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Beyond The Technical Dimensions of Water: Community-Based Efforts for Water Justice in the High Desert

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Abstract

Water injustice is a result of the co-constitution of water and power from the global to the local level. In the small High Desert town of Adelanto, CA, concerns over the water quality and its association with overall quality of life incentivized a collaborative project to investigate dealings of water. A multidimensional analysis of the water system uncovers an instance of water injustice that is complex and linked to water issues regionally in the Inland Southern California area, as well as globally. Globalized discourses, climate change, global capitalism and flows of immigration are some of the global processes linked to water in Adelanto. A dominating narrative of water scarcity and a technocratic approach to water has left little room for local knowledge and community participation while also producing a problematic water system that has ultimately fostered a sense of mistrust in the safety of water among residents. Further, comparison of different sources of information on the water quality reveal misalignment between the reporting of contaminant levels. Testimonies from residents express concerns over the odd taste, smell and appearance of water, and indicate that the issue is likely connected to overall disinvestment from immigrant, low-income communities and other marginalized communities. Findings stress the importance of local knowledge in the face of a technocratic water system that has produced intersecting forms of injustice. Equitable, safe and trustworthy access to drinkable water depends upon developing community water monitoring systems, empowering community members to make political claims, and fostering intimate connection with water.

Keywords*: water justice, drinkability, City of Adelanto, High Desert local-global, power relations, community-based project, technocratic, local knowledge*

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Introduction

Southern California has a bad rap when it comes to water, and Hollywood has been sure to capitalize on the drama. The film “Chinatown” notoriously exposes the implications of Los Angeles’ imported water supply and the corruption of city officials. Based in the Inland Southern California town of Hinkley, the film *Erin Brockovich* tells the story of a single-mother-turned-activist who wins the largest environmental legal battle of its time against Pacific Gas & Electric for its contamination of the water supply with hexavalent chromium. The City of Adelanto, situated right in between Hinkley and Los Angeles, faces issues with its water supply that seem to combine elements of these two infamous cases, but is also locally unique in its struggle for water justice.

There isn’t much water to see in Adelanto, other than the concrete river (also known as the California Aqueduct) that you pass over just before getting to the main strip in Adelanto. Until two years ago, Adelanto relied upon naturally recharged groundwater wells both within and outside of city limits. From these wells, water is pumped and travels through underground pipes until it flows out of taps. Now, because the groundwater system has been overdrawn, it is recharged artificially by the aqueduct, which extracts water from snow melt in the Sierra Nevadas and brings it 444 miles down south. Because water is both pumped from the ground *and* imported, this means that water in Adelanto is fundamentally different from water in most other places in Southern California, and is therefore all the more contentious.

It is windy most days, and so dust fills the air. From what I have gathered, the dust has only gotten worse over the last couple decades – a common sign of a depleting groundwater

supply. Some of the residents I spoke with were surprised that I'd never experienced the horror of a dust storm in Claremont, in which dirt apparently hits your face so hard it feels like you're being slapped. The landscape is tan in color, with the exception of the grass at city hall. Every once in a while, you might come across a sign on an undeveloped brown piece of land that reads "Make Every Drop Count," sponsored by the City of Adelanto and PERC Water Corporation (ironic tagline: "pure genius"). Despite this sign's insistence that residents must be conscientious of the scarcity of water in the region, the main concern that Adelanto's residents have for their water is *not* how much there is, but whether that water is safe to drink to begin with.

Stevevonna Evans, a member of the City Council in Adelanto, was one of the first people I was introduced to when I began working on the Adelanto water project. We met for the first time in a Stater Bros. Market parking lot. After exchanging pleasantries, Stevevonna got in the passenger seat of my 2007 stick shift Honda. As we pulled out of the parking lot, she remarked, "None of this used to be here," referring to the conglomerate of the most commonly-found corporate stores in the Inland Empire sprawl. I asked if she's seen changes in the development of other parts of Adelanto, to which she responded no.

We drove to the North side of Adelanto, where there had apparently been more water concerns than the South side. We went door to door asking folks if they would be willing to tell us how they feel about their tap water. More than one person's first reaction to this question was to laugh and say, "I don't drink the water here". We had come with a pile of flyers advertising the opportunity to provide a water sample to leave at doors, but we hardly used any as almost everyone answered our knock and was eager to give a sample. Over and over, we

heard complaints that water sometimes looks brown and yellow, or that it smells and tastes weird.

