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The Unseen River and Infrastructural Silences: The Santa Ana River and the Ontology of Floods

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Abstract

This article discusses the history of land development and infrastructure along the Santa Ana River in Southern California. The river plays a significant role in the landscape of many of Southern California's cities and urban geographies but has been relatively underdiscussed in literature. This article approaches the river using a combination of historic ethnography and sociocultural theory to unpack the meanings of the infrastructure of the river and its relation to Southern Californians. From these meanings, the article places the river in context with environmental politics, urban development, and water management issues in California today. The article argues that the invisibility created by the Santa Ana River's infrastructure is the result of several key historic projects to protect private land ownership, which intersects with historic processes of myth making about Southern California's climate and geography. Moreover, this invisibility is importantly hiding several aspects about California's water management and water politics that provide solutions, and realities about the so-called California Water Crisis.

Introduction

It was early March 2024. My father and I had driven to the offices of the Orange County Water District's Prado Wetlands in Corona. Nestled between a paintball course and a gun range and headquartered in a small portable prefab, we both were confused. Were we even in the right place? The logo of the OCWD and a sign describing their work in removing *Arrundo donax,* an invasive species of cane that had spread like wildfire across the surface of the water assured us that we were. For such an unassuming building and such a strange location, one would not expect that the OCWD is in fact one of the most powerful water management agencies in Southern California. Located less than fifty minutes away from the wetlands was their Ground Water Replenishment System, the GWRS. The largest groundwater treatment facility of its kind in the world, the GWRS treats water before injecting it into the Orange County Aquifer, a huge water basin located underneath the glitz, glamour, and often urban decay of the OC. The GWRS and the OCWD's Prado wetlands represent a two-step process in treating and purifying water before it reaches the coast and ensuring that the OC Aquifer is kept at sustainable levels.

My father and I had come to the wetlands to see the scale and intensity in the conservation project that the OCWD had been managing. When we arrived, we had to self-guide ourselves through the wetlands, as the OCWD was busy with removing the invasive cane. My father had noted that it was surprising to see just how complicated the process was, he also noted that he had never really thought about the river before, despite driving over it for nearly thirty years. We wanted to learn more about what the conservation process had looked like. But more than that we had come to specifically answer questions about what it meant for these management agencies in handling water in a desert that is also occasionally a land of floods.

The Prado Wetlands is not a natural formation. The wetlands are formed by the levees of the Prado dam in the former boundaries of the town of Prado; in the dry season you can still make out the outline of old farmhouses in town. From the wetlands you can't see the dam completely, but you can just about make the outline of the dam crest, standing at more than 150 feet tall. The dam itself is impossible to miss; if one was to drive coming east from Orange County via the 91 freeway, it would be the first thing that one sees entering the so-called Inland Empire. A large concrete face adjacent to the dam spillway is plastered with a red, white, and blue mural that reads "200 YEARS OF FREEDOM" in dramatic bold-face lettering. The mural is equal parts garish and curious and was painted for the American Bicentennial of 1976. We had attempted to try and see if it was possible to see the dam and the mural from the ground but had no luck in contacting the Army Corps of Engineers who supervised the dam.

But if it was so easy to see the dam, then why was it that so many of the people I spoke to about the river didn't actually notice it? The reasons why or why not certain infrastructure becomes visible can be hard to explain, especially because the meanings of infrastructure and infrastructural development change over time. The Prado Dam as it was envisioned in 1941 is radically different from the Prado Dam of today; they symbolically mean two different things. While the dam was originally built to protect property and homes in the OC flood plain, today it does much more than this. To the water agencies that maintain the dam, the dam works to preserve California's ecological processes. As infrastructure evolves symbolically, so do all the interdependent environments that it interacts with. The Prado Wetland which seventy years ago would not have existed is a prime example of this. Originally the Prado basin served simply as a catchment to help protect Orange County from the most severe of floods along the Santa Ana

River, but now it serves a much more important and significant role in maintaining a very delicate balance between our cities and California's hydrology.

This balancing act now seems more crucial to understand than ever. California is a state constantly "on the edge" (Starr, 2003), precariously situated in its relation to water and in determining and provisioning water access. In Sacramento, the courts hear more than 6000 water rights cases every month. While numerous books have been written on the subject that detail and document the fraught nature of water, misuse, overexploitation, and unsustainability, (Hundley, 2001, Miller, 2001, Starr, 2005, Miller, 2010, Ingram and Roam, 2015, Miller, 2016, Arax, 2019,) there always has seemed to be an element missing in this story that I have only been made more aware of in coming to understand the Santa Ana River. The relationship Southern California shares with the Santa Ana River is more nuanced than the monolithic understanding of the "water crisis" in California that is so often described. This is not to dismiss this concern; there are elements of California's water management that can be described as definitive misuse, but in examining the ties with the Santa Ana River for Southern California there are elements of success that are worth examining.

I have lived in Corona for my whole life, and I have seen the mural of the Prado dam fade with weather and age. When the mural was restored through a public effort to attempt to have the dam listed on the National Historic Registry, I also saw the mural restored to its original colors, as it would have looked when it was first painted. It was around this time that I began to seriously explore the dam's history. The Prado Dam provides flood control for the Santa Ana River, the largest river in Southern California. Stretching from San Bernadino County in the San Bernadino Mountains and flowing all the way to the Pacific Coast near Huntington Bay, the river

has been a feature in my life from the moment I was born. It should be more important, but for its scale and its presence the river, and the infrastructure built to shape and control it, is remarkably hidden. While water management agencies like the OCWD are proud of the relationship that they share with the Santa Ana River and are very open about their work, unless one was aware of these agencies, they might as well not exist.

For my part being able to identify and understand these relationships is more important than purely academic. The dam, the river, and the water have shaped the contours of my life, and I am sure, of many other Southern Californians. This article is equally an exploration of myself as it is of history, water politics, and land use. Living near the Santa Ana River, living near any river means living within an ontology of floods. It means being formed by attempts to control and harness water.

Through contextualizing the evolving contexts of the Santa Ana River and its infrastructure, we can use infrastructure to study an archeology of the present. Anthropologists studying infrastructure, and historians of Southern California can visualize the changing cultural and social values expressed through land and resource management, urban planning and material relationships with nature and natural environments. I argue that the Santa Ana River is invisible because of a historic process that aimed to constrain the river in order to protect private land and property along the river. More importantly, the invisibility of the river stems from the relationship between private development of land and property in California alongside a historic mythos that reimagined the Southern California landscape, and its ecologies and hydrology. In essence, the river was made invisible because it was transformed to fit the emergence of this mythos over time.

