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## The Future of Water in Orange County California

### **Introduction**

Water is a critical resource for survival and daily life, but it is often taken for granted in the Western world. Although three-fourths of the world's surface is covered by salt water, historically the process of removing salt and providing fresh water has been difficult and expensive. The recently proposed Doheny Desalination Project in Orange County, California, would provide an additional source of freshwater for this highly populated and dry region. While the need for more water sources is great, there are potential disadvantages to desalination plants like the one proposed in southern California. Some critics point to damage which desalinization processes can create in ocean ecology. The debate for whether the Doheny Desalination Project should be constructed highlights ethical arguments for how humans should treat our environment when utilizing resources. I believe that while the needs of human survival should be a top priority, efforts need to be made to minimize the negative impacts to the environment.

### **Background**

States such as California have experienced many severe droughts, most recently between 2014 and 2017. California currently acquires its potable water from surface water, mountain snowpack, and groundwater sources. As climate change reduces the

snowpack in some areas as well as replenished groundwater, new water solutions must be identified and implemented. Water desalination plants have been successful in some areas of the world like Israel, where they now provide over 100% of the country's water needs [1]. This has enabled Israel to become a net-exporter of fresh water in a very dry region. Only two desalination plants have been built in California to date, but as water needs grow desalination will continue to be one of the most promising sources of freshwater [2].

Water desalination is the process of collecting ocean water through intakes underneath the ocean floor and removing the salt and constituents, resulting in fresh water and highly concentrated brine waste. The process of removing the salts from the saltwater includes: pretreatment, greensand filters, membrane filters, chemical cleaning and post-treatment. From the total volume of seawater taken in, 40-50% of it is turned into fresh water and the rest is left as highly concentrated chemical brine [3].

Advancements in membrane technology proposed in the Doheny Desalination Project would allow the overall process to become much cheaper and more efficient [4]. There are still many potential risks in the desalination process, however, and these need to be addressed if ecological harms are to be avoided.

Desalination can harm marine life different ways. If implemented incorrectly, water intakes can draw in microbial life essential to plant growth as well water. This can include "plankton, fish eggs and larvae" [3]. By placing the intake in a place of low biodiversity, this risk can be reduced. By increasing the efficiency of the conversion process, less overall ocean water is required to produce the same amount of freshwater. This also reduces the environmental impact of the desalination process.

Additionally, the disposal method used for produced chemical brine can pose environmental risks. These disposal methods include evaporation ponds, deep well injection, and land application. Directly discharge of the brine back into the ocean poses the biggest risk to marine life. This kind of discharge “can disrupt natural salinity balances and cause environmental damage to marine ecosystems, especially sensitive marshes and fisheries” [3]. Other methods of disposing of the brine should therefore be used.

### **Stakeholders**

#### **The South Coast Water District**

The South Coast Water District (SCWD) is currently the sole developer of the Doheny Desalination Project in Orange County. They will contract out portions of the project, but they are responsible for directing the completion of the project. The SCWD is responsible for managing the California water systems in their area. Their primary goal in pursuing the Doheny Desalination Project is to provide a new source of freshwater for the community. The SCWD contracted with Boyle Engineering Corporation to receive estimates for how much the facility will cost. The capital cost of the project is estimated to be about \$170 million, the total annual operating cost to be about \$24 million and is projected to produce between 8,040 - 9,150 acre feet of fresh water per year [5]. In addition to improving “water security” for California, SCWD also needs to operate with a profit. Desalination plants have the potential to solve a important water issues in California, but because of its profit motive the primary concern of the SCWD is unlikely to be the environment and minimizing its ecological impact.

## The Pacific Institute

The Pacific Institute, based out of Oakland, California, operates as a global water think tank to influence policy decisions. Their mission is to “create and advance solutions to the world’s most pressing water challenges” [6]. The Pacific Institute supplies scientific reports covering issues of desalination in California, as they value a deeper investigation into the potential impacts desalination can cause. These include promoting societal esteem of science, the valuing of the world’s ecosystems, and promoting ecologically informed decision-making by corporations, governments, and non-profit organizations. The Pacific Institute is not strictly against desalination, but wants to ensure all desalination plants in California are held to high environmental standards and the negative impacts of these activities are minimized.

