the 25 to 50 gpm (13 MGY -26 MGY) range. The purpose of these wells is to address disinfection byproduct levels in the distribution system and not necessarily for water supply augmentation. The importance of this project is to offset greater potential disinfection byproduct levels that may results from other supply projects.
- Environmental Impact: Minimal. Many of these proposed wells could be located at tank sites currently owned by the city. The low proposed flow rates for these wells should be insignificant to nearby wells or neighboring water systems.
- Practicability: Very practical under the current county well governance. While the effectiveness of ground water management in this county is poor and unorganized, this could change in the future. New regulations could make this option more difficult. These small well would probably cost approximately $200,000 each.

Project #6: Repurpose North Coast Main to deliver WWTP advanced tertiary treated reclaim water to City residents, north coast farmers and San Lorenzo River stream augmentation

The first phase of this project would be the installation of a 5.0 million gallons per day membrane plant located near the city landfill to treat raw coast water for delivery into our distribution system. The current raw water coast main would effectively end at this filtration plant.

The second phase of this project would be to disconnect the remaining main which runs to the Coast Pump Station at the San Lorenzo River and convert it into a reclaim water line. This line could be connected to the WWTP via two

options. The first option would be a pipeline from the WWTP up Bay Avenue to Iowa Street to connect with the coast main near the Bay Street Reservoir. This pipeline could also be extended up to UCSC as well. The second option would be to utilize the Scotts Valley WWTP effluent line which is being considered for conversion to a reclaim waterline for the Pasatiempo Golf Course. This effluent line is located very close to the coast main at several sites and runs to the City's WWTP. Construction costs for this second option would be minimal.

A third phase would require an upgrade to the WWTP to remove nitrogen and phosphate from it's reclaim water and treat it to a level for discharge into the San Lorenzo River augmenting the water flow in the river as needed for fish habitat.

- Effectiveness: Past studies of reclaim water have discarded this option because the city lacks the infrastructure to distribute reclaim water to customers. The cost of digging up city streets to install reclaim pipeline was believed to be cost prohibitive. Repurposing the coast main to a reclaim water main removes this obstacle. Water savings from this project would need to be studied, but I believe that 1 MGD of reclaimed water could be distributed to the Harvey West Industrial/Park area and UCSC alone for landscape irrigation and industrial uses during the summer and fall which would equate to about 180 MGY.
- Environmental Impact: Minimal, Most of the infrastructure is already in palace. Some modification at the WWTP may need land acquisition.
- Practicability: Reclaim water is used throughout the state and county. The ability to use advanced treated reclaim water for discharge into the San Lorenzo River would need to be studied.

Project #7: Build a second 10-12 MGD WTP at the San Lorenzo River Pump Station

A feasibility study has already been performed by the city to locate a second WTP at the San Lorenzo River Pump Station. If one were to upgrade this study to include concepts and technology used in the County transfer study, the city would be able to potentially treat river water up to approximately 200 ntu (a measurement for water cleanliness) which would allow the city to capture millions of gallons of additional winter rain water. The ability to stay on the river longer as the primary water source would greatly increase the opportunities to pump water from the San Lorenzo River up to Loch Lomond. While the Water Transfer study proposes to transfer this water to neighboring water districts, I would not recommend pursuing this option.

- Effectiveness: The technology described in the County Water Transfer study is proven to effectively treat the proposed 200 ntu water. Disinfection byproduct formation would need to be studied. There are four scenarios presented in this study that can be looked at to determine quantity of additional water available, depending on what water rights the city would be able to attain. I would anticipate 1,500 Acre-foot per year increase in water supply with and additional capability to pump 100 million gallons to the lake each year based on scenario 3 of the water transfer study. The cost of this option is probably in the 30 million dollar range since the city already owns the property for the proposed site.
- Environmental Impact: Significant work at the River intake structure during construction. If Ranney Collectors were utilized with this project, this impact would be greatly reduced.
- Practicability: Two studies have already been performed to show that this project is practical.

Link to Ranney Collector Webpage:

http://www.layne.com/en/solutions/construction/ranney-collector-wells.aspx?mid=278

Wilson Fieberling
249 Third ave.
Santa Cruz, CA 95062
July 24, 2014

Santa Cruz Water Supply Advisory Committee
212 Locust Street Suite A
Santa Cruz, CA 95060

My name is Wilson Fieberling. I was Director of Public Works and City Engineer of the City of Santa Cruz from 1962-1982. Prior to coming to Santa Cruz, I had the same position in the cities of Roseville and Davis, California. For those cities, I was in responsible charge of their water systems. I have the necessary knowledge and experience to evaluate the many alternative solutions to our water supply problem. I have spent hundreds of hours studying our problem and have concluded that the best solution, by far, is to build an off-stream storage reservoir. This is one of the six alternatives listed on page 10, chapter 5 of the City 2010 Urban Water Management Plan, which is the most recent document that the city has put out explaining why desalination was selected.

Last year I met with the City Manager and Mayor, Hillary Bryant. She asked me to submit my off-stream storage solution to the Water Department in a comment letter on the E.I.R for the desalinization proposal. I complied with her request and I will ask the Water Department to attach a copy of it to this letter. It would be impossible to include all of the information in a two page letter. If it turns out that it is not feasible to build my recommended reservoir, which is to be located on state park land north of the existing city landfill 3 miles west of the city, I have located four other sites which would be suitable.

An off-stream storage reservoir with about 1 billion gallons capacity, which would be resupplied by pumping winter water though a 30 inch diameter pipe from the San Lorenzo River, would provide all of the water needed to take care of all of the needs of the city and the Soquel Creek Water District. These would include water to permit the District to rest their wells during the summer to prevent salt water intrusion, water to supply the city's need for water in dry years, and water to permit the city to release sufficient water to augment fish flows in the San Lorenzo River and coastal streams.

It is my opinion that if an off-stream storage reservoir of sufficient capacity is not built, the people of northern Santa Cruz County will suffer enormously in the future with periodic water shortages and with the highest water rates in the state.

Sincerely

Wilson Fieberling

TO: Heidi Luckenbach, Desalination Program Coordinator, City of Santa Cruz Water Dept., 212 Locust Street, Suite C, Santa Cruz, CA 95060
hluckenbach@cityofsantacruz.com

July 31, 2013

Dear Ms. Heidi Luckenbach,

My name is Wilson Fieberling. I was City Engineer and Director of Public Works of the City of Santa Cruz from 1962–1982.

Most people of northern Santa Cruz County feel that some of the winter runoff water from the San Lorenzo River could be pumped to a storage reservoir and then used in dry periods. We feel that it is foolish to let the fresh water mix with seawater and then have to remove the salt at greater expense and high energy use. In an average year, winter storms produce flows of about 25 billion gallons of water in the San Lorenzo River. We only use about one billion gallons and the rest is wasted into the ocean.

In 1953, the State Water Resources Board prepared Bulletin #5 entitled "Santa Cruz, Monterey Counties Investigation." This listed sixteen possible dam sites and estimated safe yield and construction costs. To serve the City of Santa Cruz it recommended construction of an off stream storage reservoir which was not on an active stream. It was called Doyle Gulch reservoir to be located near the south end of Rodeo Gulch road which is between Santa Cruz and Capitola. The first stage of this reservoir would have a capacity of 980 million gallons. A pumping station would be installed on the San Lorenzo River and 4.5 miles of 30 inch pipeline would be built to the reservoir.

The engineering firm, Brown and Caldwell, prepared a report for the City in 1956. They adopted the Doyle Gulch reservoir and calculated a safe yield at 2.4 billion gallons per year for the first increment. This much capacity was possible because water could be pumped from the river during winter storms which happen even during dry years. This reservoir might not be practical now because the land has been developed and the cost of the pipeline would be too high.

The City decided not to build the reservoir, but to acquire property and build reservoirs on Newell and Zayante creeks. I believe the City did this because we had experienced a major flood in 1955 which devastated the downtown and other low lands. This required construction of levees along the river. The two reservoirs would have eliminated flood waters from about 20% of the San Lorenzo watershed. The levees were designed to accommodate the largest storm on record centered upon the San Lorenzo watershed. We now have the threat of global warming which could result in larger storms such as Hurricane Sandy on the east coast and the Hurricane Katrina flooding in New Orleans. Flooding in Santa Cruz is also much more likely because the City is not systematically removing the silt and sand deposits in the lower reaches of the river as was originally

contemplated. If storm flows should happen during high tides the chances of flooding are high.

In 1980, the City decided not to build the Zayante dam and gave up the water rights as it was considered to be growth inducing. The City Council has never authorized an engineering study to justify this action. If the Zayante dam had been built the bonds would have been paid off by now and plenty of water would be available for our present and future needs.

Seawater desalination has been recommended to be the supplemental supply. A plant site is to be found on the west side of Santa Cruz and up to 2.5 million gallons per day will be distributed in west Santa Cruz. People in west Santa Cruz are concerned about the variable quality and taste of desalinated water as compared to the excellent water now received. Our good water would be exported to people in the Soquel Creek Water District. They are also concerned about locating pumping stations and the desal plant there due to the noise and vibration impacts. On average the desalinated water will be used by the City as supplemental supply 6 months of every six years. For the other 5.5 years, 2.5 million gallons per day of City water from other sources will be sent to the Soquel Creek Water District to reduce pumping from their wells, thus reducing salt water intrusion. The City will pay 58% of the capital cost. It is my opinion that this is a very poor financial arrangement for the City. The City water department estimates that it will cost 7 to 12 times as much per gallon than surface water. In order to study desalination, City water rates have risen greatly in the last decade only exceeded by the rates in San Diego and San Francisco. In order to return the salt and solids in the seawater to the ocean, the City plans to mix it with the sewage effluent and return it through the ocean outfall pipe. This will dilute the salt to acceptable levels. This is a waste of a valuable asset because the effluent is nearly clear water and should be used to recharge water aquifers, irrigate golf courses and parks as well as agriculture lands.

I have developed a solution which will solve the problem of extra supply to Santa Cruz, supply water to Soquel to prevent salt water intrusion, supply water during dry weather to provide for tier 3 fish flows in the San Lorenzo River, Laguna Creek, Liddell Creek, and Majors Creek, and reduce flood flows in the San Lorenzo River during winter storms. All this at a fraction of the cost per gallon of desal. I would construct an offstream storage reservoir with 1 billion gallon capacity three miles north of the City and north of the sanitary land fill and on State Park Land. Most of the dam has already been build as a result of the landfill. There is no water in this stream and it has never been a fish habit because the watershed area is so small. A waterproof reinforced concrete membrane would be placed on the slope of the dam and the southerly part of the west canyon wall. It would be necessary to have the site evaluated by a competent geotechnical engineer. In order to have a capacity of 1 billion gallons it would be necessary to deepen the reservoir about 25 feet, utilize steep banks and enlarge the reservoir area. Soil and rock from the excavation can be utilized to cover future garbage. It could be drained periodically to remove silt deposits. State Parks now own the Wilder Ranch State property as well as the Coast Dairy acquisition which have agricultural crops requiring irrigation water. This is the only State Parks, that I know of, with the word "Ranch" in its title and it should

expose the public to the present day coastal agriculture which is so important to our economy. State Parks should also participate in the use of reclaimed water permitted for irrigation.

The reservoir would not be visible from any part of the park used by the public. The City's 100 acres are surrounded by park land and the State should be anxious to include it within the park. The City could convey this land to the State in exchange for the right to operate a reservoir. The City would be able to operate the landfill until it is full. The State would be able to supervise the landfill to assure that the area would be turned over to the State in suitable condition for future park purposes.

During high water flows excess water from the San Lorenzo and North Coast streams would be pumped to the new reservoir. From the San Lorenzo, water would be pumped from the existing intake structure on Highway 9. A 30 inch pipe would run south on the levee, then on to lower Front Street and to the train tracks. Thence, within the recently acquired rail right of way to Dimeo Lane, and to the north end of the reservoir, this reservoir would be equivalent in size to the first increment of the Doyle Gulch Reservoir. It would yield the same 2.84 billion gallons that the Doyle Gulch would supply. This is because, even in dry years like 2012, winter storms do occur and the reservoir can be filled. The routing I propose for the 30 inch pipeline will pass a few feet above the City's outfall tunnel so that the properly treated wastewater could be pumped into it at a future time. This provides another future water supply option. Farmers in the Pajaro and Salinas valleys, where salt water intrusion is a serious problem, have learned to use reclaimed water. Water could be withdrawn from the reservoir near the surface at the south end and conveyed to the City in the existing pipeline from the north coast.

The new offstream reservoir is important because the City needs another source during winter storms. The only present source during winter storms is Loch Lomond because the river and coastal streams are full of silt and sand. Using flows from Loch Lomond makes it impossible to pump winter water from the Felton diversion to Loch Lomond during winter storms. Thus, Loch Lomond can not be used as an off stream storage facility for San Lorenzo river water. The City's water rights only allow it to use about 1 billion gallons per year from Loch Lomond. However, water could be stored in Loch Lomond to be released in dry weather to supplement fish flows. I understand that the amount of water needed for fish flows has not been determined, but it would be large. It is foolish to assume that the people of Santa Cruz could afford to pay for sufficient desal plant water to provide for fish flows. How will this water be provided if the desal option is adopted?

Why does the draft EIR only analyze the desalination alternative? It only solves two of the problems, the need for extra water in Santa Cruz dry years and the need for water in the Soquel Creek Water District so that wells can be rested to prevent salt water intrusion.

My alternative solves all of the City's and District's water supply problems, including provision of tier 3 flows in the San Lorenzo River, Laguna Creek, Majors Creeks, and Liddell Creek. It also mitigates winter flooding problems. All of this achieved at a

fraction of the cost per gallon. Initially, desalination would produce 2.5 million gallons per day or 912 million gallons per year. The safe yield of the reservoir would be 2.84 billion gallons, nearly 3 times as much.