This reconfiguration drastically expanded the relationship between man-made developments and the river, causing the two to become inexorably intertwined. The visibility (or invisibility) of infrastructure is thus, sometimes rendered secondarily, made apparent only through the kinds of metamorphizing effects which infrastructure enables. In the case of the Prado Dam and the Santa Ana River, these visualizations are in the kinds of livelihoods and built environments that they have created, in the delicate political relationships between government agencies and bodies of experts who tend to our water resources, and often a fraught dynamic between the natural and constructed environments.

In demonstrating that the relationship between material development and nature are intertwined, I demonstrate that sometimes complex man-made interventions in preserving natural processes are not only possible but are sometimes necessitated because of continual man-made alterations of the natural environment. This relationship between the project of making the river invisible and the effect it had on the environment has also contributed to the process of water management along the river largely invisible. I assert that this demonstrates that resistance to climate change intervention is itself part of discomfort and anxiety about human agency in reshaping the environment.

Coming to be with Water

Talking about the history of California means talking about the history of the intensification of water use, and water extraction. But it also means talking about how people relate to water, or how people in California have understood it. In order to understand why the Santa Ana River and its infrastructure exists, it is important to understand the historic sequence of events that led to its construction. The history of the Santa Ana River shows how our

relationship to water has changed, and importantly, why we decided to try and change that relationship. This history is also important for illustrating how the symbolic meaning of infrastructure changed over time. How did Southern California come to be with water? Where did an imagined structure and order begin to emerge in a water regime along the Californian frontier? And when, how, and why was the Santa Ana River rendered invisible? These questions can be examined in the lens of incremental stages of technological reconfigurations, or it can be examined through political and cultural shifts about land use and ownership; I will explore both holistically. In examining the issue of technology, I draw from Brian Larkin's review of the current understanding of anthropologies of infrastructure. Brian Larkin proposes that the defining feature of infrastructure is "when one technological system comes to dominate over others or when independent systems converge into a network." (Larkin, 2016) The issue historically through this understanding then becomes a question of where this domination/convergence occurs.

Using this understanding, I argue that there are five major periods wherein the contours of the Santa Ana River are changed by the emergence of a new kind of infrastructure. Each of these periods also represent a point where the cultural role of infrastructure shifted. Sometimes this was because existing infrastructure had begun to be used or regulated in a different way, and sometimes it was because physically new infrastructure replaced older systems. The first phase is the period of Spanish occupation and the Spanish Missions Period beginning with Governor Gaspar de Portlá, who divided the river and apportioned its water. The second is the arrival of American ranchers and the development of ranches in Southern California, when the first private water rights were allocated. The third is the beginnings of the Southern California

citrus industry in which private water use crystalized and private land ownership intensified. The fourth is the beginning of urbanization before World War II in which government involvement in water management expanded, and the fifth is the period after the 1969 legal settlement over ground water with the Orange County Water District, which marked an important shift in the priority of water management agencies, a shift that is central to water politics along the Santa Ana today.

Owning a River

When Juan Rodriguez Cabrillo, the first European to lead an expedition into *Alta* California passed by the mouth of the Santa Ana River, as he would have had to sailing north along the California cost during his 1542 expedition, he either did not see, or did not record it. It wasn't until another two hundred years later when Gaspar de Portlá, the governor of *Baja* California, led his expedition, which founded the California Missions headed by Father Junipero Serra, was the first known recording of the river made in writing. The history of the river, however, did not begin with the Spanish, nor does the long history of land use and land management along the river.

Before Portlá and his expedition crossed the river near present-day Anaheim, California's Native Americans had been living along and reshaping the river for over 9000 years. Along Bolsa Chica where the Santa Ana River exits into the Pacific, the Tongva, Acjachemen, and Chumash tribes harvested Pickleweed (*Salicornia*) which was used as a food source, and a resource for making soaps and glass. In what is now present-day Riverside, members of the Tongva and Cahuilla communities practiced slash and burn agriculture along the Santa Ana to control weeds, open areas up to harvesting and to clear detritus and debris accumulated through

periods of drought (Anderson, 2005.) For as long as there have been human populations near the Santa Ana River, there have been different approaches to change and utilize the land around it, and to harness the river itself. To the Spanish, the Santa Ana River was anything but invisible: It was a tool in supporting their colonial ambitions.

In order to maintain their settled lands and to legitimize the territorial claims made by the Spanish in California, Spain needed Spanish subjects living in California. California, however, was isolated, difficult to reach due to the unfavorable wind currents off the coast, and impassable mountain terrain overland through Mexico due to the Sierra Nevadas. Overland travel was also dangerous due to hostile relations between the Spanish and Native Americans living in the American Southwest.[1] (Miller, 2001. Hackel, 2005.) All of these factors discouraged Spanish civilians from settling in what was viewed as a colonial backwater. (Starr, 2005. Hackel, 2005.) Because of this, California remained sparsely populated during the Spanish and later Mexican periods between the 1780s and late 1830s. Spain therefore was heavily dependent on the Mission systems in order to sustain their holdings. Missions were uniquely situated in California at a period where the rest of the Spanish Empire began to pivot toward settled towns and military *presidios*. Governor Portlá largely selected missions as the means to settle Alta California because of the limitations preventing a larger colonial migration. (Hackel, 2005.)

The imperial project of the Spanish in California in the 18th century and the Mission system established by the 1780s most major feature was the extent to which it restricted access to the river and to water. The Spanish Missions near the Santa Ana River, including Mission San

1. An overland route did exist, mapped by Juan Bautista de Anza, but extreme hostilities between the Spanish and several Natie American groups in the southwest made travel impossible. The Spanish came to know the region as the *Tierra de Guerra:* the land of war. Several revolts against Spanish missions had earlier wiped out missionaries in the region, notably including the Pueblo uprisings of the 1600s.

Luis Obispo and Mission San Luis Rey, depopulated Cahuilla and Tongva populations living along the Santa Ana River to supply the missions with both a work force for the growing labor demand needed to maintain the mission, and a population of neophytes to convert and "civilize" the indigenous inhabitants. (Mitchell, 2006.) The process of depopulation involved coercion, kidnappings, violent dispossession and required a network of encampments, facilities, and military posts to observe, patrol, and enforce Spanish claims and jurisdiction over areas that the Native population could escape to. The missions served to restrict indigenous movement and although Mission Indians were never legally considered slaves,[2] in many cases they worked in slavery-like conditions. (Hackel, 2005. Starr, 2005.) The first infrastructure of the Santa Ana River included these settlements, all part of a larger project to claim ownership of the river and its lands.