In the first area we went to, a couple houses that appeared to be broken into lined the street and the residents spoke of their feeling of abandonment by the City, asking when the new infrastructure funding would finally reach their pot-holed street. Just across a major intersection, green laws and two-story houses lined the block where we collected samples next. We stopped our water sample outreach when the sun set, and as Stevevonna commented that she didn't want to be in the area after dark. Driving back, I asked if she wanted me to put an address into my phone, she responded that she doesn't ever use her phone for directions in Adelanto. There aren't too many places to get lost in Adelanto.

Figure 1: Location of Adelanto in Southern California region

From my first impressions of Adelanto, I got the sense that this was a place with a complexity –a cluster of interrelated problems– of which I was only scratching the surface.

Surrounding these problems is a high level of uncertainty about the safety of the drinking water and competition between the values of the City and its residents (the City focusing on water supply while the residents on water quality). Dealing with a water source that is both local and recharged non-locally further complicates the representation of the water system, and puts the people who inhabit and govern Adelanto's arid landscape in a difficult position to propose solutions.

The underpinnings of Adelanto's water issues are shared across a much broader regional and global landscape. Adelanto's water system parallels other cases in the Southern California region in its adoption of a dominant hydrologic discourse, based upon Western knowledge systems that assume humans can control nature through technical feats. Consequently, this discourse produces the inequitable distribution of water across varying scales. Globally, Adelanto is just another local example of how a community of people already bearing the economic brunt of global capitalism is also disproportionately impacted by climate change (as the amount and the quality of water are intimately connected). Flows of immigration also impact people's relationship to water.

The following project-based thesis investigates the issue of water injustice in Adelanto and places it in a regional and global context, while also honoring the local specificity and details of this project. Water injustice in Adelanto is a result of the co-constitution of water and power from the global to the local level. A technocratic[1] approach to water has left little room for local knowledge and community participation while also producing a water system that has ultimately fostered a sense of mistrust in the safety of water among residents.

[1] An approach by which those with technical knowledge of the water maintain control over it and assert that any issue may be broken down into distinct and manageable parts.

Additionally, technocratic control has both aggravated water issues and insisted upon having the remedies for them. Equitable, safe and trustworthy access to water depends upon developing community water monitoring systems, empowering community members to make political claims, and fostering intimate connection with water. Therefore, the project component of this thesis aims to shift relations such that the community is recognized for holding valuable knowledge and the power to influence dealings with water.

Project Description and Methodology

This thesis is grounded in a collaborative research project that brings together multiple efforts to achieve the shared goal of water justice in Adelanto and draws upon my personal experience as a coordinator for these efforts. The project grew out of concerns from Adelanto community members over the quality of water coming out of their taps and a lack of trusted information from city officials about the safety of the water. This project researched the relationship between the community and their water, investigated relevant place-based information, and provided additional water testing with the aim of facilitating community-led efforts towards securing equitable access to safe and drinkable water.

Water (in)justice implies that water-related issues, such as drought and access to clean water, impact the health and livelihood of certain communities in disproportionate ways. In other words, unjust water systems exist when the management of water resources widens the gap between the “haves'' and the “have-nots”. My methodology drew from researchers Margareet Zwarteveen and Rutgerd Boelens (2014), who conceptualize water justice based on an interdisciplinary ontology that recognizes the socio-cultural meanings of water. Calling for

water justice requires that we consider the ways in which water-related inequalities both relate to broader systems of domination, and are situated in local contexts. Cultural recognition and political participation are key components. Just water systems equitably distribute safe and drinkable water that is retrieved from ecologically sustainable sources, and rely on the building of alliances across difference to do so.

Analysis of the technical, social, cultural, and political dimensions of water is based on myriad sources of information. As a first step, I reviewed historical accounts of Adelanto's water supply. With the historical context in mind, I investigated information provided by the City on their current water system, mainly drawing from the recent 2020 Urban Water Management Plan. This set up my applied project to compare water quality data and analysis from five different sources, including PERC Water Corporation Consumer Confidence Report, the Environmental Working Group, the California Office of Environmental Health Hazard Assessment, the US Air Force, and the Claremont Colleges' own Keck Science Department. I supplemented this information with interviews with community members and field notes from my interactions with those involved in the project.

