From Waves to Wells

Seawater Desalination and Coastal Groundwater Basins

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Traditional sources of freshwater are dwindling as a result of increased demand, reduced natural replenishment, volatile weather patterns, and extended-duration droughts. Desalination, the industrial-scale removal of salt from saline water to create fresh product water, can be a valuable source of "new water." "New water" is recognized in California as water that would not occur in a watershed or groundwater basin but for human intervention to cause the water to be captured or created. The California Water Plan Update 2023 identifies a goal of increasing desalinated product water by 28,000 acre-feet per year by 2030 and 84,000 by 2040. New desalination projects would benefit from clarifying the project's legal rights to desalination source water and product water.

Creating "New Water" Through Desalination

Desalinating seawater can have negative impacts on marine habitats. To reduce the capture and death of marine organisms from desalination, California's State Water Resources Control Board (State Board) has identified underground extraction, rather than open-water intake, as the environmentally preferred method for desalination whenever feasible. Underground extraction can occur offshore beneath the seafloor or onshore from aquifers infiltrated by seawater, as illustrated in Figure 1. Seawater drawn through the well screens is transported to a desalination processing plant that separates out the salts, resulting in fresh product water.

Along the California coast, groundwater basins exist adjacent to the ocean. Many basins extend from many miles inland to offshore beneath the seafloor, as illustrated in Figure 1. Groundwater basins arise when surface water and precipitation percolate through the ground and accumulate in water-bearing geologic formations capable of yielding a substantial freshwater supply, also described as an "aquifer."

If the volume and pressure generated by inland percolation create a seaward gradient, freshwater may slowly flow offshore through the aquifer. Conversely, if the inland extraction of freshwater from the aquifer reduces the volume and pressure in the groundwater basin and creates an inland gradient, seawater infiltrating through the seafloor into the aquifer is pulled landward past the shoreline. This latter phenomenon is commonly referred to as seawater intrusion. Where the freshwater/seawater interface is located depends on the influences of natural percolation and human extraction, among other factors, plus the extent of seawater infiltration into the offshore aquifer beneath the seafloor.

Where seawater meets fresh groundwater, the freshwater dilutes the seawater, creating a zone of brackish water with salinity ranging from about 35,000 parts per million (ppm) for seawater, down to about 1,000 ppm, the upper threshold for generally usable freshwater. Drinking water requires salinity under 500 ppm. The brackish water zone can be located seaward of the shoreline or inland of the shoreline, depending on the gradient. Figure 1 illustrates the underground seawater/brackish water/freshwater interface zone for a seawater-intruded aquifer, with the original and existing interface locations identified.

Coastal settings in California have been extremely desirable for urban and agricultural development. Inland groundwater pumping has been a significant source of municipal and irrigation water supply. Seawater intrusion has occurred as a by-product of this historic use. For example, in the Salinas River Valley, inland agricultural and municipal wells have caused the freshwater/seawater interface to move from offshore to about four miles inland.

Many groundwater basins adjacent to the coast are now over-drafted and subject to extraction prohibitions. Where new wells are prohibited, is a groundwater right needed to extract

