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THE 2015-2016 CONTRA COSTA COUNTY GRAND JURY
725 Court Street
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Report 1606

Reclaiming our Water

More Complicated than it Might Appear

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Contra Costa County Grand Jury Report 1606

Reclaiming our Water

More Complicated than it Might Appear

TO: Contra Costa County Board of Supervisors; City Councils of the Cities of Concord, San Ramon, and Walnut Creek; Boards of Directors for Central Contra Costa Sanitary District, Contra Costa Water District, Dublin San Ramon Services District, and East Bay Municipal Utilities District

SUMMARY

The recent drought has raised public awareness about the idea of using more recycled wastewater for irrigation and industrial purposes. The Grand Jury launched an inquiry into what obstacles were preventing water recycling from occurring on a broader scale.

While the recent El Niño storms provided some respite from the current drought, it is too soon to know if this is the end of this drought cycle or just a short pause to the start of a much longer mega-drought.[1] In either event, recycled and recovered water are key factors in achieving sustainable solutions to the water problems within Contra Costa County (County).

More can be done to maximize the use of recycled and reclaimed water in the County, but the infrastructure is not in place and any increase in supply must be carefully balanced with customer demand. Other obstacles in pursuing such a plan include: infrastructure cost, quality of the recycled water, identifying willing customers, facilitating water and wastewater utility cooperation, and potential legal challenges under California's Proposition 218.[2] Another challenge lies in the comparative cost of

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[1] *The West Without Water* – *B. Lynn Ingram and Frances Malamud-Roam (2013) and studies done for Contra Costa Water District note that tree ring and other historic evidence (such as changes in Delta salinity levels) suggest California experienced several hundred-year-long droughts in the past 1000 years.*

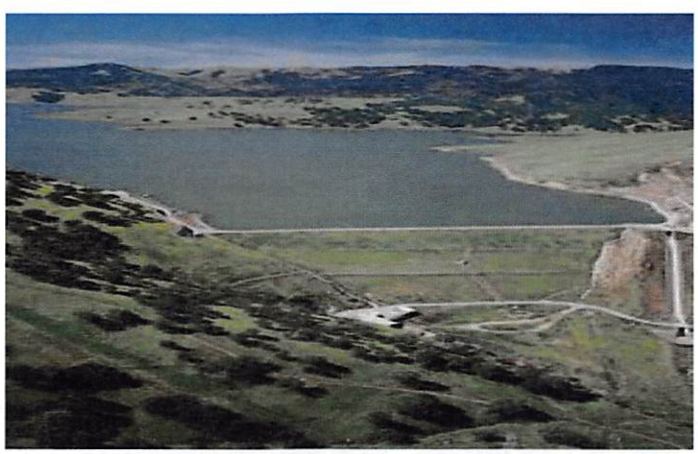
[2] (http://www.californiataxdata.com/pdf/proposition218.pdf)

desalinization plants. In Southern California brackish water desalination costs around $1600/acre-foot, and sea water desalination costs around $2400/acre-foot. By comparison, Central Valley Project water, which is used in this County, costs around $600/acre-foot at the point it is delivered to the treatment plant.

We learned that little is being done to increase capture of stormwater for reuse. Additionally, opportunities exist for supplying recycled water to industrial users, and "wheeling" the previously supplied fresh water to other customers in the County.

This report makes recommendations that address these findings. They include:

- Facilitating (possibly through a Task Force) the formation of a Joint Powers Authority (JPA) to: (i) integrate efforts to use recycled wastewater, (ii) capture stormwater, and (iii) revisit desalination options to supplement the County's water needs
- Promoting siting of desalination demonstration plants by making unused or under-used County land available for lease
- Promoting public awareness, education and involvement by forming a Water Reuse Advisory Council that includes citizen stakeholders and technology experts to advise the Board of Supervisors
- Adopting ordinances that promulgate recycling and recovery of water on a county-wide basis, with appropriate rules for planned communities and large commercial buildings
- Emphasizing capture and reuse of stormwater where possible in all new County flood control projects
- Promoting on-site capture and reuse of stormwater wherever practical
- Facilitating the use of satellite wastewater treatment plants, where appropriate



Los Vaqueros Reservoir (CCWD)

GLOSSARY OF TERMS AND ACRONYMS

Acre-feet per year (afy)–1 acre-foot = 325,851 gallons or 1233.5 cubic meters
Million gallons per day (mgd)–1 million gallons per day = 1121 afy
Brackish Water– saline water with TDS between 1,000 to 10,000 parts per million
California Department of Water Resources (DWR)
Central Valley Project– irrigation project managed by U.S. Bureau of Reclamation
Clean Water Act– federal law governing pollution of surface water
Desalination– removal of salts and dissolved solids from saltwater (brackish or sea)
Direct Potable Reuse (DPR)–wastewater cleaned sufficiently for direct reuse
Humidification Dehumidification (HDH)–alternative desalination technology
Indirect Potable Reuse (IPR)–term for wastewater cleaned sufficiently for indirect reuse
Integrated Regional Water Management Plan (IRWMP)
Joint Powers Authority (JPA)–two or more government agencies that have agreed to work together on projects of common interest
Local Agency Formation Commission (LAFCO)–its charter is to encourage orderly and efficient provision of services, including water, sewer and flood control
Megawatt-hour (MWh)–a unit of electrical consumption or usage
National Pollutant Discharge Elimination System (NPDES)
Reverse Osmosis (RO)–membrane separation desalination technique
Potable Water–water safe enough to drink and cook with, i.e., free from harmful pathogens and contaminants
Solar Desalination (SD)–alternative desalination technology using heat and/or photovoltaic energy from the sun
State Water Project (SWP)–irrigation project managed by State of California
Tertiary Treatment–advanced treatment (following secondary treatment) that produces higher quality water with essentially all suspended matter removed, and (usually) some reduction in nutrient content
Title 22 Recycled Water–treated wastewater suitable for industrial or agricultural reuse, but not potable quality
Total Dissolved Solids (TDS)–dissolved salt or mineral constituents in water
Wheeling–allowing someone else's water to be moved (either notionally or actually) through your transmission system into the users system; usually for a fee