My methodology was based on the indispensability of Adelanto's community members in the present moment and in a sustainable and just future. Community voice and input from the spokespeople of two collaborative organizations—El Sol Neighborhood Educational Center and Inland Coalition for Immigrant Justice—was critical at each stage of the project. A team consisting of those two groups, representatives from Keck Science Department, Pitzer's Community Engagement Center, and the Robert Redford Conservancy met bi-weekly to share updates, collaborate on items such as the water sample posts for outreach, plan ways to

combine efforts and take care of whatever new challenge came up. Door-to-door interaction with community members was a central part of the project and contributed to qualitative data.

When collecting data I was often accompanied by Council Member Stevevonna Evans, or both an Inland Coalition for Immigrant Justice intern, Olivia Rosenberg-Chavez, and El Sol organizer, Leonor Garcia. We retrieved 20 water samples from homes in Adelanto and conducted 9 interviews, attempting to space our visits across a variety of neighborhoods in Adelanto. We identified participants for the study by contacting those who we knew had experienced issues with their water, and by visiting the homes of residents we did not not have previous knowledge of. Interviews were recorded, transcribed, and then coded thematically.

Students from two classes at Keck Science tested the water samples and the Professors of these courses completed the final analyses. The Advanced Laboratory in Chemistry class, taught by Professor Katie Purvis Roberts, tested for elements in 20 samples of water. An additional 6 samples, tested preliminarily by A&R Laboratories, were included in this analysis. Students in the Integrated Biology and Chemistry class, headed by Professor Jason Tor, measured water hardness, alkalinity, chlorine, chromium (VI), and the occurrence of microorganisms in 12 samples of water. I used Geographic Information Systems (GIS) to layer the City-provided underground water infrastructure maps with the sample locations.