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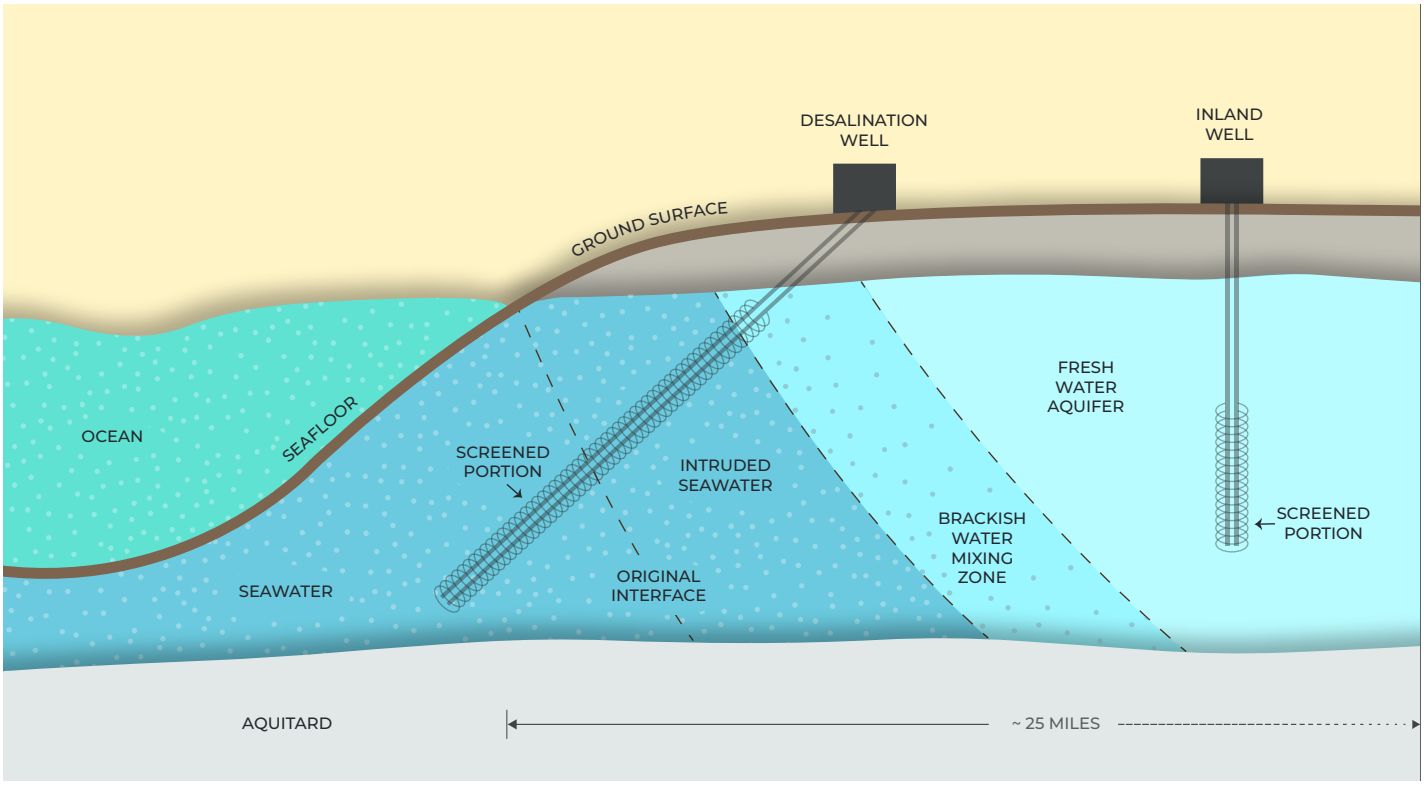

Fig. 1. Underground Extraction of Seawater © David Osias and Tara Paul (reprinted with permission)

seawater or brackish water from aquifers beneath the seafloor or beneath onshore land? If not, why not, and who has rights to the desalinated product water?

California's Water Rights Framework

California water rights are governed by three primary doctrines: (i) water rights are usufructuary, (ii) water rights require beneficial use, and (iii) the type of water right depends on the source of water to be beneficially used.

A usufructuary right confers a right to *use* water. There is no exclusionary right or possessory right to any body of water. The usufructuary nature of the right allows the use of water by others when there is water available in excess of the right holder's needs or when the right holder is not using the water.

The usufructuary water right also is limited to beneficial uses. Nonuse is not considered to be a beneficial use. For example, California Water Code § 1240 provides: "The appropriation must be for some useful or beneficial purpose, and when the appropriator or his successor in interest ceases to use it for such a purpose the right ceases." A water right holder may only take the amount needed for beneficial purposes. Beneficial uses include a wide variety of purposes, but none of them envision the need for significant desalination as a condition to use. Beneficial uses include domestic, municipal, or industrial purposes; irrigation; power; mining; and fish and wildlife preservation. The necessity of beneficial use, along with a requirement for reasonable use and the prohibition of waste, is embodied in the California Constitution, Article 10, § 2.

California is a hybrid state with respect to types of water rights. For surface water, California recognizes riparian and appropriative rights, and for groundwater it recognizes overlying and groundwater appropriative rights. Each of the rights is subject to different processes for vesting, exercising, and management. The determination of which type of right is applicable depends on the source of freshwater involved: surface water or groundwater. Surface water includes lakes, streams, and "subterranean streams flowing through known and definite channels." Cal. Water Code § 1200. Groundwater is the result of percolating precipitation and surface water that accumulates underground in aquifers, instead of flowing through subterranean streams.

Not all water fits neatly within this dichotomous framework. For example, precipitation that has neither percolated underground nor found its way to a water course may be captured and used without the need for a water right. Ephemeral water that temporarily drains through a swale or depression for a short while following a precipitation event also may be captured and used without a water right. These are forms of unreliable vagrant water. All land-based water arises from precipitation, but not all land-based water requires a water right for capture and use.