Why does the draft desalination EIR eliminate other reservoir alternatives for the City in two paragraphs on pages 8.2-10, when State Water Resources recommended an off stream storage reservoir to supply the City, and the 2010 Urban Water Management Plan lists offstream storage as one of the possible sources of supply?

The EIR is required to consider a reasonable range of alternatives. And this is a reasonable alternative that the city must analyze. Not having information about this alternative before making a decision on the desal proposal will deny the Council an opportunity to make the best and most informed decision which is the objective of CEQA.

Thank you,

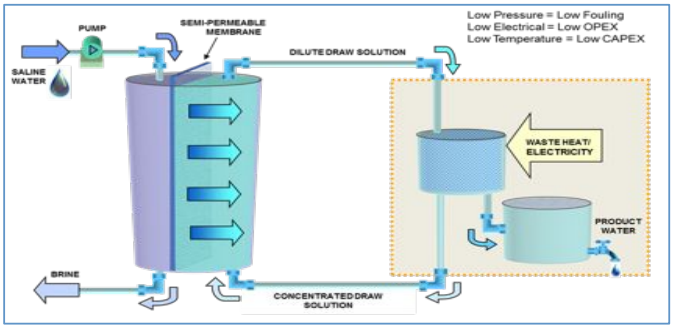
Wilson Fieberling
249 3rd Ave.
Santa Cruz, CA 95062

1 Willowbrook Court Ste. 140 Petaluma, CA
www.trevisystems.com 707.792.2681

A low GHG Desalination Process

Forward osmosis (FO) is a membrane filtration process, mimicking the natural process of osmosis, by which polluted water may be stripped of contaminants by an osmotic membrane. Trevi Systems Inc. of Petaluma, California, has developed an FO process that relies on a source of *low-grade heat* at 80°C to supply a large percentage of the system's energy requirements. Waste heat, rather than electricity, is used to desalinate the water. This FO process is at least 4 times more energy efficient than RO in electricity use. FO differs from RO in that osmotic pressure, resulting from the difference in solute concentration in the two liquids, is the major driving force for the transport of pure water across the membrane. In the RO process, water is driven through a semi-permeable membrane using an applied mechanical high pressure of 800-1000psi using energy hungry pumps. The uniqueness of Trevi System's FO desalting process rests in its use of osmotic pressure as a "driving" force to pass water through a semipermeable membrane, and then using thermal energy in the form of waste heat to produce pure water as shown in the fig 1 below. It is a simple and elegant method of purifying water while conserving energy.

Both RO and FO systems require pre-treatment of the sea water prior to desalting. Trevi's FO system requires lower chemical consumption than RO due to lower scaling and fouling, hence there is a small energy savings in FO pre-treatment. Both systems require post treatment (re-mineralization), since many of the beneficial salts are stripped out by the membrane filtration process during desalination. Post treatment and product pumping energy is similar for RO and FO.



Simplified FO Process Diagram as used by Trevi System

Market Readiness (Costs, Trials and Testing)

Trevi ran a trial with the US Navy and Carollo Engineers in Port Hueneme, California, demonstrating energy consumption below 0.8 kilowatt hours per cubic meter of water (kWh/m^3) and thermal costs of 100 mega joules per cubic meter of water ($MJ/m^{3)}$ in a 1 m^3/day system. Trevi is now conducting a second round of field trials at the Romberg Center for Environmental Studies in Tiburon, California, Masdar Institute in Abu Dubai (renewable desalination) and with the Orange County Water District (municipal waste water re-use). These studies will further validate the technology not only for coastal desalination but also for water re-use in both industrial and municipal applications at larger scale than the small Navy trial through the end of 2015.

Environmental Impact and Energy Costs, Trevi Systems FO vs. WSAC's proposed RO

WSAC's RO Electrical Energy Costs

Intake	1 kWh/thousand gallons
Pre-Treatment	2 kWh/thousand gallons
SWRO	10 kWh/thousand gallons
Post Treatment	2 kWh/thousand gallons

Total: 15 kWh/thousand gallons

Trevi's FO Electrical Energy Costs

Intake	1 kWh/thousand gallons
Pre-Treatment	1.5 kWh/thousand gallons
SWRO	2.3 kWh/thousand gallons
Post Treatment	2 kWh/thousand gallons

Total: 6.8 kWh/thousand gallons

If we compare the two tables above, Trevi System's forward osmosis process reduces the electrical energy consumption by at least 50% in a large plant. In order to achieve this reduction, a waste heat source has to be identified to provide the bulk of the energy. Examples of alternative energy sources would be industrial process steam, power plant cooling water, waste incinerator steam, bio-gas/ bio-waste thermal heat, geothermal wells, solar voltaic/solar thermal arrays, salinity gradient solar ponds and CNG, LNG or propane heat sources.

Reducing the energy consumption by 50% in turn also reduces the GHG's by 50% of WSAC's proposed RO plant. The GHG emissions from the proposed RO system is 3,950 MT CO_2/yr. and Trevi's FO system would be half of this at 1,975 MT CO^2/yr. yielding a savings of 1,632 MT CO_2/yr.

Options for GHG Reductions

Water and Energy Total	1,323
Renewable Energy	1,636
GHG Reduction Projects	70

Total: 3,092

If we look at the table above, the GHG reductions proposed still do not meet the 3,950 MT CO2/yr. requirements. If Trevi's forward osmosis system was used, then the amount of offsets needed could be reduced by 1/2, while still reaching the GHG Reduction target of 3,950 MT CO2/yr. for a carbon free goal.

An ideal solution would be to use a large CPV solar array, where the electricity is sold under a PPA, and the waste heat from the array is used to run the FO plant, resulting in an overall global reduction in GHG's even with the desalination plant running! We would propose Santa Cruz build the required infrastructure for any desalination technology, such as the intake, pre-treatment, outfall, post-treatment and pumping and decide on an FO or RO 'engine' once our ongoing trials have validated our technology and the results found commercially viable. Our plant performance will be made public once our tests conclude at the end of 2015. Any desalination plant construction will take at least 2-3 years even with expedited permitting so that a desalination technology decision need not be made now.

From Bud Miller
bmiller@cityofsantacruz.com

Residential Reuse:
Consider a Water Reuse Program. Make it Clear to the Public that the City allows grey water Reuse.Simialar to the Grany Unit Project supported by the City,let Reuse System Designers come up with approved Residential Systems.The City can analyze and approve Plans,display these Systems Online,giving credit to the Designer. .(taking into consideration the Impact on the residence Sewer System,as well as the Wastewater Collection System,and Wastewater Plant.)

City of Santa Cruz Reuse:
Consider Water Reuse for the Golf Courses, Playing fields within the City.The Wastewater Plant Effluent would be the Source, After Treatment. Install Purple Pipe when Repair or New, Sewer Line ,Water Line,Fiber,ext… are installed,in key locations Granting access to the potential User.This will Save Money and Negative Impact on the Public due to closing of streets and construction cost.
OR
Consider Using the Waste Water Plant Effluent ,after Filtering and Treating,for Discharge into the Upper San Lorenzo.This would have a positive Impact on the Watershed, through Increased flows. How much water is removed, with Increased Population,and returned into the watershed by septic Systems? Through increased Reuse flow,The Stealhead would Benefit during low flow summer months. The Water shed would then supply Potable water Far Downstream at the Existing Pump Site.

The Existing Railroad Propety could be used for the main Supply Line to both the Upper San Lorenzo or Delaveaga Golf Course,Pasatiempo,Playing fields etc…..The Reuse water Temp should be similar to that of Potable,after running underground.
* As for Desal,Remember the brine will be mixed with Effluent from the Wastewater Plant,this Reuse is Nescessary for Discharge Permitting. If you Process 7mgd of sea water,do you need 7mgd of Reuse water to mix with the Brine to meet Discharge Permit? If Desal is used for Our Potable Water Supply,is any Wastewater Plant Effluent left for Other Types of Reuse.What is the cost of Desal,Analyze,persuade,construction, maintenance,compared to other Types of Reuse? Will other types of Reuse satisfy Our needs as much as Desal Reuse?
Bud

Bud Miller
CWEA Elect.Instrumentation Tech.2
State Certified Electrician Lic.#E107500G
City of Santa Cruz WWTF
110 California St.
Santa Cruz,Ca.95060
(831)420-6047
bmiller@cityofsantacruz.com

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Public Input - Water Advisory Committe - Wave-Energy Desalination - Perth Australia as the model

Candace Brown <clbrown23@gmail.com> Tue, Jul 29, 2014 at 11:17 AM
To: santacruzwatersupply@gmail.com, Suzanne Haberman <shaberman@cityofsantacruz.com>

Hi City of Santa Cruz Water Advisory Committee,

I hope you will accept my late submission of an idea/strategy as it MUST BE INCLUDED in your deliberation.

The long-term prospect is that we will be faced with increasing swings in weather conditions and unpredictable water source. With that view of the world, and our small community, we cannot ignore the need to take our destiny into our own hands.

Creating water storage sources to capture the water already available is a good idea but it is not considering the impact on our underground aquifers and possible salt-water intrusion.

Therefore, I am leaning towards the desalination idea. However, the cost of energy makes it a very inefficient way to create a water source and therefore very expensive for a small community.

What is missing in this dialog is the need to find an inexpensive energy source for a desalination project. So as you look out on the Bay and ponder what to do…..Look no further! Wave action and the currents throughout the Bay provide a sustainable energy source.

And don't think that Santa Cruz is stretching the perspective of a wave-action desalination plant. Look to Perth who has constructed the first of its kind. Yes Perth, Australia. Below are links and I would encourage the Advisory Committee to seriously consider this option with the cost/benefit trade-offs of course always. You can google Perth Desalination and Desalination using Wave Energy and put up many more sources.

https://acaa.net.au/pdf/2008_tp_pp/perth_tp.pdf

Overview of Perth Desalination and very comprehensive on all aspects.

http://www.carnegiewave.com/files/asx-announcements/2014/140212_DPP%20Update.pdf

Wave Action Energy Source - Perth

I am happy to do further background research on this particular idea if you wish to have a further analysis and fleshing out of the idea.

All the best in your deliberation, Candace Brown

Home: 1-831-429-8362

Address: 249 Trevethan Avenue, Santa Cruz, CA 95062

Santa Cruz resident since 1974

RIPLEY PACIFIC COMPANY LLP
WATER REUSE INFRASTRUCTURE

Via email to: santacruzwatersupply@gmail.com

July 28, 2014

Santa Cruz Water Supply Advisory Committee
212 Locust Street, Suite A
Santa Cruz, CA 95060

Re: WSAC Invitation to Submit Strategies and Ideas for Improving SCWD's Water Supply Portfolio and Reliability

Dear Water Supply Advisory Committee (WSAC) Members,

Exploring new strategies and ideas for improving Santa Cruz's water supply reliability is an important task being undertaken by the WSAC. This response to the WSAC invitation consists of a 2-page summary of a comment letter provided by this team in August 2013 on the SCWD Regional Seawater Desalination Project Draft Environmental Impact Report (dEIR)[i]. More specific details related to the strategy summarized herein can be found in that comment letter. Contributors to the dEIR comment letter and this response to the WSAC's invitation include Dana Ripley, Bahman Sheikh, Mike Huck and Mike McCullough. We appreciate the opportunity to provide input to the WSAC exploration of strategies and ideas for improving Santa Cruz's water supply reliability.

Description of Strategy

The strategy proposed generally includes a potable groundwater/recycled water exchange with agricultural interests west and north from the city limits to Davenport. It was briefly explored in the 2003 Santa Cruz Integrated Water Management Plan and identified as *Reclamation/Coast Groundwater Exchange* (RCGE). It was also considered, but eliminated from further consideration in the 2013 desal dEIR. The proposal here is to reconsider this supplemental water supply in terms of increased reliability in the broader context of water use efficiency, coastal aquifer storage/management, stormwater capture, water exchanges, conjunctive use, and integrated regional water management.

While the plan considers non-potable water recycling in its initial phases, there may be future opportunities for indirect potable reuse (IPR) once the coastal aquifers and overlying soils have been characterized in sufficient detail. Figure 1 provides images of irrigation practices typical of ag parcels considered in the RCGE plan.

Figure 1 Agricultural Spray Irrigation at Wilder Ranch State Park, June 2014.

4847 Hopyard Road, Suite 4-322, Pleasanton, CA 94588-2713
office: +1 925-847-2086 fax: +1 925-416-1161

Effectiveness

Existing groundwater extraction for all parcels considered in this plan was estimated to be on the order of 850 million gallons per year (mgy) primarily during the irrigation season[ii]. About 70% of the ag parcels considered in the pumpage estimate are under control or management of California State Parks either at Wilder Ranch or Coast Dairies properties. The peak day groundwater pumpage is estimated to be about 6 million gallons per day (gpd), which compares to the existing dry weather ocean discharge of secondary effluent of approximately 8 mgd[iii]. Provided an appropriate agreement is obtained with State Parks and potentially other landowners, and a 1:1 exchange is not exceeded, there may be no water rights issues associated with this urban to agriculture recycled water exchange.

Environmental Impact

Direct beneficial use of 8 mgd of recycled water otherwise discharged to Monterey Bay, rather than using that same effluent for brine dilution, is in our opinion a far superior use of water (or effluent) resources. Even if brackish groundwater demineralization or IPR alternatives are added as subsequent project phases, the embodied energy (i.e. carbon footprint) and reject concentrate would both be small fractions relative to ocean desal. The RCGE alternative avoids ocean water intakes and minimizes future discharges to the marine preserve. It is anticipated that the Coastal Commission would prefer this water recycling alternative relative to desal.