The many varieties of settlements in which the Spanish established were guided by principles established by the Spanish *Laws of the Indies,* a legal and textual framework that guided planning and settlement development within Spanish America. The *Laws of the Indies* covered everything a colonial governor would need to manage an efficient colony and considered the proximity of a settlement to native populations, distance to major sources of water and the coast, food, and even how best to layout the foundations for defense and for clear sightlines of the surrounding areas. In Los Angeles, for example, the *Laws of the Indies* also influenced the relationship between the missions and the military presidios of Spanish California. (Crouch and Mundigo, 1977.) The missions therefore were the primary infrastructure

2. Enslavement of Native Americans was forbidden by a Papal bull issued in 1573 known as the *Sublimis Deus*. The Papal bull recognized the humanity of Native Americans and created the new colonial position of the "Defender of the Indians." In practice however, the law was ignored, and the missions continued defacto enslavement as part of conversion.

through which Spanish colonialism was enabled and the *Laws of Indies* visualized their relationship to the river and to water as a strategic resource.

The majority of the land granted by Spain in California was granted to the missions established by Portlá's expedition and their Franciscan Missionaries. The land was not owned by the missions but instead held in a trusteeship in the name of the Spanish Crown. By the 1800s however, Spain had also begun to award land to soldiers as compensation for their service. (Hackel, 2005.) Spain was from the very beginning, acutely aware of the issue of water. Water was wealth, and water was power. Mission San Juan Capistrano and Mission San Gabriel were each given two halves of the watersheds of the Santa Ana River (Santa Ana Parks, Recreation, and Community Service Agency, retrieved 2011) to control for drinking and irrigation. When Mexico gained independence in 1821, the government then took control of the missions in California and secularized their lands for state use. This process would also apportion water rights along the river. By 1833 Governor Jose Figueroa had begun to oversee the secularization of the missions altogether. Many of the missions' lands were converted into *ranchos*, massive ranches that encompassed upwards of tens of thousands of acres of land. One of the most significant examples of these grants was the creation of the Rancho de Santa Ana.

Like the Spanish, Mexico was concerned with legitimizing their claims over Alta California. Motivated by the continuing expansion of the United States West, and Russian trade posts expanding south to support the trade for Sea Otter pelts[3] (Hackel, 2005. Starr, 2005.),

3. Fort Ross in Sacramento is a surviving example of these trade posts and was the furthest extent of the Russian Empire in North America. The trade for pelts of the Southern Sea Otter (*Enhydra lutris)* resulted in the species being hunted until it was critically endangered in California.

Mexico needed to establish a continuous presence of Mexican citizens living in California. Rancho de Santa Ana was first awarded to Jose Antonio Yorba (1746-1825) in a land grant from the Spanish that included 48,000 acres centered along the Santa Ana River, encompassing the modern cities of Orange, Santa Ana, and Costa Mesa (Masters, 2019.) After his death in 1825 the land was inherited by his sons, and the sons of his nephew, Juan Pablo[4] Peralta, gradually expanding to include almost 200,000 acres. (Bowers Museum, accessed 2024.) Ranches like Rancho Santa Ana quickly subdivided the land into governable plots that through dispossession of California Natives, made California Mexican.

The large tracts of land between *ranchos* and the relative independence from both the Spanish and the Mexican government led many *rancheros* living in California to develop an independent identity as Californios. Californios were resistant to increased government presence and so the Mexican government largely allowed California to exist *lassiez-faire.* (Starr, 2005.) Those living in California saw themselves neither as Spanish nor Mexican. However, the vast majority of the land grants issued went to those of Spanish descent, relegating indigenous populations living in California to a caste of migrant laborers.[5] (Hackel, 2005.)

Water in Spanish and Mexican California was delivered either by hand, or through the use of irrigation ditches dug in the earth called *zanjas.* Native American labor was used as the primary source of labor to dig *zanjas* and to transport water, and this was true during both the

4. Spanish law required that land grants of such size required two families named as recipients.
5. The labor structure in Mexico was heavily informed by race. In Alta California, Mexico used the following categories: español, mestizo, mulato, coyote, and indio. Spanish whites were at the top, followed by half Indian, half whites, half Indian half blacks, quarter whites, and full-blooded Indians. Unlike in Mexico, these racial castes were not as central to social order and did not necessarily convey discrimination, but historic context meant that most wealth and privilege tended to rest with Spanish Whites.

Mission period and the early ranching period, at ranches like Rancho de Santa Ana. (Hoffman and Stern, 2007.)

However, there is a distinction between the two periods in that the creation of *zanjas* was on the one hand, completed utilizing a *corvee* labor system established by the state, and on the other, through private bidding for water rights for agricultural use and wage labor. In most cases, *zanjas* could not be dug at will. Landowners would need to make special petitions for the right to dig water channels from a source and specify how much water they would draw and for what use to an official known as a *zanjero*. *Zanjeros* were prominent and powerful figures. In some cases, they had salaries that exceeded those of the mayor of a township, as was the case with colonial Los Angeles until the 1850s. (Hoffman and Stern, 2007.) Water continued to be a symbol of wealth and prestige, but it had now become a commodity that rich elites could benefit, no longer exclusively the state.

Private water infrastructure and private water rights resulted in dispossession of indigenous ownership over land and water: only the wealthiest landowners of the largest ranches could afford to pay for the privilege of private *zanjeros.* But it also produced the claims of ownership which the Mexican government hoped to cultivate. It also brought about contestation and conflict in access to water, a theme that would become a common occurrence throughout not just Southern California and along the Santa Ana River, but across the entire region of California and the American Southwest as a whole. If the missions can be understood as infrastructure that rendered boundaries, and borders, then the private land grants offered by the Mexican government and the ensuing process of bidding for water rights can be understood

as the legal and civic infrastructure where those borders were negotiated. Water became, if anything, only more visible as conflict over water became more intense.