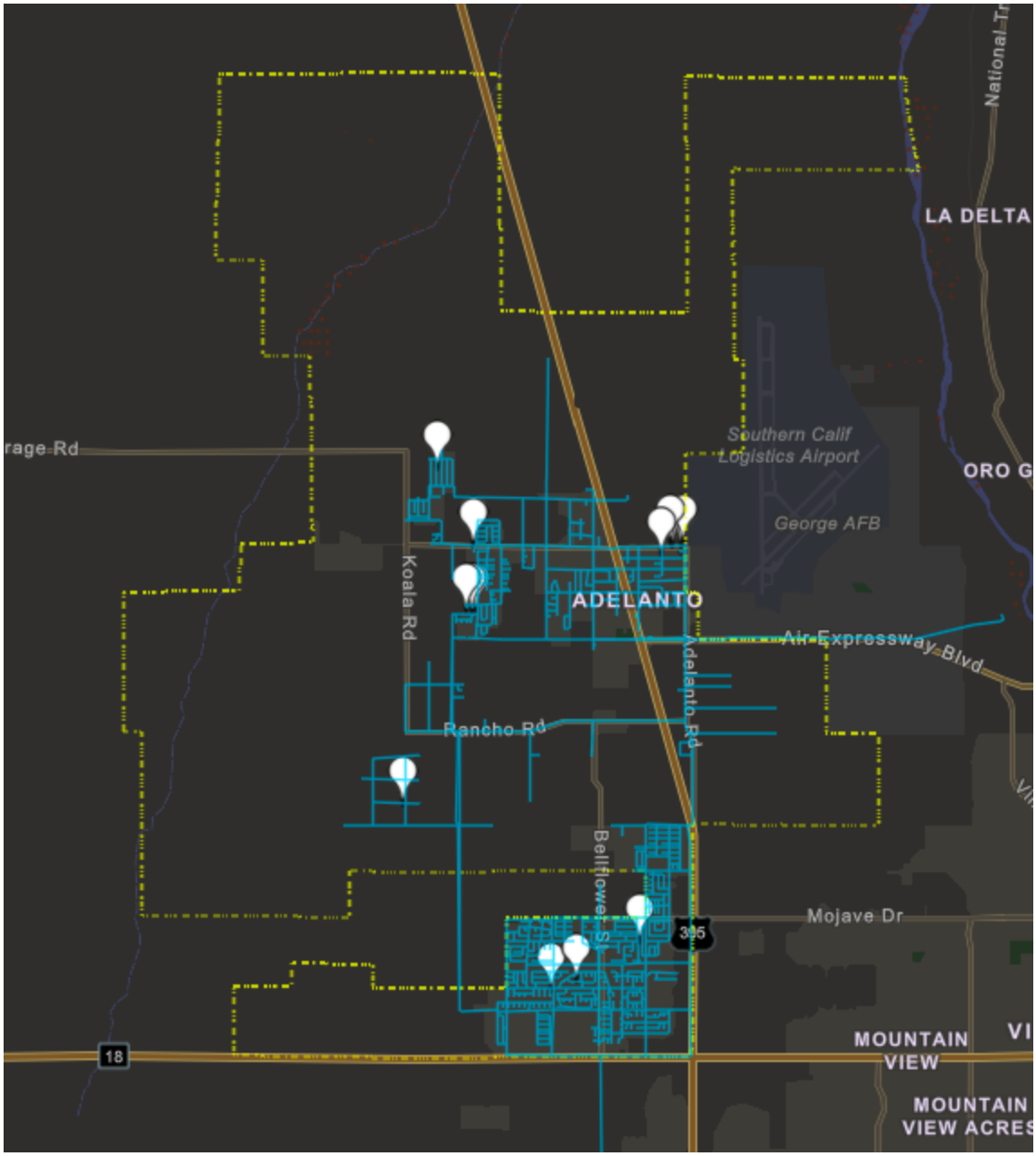

Figure 2: Locations of samples collected and provided to Keck Science Department for testing, layered with the water pipe system in the City of Adelanto.

We attempted to get further testing completed for per-and polyfluoroalkyl substances (PFAS), but our inquiries to water testing companies were largely rejected or met with suspicion. Companies reasoned that they did not want the results of their testing to be used in legal

battles, and that they only really do testing for regulatory agencies. Alongside the high cost of tests and equipment needed to measure PFAS, the inaccessibility of this type of testing represents one of the barriers to understanding which contaminants are present in the water.

The cumulative element of this project is the stand-alone report that aims to make the information about Adelanto's water transparent to organizers and residents, to provide supporting information for political claim-making, and to recommend future action steps on both the part of the City and the community. Maps, photographs, and links to resources are embedded in the report (Appendix 1).

Positionality

Growing up, my drinking water was always clear and tasteless out of the tap. I could see the Puget Sound from my front door and I sheltered from the rain most afternoons. I could safely walk to multiple grassy parks from my house. I have gone to private school all my life, and now attend a small liberal arts college. Not only am I afforded citizenship and whiteness in the US, but I belong to a settler-colonial history wherein six of my ancestors traveled to the US on the Mayflower.

All of this is to say that I have come from a different life than the majority of people I worked with in Adelanto, many of whom are low-income, from communities of color, and/or have recent histories of immigration. Further, I have benefited from the same systems of domination that underlie issues of water injustice. While I did my best to navigate this difference with respect and honesty, there were also times when I felt I was stumbling my way through my interactions, which often took place in Spanish. My solidarity with the communities

of Adelanto comes down to ways in which my inextricable ties to the injustices of this world have festered in water injustice. I became tied to this struggle when the country I call home built the military-bases-turned-Superfund-Sites in order to defend capitalism. I became tied when the same military qualified as one of the largest emitters of climate-changing greenhouse gasses. I became tied when my belonging here became predicated on naming others “illegal” for wanting the same belonging. I became tied when my water in Claremont began giving me rashes on my scalp. Adelanto may be situated in its local particularities, but it is unfortunately just one case of many in this country. Until those in Adelanto can know with certainty that they can drink from the tap, neither should any of us.

My understanding of water was shaped by a short period of my life that I spent in New Mexico working with a grassroots organization to protect waterways on the bases of ecological and cultural importance. Here, I was exposed to the acequia knowledge system, which views water as the lifeblood of community. While the acequia water system consists of traditional open-style ditches that are governed by the communities they flow through, the water system in Adelanto is underground, piped, and relatively invisible until it flows out of the tap. In other words, the community in Adelanto has a fundamentally different relationship to the water system that has made connection to and management of water more difficult than in locations where the water source is seen. Yet, it is not impossible. As my mentor from the acequia community said to me, it is about “connecting communities with the ability to articulate their relationship to water” that will make change, not just the relationship itself.

One of the most inspiring aspects of this project has been the variety of actors who have come together under a shared goal for safe and equitable access to water. I joined the project

when these actors included only a member of the city council, students and professors from Keck Science Department, the Pitzer-based Robert Redford Conservancy and Community Engagement Center. We were quickly brought into partnership with the two previously-mentioned immigrant justice nonprofits, the Inland Coalition for Immigrant Justice and El Sol Neighborhood Educational Center. The findings section in Chapter Three will expand upon the essential roles of each of these uniquely situated actors, and the incredible asset the collaborative nature of this project provided. All of this is to say that, while I myself am differently positioned than the majority of Adelanto residents and have joined a team of other diversely positioned people, we are all tied to this struggle under the shared goal of water justice. Through critical reflection and solidarity, it is possible to not only navigate these differences, but be better for them in our efforts to achieve our goal.