Practicability

Precedent for use of tertiary effluent irrigation of raw eaten food crops has at least a three decade history in California, including projects in Monterey, Watsonville, Gilroy, Santa Rosa and elsewhere. The RCGE will require two pipelines (preferably in the historic railroad right-of-way) for the exchange, but this could provide multiple benefit on the Coast pipeline replacement project already planned in part of the railroad alignment. Ultimately, the right-of-way could be used as a trail for hiking and bicycles as well as a utility corridor for the two pipelines.

The major cost components for this plan include the exchange pipelines and a 6-8 mgd tertiary upgrade. The net supplemental water with this alternative would be equal or greater than the desal project and project costs substantially lower. State and federal grants and loans would likely be available for a substantial portion of project costs particularly if multiple benefits are identified and included in the project scope. Total project costs for the non-potable water recycling initial phase would likely be on the order of half to two thirds the cost of the desal project of equivalent net annual supplemental supply.

Closing

Please feel free to contact this office at 925-847-2086 or email at dana@ripleypacific.com if you have any comments or questions regarding this strategy and ideas response letter. We look forward to elaborating further on the RCGE strategy in the WSAC second round submittal due August 29, 2014.

Sincerely yours,
RIPLEY PACIFIC COMPANY LLP

Dana K. Ripley
RCE #C59192

---

[i] See SCWD[2] Desal DEIR public comment letter #E20
[ii] *Ibid.*, Table 2
[iii] Effluent flows likely decreased due to drought conservation.

From: Dave Martin

c.dave.marting@gmail.com

Suggestion for evaluation by Water Supply Advisory Committee:

The Dual Plumbed Facility

Title 22 Code of Regulations, Regulations Related to Recycled Water, of the California Department of Public Health defines the dual plumbed system.

> **§60301.250. Dual plumbed system.**
>
> "Dual plumbed system" or "dual plumbed" means a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:
>
> (a) To serve plumbing outlets (excluding fire suppression systems) within a building or
> (b) Outdoor landscape irrigation at individual residences.

Article 3 of Chapter 3 of these regulations specifies the uses of the recycled water, including:

(i) **§60304** Irrigation.
   1) Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop,
   2) Parks and playgrounds,
   3) School yards,
   4) landscaping,
   5) Unrestricted access golf courses, and
   6) Any other irrigation use not specified in this section and not prohibited by other sections of the California Code of Regulations.

(ii) **§60305** Impoundments.

(iii) **§60306** Cooling systems.

(iv) **§60307** Other purposes.
   1) Flushing toilets and urinals.
   …

The latest annual report from the City of Santa Cruz Water Department shows that more than 60% of water sales are allocated to residential customers, where the USEPA's WaterSense Program estimates that nationwide, landscape irrigation is estimated to account for nearly one-third of all residential water use. Further, the City of Santa Cruz Water Department reports that customers using water solely for irrigation comprise close to 6% of water sales. Therefore, recycled water has the

potential to add 25% to the water supply capacity available to the Water Department if all irrigation could be switched to recycled water.

Considering again that 60% of water sales are allocated to residential customers and the USEPA's WaterSense Program estimates that 26% of indoor water use is consumed by flushing toilets, the water supply capacity available to the Water Department could be increased further if recycled water were employed to create dual plumbed residential facilities within the water service area.

Why recycled water?
As Santa Cruz continues to grow, let us look toward the examples set by bigger cities who have already considered all possible methods to increase water supply.
Just a few California cities that currently use recycled water to supplement their water supply:

Sacramento and surrounding cities	Clovis
San Jose and surrounding cities	Carlsbad
San Diego and surrounding cities	Pittsburg
Los Angeles and surrounding cities	Watsonville
Redwood City	Santa Barbara
Santa Rosa	Oxnard
Ontario	Stockton
Pleasanton	Lancaster

The Association of California Water Agencies calls water recycling "a reliable, economically feasible and environmentally sensitive means to maximize California's water resources and reduce the demand on freshwater systems. Recycling programs mimic the way nature purifies water and treat wastewater so that it can be safely used to irrigate landscape, golf courses, crops and freeway medians, replenish groundwater basins, flush toilets and act as a barrier to seawater intrusion. Recycled water is also increasingly being used by industry in cooling processes, new home construction and for other purposes."

The practicability of utilizing recycled water in Santa Cruz would first involve an engineering study of where to produce the recycled water. The next phase of the project would study the most cost effective areas of the city to first introduce the in-ground water mains carrying recycled water and would consider candidate new or retrofit facilities for the dual-plumbing infrastructure.

For questions please contact:
Charles David Martin
376 Lee St.
Santa Cruz, CA 95060
c.dave.martin@gmail.com

or

http://www.cdph.ca.gov/certlic/drinkingwater/pages/lawbook.aspx
www.acwa.com
http://www.epa.gov/watersense/

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

MAJORS CREEK

DAVID LAUGHLIN <DLAUGHLIN@ebold.com> Tue, Jul 15, 2014 at 8:52 AM
To: santacruzwatersupply@gmail.com

Greetings. An additional source of water is Majors Creek on the North Coast. It appears that the location with the greatest capacity for impoundment is partially in Wilder Ranch Park, has paved road access adjacent and would require either "dead ending" or rerouting of only one road. The fact that the land ownership involves relatively few private property owners would make acquisition straightforward and the proximity to the existing water line to Santa Cruz makes this a natural. If the project were "marketed" and designed with a public recreation aspect, support would be broad-based. Quite likely at least a preliminary feasibility assessment has already been done, which you should get a hold of and review. And, although the capacity is modest, a reservoir at this location could be part of the solution. Lastly, it is my understanding that, because of the natural gradient of the creek, it is not a habitat for endangered fish, eliminating one of the major environmental concerns.

The only creditable objection I foreseen might come from the residents on the west or oceanside of the "dead-ended "road in terms of fire response times, which would be addresses by rerouting the road instead of dead ending it. .
In any event Majors Creek should be evaluated as a partial solution in the search for alternative water supplies.
Thanks for your time.

From: John McGuire
johnandcarol@att.net

Water Supply Alternatives

1. Water reclamation:

Water reclamation is a tried and true alternative. Orange County has been doing it for about 40 years. Reclaimed water can be used as a hydraulic barrier to seawater intrusion thus allowing greater pumping from the inland basin. Reclaimed water can, and should be used to supply the two golf courses, which use about 2mgd between them. When the golf courses are not in need of irrigation, the 2mgd can go to groundwater storage through percolation basins or direct injection. Also cemeteries and parks can use the reclaimed water. Costs are associated with treatment, solids disposal and distribution piping. While initial piping may be costly, the long-term cost is minimal. If groundwater recharge were used, private wells in proximity to recharge wells would have to be abandoned and municipal water supplied.

2.Purchase water:

Purchase of out-of-county water. It may be possible that the Santa Clara Valley Water District and the San Jose Water Company which operate Lexington Reservoir and Lake Elsman, respectively, have excess water in winter and, in the case of SCVWD in Fall when they ready the reservoir for winter floods. Pumping of excess water could discharge to the headwater of Soquel Creek at Summit Road for improved fish habitat and diversion downstream for recharge or treated direct use by Soquel Creek Water District. This new water could be shared with Santa Cruz.

3.Waste water treatment for semi direct use:

This is a proven method of providing potable water for public consumption. Except the public seems to consider it the least safe method. By providing discharge of treated wastewater to San Lorenzo River, up stream of the City in-takes at Tait Street, thus blending with the River, the stigma is reduced. However, the reclaimed water should be safe for all purposes. The additional treatment at the existing water treatment plant will provide a double safe potable water.

4. Increase surface diversions:

The San Lorenzo River and North Coast streams (except for Liddell Spring) are somewhat flashy and turbidity increases quickly rendering their waters difficult to treat. Constructing side stream facilities to reduce turbidity may allow using existing surface sources for longer periods. While high flows are beneficial to fish movement, the higher flowing turbid water is generally far beyond fish needs and thus available to the community. Two such side stream methods are a slow sand filter and a Ranney Collector. The Ranney collector is a system of horizontal wells adjacent to a stream emanating from

a single caisson. The Soquel Creek Water District could also use this system on Soquel Creek if water rights could be secured. Fish are not affected by this system because channel flows are high and intake pressure at the stream bank is low.

5. Desal:

Desal can provide our water needs but must be combined with environmental and cost tradeoffs. Regards the environment: intakes must be below the ocean floor to eliminate any chance for fish harm and treatment site must be located to eliminate neighborhood issues. Regards costs: cost must be borne by new development and power must be derived from solar energy.

6. Do nothing:

Do nothing, implies conservation would continue and a policy of neutral water growth would handle future development for a short period. Customers would probably volunteer to remove turf and opt for no water using hardscapes and parks and golf courses might find ways to tap into reclaimed water sources. A moratorium on new water demand would have to be considered.

John McGuire
Member
Engineers for Water Alternatives
415 National Street
Santa Cruz, CA 95060
johnandcarol@att.net

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Idea for extending water supply in SC

Kathy Haber <dannynor@cruzio.com> Tue, Aug 5, 2014 at 3:55 PM
To: santacruzwatersupply@gmail.com

Dear Committee, My idea is simple in concept, but probably complex in implementation. If you look at a map of Santa Cruz City, you will notice that Bay Street runs right past the sewage treatment plant and up to the University. At the U. there are at least 10 acres of playing fields, several of which are very close to the extension of Bay St where it crosses onto U. land.

I propose running a "purple pipe" carrying maximally treated recycled water up Bay St to irrigate the playing fields at the U. Now, how hard can that be? Digging up Bay ST and improving it would be a great idea, in any case. And then the U would have the moral high ground to insist on letting it's expansion go through.

Best wishes to all you who do this important public work,
Kathy Haber

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Please start Desalination discussion and let the public vote!

Mark Agnello <iggysc@cruzio.com> Wed, Jul 16, 2014 at 2:44 PM
To: santacruzwatersupply@gmail.com

If we wait until its an emergency to start this we will really have missed the boat. Its obvious now that we got to do desalination and ASAP! Mark Agnello 158 National St. Santa cruz, Ca. 95060 ph. 831-345-5041

STRATEGIES AND IDEAS FOR IMPROVING THE RELIABILITY OF SANTA CRUZ'S WATER SUPPLY

Submitted to WSAC by Paul Gratz - July 28, 2014

Using Available Recycled Water for Santa Cruz Golf Courses

Using recycled water supplied from the Scotts Valley tertiary wastewater treatment plant in order to provide for the year round irrigation needs of the two golf courses located within the City's water service area.

The dEIR does not describe and evaluate the alternative of directly using recycled water supplied from the Scotts Valley tertiary wastewater treatment plant in order to provide for the year round irrigation needs of the two golf courses located within the City's water service area.

The dEIR describes, evaluates and eliminates the use of a recycled water and potable water exchange with the Scotts Valley Water District and the City involving the Pasatiempo Golf Course (dEIR 8.2-16-77).

However, the dEIR is deficient in not identifying and evaluating as a supply alternative the conveyance of recycled water from the Scotts Valley wastewater treatment plant to the City and Soquel Creek Water District.

Since 2001, to save costs and resources the City of Scotts Valley's wastewater tertiary treatment facility has produced high-quality competitively-priced water for unrestricted landscaping and irrigation uses -- mainly parks, schools, residences, medians, cemeteries, agriculture, and businesses.

At the facility, state-of-the-art ultraviolet disinfection kills pathogens without the use of chemicals such as chlorine. Following disinfection, the tertiary treated water meets State Title 22 standards for water reuse in California and is safe for all permitted uses, including replenishment of water supplies such as rivers, groundwater basins, aquifers, and reservoirs.

Scotts Valley's 1.5 mgd (expandable) tertiary treatment plant operates at about 20% capacity. Currently, surplus water is discharged through the ocean outfall at the City's Regional Wastewater Treatment Facility. The Scotts Valley plant management is actively seeking potential regional customers for its state approved and affordably priced recycled water.

In 1989, the City's Water Master Plan prepared by Leedshill-Herkenhoff, Inc. identified as an alternative the reuse of treated wastewater from Scotts Valley "to be a viable and potentially cost-effective reclamation program available to the Santa Cruz Water Department."

In October 2007, Water Department Director Bill Kocher informed the Water Commission that "recycled water for irrigation purposes is recognized as a viable means of conserving water resources" and the "use of reclaim is a notable void in the City's Integrated Water Plan." With

regard to the Scotts Valley tertiary treatment plant, he added "the unused portion of this valuable resource is currently being wasted to ocean disposal."

On October 1, 2007, Deputy Director Almond reported at the Water Commission meeting that "recycled water is a missing element in the IWP. It would shift the delivery of water from the summer months to the golf courses to the winter (rainy) months when the City has abundant supplies. The state is promoting regional interagency projects by providing grant funding." The Water Commissioner's comments included the following recommendations (edited):

- The City should consider providing reclaimed water to additional City facilities such as DeLaveaga Golf Course and Harvey West Park.
- It is important that this project be able to demonstrate an advantage to, or improve our system in the next five to ten years, not just trading water. It should be equal to, or exceed the Water Conservation efforts described in the IWP.
- It would be helpful to be able to make a case that our need for future increments of desalinated water may be delayed or reduced in the future.

Santa Cruz Water Department's largest users of potable water for landscape irrigation are the Pasatiempo and DeLaveaga Park golf courses (dEIR 8.3-40). Together they use approximately 100 million gallons of potable water annually -- equivalent to the production of the proposed scwd2 seawater desalination plant operating at full capacity for 40 days. Pasatiempo's annual water demand is approximately 30-45M gallons and the DeLaveaga Golf Course along with the adjacent park use ranges from 40-55M gallons.

Section 4 of the City's Urban Water Plan I includes a chart of annual combined water consumption for the two golf courses expressed with for four sample periods: 2007-111M, 2008-120M, 2009-91M, and 2010 78M.

Currently, the potable water used by the City's landscape accounts is sold exclusively by the Water Department. The two golf courses are the largest landscape accounts and constitute a major source of revenue for the Water Enterprise fund. City taxpayers, however, subsidize the entire cost of the water and associated energy used by the municipally-owned DeLaveage Park golf course and the adjacent lower park.