This contestation is most apparent during the arrival of Americans in the 1840s. While population booms in California initially began in the north, the result of the discovery of gold near Sutter's Mill, American ranchers began to arrive in small numbers in Southern California around the same time. After the United States conquered California in the Mexican-American War[6], American ranchers came to Southern California to start ranches of their own. To acquire the land and water needed to own ranches, Americans would litigate the claims held by Spanish *rancheros*. Because Spanish and later Mexican land grants were frequently vague or ill defined, it became expensive, if not financially ruinous for *rancheros* to hire surveyors, and lawyers to defend their claims. Even if they had won their cases in court, they frequently needed to sell their land to American ranchers in order to pay their legal fees. (Starr, 2005.)

Litigation will become a central tenet of the story of water in California. The scarcity of water makes litigation seem inevitable, especially in the context of an established legal doctrine and civic infrastructure that favored private development. This favoring of government disinvolvement in the developing frontier initially was the result of California's isolated geography from Mexico. Later it was the result of the staunchly libertarian identity that developed in California's resident population beginning with Californios. This rarified in the adoption of California's unique doctrine of water rights, the so-called "California Doctrine" which was widely adapted in the American west. Emerging from the landmark California

6. One of the final battles of the Mexican-American War was the Battle of Santa Ana, fought near the Santa Ana River in Chino. The battle denied Mexican reinforcements from regrouping with forces in Los Angeles and ended the war in Southern California.

Supreme Court case, *Lux v. Haggin* (1886), the issue of water rights was rooted in the issue of accessibility and was buffeted by class dynamics that had been growing since the Spanish missions (Bremer, 1999.)

Charles Lux and James Haggin were not just arguing against conflicting water rights claims, but instead presented what they believed should be the future of California's water policy. Lux and his business partner Henry Miller argued in favor of a riparian doctrine, which permitted equal access to water along a river's flow. James Haggin, instead argued in favor of prior appropriation; first in line and first in right, a principle that went back to the early days of miners who struck their claims in the Gold Rush (Hundley, 2001.) Haggin claimed to represent the poor and the common everyman in upholding the superiority of prior appropriation; to him and his supporters, prior appropriation offered fair and equal access to whoever had the initiative to stake a claim for themselves (Bremer, 1999.) While the court found in favor of Lux and Miller, they also ultimately decided that both the doctrines of prior appropriation and riparian rights were valid and would both be respected within the state of California.[7] The result was legal chaos in a landscape known for aridity and frequent drought.

What then, was the reason or the mechanisms by which this fundamentally libertarian water regime changed? When did water go from being a private commodity that accentuated territoriality and land ownership to a public good that the state had a vested interest in? More important, how did this understanding of private property rights influence the forms that infrastructure took along the Santa Ana River and elsewhere in California?

7. The adoption of both riparian rights and prior appropriation is known as the "California Doctrine." The California doctrine has been adopted as the standard model for water rights in the American west. At least 12 states utilize the California Doctrine for their water rights system. California Doctrine is especially important for explaining water sharing agreements, inter-state water compacts and the litigious nature of water rights in the west, as rights are determined on a case-by-case basis.

Prado's Historic Promise

My mother had told me in the beginning of 2005, there was a flood near the opening of the Prado dam. She explained the flood had required a friend of hers living in a housing park near Green River Road to evacuate. She described that the rain was unlike anything she had ever seen before; that it was "simply unbelievable." My father added that because of the flooding, he was stranded on the other side of the Santa Ana Canyon, in Anaheim where he worked. The flood, caused by a surge in winter storms that year, flooded the Corona municipal airport just north of the dam, water literally spilling out of the Santa Ana river's banks. KCAL reports from the time reported that "the water is coming in quicker than they can release it out at the dam."

That flood resulted in an emergency project by the Army Corps of Engineers to expand the downstream capacity of the river channel from 5,000 to 30,000 cubic feet per second. The sextupling of the flow capacity was not the first response the Army Corps of Engineers had made in responding to concerns about floods or a potential failure of the Prado Dam. The construction of the massive 550-foot tall Seven Oaks Dam (almost five times the height of Prado) from 1993 to 2000 began in response to earlier fears that Prado was not enough to contain the potential threat. Even still, its construction did not prevent the flood my parents remembered.

The Prado Dam represents a historic promise, one that is important for understanding the origins of the questions I pose above. The history of flooding and great works to mitigate or control them is a storied one in California and Prado is central to this story along the Santa Ana River. The promise of the Prado Dam is where the meanings of the dam symbolically become

clear. Prado represents many different things as symbols often do but the dam as a symbol of promise is the most all-encompassing representation of its historic role.

In the 1860s and 1870s, many new towns and settlements were founded in Southern California. With respect to water, many of these settlements were either founded with access to river water along the Santa Ana River in mind or were enabled through a combination of irrigation and drainage projects that aimed to transform the landscape. Two vignettes create a story about the kinds of people who came and what they were looking for.

It is important to picture the motivations of the people who came to California from their own contexts. Something that is often lost in the story of California and its water is that the people who came unwisely overexploited California's resources. There is some truth to this, and there are examples from the Santa Ana River during this time that support this. For example, the construction of Big Bear Dam[8] by Frank Brown and its hasty construction is one such example (Williams, 2021.) But there are also stories that reveal more complexity and nuance.

My home city of Corona resides in Riverside County, and the seat of the county, the city of Riverside, is a clear example. In 1870, two abolitionist Congregationalists by the name of John North and Dr. James Greves left their work in Tennessee with the Freedman's Bureau and came to California. Disillusioned by the lack of progress in advancing African American rights and equality in the former Confederate States and maligned by reconstruction politics, they came to California to escape the horrors of the American Civil War. (Patterson, 1996.) North and Greves

8. It should be noted that there are two iterations of the Bear Valley Dam, the first built by Brown was complete in 1884. A replacement was built in 1910 and is still in use today.

were looking to establish a Utopian community of like-minded individuals in what they believed was an Edenic paradise. Inspired by stories about the rich agricultural wealth and bounty of the landscape they had hoped to establish a colony of progressives far away from what they saw as America's biggest failure.

Greves was especially nervous about the transaction. On route to Southern California, he travelled separately from the group of colonists who were his colleagues, afraid that the whole project would fall apart. His biggest fear? Water. Greves and North did not believe that the colony's originally planned location was viable. They had previously settled on a location near what is present-day Pasadena but North had concerns that the proximity to Los Angeles would jeopardize their claims to water rights and potentially invite crime from the neighboring town. (Patterson, 1996.) Instead of this North had heard from individuals in Los Angeles that pointed to a potential location around fifty miles east near a silk colony that had been present since 1868. North and Greves determined that the location was satisfactory and that water rights could be purchased from a *rancho* that held the title to flow along the river. This was the Santa Ana River, and upon purchasing the land Greves and North had brought their colony to the plot that would eventually develop into downtown Riverside.