## California Department of Food & Agriculture

The CDFA is a state government entity whose primary concern is monitoring and regulating food and agriculture in the state of California. They represent the opinions and scientific research of all California citizens in protecting many of the state’s greatest natural resources, including water. Since water is of vital importance to growing crops and the agricultural industry, water is a primary concern of the CDFA. The CDFA has published their “California Water Action Plan” to outline the concerns of the state regarding water needs. The plan recognizes there are many water challenges including droughts, declining groundwater supplies, loss of wildlife habitat, floods, population growth, and climate change. The CDFA recognizes there is not a single solution which would solve all the current problems surrounding water needs, and that compromises must be made. The CDFA contends, however, that change is needed since an

unregulated environment would result in increased water scarcity and a loss of water security in the region. [7]

Water desalination is, therefore, of great interest to the CDFA as a source of more freshwater. Water desalination may offer the greatest sustainable supply of freshwater for the California public. The CDFA is a promoter of the Doheny Desalination Project as it marks the start of a new chapter in the history of meeting the region's water needs. Securing this source of freshwater would fulfill one of the CDFA's values for water security for Orange County.

The CDFA does, however, have more concerns beyond the promotion of desalinization to provide greater freshwater resources. One of the CDFA's core values is protecting natural ecosystems. This positions them as a key advocate to minimize the negative ecological impact, which desalination systems could produce.

### **Common Ground**

While each stakeholder is on a spectrum between the meeting the water needs of the region and environmental protection, each can agree that California's current and future needs for sources of freshwater are growing. It is therefore important to critically evaluate each new potential source of water. All stakeholders recognize the potential for water desalination to provide a substantial amount of new freshwater resources. Whether this potential outweighs the negative impacts it may cause the environment, or how much the potential risks can or should be minimized, is an issue of debate and disagreement. This highlights a conflict of interests between those wanting to profitably augment regional water resources, and those advocating for environmental protection

for the ocean and surrounding natural environments that would be affected by the Doheny Desalination Project.

### **Solutions**

In light of the greater issues of population growth, decreasing water supplies, and climate change; I put forth that Doheny Desalination Project should be constructed in Orange County. This recommendation is accompanied by the terms that the recovery rate of freshwater be 55% of the saltwater collected, and a zero liquid discharge system for brine disposal. These terms will assure that no aquatic species will see a decrease in population. These terms are concessions to concerns from the Pacific Institute and the CDFA that may be realistically implemented without operating the facility at a loss.

The Doheny Desalination Project's operation is most critical to the value of fulfilling human needs. In order for the sustainability of human life in California, water security must be achieved. In line with the CDFA's Water Plan, however, this project should only be conducted with the intention of also seeking out, in tandem, other water sources and conservation practices. The future of water security in California is a long road and the implementation of the Doheny Desalination Project may provide further evidence into the viability of water desalination in California.

While valuing human needs first, considerations must also be made so as not to indirectly harm human needs in the long term. The Doheny Desalination Project will be a long-term project and its potential effects have been critically evaluated. There are many cornerstone species that occupy the ocean floor and as research by the Pacific Institute has shown, the desalination process has the potential to harm these species. The loss of these cornerstone species would prove detrimental to long-term human

survival as loss of ocean ecology would lead to greater problems. This is one of the causes for including the provision that no aquatic species would see a decrease in number. The Pacific Institute is supportive of the desalination process if it is conducted with considerations to the environment.

The first term of the recommendation, that the recovery rate of freshwater be 55% of the saltwater collected, is critical in having a low impact on ocean species. With current technology, 55% is the high end for the recovery rate of freshwater. By producing a higher percentage of freshwater from what is taken in from the ocean, less overall ocean water is needed. This lessened volume intake results in fewer issues caused by the intake system on the ocean life. [3]

The second term of the recommendation, that a zero liquid discharge system for brine disposal is implemented. Brine is the highly concentrated salt solution that is the byproduct of the desalination process. Poor brine disposal methods have the potential to cause the most harm to surrounding ecosystems. By implementing a zero liquid discharge system, this means that no brine solution will be released back into the ocean or underground. This method will require evaporation ponds so that the salts may be picked up as a solid waste for disposal. By assuring brine is not released back into the ocean, the risk that the highly concentrated salts would harm the ecosystem would be eliminated.

These terms for the implantation of the Doheny Desalination Project may be disadvantageous for the South Coast Water District, however, it is a needed mitigation of risks. The project will still take in a profit as the demand for freshwater will continue to rise. These terms take advantage of existing technologies and may be further updated

as advancements are made. It is in the best interests of the South Coast Water District to conduct this project properly as it is important for all stakeholders.

### **Conclusion**

The construction of the Doheny Desalination Project would improve water security in southern California and represent a key milestone in the California Water Action Plan proposed by the CDFA. Water is a critical resource for life and should not be taken for granted. The concerns of the Pacific Institute are important in weighing and mitigating the potential risks of the project. Looking to the future, water desalination is clearly a technology of great promise and benefits. The Doheny Desalination Project is a critical project that should be constructed with these proposed constraints and guidelines.

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