In 2010, the California Department of Water Resources identified and ranked eight best practices planning strategies for creating potential sources of new water supplies in diverse regions. Urban efficiency ranked first and was followed closely by recycled water. However, desalination and cloud seeding were tied in the ranking at last place (2010 Bulletin 160-09).

Santa Cruz City landscape accounts are obvious potential customers for this highly affordable and available recycled water supply option and must be robustly and impartially evaluated.

KEY QUESTIONS

1. Why has the City regularly identified "recycled water for the district's two golf courses as a low priority?"

2. What would it take to achieve the conveyance of Scotts Valley recycled water to supply both golf courses?

3. What is the irrigation market demand potential for recycled water in the proximity of the City and Soquel Creek Water District's service areas?

4. How much increase in system yield and demand offset or reduction would result from both golf courses using water from the Scotts Valley tertiary treatment plant to meet their landscape irrigation needs?

5. With the Scotts Valley recycled wastewater system in place for non-potable applications, what would be the environmental, economic, social, and political impacts for the City and Soquel Creek Water District to use this alternative supply source?

6. If this recycled water supply strategy was implemented, what sales pricing and revenue impacts would the Water Enterprise fund experience?

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Fwd: desal

paullile@netscape.net <paullile@netscape.net> Mon, Jul 21, 2014 at 8:47 AM
To: santacruzwatersupply@gmail.com

-----Original Message-----
From: paullile <paullile@netscape.net>
To: santacruzwatercommittee <santacruzwatercommittee@gmail.com>
Sent: Mon, Jul 21, 2014 7:29 am
Subject: Fwd: desal

This could be a good temp. fix for us.
until we get back on track with our rain fall.
Paul Lile
To: paullile <paullile@netscape.net>
Sent: Mon, Jul 21, 2014 6:55 am
Subject: desalination ship

http://www.earthmagazine.org/article/dry-dock-wet-tap-old-ships-become-floating-desalination-plants

Prepared for City of Santa Cruz

Porifera Strategies and Innovations to Improve the Reliability of Santa Cruz's Water Supply

July 28, 2014

Summary

Porifera, a water technology startup founded in 2009 in Hayward, CA, is focused on developing forward osmosis (FO) based technologies to reduce the cost and energy use for 1) desalination, 2) reuse (industrial wastewater, municipal wastewater, and graywater), and 3) near zero-liquid-discharge (ZLD; waste volume reduction). **Figure 1** provides an illustration of FO, the commercial term for osmosis. FO occurs when a draw solution has a higher osmotic pressure than the feed solution and water flows by osmosis through a membrane. This water flow dilutes the draw solution and concentrates the feed solution.

Recent innovations in forward osmosis (FO) technology provide new approaches to provide low cost and sustainable projects to improve the reliability of the City of Santa Cruz's (City) water supply.

These include the following new idea options:

1. *FO as pretreatment for seawater reverse osmosis (SWRO).* This approach is a modification of the City's previous desalination approach, but would utilize FO innovations to reduce energy use, simplify environmental permitting related to the intake and outfall, and reduce footprint and cost.
2. *Fertilizer Driven Osmosis for Irrigation Water.* This approach would use common commercial fertilizers and soil additives to desalinate seawater and/or reuse wastewater for "point-of-use" irrigation purposes with "little-to-no" electrical energy.
3. *FO+RO for Point-of-Use Graywater Recycling.* This approach would use FO+RO systems to reuse wastewater for "point-of-use" irrigation or other non-potable purposes. Can be used in combination with Option 2.
4. *PRO+RO.* This approach would use utilize either treated wastewater or river water and FO membranes in PRO mode to reduce the energy needed for SWRO desalination.

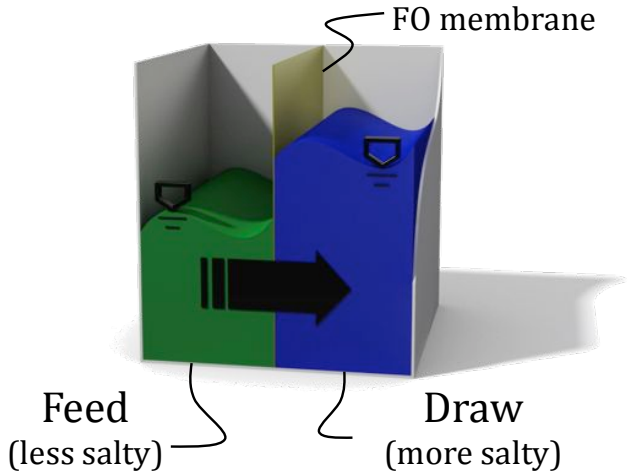


Figure 1. Water flow from a less salty liquid to a more salty liquid via Osmosis. This is the core mechanism for Forward Osmosis purification and allows reduced energy use when properly applied.

Table of Contents

The following sections provide introductory overviews of four new ideas to reduce energy use and increase sustainability while improving the reliability of the City's water supply.

New Idea No. 1: FO Pretreatment for SWRO Desalination

The first proposed option is to use submersible forward osmosis (FO) elements as the combined intake/pretreatment for SWRO desalination. The intent of this design is to provide balanced reductions in capital cost (CAPEX), annual operating cost (OPEX), and energy use. The following subsections summarize advantages and challenges with this approach. **Figure 2** illustrates this process in graphic form to visualize how this process works. **Figure 3** provides process flow rates, salinities, and recovery rates for reference.

Advantages

- **Lower Energy:** Although this approach slightly increases the energy use of the SWRO process, it often reduces the overall energy use for a SWRO project. The energy savings come from eliminating most or all of the energy needed for a) intake pumps, b) pre- and post-treatment, c) backwash & sludge systems, and d) other miscellaneous items. Energy savings depend of project specifics.
- **Easier to Permit with Coastal Commission:** This approach may simplify the permitting of the intake and discharge. For the intake, seawater would be drawn into the FO process by osmosis. So there would be no impingement or entrainment concerns. For the outfall, the overall system recovery could be less than 10% so if the seawater comes in at 35,000 mg/L of TDS, the concentrate would go back into the sea at <39,000 mg/L of TDS. Note the SWRO process will still operate at a higher recovery so pipe and pump sizes do not need to be larger to accommodate a low input recovery.
- **Lower Equipment and Construction Costs:** A FO+RO process is simpler and cheaper than a DAF+UF+RO process. There are fewer tanks, pumps, blowers, chemicals, instruments, etc. Therefore, the costs for equipment, structural slabs and supports, and building space are expected to be less than a conventional SWRO project.
- **Smaller Footprint and Reduced Land Costs:** If FO pretreatment can be installed offshore (e.g., under or around the pier), then the remaining SWRO system can be installed in a small space onshore (the space would be smallest assuming the permeate can be sent to the Bay Street Reservoir).

- **Better permeate water quality, less post-treatment required, and the best pretreatment solution during red tides:** There are numerous water quality benefits. These include:
  1) FO+RO has higher rejection of boron, algae, emerging contaminates, foulants etc. than UF+RO.
  2) FO+RO can utilize different salts as the draw solution to balance water quality and energy use. The lowest energy option to achieve CDPH requirements is table salt (NaCl).
  3) Utilizing MgCl2 (aka, road salt) as the draw salt provides TDS and boron concentrations than UF+RO and sufficient hardness so that calcite contractors are not necessary for post-treatment/corrosion control.

Challenges

- **Permitting Construction in an Offshore Environment:** A FO system has not yet been permitted and constructed in an offshore environment. It is anticipated that permitting will be easier if it could be installed onto an existing structure such as a pier.
- **Track Record and Durability in Offshore Environment:** We have not tested our submersible FO elements in an offshore environment, only in wastewater tanks. We are currently working with an oil company to test our submersible FO elements in their offshore simulation and torture chamber. This will allow Porifera to determine durability in offshore environments and to design improvements if necessary.
- **Biogrowth:** we have not yet determined the best approach to protect the FO membranes from marine biogrowth (e.g., barnacles) that can rupture the FO membrane in an offshore environment. It may be as simple as using a flexible fine screen that can be occasionally removed and cleaned and will be small enough to keep barnacle larvae out of the feedwater channels into the elements.
- **CDPH Permitting:** a FO system has not yet been permitted in California for drinking water. However, there is a precedent with RO to permit 2-log removal of pathogens and virus based on measured rejection of 2-log TDS. It is likely that remaining pathogen removal credits would come from chlorine and/or UV.

Note that there are many different ways to modify the design parameters of a FO+RO process. Also note that achieving the lowest CAPEX (highest membrane fluxes and RO feed pressure) will not provide the lowest OPEX or energy use (lowest membrane fluxes and RO feed pressure). Therefore, values were selected to provide a "balanced" approach to lower CAPEX, OPEX, and overall energy use compared to typical SWRO projects.

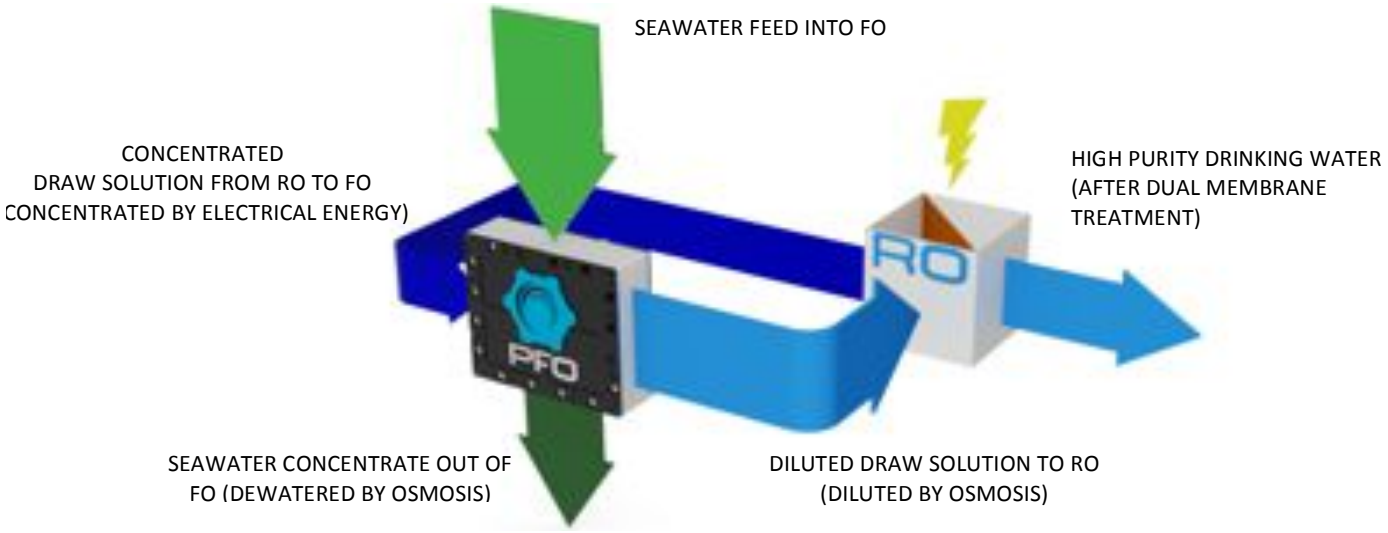


Figure 2. FO+RO Treatment Process Simplified Schematic

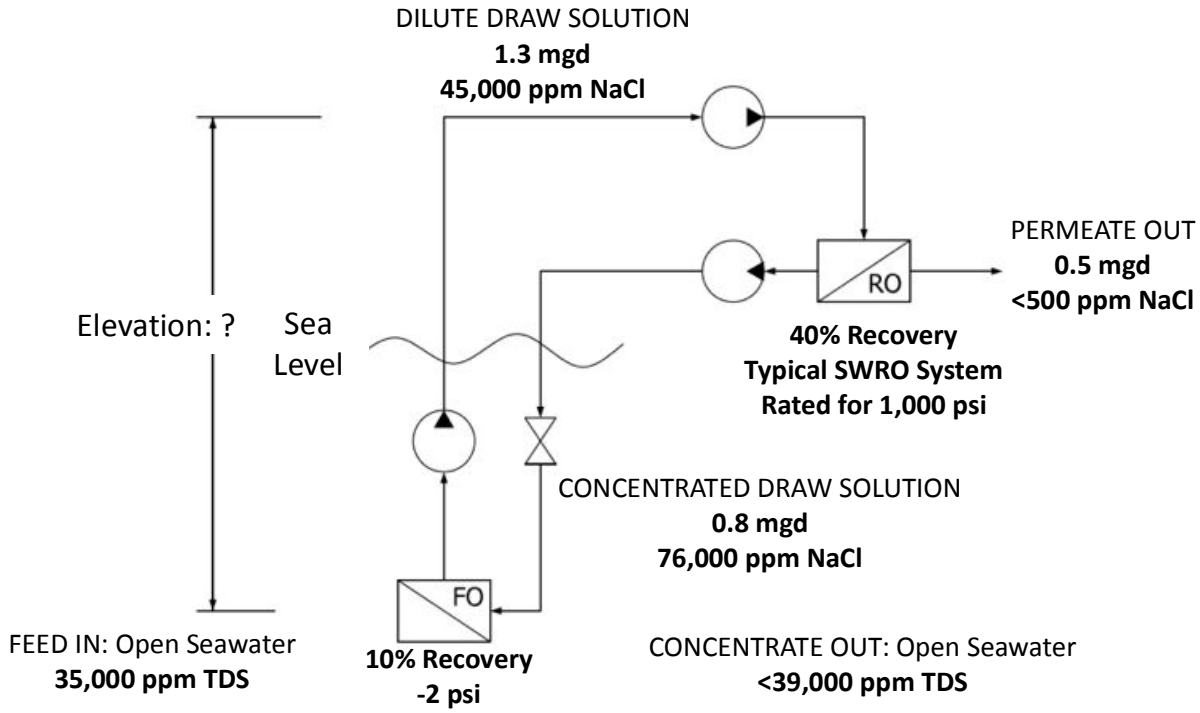


Figure 3. FO+RO Process Flow Diagram

New Idea No. 2: Fertilizer Driven Osmosis (FDO) for Irrigation Water

The second proposed option is to use FO to desalinate saline water or recycle wastewater for use as irrigation water and not drinking water. The reason is that liquid fertilizer and soil conditioners are used as the draw solution and these chemicals are not removed from the water prior to irrigation. **Figure 4** illustrates this process in graphic form to visualize how this process works.