Greves and North's story was not unique. Themselves and many others who had come to California came looking for a sense of peace that they could not find elsewhere. In California they believed that they had found it. The city of Anaheim is another example. Within the greater Los Angeles metropolitan area today, Anaheim is the second oldest city in the OC-LA area, second only to Los Angeles itself. Founded by George Hansen, a speculative businessman who believed that he could make money through founding a vineyard in Southern California, he

purchased land from Rancho Santa Ana from the Yorba family that he used to divert water from the Santa Ana River near Santiago Creek. He diverted the water for several miles to a grape colony he had established with German immigrants who he had recruited in San Francsico. Many of these German migrants came to the United States and to California to escape the Prussian Austrian War, one of many conflicts of the wars of German unification that took place in the 1860s. These German settlers are responsible for Anaheim's name, meaning "home on the Santa Ana River."

Grapes and agriculture played significantly into the myth making of Southern California. The fertility of crops grown in the area and the ease with which agriculturalists were able to find in the loamy soils of the Santa Ana watershed inspired many to come westward. Grapes shown at the Philadelphian Centennial Exposition of 1876 showed the richness of California's vineyards and were one of the most popular sites for exposition visitors. (Klein, 2018.) Other historians, such as Richard Street (1988) have urged for a greater depth of study into the effect that California's agriculture had on contributing to imagined understandings of California's landscape, beyond its material relationship. The point raised in these vignettes and by Street, is that many who came to California were promised safety and stability, the very landscape offering a sense of calm. The Santa Ana River continued to remain visible as a symbol of wealth, but it was rapidly becoming a symbol of paradise and fertility.

This third phase of development culminated in the California Citrus boom; within less than two decades many of the settlements and agrarian communities in Southern California had expanded to become massive citrus orchards that went on for seemingly forever. In order to support these orchards, large scale irrigation projects that were exponentially more complex

than the small scale *zanjas* of the Spanish and Mexican periods were undertaken. In Riverside and San Bernadino, the construction of the 11-mile-long Gage Canal, named for its builder, Canadian Mattew Gage which irrigated more than 600 acres stretched from San Bernadino down to the southern end of Riverside city. Meanwhile, in Orange County, water was readily available, even without the use of irrigation from the river. Individuals could easily draw from ground water sources, fed by the percolation of water from the river. In some places water would literally bubble up to the surface, lending the names of several cities in Southern California including Artesia, and Fountain Valley.

The boom had meant more and more people wanted to be part of the growth in Southern California, and this led to speculators like Frank Brown or the Chaffey brothers, George, and William, who irrigated the northern sections of the Santa Ana Watershed to develop cities including Ontario, Rancho Cucamonga, and Upland. The action of speculators and land developers, including the Union Pacific and Santa Fe Railroads pushed water in Southern California to the limits of what it could provide, as the demand for more and more water continued to grow as more people came to Southern California in search of its promises. This demand and these irrigation projects had their consequences and the potential for disaster. Dam failures were a common occurrence and no failure in Southern California was perhaps as magnificent in scale or effect than the breech of the canal which created the Salton Sea, an environmental disaster of unparalleled nature in Southern California which continues to have significance to this day.

But the activity of speculators, transients, and the new residences building their lives also produced risk. Such is the nature of living along a river. The threat of floods was a very stark

reality which many were consciously aware of. In 1861 and 1862, record floods in Northern California flooded Sacramento and San Francisco. Seasonal rains exceeded more than 50 inches of rain which turned the Sacramento Valley into a massive inland sea. “Relief boats on their errands of mercy, sailed over inundated ranches, past floating houses, and wrecks of barns, through vast flotsams… and the carcasses of horses, sheep and cattle, all drifting out to sea.” (Guinn, 1890.) The threat of flooding was enough that it resulted in public pressure on the California State government to intervene on behalf of farmers and communities in the San Juaquin Valley. Half-hearted reclamation projects in the 1860s and 70s saw a transition from private flood control to coordinated state flood control and water management agencies that devised levees and infrastructure designed to protect the property of those living in the valleys. (Hundley, 2001.) These same floods also affected Southern California in an uninterrupted torrent of rain that lasted for 40 days, and even completely destroyed at least one settlement at Agua Mansa. (Masters, 2012.)

In a speech given to the Irrigation Congress at Ogden, Governor George C Pardee made the issue of irrigation and flood control a matter of survival for California. Floods and control of water he argued was an existential crisis for the state. “With the factor of moisture under the control of man, his control over the creation of wealth is vastly enhanced. Civilization is based upon the existence of wealth since empires are based upon population.” (Pardee, 1903.) Pardee pointed to the success of the Riverside colony and the efforts of Greves and North and their successors in the use of water to transform the desert into a desirable space that California should become: “The Riverside colony of California has an irrigated area of 13,00 acres. These

acres constitute the basis of community life to the extent of 10,000 inhabitants. At Riverside abundance is supplemented by the highest embellishments of civilized life." (Pardee, 1903.)

Residents living in Orange County and in the floodplain of the OC were both aware of the benefits of controlling the Santa Ana River as the colony upstream of them had demonstrated. But they were also concerned with the potential for destruction. Engineer J.B. Lippincott, noting the rapid growth of the area, seriously recommended the construction of reinforced concrete channels, levees, and dams along the river in 1917. (Masters, 2012.) Lippincott was motivated by fears of a flood that had occurred in 1916 occurring again. His warnings would in the coming years become seemingly prophetic.

In 1938, another flood swept across the Santa Ana River that caused widespread destruction throughout Orange County. The flood displaced more than 50,000 people and killed at least eight-seven. The destruction was vividly recalled by several individuals, interviewed as part of oral history research conducted by Cal State Fullerton. Lives were disrupted, and the entire community had to come together in order to deal with the crisis, "We had utilized a couple of the big flatbed trucks to go into some of these places and take people out. We took most of the people to the Elks Club which was on the high spot. We had men, women, and children at the Elks club till the water had receded and their homes were in shape." (Martenet, 1968.) Schools were closed, and daily life was put on hold for weeks: "There was a pile of books nearly two weeks high sitting out on a table by itself, and the movement never moved one of those books. We didn't have school for about two weeks as we tried to get those tents back where they belonged and to get the mod cleaned out." (Bonney, 1974.)