BACKGROUND

But for the drought, much less attention would have been paid to California's Water Action Plan (known as the 20x2020 Plan). This plan calls for a permanent 20 percent reduction in water use. The Plan uses 2005 as its base year, and will "consider recycling as a means to achieve [the reduction]." It emphasizes that "it is essential for California to expand the use of recycled water." The published plans for both Contra Costa Water District (CCWD) and East Bay Municipal Utilities District (EBMUD) also propose increases in water recycling.

As the drought continued through the summer and fall of 2015, news accounts brought the public's attention to the potential for treating more wastewater to the "tertiary level" and recycling (redirecting) it for industrial and irrigation needs. Some wastewater districts serving Contra Costa are already providing recycled wastewater to industrial, commercial, and municipal users, but further use of this resource is being slowed by a combination of financial and anticipated legal obstacles.

This inquiry focuses on opportunities for expanding water recycling and recovery of our existing local water resources. It also explores how obstacles to these goals may be overcome.

As a drought or regional water shortage progresses, there is a hierarchy of choices to be made. These include:

1. *Conservation* – It is the easiest and least costly to quickly implement.
2. *Recycling of wastewater* – It is the next least costly and disruptive. Wastewater is close to the users' service area, but requires further treatment to make it useable and a distribution infrastructure to deliver it to customers.
3. *Stormwater* – It is only intermittently available but infrastructure must also exist for its capture, storage, and distribution. The reliability and practicality of this resource is both site and climate specific. It was, however, an integral factor in helping Australia through its 10 year-long drought.
4. *Desalination* – It is usually the most expensive, environmentally disruptive, and energy intensive.

In the most severe situations, all four approaches are required.

What the Experts Are Saying –
At the January 2016 Water 2.0 Conference in Sacramento, John Laird, State Secretary of Natural Resources, made some pointed observations:

- California's population is expected to grow by 25 percent over the next generation thus increasing the demand for water.

- Our water infrastructure was designed for a climate that no longer exists.

- We need to build an infrastructure that will match the new climate reality.
- Water conservation works only if you have a reliable underlying water supply.
- While the public wants to believe that if you invest more you will get more of what you invest in (water), the reality may be that you are only protecting the limited supply you currently have (or possibly even less than you currently have).
- Given the facts above, the public needs to be kept informed so that they understand the reality and are on-board when decisions are made.

At the same conference, Felicia Marcus, the Chair of the State Water Resources Control Board, commented that:

- Low interest (1 percent) state revolving-fund loans are available for recycled water and stormwater projects.
- Recycling and stormwater capture projects are also eligible for Proposition 1 matching dollars.
- The Water Board's internal priorities are: permit streamlining (to speed the approval process for new projects), groundwater recharge regulations, and indirect potable reuse regulations.

These comments suggest that the State's regulators are reacting to both long-term and short-term water supply issues by encouraging local entities to take action. However, responsible local entities may not yet be ready to take these suggested steps.

History of Water Reuse–
In some areas of the country wastewater is already being purified and disinfected up to potable quality for reuse.[3] The California Department of Water Resources (DWR) is currently drafting state-wide rules under which tertiary treated recycled water can be further purified before reintroduction (either indirectly or directly) into potable water systems. Definitive rules for "potable reuse" in California must be issued by the end of 2016.

California was once at the forefront of water recycling. In 1962, the Montebello Forebay Groundwater Recharge Project, a groundwater recharge project using recycled water, was inaugurated in Los Angeles County. More recently the Chino Desalter Authority came on line. That project, using collected stormwater to recharge the aquifer, extracts groundwater that was previously contaminated with nitrates, purifies it using Reverse

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[3] *Wichita Falls and El Paso (TX) are both involved in Direct Potable Reuse (DPR) projects.*

Osmosis (RO) technology, and sells the potable product to retail customers in nearby communities.

According to Laura Martin of *wateronline.com*, California has more groundwater recharge Indirect Potable Reuse (IPR) projects than any other state. The DWR has reviewed and approved each of these projects. Locally there are two RO plants in Alameda County and one in Santa Clara County that treat groundwater to potable quality. In 2008-2009, several Bay Area water districts cooperated in an experimental RO Plant at Mallard Slough to verify costs and feasibility of desalinating brackish river water. The plant demonstrated its feasibility but was later removed because it was not economically viable. Although the calculated cost of the potable water was roughly $1000/acre-foot, it could not compete with $600/acre-foot Central Valley Project water.