Roadmap

As a project-based thesis, the following chapters serve to contextualize the work I have been involved in this semester, provide analysis of information and data collected, and draw conclusions about the direction of water justice in Adelanto. Chapter One situates the topic, argument, and project in the relevant scholarly literature. I begin by putting into conversation different theoretical understandings of how water flows and is embedded with meanings. I then move to literature that relates water issues to the local-global nexus, including a section on the trends of mistrust in the tap water among Latinx immigrant communities. Lastly, I explore water management and governance, drawing upon studies of community-based water projects occurring globally.

Chapter Two dives into water as a case of injustice in Adelanto specifically, as well as relates it to regional and global processes. I begin with background information on the City of Adelanto and a discussion of the effects of global capitalism on the racial underpinnings in the town. Following this, I assess other relevant instances of water injustice in the Inland Southern California region and briefly connect Adelanto's water struggle to global climate change. Importantly in this chapter, I critique the technocratic approach to water by exploring information provided by the City on their current water situation.

Chapter Three includes the findings and conclusions from this research and project. I present the findings from the Keck Science Department testing and analyze the interview data collected from residents in Adelanto. I discuss the strengths of this project and areas for improvement. I finish by drawing conclusions about the underlying causes of the water issues in Adelanto and the potential for a future of community-led efforts for water justice.

Chapter 1: Complicating "Water"

A Review of the Literature

***Keywords**:* Water justice; hydrosocial cycle; Marxian theory; community-based; local-global nexus, Global Environmental Justice

Water is a foundational ingredient to life, but it is anything but simple. Articulating how society both shapes and is shaped by water, in a way that captures all the complex interactions between water and the rest of the world, has been an ongoing challenge for scholars and researchers. Relevant scholarship grapples with how water issues exist at varying scales, from the global all the way down to the local, and how water changes dynamically between and across spatial scales. In this literature review, I will put into conversation a variety of literature concerning water-society relations, issues dealing with water and community-based water projects in order to situate the rest of this thesis and the accompanying project.

Many scholars have produced frameworks for dealing with water. While there is a vast technical body of literature on water, most of the literature I will be focusing on comes from critical theory, political science, social science, and anthropological perspectives, many of which are grounded in the agential role of community. Common water-related issues include climate-driven drought, poor water infrastructure, inadequate water quality, and inaccessibility of safe water. These struggles are both interrelated and intersectional across lines of race, class, and gender. Marxian theory underlies much of the scholarship concerning water, society, and power. Karl Wittefogel and Nikhil Anand are two key players in the field of scholarship on

water-society-power relations who have shaped subsequent literatures – Wittefogel publishing in the mid twentieth century and Anand within the last decade. Additionally, Jamie Linton and Jessica Budds have made significant contributions in the framing of water. Extensively-cited David Schlosberg constructs a notion of Global Environmental Justice that ties together the literature to be considered. The literature in this review is primarily critical of the dominant hydrologic discourse, which comes from Western notions of "expert" knowledge, and the role it has played in producing water injustices (Anand, 2017; Linton & Budds, 2014; Molle, 2008; Zwarteveen & Boelens, 2014).

Below, I compare theoretical understandings of how water flows and is embedded with meanings. I then focus on literature relating water issues to the local-global nexus, including a section on the trends of mistrust in the tap water among Latinx immigrant communities. Lastly, I will discuss literature on water management and governance, with a specific focus on examples of community-based projects occurring globally.

Theoretical Understandings of Water

In 1957, Karl Wittfogel wrote "Oriental despotism: A comparative study of total power," a text that has been cited by scholars thousands of times since. Karl Wittfogel was one of the early well-known thinkers to conceptualize the relations between power and water, which he based on Marx's dialectical materialism. His historical analysis of what he calls "hydraulic civilizations" points to the important factor of control over water in state-building and power accumulation. Namely, Wittfogel (1957) argues that the construction of large-scale irrigation to support agricultural production contributed to the creation of "despotic" regimes (power is