The devastation of the flood was the impetus to finally follow through on Lippincott's plan. Lippincott's proposal was scaled up. His original proposal for a 70-foot dam instead became a hundred-twenty-foot dam, and wide concrete channels would stretch from Yorba Linda down to the Pacific Coast. Construction of the Santa Ana River dam began in Corona and finished in 1941. The Army Corps of Engineers had built a dam with a volume capacity of more than 2.5 million cubic meters of water. The Prado dam was born, rising from the Prado basin, and built on top of the ruins of the former township of Prado from where it takes its name. Prado had to those who experienced the floods of 1916, 1927 and 1938, offered a sense of solace. It was a promise that they would be shielded from such devastation again.

The Being of a Dam

The Prado Dam's construction, and subsequent channelization of the river's flow in Orange County ultimately worked to render the river invisible. The threat of floods and the destruction caused by the river threatened the dreams that people had come to California to search for, and often create. While the Santa Ana River had enabled the settlement in Southern California, it had now become a danger to those who had built so much and dedicated so much time and effort to their settlements. This places the Prado Dam in an interesting place as a symbolic object. Despite being so large and so physically visible, it works in rendering the river invisible and today has rendered itself invisible in the social consciousness. In his article, "The Politics and Poetics of Infrastructure," Brian Larkin explores the concept of what he describes as the "ontology of infrastructure." (Larkin, 2013.) An ontology loosely defined is the theory of being. Larkin's article attempts to explain different conceptualizations of where infrastructure is situated in relation to other technologies, and how this affects the nature of what that

infrastructure is materially, symbolically, and physically. In essence, Larkin's article argues that infrastructure must be understood as a mechanical object and as a cultural one. Larkin asserts in his article that, “they [infrastructures] need to be analyzed as concrete semiotic and aesthetic vehicles oriented to addresses. They can take on fetish-like aspects that sometimes can be autonomous from their technical function.” (Larkin, 2013.)

In the case of the Santa Ana River, the aesthetics of the infrastructure are found both in the infrastructure of the river itself, and the effects outside of it. I.e. the symbolic form of the infrastructure is found in the transformation of the landscape around it. Rather than the infrastructure itself being the subject of fetishization, the infrastructure instead elicits it in another. The Prado Dam allows people to continue to imagine the California landscape as essentially Edenic and unchanging. The historic myth making of the Californian landscape into an Edenic paradise was enabled through infrastructural projects like the Prado Dam and flood control infrastructure that transformed the environment into the desired form.

There are, however, examples of this infrastructure being the object of aesthetic desire here and elsewhere in Southern California. The Bicentennial mural on Prado’s face is one example: the mural being a symbol of national and civic pride. Dams are extensively used as extremely visible examples by which the state renders itself legible, and by which they symbolically assert meaning. Philip Ball discusses in *The Water Kingdom,* how dam building in Maoist China drew on Chinese history, and mythology to reinforce the power and dynamism of the communist state. Ball recounts when Mao Zedong swam across the Yellow River, he aimed to show the river as an object not to be feared, but something that could be conquered and tamed through the national spirt that he claimed to embody. (Ball, 2017.) Likewise, in the

United States, historic dams such as the Hoover Dam or the Grand Coulee Dam, built during the Great Depression demonstrated the power and legitimacy of the Federal Government, and rendered a promise of a national unity in a period of economic crisis. (Hundley, 2001.)

The Los Angeles Department of Water and Power similarly constructed their facilities and infrastructure along the Los Angeles River to project their power, and the advancing urban modernity in LA in the 1920s and 30s. LADWP constructed numerous art deco substations across Los Angeles that aimed to visually capture their forward-thinking leadership and technology (Leslie, 2017.) Later, in the 1960s when the LADWP constructed their new headquarters adjacent to city hall, architect Albert C. Martin designed the building with a massive pool that encircled the building as a moat, spraying columns of water several stories into the air to emphasize the importance of water and their role in delivering it to the city. The building's glass windows, and bright exterior lighting accentuated this point and drew attention to the DWP's role as the bringer of power throughout the county (Leslie, 2017.)

However, both the LADWP headquarters and the dams built by Mao were made equally as visible in their failures and in their immediate hubris; not just a mechanical failure, but a negative reaction to their intended messaging. The grandiosity of the LADWP display was shut off in less than a decade when rising fuel costs caused by OPEC crisis of 1973 and the increasing consciousness of the precious value of water became more apparent to Los Angeles residents. To many the fountains became gawdy and wasteful, as did its constant illumination. The building was resituated as the LADWP rebranded the structure as a green office. The building's complicated HVAC system was shut down and a visitor center in the lobby was created which demonstrated the efficacy of the LADWP's efforts in water treatment and hydraulic sanitation.[9]

(Leslie, 2017.) The collapse of the Banqiao dam in 1975 in China and sixty-one others revealed the flawed construction of many of the "Great-Leap Forward" dams, but also the questionable logic in the reasoning for their creation. Many people's lives were disrupted by the dams and their collapse were left to question their purpose; in the failure of the dams, they became opaque.

Larkin urges us to reject the aphorism that infrastructure becomes visible in its failure. He argues that infrastructure has a life and meaning of its own outside of points of failure and, while this is correct, the understandings and perceptions generated by failure are still useful, for it is in these moments when expectations about infrastructure and their promises are broken. While Larkin uses failure in his article to discuss the mechanical failures of infrastructure, I also want to include a rhetorical understanding of failure embedded within infrastructure also. What I mean is that infrastructure can fail not just physically, but emotionally, or symbolically too. Sometimes infrastructure fails because people do not accept infrastructure for infrastructure's sake, or because it loses its original intended meaning. Ultimately, the Santa Ana River's infrastructure was working to protect livelihoods, private property, and a dream of an imagined landscape of permanence and serenity. This infrastructure also continued to support an imagined garden landscape in which immigrants coming to California had come to expect in the popular images and stories spread across the country. But the widespread interventions created by such infrastructure had unintended consequences that complicated much of the hydrology of the region.

9. Visitors can now visit a museum at the La Kretz Innovation Center in Downtown Los Angeles, just south of Little Tokyo where the LADWP demonstrates their water treatment and monitoring technologies. Public education and outreach continues to be an important part of water management.