Twenty years ago, EBMUD and Dublin San Ramon Services District (DSRSD) formed a Joint Powers Authority (JPA) to distribute recycled water to supplement the water supply during the dry summer months. The partnership built a tertiary treatment plant and a "trunk line" to distribute the recycled water. DSRSD personnel operate the plant, and together with EBMUD share in the JPA's operating expenses. They distribute the recycled water primarily to commercial water customers who use the recycled water for irrigation (in lieu of less available potable water). Both EBMUD and DSRSD benefit through this partnership: DSRSD reduces the amount of wastewater it would otherwise have to pump into the San Francisco Bay, and EBMUD benefits from not having to supply more valuable drinking water for irrigation purposes.

DISCUSSION

Water Recyclers and Existing Customers –

Statewide, urban water agencies currently recycle about a third of potentially recyclable water – 300,000 acre-feet per year (afy) of 900,000 afy. In Contra Costa County, seven wastewater treatment plants are producing recyclable water (Title 22 quality) suitable for use outside their plants for industrial and irrigation purposes. The majority of this water is supplied to two power plants in Pittsburg and an oil refinery in Richmond. Golf courses, public parks, public school landscaping, and median strips use almost all of the balance. Dust suppression at concrete batch plants and public filling stations also use the remaining small fraction. Table 1 summarizes the suppliers and the recycled amounts. Currently, almost 25 percent of wastewater is recycled during the peak summer months. This is slightly lower than the state-wide average; however, all this water is non-potable quality – thus is underutilized during winter months, when it is not needed for irrigation.

Table 1 – Suppliers and Users of Recycled Water in Contra Costa County
(Most to least)

Treatment Plant	Effluent Treated, (Average Dry Weather Flow), mgd	Outside Plant Use, mgd	Comments Million Gallons per Day = mgd
Central San (CCCSD)	30	2.9 (available) 0.6 (used)	0.6 mgd committed to Zones 1 &2 plus Fill Station
Delta Diablo	12.8	7.3	During hottest summer days 100% to Calpine, purple pipe irrigation, and public "Fill Station"
West County SD	6.5	5.8	Essentially 100% of capacity is spoken for by Chevron
City of Richmond	6.03	0	Discharged to the Bay; effluent is too salty for recycling
Pinole/Hercules	3.5	0	Discharged to Bay
City of Brentwood	3.2	0.5	Purple pipe to golf courses and parks; also "Fill Station"
Ironhouse SD	2.26	1.0	Ag application; the rest goes into river
Discovery Bay CSD	1.8	0.6	Local irrigation
Dublin San Ramon SD	1.6 (from Contra Costa)	1.5 (returned to Contra Costa)	Purple pipe to golf courses and parks; also "Fill Stations"
Mt. View SD	1.25	0	100% is being fed into a marsh for wildlife habitat
Rodeo SD	1.14	0.01	Minor amount for in-plant landscape
Crockett CSD	0.93	0	Discharged to Bay
Byron SD	0.1	0	Discharged to Marsh Creek
TOTALS	71.11	17.31	Average = 24.3%*

* This is the annual average. The percent recycled increases in hot summer months and decreases in winter months.

Potential Recyclers and Potential Customers –

There are 13 wastewater treatment plants serving the County. Also, there are several industrial sites that treat and then discharge their internally generated wastewater directly into the Delta or the Bay. If some of this discharged water was further treated, it could be reused at the industrial sites instead of discharged. This would lower these sites' demand for higher quality outside water. However, it is unclear if this plan is currently economically viable.

Central Contra Costa Sanitary District (CCCSD) has the greatest potential capacity to recycle water. Even so, its ability to process Title 22 quality water for export is currently limited to roughly 3 mgd. To increase its capacity CCCSD would need to construct additional filtration units and related infrastructure. Industrial customers (Shell Martinez, and Tesoro Golden Eagle refineries) would be potential users of any such recycled water. Apart from industrial users, CCCSD is expanding its system for distributing recycled water to local golf courses. Table 2 summarizes the players, potential quantities available for reuse, and the potential needs. There are other smaller projects that would use on-site or satellite treatment plants to "harvest" a portion of the wastewater stream for golf course irrigation, before sending the balance on to the main treatment plant. Cost would be borne by the user.

Table 2 – Potential or Planned Recycled Water Projects

Treatment Plant	**Customer/Project**	**Quantity Required, mgd**	**Timeline and/or Comments**
CCCSD	Shell Martinez (cooling, process and boiler make-up water)	10	2020 and beyond – insufficient treatment capacity currently exists to supply full demand
CCCSD	Tesoro Avon (cooling, process and boiler make-up water)	10	2020 and beyond – insufficient treatment capacity currently exists to supply full demand
CCCSD	Concord Naval Weapons Station Redevelopment (residential and commercial)	2.5	2020 and beyond – treatment capacity currently exists to supply full demand
EBMUD (partner/w Pinole and/or Rodeo SD)	Phillips 66 Rodeo	2.8 (Phase 1) 0.9 (Phase 2)	Purchase agreement would have to be negotiated and a dedicated treatment plant built.
DSRSD-EBMUD	San Ramon Valley, Phase 2	0.43	Expansion of system to Bishop Ranch – 2017

The County is below the statewide average of 33 percent recycled water use. To reach "average", customers in the County must use an additional 6.2 mgd of recycled water. (The County's 2005-2020 General Plan includes a policy to "encourage the construction of wastewater disposal systems designed to reclaim and re-use treated wastewater…"). DSRSD and EBMUD will start construction in 2017 on Phase 2 of the San Ramon Valley Recycled Water Project, which will add 3.6 miles of recycled water pipeline to connect Bishop Ranch Business Park to the distribution system. However, the project is only expected to add 0.43 mgd of recycled water usage.