Advantages

- **Little to No Energy:** Fertilizer and minerals (e.g., liquid calcium and magnesium based soil conditioners used to improve soil damaged by seawater intrusion) provide the osmotic power for desalination or recycling. Some electrical input is required to power the pumps for low-pressure circulation of the two streams and for instrumentation and controls.
- **High purity desalination and recycling:** The FO membrane provides high rejection of salts and contaminants similar to SWRO membranes, so boron and chlorides are rejected sufficiently if a moderate flux is maintained in the FO process.
- **Allows concentration and reuse of high BOD waste streams:** FO membranes are excellent at concentrating high BOD and high sugar (BRIX) wastestreams. Once dewatered, these concentrated wastes can be trucked to anaerobic digesters to create biogas for energy or to ethanol plants for conversion to ethanol.

Challenges

- **Fertilizer burn:** The main challenge with this option is that the concentrations of fertilizer are often too high in the product water for direct irrigation. The amount of dilution water can range from 10-90% depending on the salinity of the feedwater and the chemicals used as the draw solution.
- **Lab-scale verification:** Therefore, Porifera would need to work with the City or customers to determine which fertilizers and soil additives are currently used in areas that require a significant amount of irrigation. Porifera can then perform simple lab-scale verification tests to determine the cost and estimates for how much water and energy can be saved.

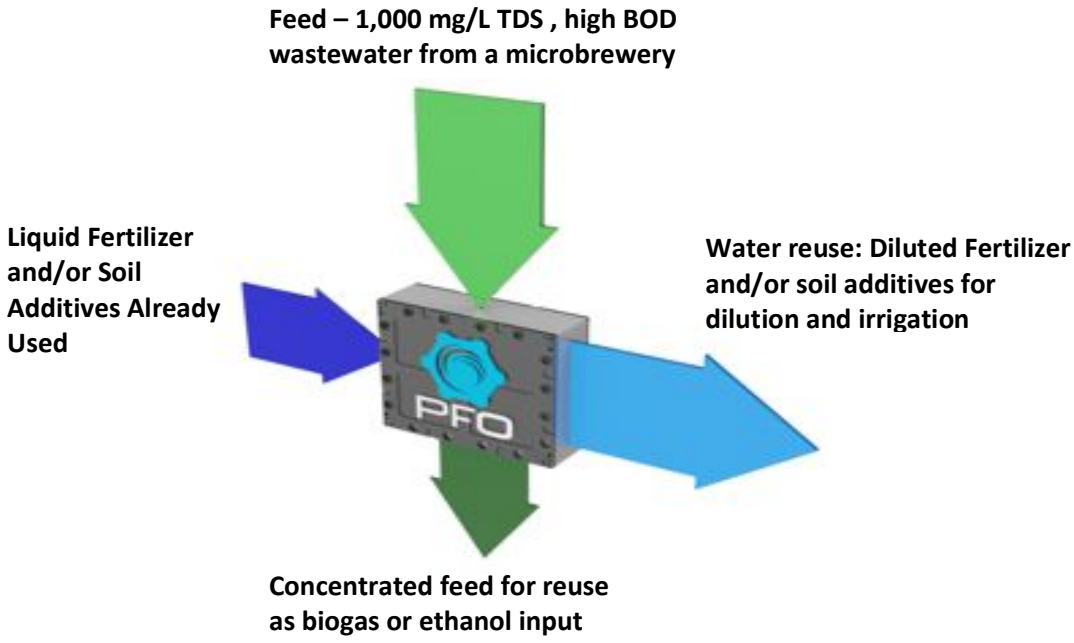


Figure 4. FDO Treatment Process Simplified Schematic

New Idea No. 3: FO+RO For Point-of-Use Graywater Recycling

The third proposed option is to use FO+RO for point-of-use treatment to reduce potable water demands for residential and commercial customers. **Figure 5** illustrates this process in graphic form to visualize how this process works. This process can provide the dilution water necessary for option 2 to be utilized without concerns for fertilizer burn.

Advantages

- **Point-of-use Treatment:** FO+RO would allow small point-of-use systems to recycle water for irrigation, washroom or other non-potable reuse at residential or commercial locations.
- **High Purity, low fouling:** FO can recycle virtually any graywater including hair, soaps, personal care products, etc. based on test data developed in collaboration with the US Army and NASA. A Porifera

FO+RO system will soon be installed at the NASA Ames green building for graywater recycling/reuse.

- **Reduced Sewer Flows:** Point-of-use reuse systems would significantly reduce WWTP sewer inflows.

Challenges

- **Cost:** Currently, production volumes of FO membranes and elements are low for both Porifera and competitors because it is a new market. Costs are expected to drop significantly over the next 1-3 years as the market expands and matures.

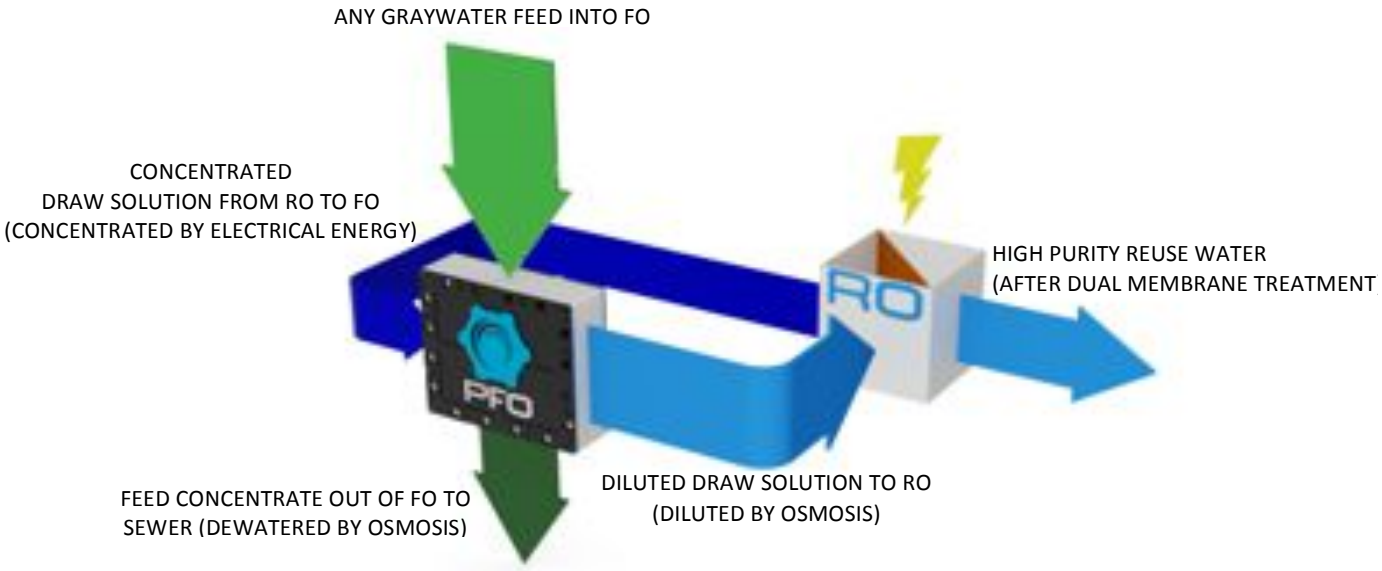


Figure 5. FO+RO Treatment Process Simplified Schematic

New Idea No. 4: PRO+RO For Low Energy Desalination

The fourth proposed option is to use FO in PRO mode to dilute seawater and reuse salinity gradient power to provide the energy input into the SWRO process. **Figure 6** illustrates this process in graphic form to visualize how this process works. This option is the farthest away in terms of development.

Advantages

- **Reduced Energy:** PRO and use of a patent pending SWRO system can capture and reuse all of the energy needed to operate the SWRO process. Some energy input into the system is necessary to overcome inherent friction and thermal losses within the system.

Challenges

- **Feasibility and Track Record:** This process has only been demonstrated at lab-scale and has not yet been developed or demonstrated for a large-scale system. Therefore, some R&D and pilot-scale verification is necessary before realistic planning level costs and energy savings can be estimated.
- **CDPH Permitting:** CDPH has not yet permitted a drinking water project that has wastewater as a feed input into the system.

Figure 6. HPCR Treatment Process Simplified Schematic

Summary of hydraulically combined PRO+RO (HCPR) process.

- PRO typically converts hydraulic energy into electrical energy. Conversely, HCPR utilizes PRO salinity gradient energy output in it's raw form (hydraulic power) without losses associated with generating electricity.
- Hydraulic power is generated with PRO, diluting seawater while concentrating wastewater. This power is directly used to desalinate the combined RO feedwater and generates high quality product water.
- Simple Power balance*: 200 psi x 1 mgd (PRO power generated) = 400 psi x 0.5 mgd (RO power consumed). Assumes feed temperature and salinity corrected to 25˚C & 32,000 ppm seawater; does not include pump and ERD inefficiencies or system friction losses.
- HPCR system requires almost no external power for desalination (higher CAPEX, but almost no energy).

Introduction to Forward Osmosis Technology

The following sections summarize the FO process and explain why PFO technology is an appropriate solution.

What is Forward Osmosis? An Overview

Forward osmosis (FO) is the process of using the stored energy in a salty stream to move non-salty water through a semi-permeable membrane via osmosis (no external energy is required). It is the opposite of reverse osmosis (RO), but similar to reverse osmosis in that the membrane rejects ions and trace contaminants. The result of the FO process is a high purity, salty water on the product side and a concentrated stream on the feed side. **Figure 7** shows how the FO process works.

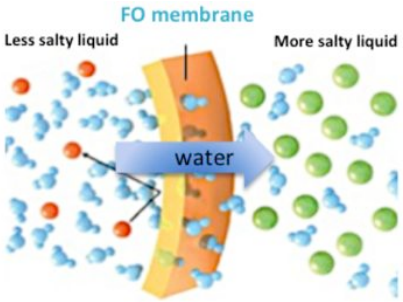


Figure 7. How the Forward Osmosis Process works.

Figure 8 provides a comparison of osmosis based technologies including forward osmosis (FO), reverse osmosis (RO), pressure retarded osmosis (PRO) and Pressure Enhanced Osmosis (PEO). PRO and PEO are variations of FO. PRO utilizes FO to capture osmotic energy and reuse as hydraulic or electrical energy. PEO adds external pressure to FO to make the separation process faster. P designates hydrostatic pressure, while π designates osmotic pressure. When both the feed water and "draw solution" have the same osmotic pressure, then they are at the same hydrostatic level as shown in the first part of the illustration. The efficiency of osmosis related processes are primarily determined by the amount of osmotic pressure difference and membrane permeability.

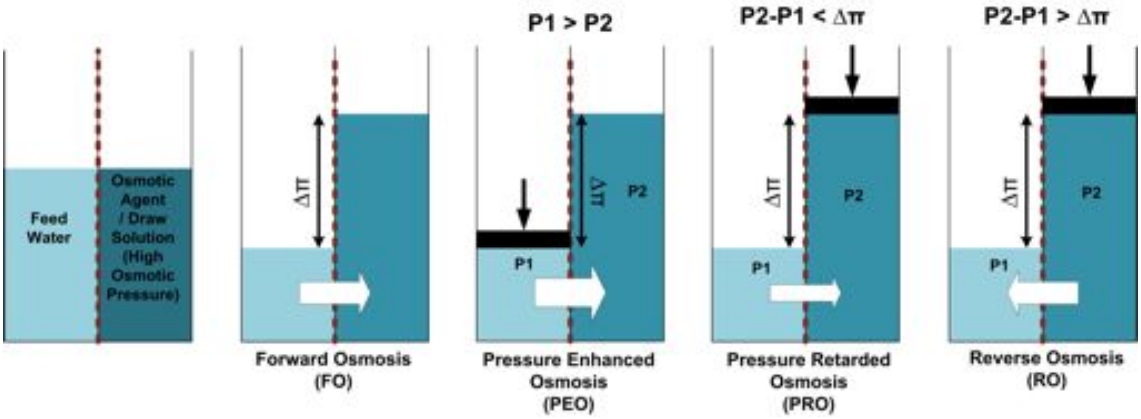


Figure 8. Overview of Osmosis Based Membrane Processes

AQUEOUS
Water Technologies, LLC

July 27, 2014

Sarah Mansergh
Santa Cruz Water Supply Advisory Committee
City of Santa Cruz

Members of the Advisory Committee,

Nothing goes back into the sea. Nothing! Our energy signature is less than RO at scale. Our system eliminates about 80% of the infrastructure your RO design requires (see attached chart). The AQUEOUS System is far cheaper to maintain; it is simpler; it does not use membranes, i.e. no membrane service contracts. We are in discussions on a pilot in Monterey Bay that should run this year.

Thank you for notifying us of the opportunity to present our approach to the freshwater crisis faced by Santa Cruz and the Monterey Bay in general. Santa Cruz is not unique in this challenge as this discussion is taking place around the world. As you know we have worked with a number of markets in helping them assess and strategically plan how to overcome surface over-appropriation and groundwater over exploitation. Santa Cruz has reviewed the situation carefully and approached options with appropriate skepticism, but one thing most water markets in the southwest still do not understand is that what they believe is the norm for draught - is not. Two major universities have studied draught cycles in the Southwest and discovered that draughts of 20 years are the norm - some have lasted 120 years. What is NOT normal is the rainfall the southwest has seen over the past 100 years.

