DESALINATION FACT SHEET
February 2016

What is Desalination?

Desalination is the process of removing dissolved minerals from brackish or seawater to produce freshwater that can be used for municipal needs such as drinking water and industrial uses. Desalination can be a tool to improve water supply reliability and self-reliance at the regional and local level.[1]

Seawater is pumped into a desalination facility through a surface or subsurface intake in the ocean or an estuary. Most existing and planned facilities in California rely on reverse osmosis (RO) as part of the treatment process.[2] In Seawater Reverse Osmosis (SWRO), seawater is pumped at high pressure through permeable membranes, separating salts from the water. Before reaching the RO membranes, the seawater is pre-filtered to remove particles such as sand, shells, seaweed and marine life which would clog the membranes. This "pre-filtration" process requires chemical treatment of the source water, and those chemicals become part of the facility's discharge. The water also undergoes additional chemical treatment after RO to make it suitable to commingle with existing drinking water systems.

Environmental Impacts

Removing salt from saltwater is an energy-intensive process. In fact, desalination's energy use is higher than any alternative water supply – about 40% more energy-demanding than pumping water from the Sacramento Delta to San Diego (the most energy-intensive water today).[3] Energy accounts for 36% of the cost to run a SWRO desalination facility.[4] Because it is so energy-intensive, desalination increases our dependence on fossil fuels, increases greenhouse gas emissions and contributes to climate change.[5] And, as energy prices go up, so goes the price of desalination.

In addition to its high carbon footprint, desalination can have significant impacts on ocean water quality and marine life through both the intake of the source water and the discharge of concentrated brine and chemicals. Many desalination plants (including Santa Barbara's) use screened intake pipes in the open ocean to draw seawater into the facility. Fish and other marine life are injured or killed when they become trapped or "impinged" on the intake screens by the suction power of the intake. Organisms small enough to pass through the intake screens, such as plankton, fish eggs and larvae – the base of the marine food chain - become "entrained" inside the plant and die when exposed to the high pressure and heat of processing the salt water.[6]

The desalination process also generates brine waste, which contains high concentrations of salts and other constituents of seawater (magnesium, boron, calcium and sulfate), as well as various chemicals used in the desalination process.[7] Brine waste is typically discharged into the ocean through a brine-specific outfall or as part of a larger effluent stream (e.g., from a wastewater treatment plant or power generating facility). Brine is saltier, denser and heavier than ocean water and tends to sink and spread on the seafloor rather than mixing with the surrounding water. Studies have shown that exposure to brine and other potentially toxic constituents in desalination effluent can harm bottom-dwelling marine life, including endocrine disruption, compromised immune function, acute or chronic toxicity, and death.[8] If not properly diluted and discharged, brine concentration on the seafloor can destroy benthic habitat.

There are several operational, design, and technological measures available to reduce the impacts of desalination on the marine environment. In particular, subsurface intakes can virtually eliminate impingement and entrainment of marine life, as they extract seawater from beneath the seafloor or beach, rather than from a pipe in the open ocean. The sand acts as a natural filter, providing a level of pre-filtration that can reduce chemical and energy use and long-term operating costs. In addition, the use of brine diffusers and/or pre-discharge dilution with wastewater can help to minimize the negative impacts of concentrated brine discharges to the ocean.

Cost
Drinking water produced by desalination is very expensive, with an average price per acre-foot that is four to eight times higher than water from other sources. Estimates for plants proposed in California range from $1,900 to more than $3,000 per acre-foot.[9] But experience from around the world suggests these cost estimates are optimistic, and they do not reflect increases from the predictable rise in energy costs.

Desalination in California
Several coastal communities are looking to desalination as a way to develop additional, reliable supplies of municipal water, particularly as a buffer in times of drought. There are currently 10 small, intermittently operated desalination facilities along the California coast (including one in Santa Barbara), and 15 more in some stage of development, with a combined production capacity of 250 to 370 million gallons per day – a 60-fold increase over today's capacity.[10, 11] The State Water Board recently adopted a state policy which requires desalination facilities in California to use the best available site, design, technology, and mitigation in order to minimize the mortality of marine life. The policy also sets standards for how desalination facilities discharge brine back into the marine environment.

Desalination in Santa Barbara
The City of Santa Barbara built a desalination plant in response to the drought of 1986-91, which was completed in 1992 at a cost of $34 million. The plant was barely used before the drought ended and it was put in long-term storage mode. In response to the current drought, the City is moving ahead with plans to reactivate the mothballed plant at a cost of at least $55 million. Once in operation, the plant would cost $5 million to produce 3,125 acre-feet of water per year.[12] At $1,600 per acre-foot, desalination would be the most expensive source of water in the City's water supply portfolio. To pay for desalination, City water customers saw their first rate increase of 38% on average in July 2015, and will continue to pay higher rates for at least the next 10 years regardless of whether the rains return and desalinated water is no longer needed.

Alternatives
In most locations, water conservation, water use efficiency, stormwater capture and reuse, and recycled water are less expensive and have multiple economic and environmental benefits, including water quality improvements, habitat restoration, reduced energy demand and natural flood control.[13]

Santa Barbara Channelkeeper's Position on Desalination in Santa Barbara
Channelkeeper believes that desalination should be a last resort after all the aforementioned alternatives are exhausted – which they have not been yet. If Santa Barbara absolutely must still resort to desalination to meet any remaining shortfall in water supply, then the best, least environmentally harmful technologies available today should be used, including subsurface intakes and brine diffusers, and appropriate mitigation should be done to offset the harm it will cause to marine life.

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[1] State Water Resources Control Board (SWRCB), Fact Sheet: Proposed Amendment for Addressing Desalination Facilities (2014).
[2] SWRCB, Draft Staff Report Including the Draft Substitute Environmental Documentation (SED) Amendment to the Water Quality Control Plan For Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges, and the Incorporation of Other Nonsubstantive Changes (2014).
[3] Arpad Horvath et al. Life-Cycle Energy Assessment of Alternative Water Supply Systems in California, Cal. Energy Commission, 4 (2011); see also Barry Nelson, et al., Natural Resources Defense Council (NRDC), In Hot Water: Water Management Strategies to Weather the Effects of Global Warming 19, 35 (2007).
[4] Heather Cooley and Newsha Ajami, Pacific Institute, Key Issues for Desalination in California: Cost and Financing (2012).
[5] Cooley et al. Pacific Institute, Desalination, With a Grain of Salt, A California Perspective 7 (2006).
[6] SWRCB, Draft SED.
[7] Heather Cooley et al, Pacific Institute, Key Issues in Seawater Desalination in California: Marine Impacts (2013).
[8] SWRCB, Fact Sheet; SWRCB, Draft SED.
[9] Heather Cooley et al., Pacific Institute, Key Issues for Desalination in California: Cost and Financing 5 (2012).
[10] Facilities are being considered in Carlsbad, Oceanside, Camp Pendleton, Dana Point, Huntington Beach, El Segundo, Oceano, Cambria, Monterey Bay, Santa Cruz, Moss Landing, and Pittsburg.
[11] Heather Cooley and K. Donnelly, Pacific Institute, Proposed Seawater Desalination Facilities in California (2012).
[12] City of Santa Barbara, http://www.santabarbaraca.gov/gov/depts/pw/resources/system/sources/desalination.asp.
[13] NRDC, Proceed with Caution: California's Drought and Seawater Desalination (2014).