The Water Suppliers –
EBMUD has two dams on the Mokelumne River plus several local reservoirs in the County. It also has an option to buy water from Yolo County during drought years and an intake structure (Freeport) on the Sacramento River to route that water to its existing aqueducts. Additionally, EBMUD is studying "groundwater banking" with San Joaquin County water authorities. This involves intentionally flooding farm land during the winter months to increase percolation into the aquifer for later use. EBMUD plans to increase its use of recycled water by 20 mgd over the next 25 years.

CCWD has rights to use up to 195,000 afy of Central Valley Project (CVP) water. The "rights" are administered by the U.S. Bureau of Reclamation and can be reduced or curtailed in drought years. In addition, CCWD has a drought year agreement with East Contra Costa Irrigation District (ECCID) to option its 1914 senior surface water rights. It also has Los Vaqueros Reservoir (current capacity 160,000 acre-feet) to help buffer the impact of multiyear droughts. CCWD recently completed a "wheeling" agreement with EBMUD, which allows it to take its CVP water at the Freeport intake structure when capacity is available, rather than from its existing facilities on the San Joaquin River.

CCWD's 10 Year Capital Improvement Plan mentions recycling, but lacks details about specific projects. The page in the Plan that mentions recycling states that any recycling project will *be equally funded by grants and untreated water rates*. Approximately ten percent of CCWD's current water demands are met with recycled water supplied by others under various Memoranda of Understanding. CCWD plays no direct role in supplying the recycled water to customers.

DSRSD gets its water from Alameda County Zone 7 Water District. The wholesale price of $1300/acre-foot is passed directly through to DSRSD's customers as part of the total water bill. It also treats wastewater to Title 22 quality and distributes it via its recycled water pipeline to larger users. DSRSD is entirely dependent on Zone 7 for its fresh water supply, and Zone 7 is heavily reliant on the State Water Project (Lake Oroville) for its water.

The remaining water purveyors in the County rely on water from CCWD in whole or in part or rely exclusively on groundwater wells to meet their customers' needs. The major water suppliers in the greater Bay Area are becoming more connected through the use of inter-ties and agreements to wheel water to meet emergency situations or when conveyance capacity is available.

Where the County Government Fits in –
The County's General Plan contains a broad principle (under section *8-di*) that encourages that wastewater disposal systems be designed to reclaim and reuse treated wastewater. Beyond that, there is no explanation in the Plan on the actions the County will take.

The County interfaces with the various water and wastewater districts through the Board of Supervisors' Transportation, Water and Infrastructure Committee (TWIC). Contra Costa LAFCO, an independent agency with countywide jurisdiction, also interacts with these districts. Both receive periodic reports from the districts on their plans and activities. LAFCO has the additional responsibility of managing boundary issues and periodically assessing the financial stability of each district. The County and LAFCO have not assigned personnel to act as a watchdog or play a facilitator role in the areas of recycled or reused water.

Obstacles to Overcome for Recycled Water Projects –
Before any recycled water project can be implemented, issues related to cost, operations, water quality, customer base, regulatory and legal compliance, financing and timing must be addressed. Additional obstacles are the need to obtain consent from the water supplier and the perception on the part of the water suppliers that their water rights and allocations might be impaired.

Projects Worth Pursuing –
RMC Water and Environment recently completed a recycled water study for CCCSD.[4] Among other options, the study considered adding 20 mgd tertiary treatment and ammonia removal capacity. Under this option, a 42-inch diameter pipeline would connect the Shell and Tesoro oil refineries to supply cleaned wastewater for cooling towers and for refinery process water. As a result, an equivalent quantity of CCWD fresh water would be "freed up" for other uses. The estimated cost to add capacity and treat the recycled water is $820/acre-foot (± 30%). While this figure is higher than the $650/acre-foot CCWD currently charges wholesale customers for raw canal water, it is anticipated that some customers would be willing to pay more for a secure supply.

With the expansion of its Los Vaqueros Reservoir, CCWD will be able to "bank" some of the newly available water and offer it to other regional water districts, like DSRSD. DSRSD and their water supplier, Alameda County Zone 7, both need additional water to support a growing customer base. After the expansion is completed, CCWD could potentially wheel the water via the proposed Transfer-Bethany-Pipeline to the South Bay Aqueduct, which connects to Alameda Zone 7's system. The responsible parties would need to negotiate the terms of such a project, including its financing, the water

[4] *CCCSD's RECYCLED WATER WHOLESALE OPPORTUNITIES – March 2016 – prepared by RMC Water and Environment*

recipients, the price per acre-foot, and operation and ownership of the equipment and infrastructure. One mechanism to move such a project forward would be for the parties to enter into a JPA.