Desalination Source Water and the Water Rights Framework

As noted above, the type of water right depends on the source of the water to be used. Moreover, water rights are only a *use*

right, not a possessory or exclusionary right, and beneficial use must be possible. Applying these concepts to desalination source water (i.e., seawater), which, by definition, requires desalination to become a usable resource, illustrates why preexisting water rights do not extend to desalination source water, regardless of extraction location.

There is an extensive body of law recognizing water rights to surface water sources such as lakes and streams. There is little doubt that the ocean itself is also a surface water body. Yet, the ocean has never been recognized as a surface water body for water rights purposes by any legislative, executive, or judicial body in California. Perhaps the historical inability to put seawater to beneficial use explains why water rights for seawater use have never been required. When precipitation, runoff, or streams reach the ocean, each becomes seawater beyond the reach of water rights. Throughout California's statutes and caselaw, all identified water bodies to which water rights attach involve water readily capable of beneficial use. Seawater is not that type of water.

A desalination intake well draws water "from" the ocean by inducing seawater to move through the seafloor into the underground aquifer and into the intake well.

Non-desalination uses of seawater in California occur and are regulated. For example, the use of seawater for power plant cooling is an industrial use subject to numerous environmental regulations. The State Board, the ultimate statewide agency for water quality and water rights administration, established a statewide policy for such uses (the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Policy)). The Policy establishes uniform, technology-based standards to minimize adverse environmental impacts pursuant to the federal Clean Water Act § 316(b). The Policy does not require water rights for seawater use. That is consistent with the definitions within and applicable to California's other water quality protection laws, which define "waters of the state," both surface and groundwater, as including "saline water." Cal. Water Code § 13050(e). Conversely, inclusion of "saline water" is not found in the Water Code with respect to sources of water for water rights purposes.

California also treats the desalination process as an industrial use of seawater requiring compliance with the State Board's California Ocean Plan (Ocean Plan) and other water quality regulations. Notably, both seawater intake and brine discharge are regulated only with respect to their environmental impacts, without requiring a water right.

Seawater Is Not Defined by Location

Although seawater falls outside the water rights framework, the question remains whether seawater that is not *in* the ocean, but is nonetheless *from* the ocean, should be treated as seawater for water rights purposes. And should seawater that interacts with a freshwater source to create brackish water at the freshwater/seawater interface be treated as seawater or groundwater? Three questions are relevant to the determination: (i) Where is the source water *from*; (ii) where is the source water *found*; and (iii) what beneficial *uses* are occurring or possible for the source water *without desalination*?

Where something is from was recently addressed by the U.S. Supreme Court with respect to where sewage in the ocean was "from." *Cnty. of Maui v. Hawaii Wildlife Fund*, 590 U.S. 165 (2020). In *Maui*, sewage was injected down through a well into a groundwater basin. The sewage migrated through the aquifer to enter the ocean. Although the *Maui* underground sewage flow was in the opposite direction (inland to ocean) than the underground flow induced by desalination intake (ocean to inland), the analytic approach utilized by the Supreme Court is nonetheless applicable.

The Supreme Court recognized the ocean and the groundwater basin as different bodies of water. Where the sewage was "from" depended on its origin, destination, and context (i.e., how close the origin and destination were to each other and how long it took the sewage to traverse the distance). *See id.* at 179.

A desalination intake well draws water "from" the ocean by inducing seawater to move through the seafloor into the underground aquifer and into the intake well. Even if the intake screens are located landward of the shoreline, the well is drawing water "from" the ocean, according to the U.S. Supreme Court's approach, if the well screens are near the ocean and the seawater does not take a long time to enter the well. As seawater is extracted, it is continuously replaced by more seawater. Thus, the source water remains "from" the ocean, and no water right is needed despite the intake location not being *in* the ocean itself.

Where the source water is "found" also may have relevance, if that location and the desalination-induced flow demonstrate that the source water is not from the ocean in a proximate or temporal sense. Applying the *Maui* reasoning, a desalination intake well many miles inland extracting water that has not been in the ocean for many years would not be extracting water "from" the ocean.