absolute and exercised oppressively). While Wittfogel does not speak directly to water quality, and his claims have been disputed by many, his writing is nonetheless foundational in a conversation about water that goes beyond its technical dimensions. Molle (2008) analyzes the scarcity of water resources through a societal lense. He argues that the overbuilding of river basins artificially creates the issue of water scarcity. Molle's research points to eight main drivers of overbuilding, including the dominant ideological rationale for state-building through achieving grandiose technical feats to control water (Molle, 2008). In more recent years, author Nikhil Anand, well-known among water scholars, has contributed to the discussion of the social implications of controlling water through his analysis of the water infrastructure in Mumbai, India. Contrary to Wittfogel's analysis of power held by those at the top social and political hierarchy, Anand's focuses on those at the bottom. Anand coined the term "hydraulic citizenship" to explain how citizenship emerges from the struggle to access and manage water and ultimately makes claims on what should be a public resource fulfilling a basic human need (Anand, 2017). Prominent thinker Brian Larkin supports Anand's application of a logic of citizenship to urban water issues. Drawing from notable theorists including Marx, Latour, and Foucault, Larkin importantly conceptualizes a framework for understanding infrastructures (including water infrastructures such as aqueducts and pipes) as material networks that facilitate the flow and exchange of goods, people or ideas over space (Larkin, 2013).

Anand and Larkin are in agreement that water networks reinforce social identity and disparities, a relationship that can also be explained by the "hydrosocial cycle," termed by Jamie Linton and Jessica Budds. Using Marx and Wittfogel as a starting place, Linton and Budds critique the dominant hydrological discourse for limiting water-related policy and

decision-making by prioritizing “expert” technical knowledge and treating water as separate from society. Instead, the hydrosocial cycle is defined as “a socio-natural process by which water and society make and remake each other over space and time” (Linton & Budds, 2014, p. 170). This concept gives insight into the co-constitution of water and power, and the different ways attending to water gives it meaning (Linton & Budds, 2014). In a Los Angeles-specific application of this thinking, David Torres-Rouff examines the meaning attached to water over time in Los Angeles, in order to understand the relationship between the environment and ethnic conflict. Torres-Rouff finds that, in Mexican American and Chinese communities where historically Mexican Californian water infrastructures remained longer, notions of water as “dirty” were co-constructed with racialized stereotypes of the people who resided there as “dirty” (Torres-Rouff, 2006). This source provides one example of how water injustice and a language of cleanliness has impacted Latinx communities in the Southern California region.

Lastly, Zwarteveen and Boelens (2014) contribute theoretical concepts that are useful for identifying and approaching water-based injustices. The authors’ conceptualization of water justice prioritizes attention to context, in which the material, economic, political, and cultural dimensions of water are recognized, and places water struggles in the arena of socio-ecological justice. In doing so, they make a case for “the transdisciplinary co-creation of knowledge,” whereby diversely positioned and skilled individuals and groups collaborate, uplift the voices of those who experience injustice, and interweave struggles in different contexts and scales (Zwarteveen & Boelens, 2014). By analyzing a diverse set of cases of water injustice, they argue that globalization (mainly of agriculture) and neoliberal policies have driven the transfer of water from what are seen as low-productivity uses to high-productive ones. Zwarteveen and

Boelens attribute global processes as the root cause of the co-constitution of water and power articulated by Anand, Larkin, and Linton and Budds. Conclusions drawn by Zwarteveen and Boelens (2014) are supported by scholarship in the following sections on the local-global water nexus and community-based water projects.

Local-Global Water Nexus

Water-related issues exist at varying scales, and are connected between and across these scales by the transboundary movement of water, as well as the transboundary social and environmental factors that impact the issues. Multiple scholars have articulated the relationships between waters at the local, regional, and global levels (Grimm et al., 2008; Lu et al., 2014; Rodell et al., 2018). Rodell et al. (2018) characterize the global nature and implications of freshwater depletion by analyzing 34 trends in water storage from satellite data. They find that, because water is constantly being moved to different parts of the earth and stored in different ways (known as the "global water cycle"), there is an immediate need for globally sustainable water management (Rodell et al., 2018). Grimm et al. (2008) find that locally altered hydrological systems in urban areas have impacts at the regional level, and that pollution entering water transport from urban sources affects biogeochemical cycles at a global level (Grimm et al., 2008). Water availability and water quality are interrelated issues (Mosley, 2015), but scholarship that considers them as interrelated *and* analyzes the dynamic between local water and global water is generally harder to come by. In an attempt to approach these issues together, Lu et al. (2014) focuses on how the "water crisis" more generally is characterized by the multi-scalar impacts of how decisions about water resources are made. Lu et. al (2014)

draws out common patterns in water equity that cut across borders and provide a cross-disciplinary framework that applies to multiple scales. The scholarship reviewed here is in agreement that there is a global need for sustainable and equitable water management due to the globalization of water-related issues (Grimm et al., 2008; Lu et al., 2014; Rodell et al., 2018).