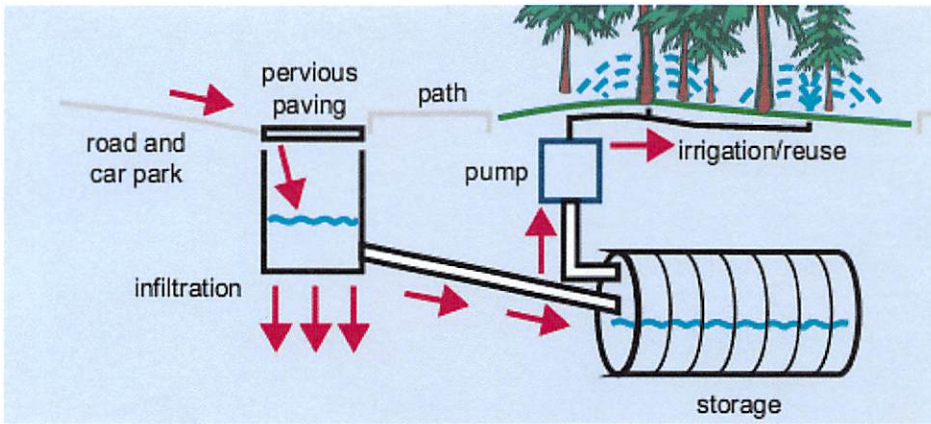
Other potential projects are small scale IPR projects. For example, DSRSD is studying injection and recovery wells as a means of fully utilizing its current recycled water capacity. CCCSD also has a capacity surplus of Title 22 quality water. That water could be treated to IPR quality and used for an injection and recovery well demonstration project with CCWD.

Stormwater Capture and Reuse –
The National Resources Defense Council (NRDC) recently graded California "D" in stormwater capture and reuse. Southern California, however, is aiming to increase its efforts in this area, with an ultimate goal of meeting at least ten percent of its total water needs from this source. According to the NRDC "capturing urban stormwater runoff in Southern California and the SF Bay Area could increase the water supply by as much as 630,000 afy while reducing a leading cause of surface water pollution." The City and County of San Francisco is also actively addressing capture and reuse of urban runoff. They recently passed ordinances mandating that new commercial buildings over a certain size must recover both gray water and stormwater for reuse on premises. This approach is most likely to yield significant benefits in high-density urban areas.

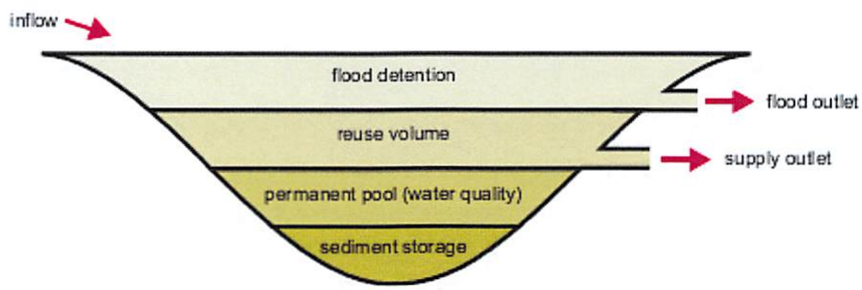
The Public Policy Institute of California lobbied for reforms to State Propositions 218, 26, and 13 to exempt water-related projects from the two-thirds majority vote requirement for new assessments, fees, charges or special taxes. The court in *Griffith v. Pajaro Valley* (2013) found that fees charged by water agencies, including flood control districts, for projects related to water or sewer services are exempt from the two-thirds majority voting requirement under Proposition 218. Thus, fees can be assessed for projects relating to capture and reuse without a two-thirds majority vote. As this remains a contentious issue, flood control districts are reluctant to go forward with capture and reuse projects until case law has been further established.

The Watershed Atlas of Contra Costa identifies 16 specific watersheds comprising roughly 513,280 acres. Assuming that future rainfall only averages 12 inches per year and that half of that rainfall soaks into the exposed soil, the remaining runoff still adds up to over 250,000 afy of locally available water. If only half of the runoff was captured, it would exceed the amount currently supplied by CCWD to its 500,000 customers. However, projects to maximize stormwater capture have not yet been identified in the County.

Australia is a leader in implementing innovative systems for stormwater capture. Two schematics for surface stormwater capture and underground storage systems are shown:



Underground Storage Scheme (NSW Dept. of Environ. & Conservation-2006)



Surface Swale Scheme (NSW Dept. of Environ. & Conservation-2006)

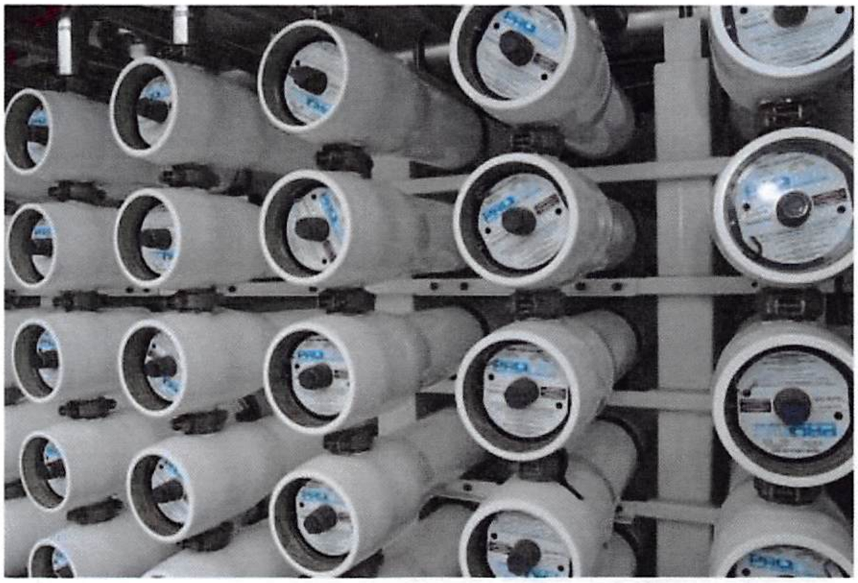
Various "water-advocates" agree that regional self-reliance and multi-benefit solutions are keys in achieving a sustainable, reliable water infrastructure. The focus on stormwater management by the County and its nineteen cities relates almost exclusively to compliance with NPDES stormwater discharge permits. These municipalities do not have plans for capturing stormwater for beneficial use, except to the extent that it promotes retention of pollutants that might otherwise be released into the San Francisco Bay or Delta.