Developing a supplemental freshwater supply system using desalination is a choice most global coastal communities are reluctantly facing. Santa Cruz has already carefully reassessed their existing supplies, seriously looked at their capture/treatment and the integrity (leaks) of their conveyance systems-technologies; honestly assessed and projected their demand no less than 50 years forward; and continues an open and honest dialogue with the customers that rely on these choices. Santa Cruz has approached this with serious informed discussion, with recent - good professional advice, and with active community participation. A host of options have been presented in responsible form.

When AQUEOUS started as a company we were not an advocate of desalination due both to its energy cost and brine waste. As some of the big desal companies will tell you, I was and remain an outspoken critic or their industry. But we found in many markets constructing a 50 year plan for strategic water sources, we reluctantly needed to consider desalination as one strategic option. As a result we decided that AQUEOUS would seek out new desalination systems or technologies we found credible and cost effective with specific concern on energy cost and cumulative ecological impact.

Five years ago we got a phone call from an old associate who was aware of our search. Frankly what he told us was not believable. But thankfully he insisted and we sent a team member down to look at what he was reporting. We had found something new and important. Since then we have worked globally to build a team of exceptional professionals who embrace desalination as an option in strategic supply sustainability.

After decades of experience in other industries, upon retirement, our inventor built a commercial scale system using already proven technologies from other industries in a new system. We asked him to apply it to

3705 Arctic Blvd #415, Anchorage, Alaska 99503 907 229 5328

desalting saltwater. The results were unbelievable so we asked him to do it again. The efficiency of the system was unheard of; the energy demand was far under the best RO at scale, the ecological implications, not only in phenomenal waste reduction, but also in footprint, intake reduction were significant.

We were delighted with this POC, but found we needed a completely independent expert of global reputation to verify this performance – and we engaged one of the world's most recognized experts. We gave him full and unobstructed access – and his first reaction was the same as ours. "Not possible." But after weeks of work and a series of global teleconferences with a number of experts, and lab result reviews, he said he would do the assessment of our new system. His report is available through the *interactive overview we will provide.*

California remains the most regulated market in the world, but we see that as an opportunity. Monterey Bay has some specific challenges as evidenced in your RO pilot report. None of these concerns require any modification of our system. Not the bio toxins, not the pharmaceuticals, none. But we need to do a seawater pilot to prove to you and the world that the AQUEOUS System is revolutionary, even disruptive. Since the POC we have made a number of modifications to the original system we are confident will further improve its process efficiency, further lower its energy demand, and further reduce its ecological impact. Our non-provisional patent is pending and we plan to update it with the results of this pilot this year.

Since our presentations in Santa Cruz last year a number of water districts around Monterey Bay have contacted us about a pilot/demo at commercial scale. We are now in discussions with one water district in the Bay and expect to be in pilot there this year. Given your renewed interest, we hope Santa Cruz will be interested along with Soquel Creek. All will benefit as will the global market in actually seeing the AQUEOUS System function in the Bay. Again, the most extraordinary is that our waste is a gel at 700°F when cool turns into a powder that is in demand by some industries.

Finally, given the strong opposition to RO in Santa Cruz, we are confident that we can present the AQUEOUS System to this community and generate a willingness to see it function in the pilot. Our presentation last year in Santa Cruz to the strongest opponents of RO ended with them supporting our system as an alternative to RO. With actual on-site proof of our claims, many who now oppose RO will likely support the use of the AQUEOUS System as a part of your rebuilding a sustainable water supply out 50 years. We'd like to do this with you and your community soon.

Attached are two illustrations to help illustrate the impact of our system. The first is a functional comparison to RO with the AQUEOUS desalination system drawing based on the POC and its analysis. The second is an illustration taken from your RO pilot's subsequent design for the system the RO industry has suggested for Santa Cruz – but you will notice red lines through most of the components. **These red lined components are NOT necessary with our system.** This should help customers see just how disruptive our system is in the desalting world and how much more cost, energy, and ecologically responsible the AQUOEUS System is compared to RO.

Thanks again for this opportunity. We look forward to seeing you soon,

Ric Davidge, Chairman

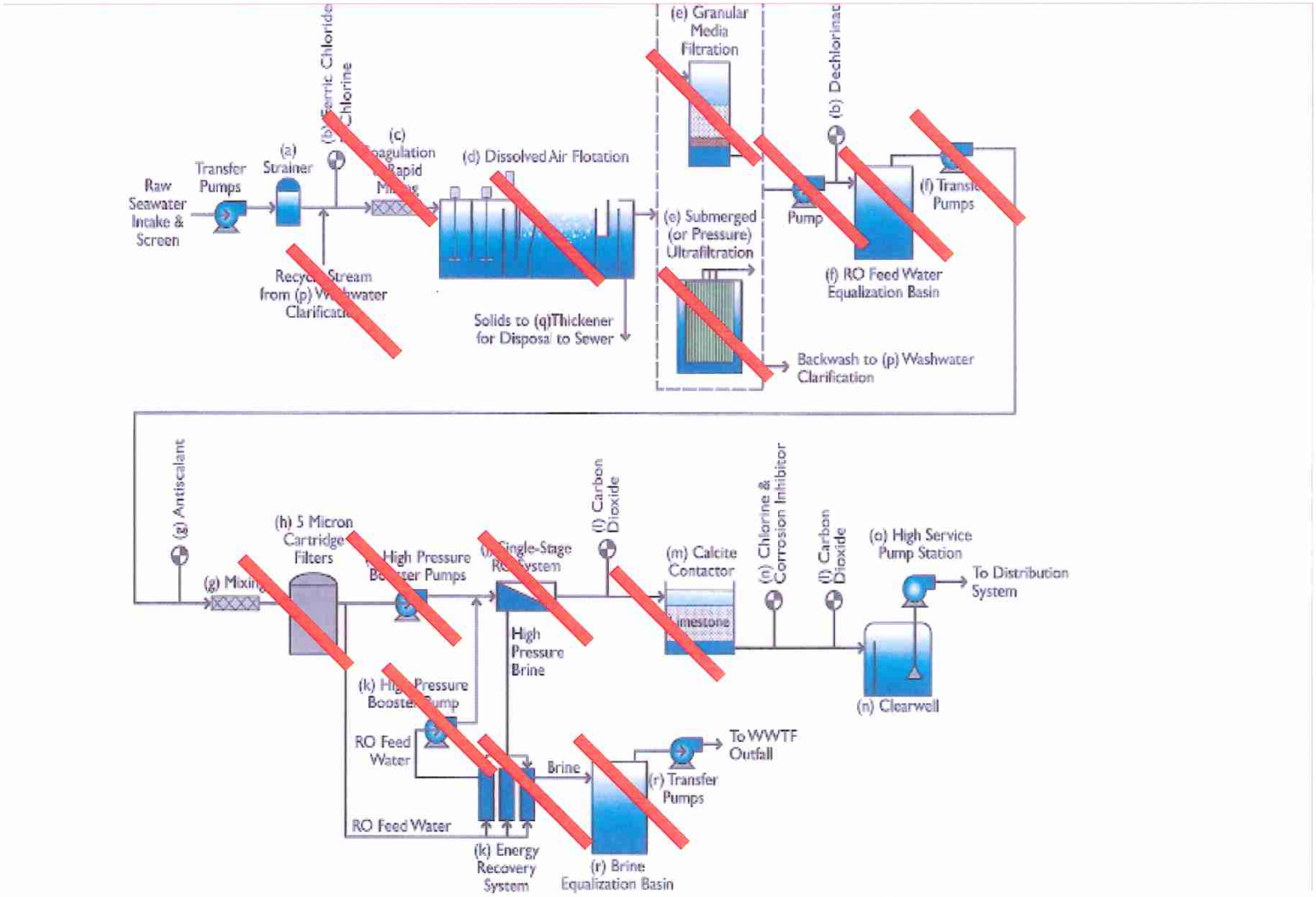
3705 Arctic Blvd #415, Anchorage, Alaska 99503 907 229 5328

Traditional RO Technology vs. the AQUEOUS System

Category	Existing Desal	AQUEOUS Desal System
Cost	Larger Capital Outlay Higher Operating Costs Higher Maintenance Costs	Less capital – simpler design. Capital cost 15-20% lower. Rapid payback, lower cost of water, lower market entry point. Lower operating costs, lower cost of water, more environmentally friendly, far less susceptible to oil's price volatility. Pretreatment eliminated. Simpler and cheaper to operate and maintain. Almost eliminates chemical uses
Footprint	Large footprint	Small footprint- 65% smaller Far less land, more environmentally friendly More portable even for large scale operations
Energy Source	Large Power	Less power demand Energy costs 25-30% lower Lower cost per cubic meter
Scalability		Highly scalable- simpler design Scale-up is straightforward due to the modularity of the major components
Technology Class	Pretreatment required Membranes required	No Pretreatment required No Membranes required
Materials Availability	High water intake. Low raw water intake utilization ~ 50% More chemicals required.	Low water intake High raw water intake utilization recaptures 80%+ of water input Waste stream becomes a profit center
Throughput Efficiency	High water input with lower intake water utilization.	Performs 10x more efficiently with less energy Only technology independent of incoming salinity High water input while at the same time producing gas which is recycled, low gel to solid waste Removes bio toxins and pharmaceuticals.
Waste Product	Solid/membrane chemical waste.	No solid/membrane chemical waste Waste stream can become a profit center
Environmental Impact	Membrane pretreatment and chemical cleaners that add additional cost and environmental concerns.	No waste goes back into the sea Greatly reduced onshore and offshore impacts
Installation Location	High construction costs, larger space requirements.	Easier to locate or co-locate, rapid deployment and installation. Land or sea.
Water Quality	330 ppm	120-170 ppm
Specific Gravity	1.004	1.003

[All of the above comparisons are based on the results of the 2008 commercial scale POC and its independent evaluation compared to RO by an international independent expert. With recent improvements to the design we anticipate the performance of the AQUEOUS System to exceed those of the POC in almost every variable.]

*This is the RO design recommended for Santa Cruz. The red slashes indicate components **NOT needed** with the **AQUEOUS system**.*



3705 Arctic Blvd #415, Anchorage, Alaska 99503 907 229 5328

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water conservation/supply suggestion

russweisz@baymoon.com <russweisz@baymoon.com> Tue, Aug 5, 2014 at 4:02 PM
To: santacruzwatersupply@gmail.com

If suggestions are still being accepted here's one:

I support aggressive water recycling including:
- upgrade our sewage treatment plant to tertiary
- lobby the state to permit general use of tertiary recycled water
- pump recycled water to new storage facilities and pond
- require use of recycled water for fire, car-wash services, park watering, etc.
- start to plan and build new water supply piping for all non-drink use.

thanks,
Russell Weisz
319 Laguna St.
Santa Cruz 95060
russweisz@baymoon.com

City of Santa Cruz Water Department
July 28, 2014

Proposal for Direct Potable Reuse (DPR)

Concept

The City of Santa Cruz Public Works Department operates the Santa Cruz Wastewater Treatment Facility that treats municipal wastewaters to secondary standards for discharge through an outfall to the Pacific Ocean. The typical daily flow rate of treated secondary water from the WWTF is approximately 8 million gallons per day (mgd). This water represents a potentially valuable resource for the region. The secondary treated water could be further treated with filtration and other advanced treatment processes to meet appropriate water quality requirements for a number of potential uses.

Direct Potable Reuse is where highly purified recycled water is purposefully introduced into an untreated drinking water supply source, immediately upstream of a water treatment plant or directly into the potable water supply distribution system downstream of a water treatment plant.

In Santa Cruz, secondary treated wastewater would be diverted from the ocean outfall to a new advanced water treatment plant and then to either the Graham Hill Water Treatment Plant for further treatment, or introduced directly into the potable water distribution system for consumption.

Variations on this concept could include reservoir augmentation (where the advanced treated recycled water is blended with source water in Loch Lomond Reservoir) or stream augmentation (where the advanced treated recycled water is released into flowing sources, such as the San Lorenzo River, to increase flows in the flowing sources).

Characteristics

Effectiveness. What is the project's effect on supply and/or demand.

Currently, DPR is not permitted in California. The most recent development in DPR regulations has been the adoption of SB918 that was signed into law in 2010 which directs the California Department of Public Health to investigate the feasibility of developing uniform water recycling criteria for DPR and to provide a final report on that investigation to the Legislature by December 31, 2016. However, CDPH has been willing to work with agencies on a case by case basis to evaluate the feasibility of both Indirect Potable Reuse (IPR) and DPR projects. And, with the ongoing water supply shortage throughout the state, these regulations may be expedited.

If regulations make DPR more readily useable, the project would be limited by the amount of wastewater produced each day. This number exceeds all water shortage numbers conceived to date.

Environmental Impact. Provide a brief consideration of expected impacts.

Impacts associated with the project would likely be related to construction activities only. A new treatment plant and pump station as well as infrastructure would be required to treat and move the water to the distribution system, San Lorenzo River, Graham Hill Water Treatment Plant, or Loch Lomond. Operational impacts may include increased energy required to treat the water. Environmental benefits may include enhancement of local streams and reduction in volume of discharges wastewater.

Practicability. How practicable is the project to construct and operate with regards to cost, reliability, and community considerations.

As mentioned above, CDPH does not yet permit DPR. While this is a current obstacle, this will likely change in the not too distant future. Community considerations may present another issue as this concept has also been referred to "toilet to tap" and associated with "the ick factor." While a significant amount of work is going into public education, this will continue to be a hurdle to a DPR project. With regards to cost, the cost estimate would likely be similar to that of a desalination project; while the DPR project would not require an ocean intake, it may require a large pump station and a significant amount of new pipeline.