But a further word of caution is necessary to avoid conflating *origin* with *location*. The labels ascribed to source water are often misinterpreted. The name "seawater" implies it is water *in* the ocean, just as the name "groundwater" suggests it is *freshwater* under the ground. Neither implication identifies where the water is from. Seawater infiltrating into a sub-seafloor aquifer is still seawater, even though it is then found under the ground. If a landward gradient moves that subsurface seawater inland past the shoreline, it does not stop being water from the ocean. This distinction is explained by the California Department of Water

Resources (DWR): "[b]ecause 'brackish water' and 'sea water' do not refer to locations but are [rather] descriptors of degrees of salinity, brackish water does not necessarily refer to subsurface water (groundwater), and sea water does not necessarily refer to open or surface water. . . ." Thus, "water characterized by the terms fresh, brackish, or sea may be withdrawn from surface or subsurface locations." DWR, *Desalination (Brackish and Sea Water): A Resource Management Strategy of the California Water Plan*, at 4 (July 29, 2016) (DWR Desalination Plan).

Some argue that where water is extracted from should be determinative of whether it is seawater and cite to certain definitions of groundwater as "water found beneath the Earth's surface." For example, California Water Code § 10721(g) defines groundwater in part as "water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water." In reliance on that statute, opponents of a desalination project adjacent to an overdrafted groundwater basin have argued that even seawater found beneath the seafloor in an aquifer that extends landward is not seawater by virtue of its location and therefore cannot be extracted.

The location where desalination source water is extracted (underground) does not change where it is from (the ocean) or convert the source water from what it is (seawater). The Water Code defines groundwater basins and identifies seawater as an intruder into the groundwater basin, not as water in the basin. Cal. Water Code § 10721(x). This distinction between the intruding seawater and the groundwater to be protected is consistent with the *Maui* decision, in which the Supreme Court recognized the groundwater basin and the ocean as distinct water bodies, despite their hydrologic connection.

The State Board's Ocean Plan, Revised 2019 (Ocean Plan), recognizes that seawater is not *location* dependent, but rather *origin* dependent. The Ocean Plan defines seawater as "salt water that is in or from the ocean," regardless of whether it is found "beneath the seafloor, beach, or other contiguous land with hydrologic connectivity to the ocean." Ocean Plan app. I, at 69–70. The DWR likewise cautions against confusing the source water extraction location with the origin of the source water, noting, "[g]roundwater wells located adjacent to or underneath surface waters, in particular the ocean, are a way to extract saline surface waters when the groundwater is directly connected to and readily replenished by surface water." DWR Desalination Plan at 7.

California law recognizes that pumping water from below ground to draw water from an adjacent surface water body is functionally (and legally) the same as drawing water directly from that adjacent surface water. Most circumstances arise from situations that are the inverse of the desalination setting; a well owner claims *not* to be drawing from the adjacent surface water to avoid restrictions or procedural requirements applicable only to surface water. In cases in which wells have drawn water out of streams, courts have held that the pumping should be treated as an appropriation (or riparian use) of surface waters. In one such case, the California Supreme Court explained, "one who has no legal right to the surface flow of the stream may not, by indirection, acquire that right by a subterranean tapping and taking of it." *Montecito Valley Water Co. v. City of Santa Barbara*, 144 Cal. 578, 588 (1904). This same rule should govern the ocean accessed by wells near the shoreline extracting water from an aquifer underlying the shore and ocean floor filled with infiltrating seawater.

The quality of the source water also can be relevant to answering the question of who has the right to extract and use it. Highly saline source water may require no water right if the source water cannot be put to a beneficial use without desalination. The level of salinity is particularly relevant to brackish desalination source water at the seawater/freshwater interface. Unusable commingled seawater and freshwater resulting in unusable brackish water should require no water right. When water is a component of a fluid requiring separating out the water component in order to put it to use, like sewage, no water right is required to use the sewage, and the operator creating reclaimed water from the sewage has the sole right to the reclaimed water. Water Code § 1210 provides that the owner of a wastewater plant treating sewage holds the exclusive right to the treated wastewater as against anyone who has supplied the discharged sewage into the wastewater collection and treatment system.

The location where desalination source water is extracted (underground) does not change where it is from (the ocean) or convert the source water from what it is (seawater).

An analysis of whether reasonable beneficial use is occurring with brackish water should be determinative as to freshwater right holders. If no beneficial uses are occurring or reasonably possible, even though the salinity is considerably lower than ocean salinity, exclusive rights to the brackish source and product water should be in the desalination operator in a manner similar to the sewage treatment plant operator.