The storage capacities of groundwater basins in the County have not yet been quantified. Even if significant (tens of thousands of acre-feet) storage capacity were identified, well drilling data collected by US Geological Service and California DWR suggest that augmented recharging could be difficult. Contra Costa's basins have layers of impermeable and low permeability clays that slow percolation, thus natural percolation from the surface is limited in many areas. Additionally, geological faults impede the flow of groundwater from one area to another.

Desalination Options –
The most prevalent technology for desalination, Reverse Osmosis (RO), involves forcing water molecules through filtering membranes at high pressure to remove salts

and other impurities. Sea water systems require 2 cycles (stages) to produce fresh water. Brackish water requires only one cycle to produce fresh water and, thus, is a less expensive source than sea water. The process is slightly more efficient when the inlet water is warmer.

A large sea water desalination plant was just completed in Carlsbad, CA, which is producing fresh water for approximately $2200 to $2400/acre-foot. Recent RMC estimates for producing DPR quality water from wastewater supplied by CCCSD ranged from $2200 to $2300/acre-foot, a cost that is on a par with sea water desalination, but higher than brackish water desalination. This suggests that in certain scenarios brackish water desalination might be a less costly option than recycling wastewater up to potable quality.



Bank of Desalination Membrane Filtering Tubes

RO is considered to be a "mature" technology, meaning it is unlikely that there will be breakthroughs in the near future that will drive either construction or operating costs down. According to the California Energy Commission in 1980 it took 36 MWh of electricity to produce one acre-foot of desalinated water. Currently only 3.5 MWh is needed – which is roughly fifty percent energy efficiency – extremely good for an industrial process. By comparison, almost the same amount of energy is needed to import an equal quantity of surface water to Los Angeles and San Diego from the Colorado River.

At least two emerging technologies may place less demand on the electric grid in the future: solar desalination (SD) and humidification dehumidification (HDH) desalination. The former uses solar concentrators and panels to produce fresh water and salt cake from brackish water. The latter is designed to use waste-heat (hot air) to promote evaporation on one side of a heat transfer surface and condensation of fresh water on the other. "Dewvaporization" is one variation of the HDH process. It uses a common heat transfer surface and is theoretically even more energy efficient. Although pilot plants have been tested with both methods, thus far there is little interest in taking the next step to an industrial scale operation. Appendix 2 contains a discussion of other desalination options.

The U.S. Bureau of Reclamation funded an HDH pilot plant. One of the goals for the project was to "develop methods to make desalting more efficient through promotion of dual-use facilities in which waste energy could be applied to desalting water." The 5,000 gallons/day pilot plant is located at a wastewater treatment plant near Phoenix, Arizona. The HDH process uses low-grade heat and waste heat to promote evaporation of the wastewater stream. A similar plant could be built at CCCSD. It uses natural gas from the adjacent landfill as fuel for drying its treated solid waste; thus, waste heat should be available for an HDH desalination plant.

Regardless which technology is selected, water professionals believe that desalination plants will ultimately be part of the water reliability solution. In addition to treating water from the San Francisco Bay and the Delta, they also can upgrade groundwater that contains a high level of total dissolved solids (TDS). Such water is currently blended with higher quality surface water, limiting the amount that can be used.

The California Legislature is considering allowing "surplus" solar power to be used for desalination projects at below market price. This would make such projects an even more attractive alternative.

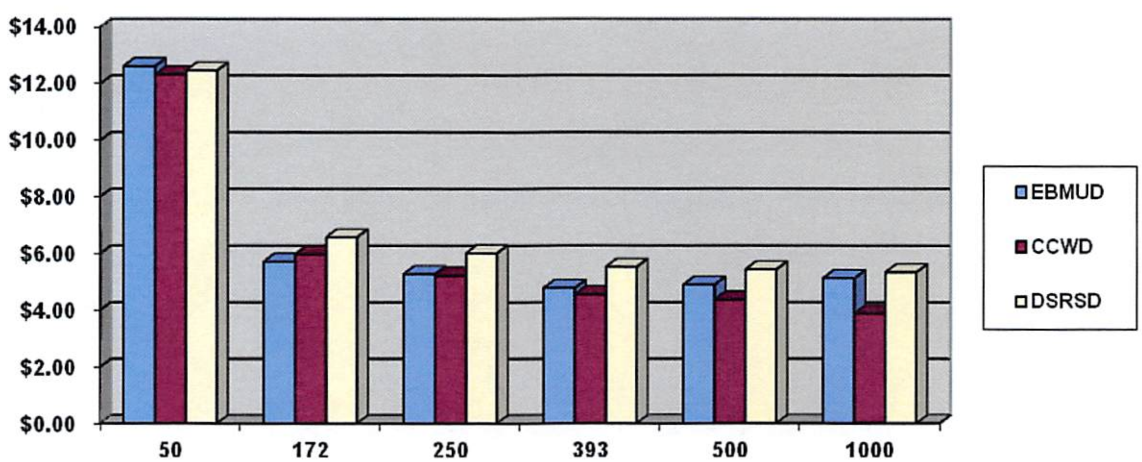
The Cost of Doing Nothing –
If nothing is done, the result may be higher rates for less water. While some environmentalists view this as a "least worst" outcome that will rein-in wasteful practices and minimize environmental impacts, there are disadvantages:

- It adversely affects lifestyle choices, such as: outdoor pools, home gardens and orchards, and landscaping
- It discourages new industries that need water to operate their businesses from locating here
- It leaves the County's residents at the mercy of the weather and reliant on stored water reserves

If water conservation is the only approach used, customers could end up paying almost as much each billing cycle while using less water. On the other hand, if the water shortage is approached using a combination of water conservation and water treatment, customers may ultimately pay less than water conservation alone. This is because a water supplier can increase its profitability by providing treated water to its customers. Increasing the amount of water delivered generally does not increase a water supplier's fixed costs and can help to cover those costs. The fixed costs come from debt financing of infrastructure that must be paid off (such as the Los Vaqueros Reservoir and the Freeport Intake on the Sacramento River), employee salaries, and maintenance costs on equipment that must be kept in operation regardless of the amount of water passing through.

The bar chart (Table 3) illustrates conservation's unavoidable consequence: the first few gallons of water used become more expensive as total consumption decreases. This may seem counter-intuitive, given that the unit rates incorporated on tiered-rate water bills show progressively higher unit costs when the "life-line" quantity is exceeded. However, the reality is the fixed "service charge" is added on top of whatever amount of water is used.

Table 3 – Unit Cost Bar Chart



Vertical-axis = dollars/unit (748 gallons) based on a 61 day billing cycle
Horizontal-axis = average gallons per day over 61 day billing cycle

Water providers recently pointed out that water conservation has resulted in "drastic losses in revenue needed for infrastructure investments and fixed cost recovery (costs incurred regardless of amount of water used – representing about 70 percent of customer bills)." A recent Fitch Ratings survey revealed that 78 percent of municipal water agencies have already, or plan to, adjust rates to offset losses from mandatory conservation. Clearly the downside of conservation is that the retail customer will not be saving much money for using less water.

Final Observations –

- Water supplies are not growing, but population is.
- Desalination of brackish water (where available) needs to be revisited. Estimated costs are slightly lower than DPR quality water and public acceptance could be easier to gain.
- The estimated costs for IPR and DPR remain relatively high, even though the energy cost to operate the plants should be lower than desalination plants.
- Unless CCCSD can get a State or Federal grant to increase its capacity for recycled water, it cannot be cost competitive with raw canal water supplied by CCWD to their industrial customers.
- State matching grant money and low-interest loans are available for recycled water and desalination projects.
- Recycling Title 22-quality water to year-around customers has a better chance to maximize its use, provided willing customers can be signed up.
- Both mandated conservation and recycling water potentially reduce water purveyors' revenue resulting in upward pressure on billing rates.
- Stormwater should be part of the water sustainability solution – even though its expected contribution will be limited.
- The Board of Supervisors could (through a Task Force) be an effective facilitator in the formation of a recycled water JPA.
- The Board of Supervisors could (through an Advisory Council) be an effective facilitator in educating and encouraging the participation of the public.

FINDINGS

F1. Among obstacles to using more recycled water are: determining who will pay for installing the necessary infrastructure and distribution system; finding a willing customer; and minimizing the financial and legal impacts to the current potable water purveyor.

F2. Water purveyors and wastewater processors can share water treatment costs and revenues under a JPA.

F3. State matching grants and low-interest loans are available for small indirect potable reuse projects, which could potentially increase water supply.

F4. Indirect potable reuse projects are ideal for areas in the County where other new water sources are unavailable.

F5. It is difficult to develop large recycled water projects without the cooperation and commitment of water purveyors and customers.

F6. Where recycled water can be wheeled to one customer, it could “free up” an equivalent amount of fresh water that could then be wheeled to another customer who might be willing to pay more, thus creating “win-win” results for recycled water projects.

F7. While stormwater capture and reuse has potential for contributing to the County’s long-term water needs, the County has focused on NPDES compliance.

F8. Contra Costa County and its cities could adopt water saving and recycling ordinances for large commercial buildings, similar to those adopted in other large urban locations such as San Francisco.

F9. Satellite wastewater treatment plants are feasible in situations where the user is distant from existing recycled water distribution systems, needs water for irrigation, and is able to meet the costs to build and operate the plant.

F10. The County is below the State average in use of recycled water.

F11. Desalination technology continues to evolve, including smaller scale solar powered and HDH (“Dewvaporation”) pilot plants, although neither has been developed to full commercialization.

F12. Citizen involvement (possibly through an Advisory Council) is a key to getting buy-in for recycle and IPR/DPR projects because it is citizens who pay for, consume, and depend on a reliable source of pure water.

F13. There is no single point of contact for water recycle and reuse issues in the County.

RECOMMENDATIONS

R1. The Board of Supervisors should consider facilitating (possibly through a Task Force) the formation of a JPA to promote water recycling, stormwater capture and desalination projects.