Building the Prado Dam controlled the floods along the Santa Ana River but also marked the beginning of a much larger endeavor. A project of managing nature itself. Symbolically the dam represents a kind of human conquest and superiority over the natural world, one that has been muddied over time, but what does that actually look like in practice? What have the consequences of the Prado Dam been and what effect does the invisibility it renders have on how nature is either ignored or acknowledged?

Managing Natural/Water Futures

The Orange County Water District's Ground Water Replenishment system, located in Fountain Valley, is a massive maze of pipes, pumps, and siphons that treats and injects over 130 million gallons of water per day into the Orange County aquifer. As of writing, the OCWD claims that since its opening in 2008, it has treated 400 billion gallons of water and provided approximately 35% of the water needs of Orange County. Visiting the OCWD website displays a prominent link where they proudly discuss the facility and its role in maintaining the Orange County aquifer, an underground reservoir of water which supplies 85% of the potable water needs of the OC. (OCWD, 2018.) The GWRS, when first opened, received the Stockholm Industry Award, the highest award given in the industry for water management projects. There is a boggling array of statistics, every conceivable metric measured and tabulated from the capabilities of the GWRS to the demand expected for water in the OC, all used to keep a carefully balanced budget of water drawn from the aquifer.

The documents show how important maintaining the balance of numbers is: in 1965 studies into the Talbert gap, a barrier of sand and silt created by alluvial deposits, revealed a vulnerability to the Orange Aquifer to saltwater intrusion. (OCWD, 2018.) Maintaining aquifer

levels is achieved by the GWRS, an essential piece of infrastructure to prevent contamination. All the equipment and data the OCWD collect is part of a complex, two-step process of water treatment that begins with the Santa Ana River and the Prado Constructed Wetlands; biological filtration at these wetlands is the first step in an incredibly complex process of political and technological intervention.

The kind of intervention taking place in the GWRS and through their arbitrations by the special water master are not much different from the ones made by settlers in the 19th, or the early 20th centuries. The dam itself was the result of several decades of irrigation and water harvesting practices in places like Anaheim and George Hansen or Santa Ana and Santiago Creek, which were predecessors to its construction and enabled further development. When the Prado Dam was constructed, it was built to serve a response to an identified need for flood control that led to consequences of its own. Those consequences required additional interventions, and so and so forth, each new part of the infrastructure compounding in a larger system.

In her book *Under a White Sky: The Nature of the Future*, Elizabeth Kolbert argues that these interventions have become increasingly common in the 21st century, and that they may even now be necessary in combating climate change (Kolbert, 2021.) Two chapters from Kolbert's book stand out immediately in my mind. The first discusses the consequences of the Chicago Sanitary and Ship Canal, built to redirect the flow of the Chicago River in 1900 to prevent sewage from accumulating in Lake Michigan. Kolbert illustrates how while the Chicago Sanitary and Ship Canal diverted water and prevented epidemics of cholera and typhoid, it linked the previously two unconnected water systems of the Mississippi River and the Great

Lakes. When Asiatic Carp was later introduced to control invasive populations of reed, themselves introduced as an intervention to preclude the use of toxic pesticides like DDT (Rachel Carson herself suggested the use of the carp as a biological control in *Silent Spring*), they spread quickly and risked becoming invasive in the Great Lakes via this canal. Already viewed as a nuisance in the Mississippi River, the Army Corps of Engineers returned to their canal to build an electric barrier intended to keep the fish out.

The second chapter by Kolbert is about the levees and dams built to regulate flooding along the Mississippi River itself. These levees, successful in stopping the flooding of the river, have also had the unintended consequence of dooming the Louisiana Peninsula to sink into the Gulf of Mexico: without the deposition of new silt from flooding, the coast is slowly being eroded into the sea. Now, the Army Corps of Engineers is spending billions of dollars erecting a new set of barriers designed to entrench the coastline and prevent further erosion. The extremity of the situation is described quite plainly by Kolbert: “Every hour and a half, Louisiana sheds another football field’s worth of land. Every few minutes, it drops a tennis court’s worth. On maps, the state may still resemble a boot. Really though, the bottom of the boot is in tatters.” (Kolbert, 2021.)

In California, similar interventions are already taking place, or have already affected the state materially. The GWRS is one example. The redirection of the Santa Ana River away from its natural course, that it is into the former OC floodplain, and the encasement of the surface in the miles of asphalt, concrete, and suburban lawns has necessitated new means by which to ensure water finds its way underground. Saltwater intrusion is not just a matter of concern for the south, but for the north as well. In Northern California, the risk of over drafting the Sacramento

and San Joaquin Rivers via the California Aqueduct is that it could potentially reverse their flows, leading to a massive intrusion of saltwater via their deltas. The problem has meant that the State has had to limit the amount of water that may be sent south, either for farming or for urban use.

These interventions can be incredibly politically charged. Mark Arax's book *The Dreamt Land*, through a combination of journalistic reporting and ethnographic interviews shows how the contentious issue of water conservation in California's Central valley has exacerbated politics to the fringe extremes. Arax discusses how politicians in Kern County rally slogans chanting, "to hell with the Delta Smelt," in reference to the endangered species of fish living in the California Delta. The language is in reference to how Delta Smelt have become a polarized mechanism by which the state is able to enforce the amount of water it distributes via the aqueduct through the endangered species act[10] (Arax, 2019.) but limiting the amount of water via the aqueduct has created its own set of problems. Aside from the political tension, farmers living in the central valley have resorted to using ground water to offset shortfalls in the amount of water expected from the north. Derricks in Fresno or in Bakersfield aren't drilling for oil, they're drilling for subsurface water in aquifers. The use of water from these aquifers has been so extreme that it has led to ground subsidence. This has been a historic problem, not just a recently developing one; the central valley is at a lower elevation today than it was fifty years ago, demonstrated dramatically in a picture of USGS surveyor and hydrologist Joseph Poland in

10. Pumps used by the California Aqueduct to divert water from the California Delta have a tendency to also trap Delta Smelt in the pumps. While the reasons why water diverted from the delta are limited for other reasons, including the fear of saltwater intrusion, no other legal mechanism for limiting water flow is as visible as the use of the Endangered Species Act by the California Department of Fish and Wildlife. The issue gained national attention when President Trump made it a campaign issue in the runup to the 2020 election, pledging to limit the authority of the Department of Fish and Wildlife to invoke the Endangered Species Act to limit the amount of water that could be pumped.

the San Joaquin Valley.