City of Santa Cruz Water Department
July 28, 2014

Proposal for Zayante Dam

Concept

The Zayante Dam project has a history extending back almost 40 years. Originally recognized as a potential reservoir site by the California Department of Water Resources in 1943, a dam on Zayante Creek has been under consideration by the City of Santa Cruz since at least the mid-1950s. While Zayante Creek was initially the preferred alternative for a major reservoir in the 1957 Santa Cruz County Master Plan of Water Development, Newell Creek was eventually chosen for development first due primarily to lower costs. This resulted in the creation of Loch Lomond Reservoir.

A reservoir on Zayante Creek could function in two ways.

1. The reservoir could be used only during drought conditions. I.e., the total natural flow of the stream could be released (once full) except to replace evaporation losses. This would limit the environmental impacts. However, the unit cost of water would increase.

2. The reservoir could function similar to how existing storage is used – to supplement other supplies as they diminish throughout the dry season.

Both alternatives would require a new dam, pump station* and infrastructure to connect the new storage to the existing system.

*Regulatory requirements may require off-stream storage which could require a new pump station. In addition, off stream storage would eliminate the benefits provided by option 1 above.

Characteristics

Effectiveness. What is the project's effect on supply and/or demand.

A completed reservoir would likely have been sized to effectively meet the City's water supply shortage needs.

Environmental Impact. Provide a brief consideration of expected impacts.

The environmental impacts of construction of a dam may be significant and may or may not be offset by environmental benefit. Issues in particular that would need to be evaluated include loss of habitat within the inundation zone, impacts to downstream fisheries, and overall impacts during construction of the dam, pipeline and potential pump station.

Practicability. How practicable is the project to construct and operate with regards to cost, reliability, and community considerations.

Several issues would need to be fleshed out.

1. Seismic stability. While an engineering study did address seismic stability, and did conclude that a dam could be constructed to withstand seismic forces from the Zayante and San Andreas faults, regulations have changed. This analysis would need to be redone.

2. Impact to downstream fisheries and upstream wildlife and habitat in the inundation zone.

3. Economic feasibility. Dam construction costs would need to be combined with the cost of mitigation measures. Costs are unknown.

City of Santa Cruz Water Department
July 28, 2014

Proposal for Indirect Potable Reuse (IPR)/Groundwater Recharge

Concept

Indirect Potable Reuse (IPR)/Groundwater Recharge project could be a regional project which would make use of highly treated wastewater by injection into the over-drafted Soquel-Aptos area groundwater basin. While the final regulations for IPR-groundwater recharge are not complete, the City and District could work with the CDPH on a case-by-case basis to evaluate an IPR project. Secondary effluent from the City of Santa Cruz Wastewater Treatment Facility (WWTF) could be treated with an advanced water treatment process including coagulation, filtration, full desalination, advance oxidation and ultraviolet light, and disinfection. The advance recycled water treatment facility would be a similar size to the proposed scwd2 Regional Desalination Facility and could be located on the Westside of Santa Cruz to be near the wastewater plant effluent supply. The recycled water supply could be pumped to a series of injection wells in the District service area through a new distribution network of purple pipes and related improvements. Injection, monitoring and extraction wells would be built to operate the system and recover the injected recycled water.

A variation on this concept would be to install the injection wells strategically to function as a seawater barrier to seawater intrusion into the basin.

Characteristics

Effectiveness. What is the project's effect on supply and/or demand.

Indirect Potable Reuse for Groundwater Recharge may have an impact on supply if this active recharge is effective and allows a fairly immediate use of this water through withdrawals from the basin. This issue would need to be better understood to demonstrate its ability to function as a water supply option. This could be accomplished through a paper study of known information, development of a groundwater model, or combination of the two. Similar evaluation would be needed to better understand the effectiveness as a seawater barrier.

Environmental Impact. Provide a brief consideration of expected impacts.

Environmental impacts would be associated with the construction of the project the extent of which is unknown. In addition to construction of a treatment plant, there would be a significant amount of pipeline, and number of injection wells and associated pumping required to complete the project. Another issue that must be resolved is the impact to the groundwater basin (assumed positive), nearby streams that may receive outflow from the recharge, and impact to neighboring (existing) production wells.

Practicability. How practicable is the project to construct and operate with regards to cost, reliability, and community considerations.

Reviews done to date indicate that challenges to establishing an IPR groundwater recharge program in the Santa Cruz area Soquel-Aptos groundwater basin include the lack of available blending water (e.g. excess surface or groundwater available for blending recycled water), physical constraints with the complex geology and groundwater basin characteristics, avoiding the high number of private and municipal wells regulatory restrictions and uncertainties, and high project cost. Despite this, state government may adapt these regulatory restrictions to address the severity of the current (2014) drought. Further knowledge of the region's geologic makeup may alter current IPR Groundwater Recharge capabilities.

To be able to inject 1 mgd of recycled water into the groundwater basin, the IPR project could require up to 1 mgd of blending water. The injection well and underground geology would then need to be able to absorb a total injection of 2 mgd of water. The blending water could be groundwater or treated surface water. However, there is limited groundwater and treated surface water sources that could serve as blending water. As a result, the lack of blending water would limit the amount of recycled water that could be recharged into the groundwater basin.

The Soquel-Aptos area groundwater basin, especially the Purisima formation, is comprised of complex geology and hydrogeologic conditions that appear to limit the volume of water that could be injected and then recovered. The areas for injection are limited by bedrock and proximity to the ocean and other wells (both private and municipal). Numerous small injection wells, monitoring wells and extraction wells, with distribution piping, would likely be required to inject and withdraw the recycled water. The associated costs and volume of additional supplemental water that could be recovered following injection is not clear and would typically be less than the volume that is injected.

There is limited space to locate injection wells away from drinking water wells. Locating recycled water injection wells to meet the physical and travel time separation requirements would be very challenging as there are over a thousand private potable water wells within the area referred to as the Soquel-Aptos area groundwater basin, as well as the nineteen municipal wells for District and City. While the agencies could try to buy out private well owners to create sufficient separation space, the combination of large numbers of existing wells, the rugged terrain and underlying geology and the urban areas over the basin limit the ability to locate injection wells that comply with the CDPH separation requirements.

City of Santa Cruz Water Department
July 28, 2014

Proposal for Indirect Potable Reuse (IPR)/Regional Recycled Water

Concept

This alternative considers the regional use of recycled water (RW) for landscape irrigation to reduce the demand on the City and District potable supply systems. Secondary effluent from the City of Santa Cruz wastewater treatment facility (WWTF) could be treated with coagulation, filtration, partial desalination, and disinfection to meet California Title 22 requirements for unrestricted irrigation use. The recycled water supply could be pumped to large irrigation customers with large landscapes in the City and District service areas through a new distribution network of purple pipes and related improvements. Smaller landscape areas could be included; larger landscapes were considered, at least preliminarily, as being more cost effective.

Characteristics

Effectiveness. What is the project's effect on supply and/or demand

This project could be a form of demand management which could have an impact on a supply shortage.

It may be possible that a regional recycled water for irrigation project be operated to provide up to approximately 1,200 AFY of recycled water to large irrigation users in the City and District service areas. Early estimates indicate that in normal years this would offset approximately 950 AFY of potable water use for the City. However, in drought years, the City's Water Shortage Contingency Plan assumes that irrigation use would be significantly restricted. While parks and golf courses could stay green during a drought, the City would not have additional potable water supply as a result of the regional recycled water for irrigation project. Therefore, this does not appear to meet the supplemental potable water supply objectives of the City.

Recycled water to the District area could provide approximately 250 AFY of recycled water for irrigation. This could reduce the District's shortfall of 1,500 AFY to approximately 1,250 AFY, an amount that would still be needed from another source to reduce groundwater pumping. Therefore, this does not meet the supplemental potable water supply objectives of the District.

Environmental Impact. Provide a brief consideration of expected impacts.

Impacts of this project would likely be associated with the construction of the various components: treatment upgrades at the WWTF, pump stations, pipelines. These would be temporary in nature. Another impact that would need to be considered is the cumulative impact of this project in combination with an additional supply project that may still be required should this form of demand management prove to be in adequate in meeting supply shortages.

Practicability. How practicable is the project to construct and operate with regards to cost, reliability, and community considerations.

A conceptual level project capital cost of approximately $100 million was developed during the scwd2 desalination project; this cost is assumed to be shared by the City and District. This capital cost is less than the regional desalination project because the overall recovery of the recycled water plant would be higher, only a part of the effluent would require reverse osmosis desalting, and the materials of construction do not need to resist the corrosivity of seawater. However, the cost of the conveyance system for the regional recycled water project would be fairly significant. The new distribution system is estimated to require over 20 miles of dedicated recycled water main and lateral pipelines, and at least two system storage tanks and pump stations.

The average annual operating costs include treatment and pumping of recycled water to the large irrigation customers in the City and District areas. The operating costs are lower than a desalination facility because the overall recovery of the recycled water plant would be higher, the energy for treatment would be lower, and the average annual flow would be lower.

This project would likely be a reliable producer of recycled water and there is no known reason to expect anything other than public acceptance.

STRATEGIES AND IDEAS FOR IMPROVING THE RELIABILITY OF SANTA CRUZ'S WATER SUPPLY

Submitted to WSAC by Paul Gratz - July 28, 2014

Inter-District Groundwater Management, Restructuring and Consolidation

Currently, the region's watershed area lacks a systemic perspective and structure with regard to comprehensive water supply and demand management coordination required for effective institutional planning and implementation.

As a result of the region's fragmented and wasteful water-district governance structures, communities face increasing risks to their water supply and the environment, including salt water intrusion and the population collapse of endangered species.

Preparing the region to successfully manage common water challenges requires coordinated restructuring and consolidation at all levels in order to protect the environment, accommodate sustainable growth, and foster conditions that allow the economy to thrive.

It is essential that the City of Santa Cruz take the front-end role in advancing regional reorganization by bringing together contiguous water districts to facilitate a comprehensive vision and policy for water planning, management, and resource conservation.

This long overdue approach would institute best practices and align common groundwater water resources in a manner that collaboratively responds to local conditions and opportunities that cross jurisdictional boundaries. Essential to achieving results is the participation of LAFCO and the County Water Resources Division Agency.

To the extent that political leadership can be provided in order to bolster confidence with consistency, technical expertise, information, transparency, and accountability to advance the development of an integrated regional water management system will determine if the area can reduce water use and environmental uncertainty – essential for achieving a sustainable water future.

By eliminating costly duplicative operational functions and pooling assets that currently exist among the different water districts and agencies, the regional structure could deliver cost-effective programs and a coordinated array of incentives to improve ecosystem health and water supply reliability.

The regional water systems faces many challenges for providing a safe and reliable water supply. These challenges include adapting to new regulatory standards, underinvestment in upgrading or replacing aging infrastructure, source water availability, and increasing budgetary constraints.

Also, ongoing operating losses are occurring as water sales plummet because conservation and price hikes are expected to lead to double-digit rate increases. Most importantly, the significant revenues once generated by the large water-consuming manufacturing sector that previously existed in Santa Cruz are gone forever.

A cohesive water system would provide a range of potential opportunities for the region, including:

- Breaking down bureaucratic barriers and silos
- Reductions in administrative overhead and integration of operating management
- Optimization of operating assets
- Economies of scale
- Effective water transfers and recycling distribution
- Uniform water-neutral development policy
- Aquifer restoration
- Community control over well drilling
- Enhanced conservation, outreach, and community engagement
- Advancement of technology adoption
- Strengthened financial capacity and savings
- Improvement in emergency response
- Focusing program resources on improving community-responsive outcomes
- Bolstering the region's economic vitality and quality of life.

Questions

What policies, resources, opportunities, and leadership could be identified for achieving regional inter-district restructuring and consolidation?

What would it take to conduct an unbiased and robust study to determine the feasibility and appropriateness of employing the strategy of regional inter-district groundwater management, restructuring and consolidation?

Related

The water revolution California needs
http://articles.latimes.com/2014/mar/27/opinion/la-oe-0325-graham-drought-australia--water-market-20140328

Dr. Wade Graham Presentation to BizFed Institute - Clean Water for Life and Business
https://www.youtube.com/watch?v=_tzxrBpk8nI&list=PLCm1Hjuuu-eZqo1DTI2L_b13Hm0gtAfrK&index=2

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water used by mobile home parks

John B Corgiat Jr <jcorgiat@hotmail.com> Tue, Aug 5, 2014 at 9:58 PM
To: santacruzwatersupply@gmail.com

Many mobile home parks (MHPs) have master meters for gas, electricity and water, and then the park has its own meters that the park reads and then bills the residents for the gas, electricity and water used by each resident using the same rates that the utility companies would use if the utility company was billing the residents directly.

The California Public Utilities Commission (CPUC) is in the process of establishing a procedure for PG&E to take over the gas and electric systems in MHPs (CPUC Proceeding Number: R1102018). For the most part, PG&E will be establishing new service lines to each space in the MHPs and then deactivating the old service lines. These gas and electricity replacement service lines will require digging up the streets in MHPs to install the new service lines.

It sure seems an oversight that the CPUC is not including water lines in this process, since replacing water lines will also require digging up the streets.

Is it possible that the Water Supply Advisory Committee might be interested in helping to correct this oversight?

I look forward to hearing from you.

Thank you.

John Corgiat, Vice-president, Villa Santa Cruz Cooperative, Inc.
2435 Felt St Spc 106
Santa Cruz, CA 95062-4261
831-479-4360
jcorgiat@hotmail.com

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water ideas

Linda Sorauf <linda_sorauf@yahoo.com> Sun, Aug 3, 2014 at 7:50 AM
To: santacruzwatersupply@gmail.com

Hi. I saw that you are collecting ideas about water management in Santa Cruz.