Relevant to this particular thesis is scholarship that focuses specifically on the connections between immigration flows, environmental justice, and notions of water. David Pellow, a prominent critical environmental justice theorist based in California, and Jasmine Vazine articulate the intersections between environmental justice and immigrant populations, particularly those with Latin American roots. They argue that issues of environmental justice affecting immigrant populations can be situated in a history of Latinx immigrant labor in the US, racial capitalism, and other ideologies that underlie domination. In particular, the article touches on the water quality issues at FCI Victorville, an immigrant detention center, which is located on the George Air Force Base Superfund site adjacent to the City of Adelanto (Pellow & Vazin, 2019).

Another intersection present between these three spokes (immigration, environmental justice, and water) is the trends of disproportionate mistrust among Latinx immigrant communities in tap water. Pierce and Gonzalez (2017) find that minority communities are more likely than white communities to perceive tap water to be unsafe for drinking. In particular, immigrant communities are even more likely to distrust tap water, and immigrants from Latin American countries are more than twice as likely to distrust their tap water than non-Latinx immigrants (Pierce & Gonzalez, 2017). Another qualitative study finds that a disproportionately high number of participants, who were predominately Latinx mothers, do not drink the tap

water and felt it was unsafe to drink based on taste, appearance, smell, and suspicion of health impacts. The article documents a preference for bottled beverages, substituting water consumption for Gatorade or juice over tap water when bottled water is not available (Scherzer et al., 2010). Scherzer et al. (2010) represents a body of scholarship on this trend that studies the dental health-impacts within these communities due to the lack of fluoride in bottled and filtered water that helps to prevent cavities.

While these sources provide useful information in identifying some factors determining level of trust in tap water, they do not question whether instances of water injustice may be impacting minority and immigrant perceptions. Williams, Florez, and Pettygrove (2001) make an effort to understand how the exposure to environmental harms that are disproportionately present in minority communities affect water consumption patterns among Latinx communities. However, they conclude that further research is needed to understand whether this connection can be made (Williams et al., 2001). It is important to mention here that research on trends of mistrust should not be used to support racialized conclusions that Latinx and immigrant communities are "overreacting." Rather, this research should invoke questions about what these findings may show about longer histories of water injustice and how perceptions of water can flow across borders.

Community-Based Water Projects

Instances of water injustice whereby the central water-related issue was water quality, and the community-based projects that address this specific concern, mirror the Adelanto water project most closely. The Flint water quality crisis is widely known and written about as a prime

example of environmental racism in the US. Carrera and Key (2021) analyze the quintessential role of organized community mobilization in response to the public health crisis. Critical to their analysis is that water injustice was the form of tacit abandonment by the government in its failure to protect the community. Rather than treating the residents of Flint as victims for whom science is the saving force, Carrera and Key (2021) construct a counter-narrative. Their analysis positions the residents and people of color as the main actors responsible for opening conversation on environmental racism, water quality and infrastructure nationally (Carrera & Key, 2021).

García and Brown (2009), Wilson et al. (2018), and Burgos et al. (2013) present three case studies of water quality-related participatory research and monitoring. García and Brown (2009) situate their study in the Andean watershed and more broadly in the Latin American waterscape. Youth played a participatory role in the analysis of availability, use and quality of water, as well as in mapping water, which the authors argue was beneficial both to youth education and local decision making (García & Brown, 2009). Also based in Latin America, Burgos et al. (2013) analyzes the adoption of Community-Based Monitoring (CBM) of water quality in rural areas of Mexico, offering guidelines to evaluate the success of CBM and motivating improved implementations of the model (Burgos et al., 2013). Similar to García and Brown's findings on the positive impacts of community participation in decision-making, Wilson et. al. (2018) highlight the importance of not only valuing Indigenous knowledge, but of continued Indigenous participation in decision-making on water governance and stewardship. This study identifies CBM as a form of sovereign Indigenous governance – a conclusion that may

be viewed in tandem with Nikhil Anand's conceptualization of "hydraulic citizenship" (Anand, 2017; Wilson et al., 2018).