Desalinated Product Water as "New Water"

Water rights do not extend to seawater, despite the location from which the seawater is extracted, nor to that portion of the seawater/freshwater interface classified as brackish water that is unusable without desalination. Thus, the remaining question is: Do groundwater water right holders have any rights to the product water from desalination?

The DWR defines "new water" as "[w]ater that is legally and empirically available for a beneficial use; it can be developed through many strategies, such as capture of surplus water,

desalination of ocean water, and reductions in depletion." DWR Water Basics Glossary. The DWR explicitly recognizes desalination as a process to *create* new water. "Because desalination makes use of saline water sources that otherwise are unused and unusable, desalinated supplies represent a 'new' supply source to the state." DWR Desalination Plan at 31.

"New water" is water that would not occur without human intervention. The concept originated with imported water but is now recognized as applicable to salvaged water, developed water, recycled/reclaimed water, and desalinated water. Imported water from another watershed or basin, even if commingled with native supplies, does not lose its status as new water and is unavailable to native-supply water rights. But for the importation, the water would not be there; hence, it is "new water." "Salvaged" water and "developed" water are similar. "The general rules governing rights to the use of salvaged and developed water are the same . . . that the person who by his own efforts makes such waters available is entitled to use them, provided that in doing so he is not infringing on the prior rights of others." Wells A. Hutchins, *The California Law of Water Rights* 383 (1942). The technical difference between the two terms is that salvaged water refers to new water that is saved from the supply through conservation methods, whereas developed water is new water that is added to the supply. Under the salvaged water doctrine, "full recognition is afforded of the right to water of one who saves as well as of one who develops it." *Pomona Land & Water Co. v. San Antonio Water Co*., 152 Cal. 618, 624–25 (1908). The "priority of the overlying right does not extend to water made available by the efforts of another." *City of Santa Maria v. Adam*, 211 Cal. App. 4th 266, 304–05 (2012).

Seawater and brackish water remain unusable because of their salinity, regardless of whether extracted directly from the ocean, beneath the seafloor, or seawater-intruded onshore locations. The desalinated product water would not exist but for the desalination project. Thus, it is "new water" to which the desalinating party has exclusive rights.

California's Constitution Supports Desalination

California's Constitution strikes a balance between water conservation interests and the utilization of water in asserting that "the general welfare requires" water resources in the state to "be put to beneficial use to the fullest extent of which they are capable" and that "waste or unreasonable use of water be prevented. . . ." Cal. Const. art. X, § 2. This constitutional policy recognizes that water resources should be available to support as many interests as possible, along with a need to protect water resources from wasteful practices. It mandates that where there is sufficient water to meet all recognized and existing beneficial uses, parties interested in using any surplus water should not be barred from lawfully doing so. Particularly in the context of developing new water by desalination, the Constitution compels an outcome that maximizes the beneficial use of water to the fullest extent possible without injuring others.

Desalination project opponents fear possible future injury to coastal groundwater basins. This fear should be insufficient to negate approval of a desalination project. Water rights protections for groundwater users and desalination are not mutually exclusive. California law requires a "physical solution" for water rights conflicts, if possible, to allow new users while preventing harm to existing users. *Peabody v. City of Vallejo*, 2 Cal. 2d 351, 379–84 (1935). A "physical solution" establishes judicially supervised conditions for new users that impose protections against injury for existing users. Importantly, courts are not just allowed to order a physical solution—they have an affirmative duty under the Constitution to impose one whenever it is feasible to do so.

Resolving disputes involving desalination projects and groundwater users requires a balancing of interests pursuant to the California Constitution and application of the physical solution doctrine. Native water supplies may be inadequate to meet future demand. Some local agencies will need new sources of water, and for some, creating new water by desalination is the only viable option to meet critical future needs. In the absence of injury to others, or if the risk of injury can be resolved with a physical solution, the prohibition of a desalination project may be contrary to the California Constitution. Because the desalination process creates new water that would otherwise be unavailable to rights holders, and where future adverse impacts can be monitored and prevented or mitigated, the physical solution doctrine is the proper and required method to resolve objections to desalination projects.

Desalination Is a Legally Viable Source of New Water Supplies

Desalination is a source of water that is immune to drought and climate change. It is a new source of water to which preexisting water rights do not attach. Seawater is outside the realm of water rights, regardless of where extracted; similarly, unusable brackish source water from seawater intrusion also should be an available source for a desalination project. Risks to coastal groundwater basins and existing groundwater users can be avoided and managed through application of the California Constitution mandate requiring a physical solution as an equitable remedy.

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