I am wondering why we are not hearing more about reclaiming waste water. I know it sounds gross to some people, but in the end all water is recycled during the natural water cycle anyway. Reclaiming waste water seems to me to just speed up the natural water cycle. Maybe I am missing something and it is complicated, but I think it should be in the mix in terms of discussion and educating the public.

Thanks for considering.

Linda Sorauf

112 Oxford Way

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Santa Cruz City Residential Water Rate Increase Proposal

Michael Veglia <msvphoto@pacbell.net> Tue, Jul 22, 2014 at 10:58 AM
Reply-To: Michael Veglia <msvphoto@pacbell.net>
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>
Cc: "citycouncil@cityofsantacruz.com" <citycouncil@cityofsantacruz.com>

Dear Water Supply Advisory Committee & Santa Cruz City Council,

Please include careful evaluation of the propsoed Santa Cruz Water Dept. residential rate increase (Santa Cruz Sentinel 7/22/2014) in any SC City water discussions. Please also be sure to pay careful attention to CA AB 685: http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0651-0700/ab_685_cfa_20110425_121011_asm_comm.html Please make note of the word Rosemary Menard conveniently leaves out when quoting this bill, "affordable."

My dealings with the City Water Dept. this year over our allocation have been very bad (we live in what is essentially a single family home but get an allocation of only 7 CCFs per month for a family of 4 but were denied an allocation increase). The City Water Department's idea of customer service is totally adversarial which combined with the lack of professionalism, misinformation, and in some cases bold lies has been infuriating to say the least. I have been a SC water customer through the last two major droughts under the former Water Director and the experience this time is a nightmare in comparison.

Now, as good citizens my family has managed to achieve draconian savings. We are averaging less than 5 CCFs per month for a family of four (which equates to about 25 gallons per person per day). This is not sustainable long-term without property wear and tear impacts, but for the hopeful short term of this drought we are managing. Our reward? A potential massive rate increase. Totally not okay. I currently pay, on average, $60 per month in Santa Cruz City Utility taxes alone. Property taxes are around $5000/year. We are on a modest income. The proposed rate increases are not afforable for us, and certianly not afforable for those of less means than ours.

How does this proposed rate increase reflect the Governer's directive in AB 685? Doesn't this magnitude of increase require PUC approval?

Maybe instead of making residential rate payer shoulder the load commerical and government customers should pony up first. Does the city pay a utility tax on all the water used to keep the Delaveage Golf Course green?

Thank you for your time in considoring this.

Regards,

Mike Veglia

Water Strategies Patti Shimokawa, July 28, 2014

July 28, 2014 – Submission overviews due: Submit brief descriptions of the idea or strategy via email to santacruzwatersupply@gmail.com or by hand or mail delivery to WSAC at 212 Locust Street, Suite A, Santa Cruz, CA 95060. Please limit each submittal to no more than 2 pages.
Your submission should:
Briefly describe the idea or strategy, and
Characterize its:
effectiveness (how it will affect supply and/or demand)
environmental impact (a brief consideration of expected impacts)
practicability (cost, reliability, and community considerations)
You may, of course, submit more than one suggestion.

This is not a formal proposal, but a statement of opinion and what I desire to see more of in my community.

I would like to see much more emphasis on **conservation as a way of life**, not something we do when there is a "problem", as many problems can be greatly reduced or avoided altogether by conservation practices.

I would like our local governing and decision making people to drop the story that **conservation is just too hard** for people! I saw many statements in local publications from city council and water agency people saying that our community members can't be asked to conserve, or are not interested in conserving, which **is proved wrong every time we are asked to conserve.**

Stop punishing people for doing bad, and reward them for doing good. Have conservation heros and mentors.

I would like the idea of **sacrifice for the common and future good** to become our standard life style and measuring stick. Our leaders need to lead us in that direction, not reinforce the personal rights status quo.

I would like to see **Permaculture design principles** become standard practice.

A recognition of the fact that human population cannot grow indefinitely on this planet, and that our focus as a species needs to be sustainability, not growth. Please stop acting as if we can grow our city, our economy, our population indefinitely! That is not reality, it is fantasy! It is a pyramid scheme!

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Re: Invitation to submit strategies and ideas to the Santa Cruz Water Supply Advisory Committee

Pete Haworth <pete.haworth40@gmail.com> Thu, Jul 17, 2014 at 1:45 PM
To: SantaCruz WaterSupply <santacruzwatersupply@gmail.com>
Cc: semmansergh@hotmail.com

Thank you for the invitation.

Unfortunately, I'm pretty appalled at the idea that the average man in the street can have any meaningful input on a subject as complex as solving the city (and county's) water issues. They simply don't have the knowledge necessary to make sensible suggestions.

I'll extend that to the whole idea of the WSAC. Committees like this are formed for political reasons and seldom have any positive practical results. Especially when a member of the committee and Director of the SC Water Department is on record as saying that we don't have a water crisis.

I'm sure the majority of the committee members are well meaning and some, but certainly not all, are open minded enough to consider the possible solutions to the water crisis in an unbiased way but the whole subject is vastly complicated and subject to political, governmental, and natural complications that hardly anyone on the committee has any knowledge of.

Meantime, water is being drained on a daily basis. It's been 5 months since the WSAC was formed and as far as I know not a single solution has been proposed. SInce it's formation and using the city's water savings daily usage targets, 1,222,000,000 galloons of water have been used by city residents. To put that number in perspective:

- if each gallon was a penny, it would total over $12 million dollars

- a 3000 square foot house would have to be over 5400 stories high to hold that amount of water

- if each gallon was an inch, they would stretch for 19,286 miles if laid end to end.

I wish you and your committee members luck but seriously doubt you'll be successful

On Mon, Jul 14, 2014 at 12:29 PM, SantaCruz WaterSupply <santacruzwatersupply@gmail.com> wrote:

> This is Sarah Mansergh with the Santa Cruz Water Supply Advisory Committee (WSAC). First off, I want to thank you for attending one or all of our committee meetings. I realize these haven't been the most thrilling meetings to watch but with most of the logistics out of the way we are looking to move forward with the actual goal of our committee-to come up with a sustainable solution to our water supply questions. Part of that is the included invitation that I would appreciate if you could distribute to anyone you know who may be interested in participating in this process. The WSAC is currently in a fact finding phase of our work plan and as part of this process we are inviting the submission of ideas and strategies for addressing our water supply concerns. These can be fully formed projects or ideas that can be combined to create a packet of solutions. You will find specific details about the proposed process and some general guidelines for submission in the attached pdf. Please feel free to pass this

along to anyone else who may be interested.

If you are interested please submit a 2 page overview to this e-mail address or mail to WSAC at 212 Locust St. Santa Cruz, CA 95060 by July 28th, 2014.

Thank you,
Sarah

For more information about the WSAC and its work please visit the following website: http://www.cityofsantacruz.com/index.aspx?page=2018

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Re: INVITATION TO SUBMIT STRATEGIES AND IDEAS FOR IMPROVING THE RELIABILITY OF SANTA CRUZ'S WATER SUPPLY

Rainbow Mitchell-Fox <rrepstein@live.com> Mon, Jul 28, 2014 at 10:10 AM
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>

Dear Water Commission,

Thank you for your request for public input.

I respectfully ask that the Commission examine the current water rationing allotment ordinances, and how it addresses single family dwellings serviced under one multi-family account. The current allocation system does not allow enough flexibility to fairly service all the Santa Cruz water customers, and more needs to be done to ensure equity and fairness.

The 2009 Contingency Plan recognized the problem in dealing with this issue (p.59). However, the current allocation system, and the exceptions in place, do not adequately address the needs of two single family homes serviced under one multi-family account. This is directly negatively effecting our family home and the home of our neighbor. Both families are having to carry a greater burden of the rationing than other similarly situated residents.

Laguna Beach County Water Department water budget allocation review is a good example of how better to work with water customers to ensure adequate water allotments for their individual needs. http://www.lbcwd.org/modules/showdocument.aspx?documentid=198

Please consider the effect of rationing on the residents, and how increased water rates and fees effect low-income residents, who conserve out of necessity. $25 or $50 may not be a lot to some, but to others it greatly effects the monthly budget. This creates an inequality of the water rationing system and fees structure, and thus not all of the residents of Santa Cruz are being fairly treated.

My family has been conserving water for decades. We have removed our lawn, grow drought tolerant plants, limit showers, capture water, read our meter, and spend a lot of time worrying that we might go over our minimal allotment. Then, we are told we aren't doing enough, and that to ask for a fair consideration, well then we are "water wasters." As a long time local resident, I am very, very saddened to be treated with such disdain.

Safe, Clean, Affordable, and Accessible Water is a Human Right! Please do more to consider the moral of residents, how to better appreciate those who have been doing their part, and how better to encourage long-term conservation.

Thank you.
Sincerely,
Rainbow Mitchell-Fox
345 Pennsylvania Ave.
Santa Cruz
831 427-2798

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

water pricing

james <jcookster999@hotmail.com> Wed, Jul 16, 2014 at 10:20 AM
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>

Dear Committee,
If conservation is really the objective then the solution is really very simple.
We are a family of four with a large garden and many young fruit trees that require water to flourish.
Pre drought we have always been conservative and not wasted water. Now that our consumption has been a focus it has become clear to me that we can use way more water than normal and still be under our "ration" of 10 units. Go ahead kids, fill up that tub, we have an extra 50 gallons a day to use. Somehow we still are only using 5 units, I am not sure how people are able to use 10 units and we are a family of four.
Our bill shows the actual water cost us $10.28 dollars last month, where is the incentive to use less water? Sure we want to do the right thing, but people's behavior is VERY strongly dictated by money, our water is clearly far too inexpensive. I understand the issue of having to raise revenue for payroll/capitol improvements etc. but if conserving water is really the issue, then lower my hookup fee and other fixed costs and transfer those costs to the price of the actual water and watch our water use plummet. A radical change of thinking but perhaps it is time.
Many other industrialized countries use less than 30 gallons per person per day without their economy tanking while maintaining personal freedoms, It's time to perhaps rethink our pricing structure to actually encourage conservation. If that is really the issue. Thanks for taking the time to read my letter and i hope it is
taken seriously. James Cook

SantaCruz WaterSupply <santacruzwatersupply@gmail.com>

Affordability

hawkland@pacbell.net <hawkland@pacbell.net> Thu, Jul 24, 2014 at 10:08 AM
To: "santacruzwatersupply@gmail.com" <santacruzwatersupply@gmail.com>

Dear Water Supply Advisory Committee,

California AB 685 aims to ensure universal access to safe water by declaring that "every human being has the right to safe, clean, affordable, and accessible water." When Water Director Menard made her budget proposal to the council, she echoed this, but left out affordable. No plan should be considered until affordable is part of the priorities.

The task at hand is very difficult for you and it is hard to see new sources for water. But please do not lose sight of fairness and the needs of low income families. The water dept. did not keep this as a priority in the current rationing plan, and seems to be failing to consider this again with the proposed rate hikes.

There are ways to create funds to benefit low income families such as is done with the state HEAP program. One added difficulty here is that water bills can cover many families and only some of them may be low income. Low income families are more likely to be in multi-unit housing. And landlords are free to increase rents to cover any added costs. There must be a way to offer rebates directly to individuals.

One way to increase the water supply is to continue the encouragement of water conservation. However, for a non-emergency plan, the time should be taken to create a fair, census based plan. There should be allowance for vegetable gardens, pollinator gardens and other landscape needs. There should be greater flexibility than is present in the current plan. The current plan places the greatest burden on low income residents and this should be avoided.

Sincerely,
William Epstein
Santa Cruz

STRATEGY FOR IMPROVING THE RELIABILITY OF SANTA CRUZ'S WATER SUPPLY

Submitted by: SUSTAINABLE WATER COALITION

Overview:

The *Sustainable Water Coalition* submits that the City of Santa Cruz/Soquel Creek Water District's Integrated water plan and desalination project must be among the strategies considered by the Water Supply Advisory Committee. The project has undergone more thorough study and review than any other potential strategy. While this project has temporarily been put on hold, it remains a viable option, perhaps the *most* viable option, for providing a long-term sustainable water supply for our region.

- Effectiveness –Currently, our community is completely reliant on rainfall to replenish surface and underground water sources. Desalination is the only solution, other than increased storage, that does not depend upon regular rainfall. It is now clear that regular rainfall is not in our future and that developing new storage capacity, whether in-stream or off-stream, is, at best, an extremely difficult proposition for both practical and political reasons. In addition, the joint City of Santa Cruz/Soquel Creek Water District desalination project is a regional solution that not only addresses the needs of water users served by the City's water system, but also addresses the needs of those served by Soquel Creek Water District, where storage is not an option. The *only* strategy that can absolutely be relied on to provide a sustainable new supply of water is desalination.

- Environmental Impact—
    - The draft Environmental Impact Report found that impacts from the ocean intake system would operate at such a low flow level that any impacts to sea life would not cause marine populations to drop below self-sustaining levels, creating no greater impact in marine populations than happens naturally.
    - The draft Environmental Impact Report found that the output of brine, once combined with the existing wastewater treatment outflow, would closely match the ambient sea water surrounding the discharge point.
    - The Sustainable Water Coalition believes any desalination plant operated in Santa Cruz County *must be carbon neutral*.

- Practicability –
    - The City Water Department has estimated that the cost of building a desalination plant would increase the average residential bill by only $5/month. Even if it were twice that amount, it would be a manageable cost to pay for a sustainable new supply of water for our community.
    - A desalination plant is the strategy available that provides a reliable supply of water for our community. Waiting for rain is not a reliable approach.
    - The Sustainable Water Coalition believes that a single pump station should either be located on the Santa Cruz Municipal Wharf, or be co-located with the desalination plant, **NOT IN WESTSIDE RESIDENTIAL NEIGHBORHOODS.**

Submitted by:
Sustainable Water Coalition
Matthew A. Orbach, MCRP
redmattsc@gmail.com
831-600-5469