R2. CCCSD and CCWD should explore the feasibility of cooperatively developing an IPR Injection Well Project.

R3. CCCSD, CCWD, and DSRSD should consider the formation of a JPA to expand CCCSD's tertiary treatment capacity in order to free up fresh water for domestic and commercial customers.

R4. The Board of Supervisors should consider directing that priority be given to capture and reuse of stormwater where possible in all new County flood control projects.

R5. The Board of Supervisors should consider adopting ordinances that promulgate recycling and recovery of water on a County-wide basis.

R6. The city should consider adopting requirements relating to the use of reclaimed water for planned communities and large commercial buildings to maximize its use.

R7. The district should consider facilitating the use of satellite wastewater treatment plants, where appropriate.

R8. The Board of Supervisors should consider adopting a County goal to exceed the State average for recycled water use and establish a target date.

R9. The County and Districts should consider meeting to discuss each District's need for land for demonstration of scaled-up recycling and desalination projects using green technologies, which may qualify for State grant money, and the County's ability to lease such land.

R10. To promote public awareness and citizen involvement, the Board of Supervisors should consider establishing a citizen's "Water Reuse Advisory Council" which includes citizen stakeholders and technology experts to advise them on all water reuse issues affecting the County.

R11. The Board of Supervisors should consider designating a single point of contact within County government for water recycle/reuse issues or establishing a permanent water sustainability subcommittee under their Transportation, Water and Infrastructure Committee to advise the committee on water reuse issues.

REQUIRED RESPONSES

	Findings	**Recommendations**
Contra Costa County Board of Supervisors	F1, F2, F7-F8, F10-F13	R1, R4, R5, R8-R11
Board of Directors for the Contra Costa Water District	F3-F6, F9	R2, R3, R7, R9
Board of Directors for the Central Contra Costa Sanitary District	F3-F6, F9	R2, R3, R7, R9
Board of Directors for the Dublin San Ramon Services District	F3-F6, F9	R2, R3, R7, R9
Board of Directors for the East Bay Municipal Utilities District	F9	R7, R9
Concord City Council	F8	R6
San Ramon City Council	F8	R6
Walnut Creek City Council	F8	R6

These responses must be provided in the format and by the date set forth in the cover letter that accompanies this report. An electronic copy of these responses in the form of a Word document should be sent by e-mail to epant@contracosta.courts.ca.gov and a hard (paper) copy should be sent to:

Civil Grand Jury – Foreperson

725 Court Street

P.O. Box 431

Martinez, CA 94553-0091

APPENDIX 1

METHODOLOGY

The Grand Jury surveyed a cross-section of wastewater treatment agencies; attended various public meetings at agencies, special districts, and boards; and conducted sixteen interviews with managers, technical specialists, and water industry consultants from:

Cities that treat their own water and/or wastewater
Contra Costa Central Sanitary District (CCCSD)
Contra Costa Clean Water Program (CCCWP)
Contra Costa Water District (CCWD)
County Departments with responsibility for water-related issues
Delta Diablo (DD) – formerly Delta Diablo Sanitary District
Diablo Water District (DWD)
Dublin San Ramon Services District (DSRSD)
East Bay Municipal Utilities District (EBMUD)
East Bay Leadership Conference – Water Task Force
East Contra Costa County Integrated Regional Water Management (Plan)
East County Water Management Association (ECWMA)
Local Agency Formation Commission (LAFCO)
San Francisco Bay Regional Water Quality Control Board (SFBRWQCB)

APPENDIX 2

OTHER DESALINATION OPTIONS–

The information below expands on some other technologies available for desalination. Electrodialysis and Forward Osmosis were not previously discussed in the report.

Electrodialysis (ED)–

ED is an ion exchange membrane process that uses electrical potential as a driving force to remove salts from brackish or sea water. Reportedly the process operates most efficiently with brackish water containing less than 3,000 TDS. This technology may be best suited to smaller projects. According to Lee and Moon (in *Desalination – Water from Water*), a 10,000 cubic meter capacity plant could produce desalinated water for $0.83/m^3 or about $1024/acre-foot. However, brine disposal costs would have to be added.

Forward Osmosis (FO)–

FO is an osmotic process similar to reverse osmosis, but instead of a pressure gradient, it uses a higher concentration "draw" solution as the driving force to move water across a semi-permeable membrane. This produces a less concentrated solution on the draw side of the membrane from which the water must then be extracted. A pilot or demonstration plant was built by NASA Ames Research Laboratory recently. According to McCutcheon and Bui, (in *Desalination – Water from Water*), "FO promises to enable low cost desalination with improved recovery and fouling resistance..." For wastewater treatment it could be "hybridized" with existing RO units. In this scenario it would act as a pre-filter to skim out the water from an otherwise unprocessed waste stream.

ADDITIONAL REFERENCES AND SUGGESTED READING–

Water 4.0: the Past, Present and Future of the World's Most Valuable Resource, David Sedlak; (Yale University Press: New Haven, CT), 2014

Desalination – Water from Water, Jane Kucera, Editor; (Scrivener Publishing: Beverley, MA), 2014

Desalination with a Grain of Salt – A California Perspective, Heather Cooley, Peter H. Gleick, and Gary Wolff; (Pacific Institute: Oakland, CA), June 2006

Desalination Engineering: Planning and Design, Nikolay Voutchkov; (McGraw-Hill: New York, NY), 2007