The problem of groundwater is the reason why California has passed the Sustainable Groundwater Management Act, sometimes colloquially referred to as "Sigma." California's hydraulic experts, including those at the California Department of Water Resources have recognized the danger in depleting California's ground water resources. Once a groundwater aquifer is exhausted, it is impossible to restore. The GWRS works to prevent that, it is working to mitigate risk and therefore is continuing to keep the promise made in 1941 by the Prado Dam.

This is the final phase of development, which leads us to the understanding of the infrastructure of the river in the present. While the construction of the Prado dam did indeed work to prevent floods, it also inhibited the natural processes that enabled the transformation of the areas around Orange County. Built in a flood plain, the availability of water from ground water was because of the flooding action of the Santa Ana River. The Santa Ana River, constrained by the channelization completed in 1947, and the construction of the Prado Dam no longer flooded in this plain and prevented the natural recharge of the basin.

The GWRS is therefore itself a microcosm in the points raised by Kolbert. It was built to address technical challenges created by technical interventions. Even at the GWRS itself, the process of treating the water within the facility creates pure distilled water which cannot be returned to the aquifer. It requires yet another intervention in the form of mineralization, as the water treated is itself *too pure*. If injected into the aquifer before this process, it could cause damage to pipes, and drainage systems through mineral leaching.[11]

When saltwater intrusion was detected in 1956, the historic Orange County Water

11. Treated water that has gone through the purification process at the GWRS has a functional PH balance between 5 to 5. 8. Mineralization is completed through the addition of a lime (calcium hydroxide) slurry.

District, which had managed ground water in Orange County since 1933 began to file several lawsuits against upstream producers intended to regulate the problem. (Blomquist, 2021,) Salinity had been found as far as three miles inland, and a series of lawsuits to protect Orange County's rights to the Santa Ana (i.e. its Riparian Rights, vs. the Appropriative Rights of those upstream) ensued. The most important was an arbitration ruled in the closing of a suit with the city of Chino in 1969. This lawsuit stipulated an allocation of water for recharge basins in Orange County and resulted in a standardized agreement between Riverside County, San Bernadino County, and Orange County that all water must pass through treatment facilities and meet regional standards set by the Santa Ana Regional Control Board. (Milkovich, 2023.)

The Santa Ana River, however, is a river heavily dependent on seasonal water availability. Fed by snowmelt, the flow of water along the river does not always remain consistent, and so preserving the Orange County Aquifer would require more than legal agreements between all parties. This was the motivation behind the construction of the predecessor of the GWRS, Water Factory 21, in 1975. Water Factory 21 took treated and purified recycled water, blending it with imported water from the Metropolitan Water District, who manage the Colorado River aqueduct and the California aqueduct to ensure that the water pulled from the Orange County aquifer was equal to the water put in the aquifer. (Milkovich, 2023.) Water Factory 21 was built at the same time as a shift in environmental priorities in California, as people became more aware of the issues of California's water. Critical analysis had begun to be made about the California aqueduct and on California's reliance on imported water to meet water deficits. In this way, Water Factory 21, and later the GWRS came to also contribute to the promise of

stability and security made by the Prado Dam, even if the processes it invoked were largely unseen.

Today, many other cities in California are pursuing the act of managing nature that the OCWD has remained successful in. San Diego is constructing its own version of the GWRS dubbed “Pure Water San Diego” in the city of Mira Loma. Functionally the facility will do much of the same work as the GWRS. San Diego had earlier attempted to build such a plant in the vein of Water Factory 21, but the plan ultimately was shelved when public outcry over the facility derided it as a “toilet to tap” scheme. The OCWD, and ultimately Water Factory 21 and the GWRS were successful for the ways they drew upon the rhetoric of the environmental movement and the authority of public health officials and health politics. They were delivering a promise that the early San Diego facility did not. These facilities continue to grow more important as the issue of water in California becomes more and more politicized. A growing trend of apocalyptic climate predictions warns that California’s future is uncertain and that the state is powerless to do anything about it. Companies have begun trading water futures, buying and selling speculative water rights. But facilities like the GWRS and Pure Water demonstrate otherwise. But the success of these facilities is hidden in their very success itself. There is no crisis hidden in them. There is no failure to discuss. The invisibility matters because it has hidden successful water management techniques that could work to reverse the water crisis in California.

Conclusion and Future Research

California’s relationship to water and land can often be aggressive, fraught with both interpersonal conflict and nature. Infrastructure so frequently is built with the intent of

restricting nature or restricting its influence. California has some of the most visible examples of water infrastructure and some of the most egregious examples of when such infrastructure is allowed to go unchecked. But such infrastructure also comes as the result of desires and the dreams of the individuals who build it. These desires can sometimes go forgotten or become overlooked, either because they seem obvious or because they become lost in the technical function of infrastructure itself. The infrastructure, including its flood control channels and the Prado Dam have succeeded in making the river invisible. People no longer have to think about floods and the infrastructure of the river has thus lost its meaning through its own success. They no longer either want to because doing so reminds them of risk and the threat to the dream of California. Despite this, we still very much live within an ontology of floods. Arkstorms (also known as atmospheric rivers), like the kind that flooded California in 1861, or the one that poured down on Orange County in 1938 are likely to become more common with rising global temperatures. In 2023 and 2024, Arkstorms pushed the Prado Dam and its reservoir to the limits leading to another series of questions from the Army Corps of Engineers about its capabilities.

In rarifying this point I point to a larger issue about the nature of infrastructure and its ability to produce these silences. The politics of the California water crisis tend to ignore the facts of the Santa Ana River, or other successful examples in which water management agencies have come to correct historic mistakes in water management, like the OCWD. The invisibility produced through the historic development of the river and its infrastructure contribute to this problem. These examples should be understood, as well as the social implications that they create. With the rise of trading in so-called water futures, I see a potential relationship between

these silences, and a neoliberal trend of privatization and commodification of water vis-à-vis the production of risk. Is this the next stage of California's water infrastructure? Is this the sixth stage of the life of the Santa Ana River and its relationship to people? This article is limited in its abilities to answer those questions and it raises many more. How for example does the role of experts foster in shaping the imaginings of infrastructural development? And how for example does California's legal system either stymie or contribute to solutions for sustainable water management? More study, particularly on how the culture of expertise in water management agencies has contributed to the success of the water management of the Santa Ana River, is needed.

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