Can We Desalinate Water without All the Mess?

A new generation of small, modular, mobile, wave-powered devices is looking to tackle desalination's biggest problems head-on.

by Becki Robins
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In May 2022, California officials unanimously rejected a plan to build a US $1.4-billion desalination plant in Huntington Beach. The plant, the officials said, would produce costly water and possibly harm the marine environment. The decision wasn't an outright rejection of desalination, but it did highlight some of the problems that have made desalination an impractical solution to California's water problems.

Dragan Tutic, founder and CEO of Oneka Technologies, says large desalination plants powered by fossil fuels aren't the only way to get fresh water out of the ocean. His company is getting ready to bring what it says is sustainable, practical desalination to the small city of Fort Bragg on California's North Coast.

Fort Bragg was a lumber town until the Georgia-Pacific mill closed in 2002. Today, it's a popular tourist spot featuring undomesticated beaches wrapped in rocky cliffs, lively tide pools, and a beach famous for sea glass.

As in much of California, water is a precious commodity in Fort Bragg. The city has only three surface water sources: the Noyo River and two small tributaries. In dry years, all three can slow, and the Noyo can turn brackish, putting the city at risk from shortages.

"We're kind of stuck," says John Smith, Fort Bragg's director of public works. "That's why we're looking to the ocean."

Desalination is an idea that keeps reappearing in the Golden State, where overdrawn groundwater and shrinking reservoirs are critical problems. On a superficial level, it seems simple: take the salt out of the abundant salt water just offshore. But typical desalination facilities are big, expensive to operate, and environmentally unfriendly, especially when the resource-intensive process is powered by fossil fuels. The Carlsbad desalination plant in

Southern California, for example, sits on 2.4 hectares of land and uses 246,156 megawatt hours of electricity per year—equivalent to the usage of roughly 23,000 homes.

Oneka's experimental water desalination device isn't like California's other desalination plants: it's a 6.5-meter-wide buoy. The small footprint is a bonus, but the device's main advantage is that it's ocean powered. As the buoy moves back and forth with the waves, it draws water through a filter and then through a reverse osmosis membrane, which removes the salts and other tiny particles. "Surprisingly simple," says Smith.

Andrea Achilli, a chemical and environmental engineer at the University of Arizona who is not affiliated with Oneka, calls devices like this direct desalination systems. Direct desalination can also be accomplished with solar energy, which can be turned into heat and used for thermal desalination. In simple terms, thermal desalination boils salt water, collecting the vapor and leaving the salt behind. Similarly, the Oneka buoy doesn't take energy from an external source; it has everything it needs on board. "It's a very good use of the wave energy," says Achilli.

More established desalination techniques have other environmental problems the buoy also manages to avoid. Standard desalination produces brine—the intensely salty slurry that's removed to make salt water fresh. This brine has to be managed and disposed of. But the brine diffused by Oneka's buoy is low concentration, Tutic says, which means it can get discharged back into the ocean, where it will have little to no environmental impact.

Oneka has already deployed this technology off the coasts of Florida and Chile, and it's modified the design as potential problems arose. Tutic says one major challenge has been making the buoy robust enough to withstand storms. "Our first version that we deployed back in 2015 and [2016], we tested it; we broke most of it in the ocean," he says. "But that's how we learned." Tutic says the latest generation can withstand six-meter waves and can be easily disconnected and moved in anticipation of more extreme conditions.

For now, the Fort Bragg installation will have one device producing around 50,000 liters of fresh water a day. That's not much—enough for around 43 average households—but Tutic says the pilot device's purpose is to collect water quality and system performance data that will help the company make refinements and adaptations. Eventually, he says, the company would like to install an array of devices. "It's modular," says Tutic. "You can adapt a number of units to essentially make as much water as you need."

Achilli seems less optimistic. "The energy potential from wave energy … is really large because the ocean's large," he says. But renewables are diluted forms of energy, he says, so you need a lot of materials and resources to harness all that potential. In other words, you need a lot of buoys.

As Fort Bragg looks to face its water woes, Smith says desalination is just part of the city's strategy. It also has a mobile desalination plant for treating brackish water in the Noyo River and plans to build reservoirs.

The Oneka buoys aren't a complete solution, Smith says. But the pilot project is about more than just Fort Bragg's water. It's also a proof of concept—a way to show that technology and engineering can help overcome the state's persistent water issues. "I think this is a great start," he says.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 Aerovista Place, Suite 101
San Luis Obispo, California 93401

NOTICE OF PUBLIC HEARING - PUBLIC NOTICE
ISSUANCE OF WASTE DISCHARGE REQUIREMENTS ORDER NO. R3-2023-0001
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
PERMIT NO. CA0048194
FOR THE
CITY OF SANTA CRUZ WASTEWATER TREATMENT FACILITY (SANTA CRUZ COUNTY) WITH DISCHARGE TO THE PACIFIC OCEAN

The California Regional Water Quality Control Board, Central Coast Region (Central Coast Water Board) proposes to authorize the discharge of treated wastewater from the City of Santa Cruz Wastewater Treatment Facility by issuance of waste discharge requirements. The wastewater treatment plant will discharge secondary treated municipal wastewater which includes reverse osmosis concentrate, strainer backwash, microfiltration backwash, facility stormwater, and reverse osmosis concentrate and off-specification water from the Pure Water Soquel Advanced Water Purification Facility to the Pacific Ocean and also produces disinfected tertiary recycled water. A copy of the proposed waste discharge requirements can be found on the Central Coast Water Board's tentative orders page at:

https://www.waterboards.ca.gov/centralcoast/board_decisions/tentative_orders/

The Central Coast Water Board will hold a public hearing to consider the issuance of the proposed waste discharge requirements on:

December 14-15, 2023
This meeting will be held at the Central Coast Water Board Offices
895 Aerovista Place, Suite 101, San Luis Obispo

Information is available as part of the meeting agenda, at:
https://www.waterboards.ca.gov/centralcoast/board_info/agendas/2023/2023_agendas.html

Interested persons are invited to submit comments in writing to the Central Coast Water Board by email at centralcoast@waterboards.ca.gov or to the San Luis Obispo address above no later than **October 12, 2023.** All comments received prior to that date will be considered in the formulation of staff recommendations regarding the waste discharge. The Central Coast Water Board will not accept written comments or other written submittals on the proposed waste discharge requirements after **October 12, 2023**, unless the Chair of the Central Coast Water Board rules that exclusion would create a hardship, and that the late submission will not prejudice any party or the Central Coast Water Board. Any person submitting late comments or other submittals must explain why such materials were not submitted by **October 12, 2023**. The Chair of the Central Coast Water

Board will rule on late submittals at or before the hearing. Late submittals that consist of evidence (as opposed to policy statements or comments) are generally prejudicial unless all parties and Central Coast Water Board staff have time to consider the evidence before the hearing.

Interested persons are invited to attend the hearing and may make oral comments relevant to the proposed action. Oral comments should summarize written comments. The Chair of the Central Coast Water Board will impose time limits on oral comments.

The Report of Waste Discharge, Fact Sheet, related documents, and all comments received may be inspected and copied by the public. Please submit any requests to review documents electronically to Peter von Langen at (805) 549-3688 or peter.vonlangen@waterboards.ca.gov or Arwen Wyatt-Mair at (805) 542-4695 or arwen.wyattmair@waterboards.ca.gov. Please bring the foregoing to the attention of any persons known to you who would be interested in this matter.

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CALIFORNIA Water Boards

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YANA GARCIA
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Central Coast Regional Water Quality Control Board

NOTICE OF PUBLIC HEARING AND OPPORTUNITY TO COMMENT

concerning

PROPOSED ORDER NO. R3-2023-0033
WASTE DISCHARGE AND WATER RECLAMATION REQUIREMENTS

PURE WATER SOQUEL
GROUNDWATER REPLENISHMENT REUSE PROJECT

SOQUEL CREEK WATER DISTRICT

NOTICE IS HEREBY GIVEN that the Central Coast Regional Water Quality Control Board (Central Coast Water Board) is accepting comments on proposed Order No. R3-2023-0033, Waste Discharge and Water Reclamation Requirements for the Pure Water Soquel Groundwater Replenishment Reuse Project, Soquel Creek Water District (Permit). You may download the proposed Permit from the Central Coast Water Board's website at:

http://www.waterboards.ca.gov/centralcoast/board_decisions/tentative_orders

The Soquel Creek Water District owns and operates the Pure Water Soquel Advanced Water Purification Facility and associated injection wells, monitoring wells, and conveyance pipelines, collectively referred to as the Pure Water Soquel Project. The Pure Water Soquel Project will produce and discharge advanced treated recycled water into the Santa Cruz Mid-County groundwater basin. The Advanced Water Purification Facility is located at 2505 Chanticleer Avenue in Santa Cruz, California.

The project goals are to supplement natural recharge to the groundwater basin, help mitigate the impacts of seawater intrusion, and help provide water supply resiliency and reliability. A portion of the injected water will be extracted by the Soquel Creek Water District's production wells for potable use.

A public hearing to consider adoption of the proposed Permit for the production and discharge of advanced treated recycled water to the Santa Cruz Mid-County groundwater basin will be held during the Central Coast Water Board meeting scheduled for :

December 14-15, 2023
Central Coast Water Board Offices
895 Aerovista Place - Suite 101
San Luis Obispo, CA 93401

The final meeting agenda and staff report will be available at least 10 days before the Board meeting, at:

https://www.waterboards.ca.gov/centralcoast/board_info/agendas/

The agenda will provide the specific date this item will be considered during the Board meeting, indicate the anticipated order of all agenda items, and may include staff revisions to the proposed Permit.

SUBMISSION OF WRITTEN COMMENTS
Persons interested in providing written comments on the proposed Permit are encouraged to submit comments by electronic mail. Comment letters must be received by **5:00 p.m. on Wednesday, October 11, 2023**. Comment letters received after that deadline will not be accepted and will not be included in the administrative record absent a ruling by the Central Coast Water Board Chair. Any person requesting to submit late comments must demonstrate good cause for the late submission and the Chair must find that accepting the late submission will not prejudice the Central Coast Water Board or the Discharger. All interested persons and the Discharger may speak at the public meeting and are expected to orally summarize their written submittals. Oral comments will be limited in time by the Chair.

Written comments are to be sent to the Waste Discharge Requirements Unit by email (must be no more than 15 megabytes) RB3-WDR@Waterboards.ca.gov or by mail to:

Waste Discharge Requirements Unit
Central Coast Water Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

Please also indicate in the subject line **"Comment Letter – Pure Water Soquel"**

Please direct any questions about this notice to the Waste Discharge Requirements Unit at RB3-WDR@Waterboards.ca.gov.

FUTURE NOTICES
The Central Coast Water Board will hold the public meeting at the time and place noted above. Any change in the date, time, and place of the Board Meeting will be noticed through the e-mail distribution list and posted on the Central Coast Water Board's website. Any person desiring to receive future notices concerning changes to the notice of public meeting and consideration of adoption, must sign up for the e-mail distribution list. To sign up for the e-mail distribution email list, access the Central Coast Water Board E-mail Subscription form, select the box for 'Board Meeting Agenda', and provide the required information. The subscription form is located at:

https://www.waterboards.ca.gov/resources/email_subscriptions/reg3_subscribe.html

Please bring the above information to the attention of anyone you know who would be interested in this matter.