David Schlosberg (2004) provides useful theoretical contributions to scholarship that studies how community-based projects influence global-level justice. He draws particular attention to participant diversity, equitable distribution of environmental risks, and participation in political processes. Although these practices occur at a local level, with the help of community-based projects, Scholsberg (2004) argues that they are three key aspects of global environmental justice. The essential contribution of Schlosberg's theory is that, because of the global nature of environmental justice, related work that spans across many localities must be unified in values and practice of justice, but it should *not* be uniform (Schlosberg, 2004).

Conclusion

The relevant literature demonstrates the need to adopt justice-forward approaches to water in order to counter the dominant technocratic hydrologic paradigm and patterns of water and power co-constitution. According to the literature, dealings with water on the local scale are inseparable from global processes and ideologies, and thus, community-based action for water justice may prefigure global environmental justice. While there is some literature drawing connections between perceptions of water, Latin American immigration, and environmental justice, the relationship is not yet well understood. For the remainder of this thesis, I will be discussing how water in Adelanto provides insight into these interrelated themes through the analysis of different accounts on the status of the water. This research will support both my

argument as well as the accompanying project which aims to integrate community-based methods to reach goals of water justice.

Chapter 2: Adelanto and its Water

Control over water is inseparable from knowledge and power relations in Adelanto. This section identifies Adelanto as an instance of water injustice by drawing on the "hydrosocial cycle" analytical tool proposed by Linton and Budds (2014). The hydrosocial cycle calls for an examination of the historical, hydrological, political and technical circumstances that have produced a complex reality of water. Zwarteveen and Boelens (2014) suggest that one way to deal with complexity is by acknowledging that there is no order to which water problems have been constructed and the contradictions that may be present. Knowledge will always remain uncertain and it may be more useful to accept the plurality of knowledge and ease the search for the one most accurate account of reality. Conceptualizing water justice involves a multidimensional and multiscalar approach that resists dominant understandings that reduce water to its technical dimensions and maintain technocratic control. Using this framing, the following chapter reviews Adelanto's place-based characteristics, linkages to cases of water justice in the Inland Southern California region, available documentation on Adelanto's waterscape, and connections to climate change to understand how the issue of water injustice has originated.

Adelanto in a Couple Pages

Driving from Claremont to Adelanto, I travel along a winding road through a beautiful mountain pass, climbing in elevation until I reach what is known as the "High Desert." On my first trip, I was surprised to see Joshua trees, which people travel to see from across the US, and

perhaps the world, in Joshua Tree National Park just over an hour away. When I get to Adelanto, I don't look past the pothole stricken roads and overflowing dumpsters, because this tells me about the very tangible impacts of disinvestment by the city. However, I look at this alongside a buzz of activism and energy to make claims on the public resources they have been promised. I look at this alongside a culture of generosity and relationship-building that was exemplified by my invitation to come over for dinner by two different people on the same night on one of my early visits to Adelanto. I look at this alongside a handful of strong community leaders, ready to mobilize their communities and build a coalition among themselves to fight for the shared goal of improving quality of life in Adelanto.

Figure 3: Photograph of Adelanto's arid landscape – largely undeveloped is scattered with Joshua Trees and shrubs. A power plant lies in the distance

Adelanto is a small town with a population of about 38,000 (*U.S. Census Bureau QuickFacts*, n.d.). I remember asking Adelanto city council member Stevevonna Evans what Adelanto is known for, to which she responded without hesitation, "pot and prisons" – the cannabis industry and the prisons are two of Adelanto's most prominent employers. Four prisons/immigrant detention centers in Adelanto contrast the one high school, zero colleges, and four small public parks (which are more like two dirt patches). There is a clear difference between community member's perceptions of the North side of town and the South side. The North side is associated with having more trash in the streets, more crime and worse infrastructure, while the South side has newer housing, recent development of a strip of chain off-highway businesses, and generally appears to be more invested in by the City. The City has been on the brink of bankruptcy for years, staying afloat with stop-gap measures, such as expansion of the prison-industrial complex. There is a history of embezzlement and fraud by the mayor, council members and police chiefs (Nelson, 2017; U.S. Attorney's Office, 2021) There is no way to get around that the residents of Adelanto are not happy with their town. Many people with mobility end up leaving Adelanto to build a life elsewhere.

Flows of capital and immigration have influenced who lives in Adelanto today. Around 71% of people in Adelanto's north census tract and 55% in the south census tract are living below twice the federal poverty level (*CalEnviroScreen 4.0 Indicator Maps*, n.d.). According to the US Census Bureau, 67.7% of the population is Latinx, 18.3% is Black or African American, 9.8% is White alone, 1.7% is Asian or Pacific Islander, 0.8% is Indigenous. Only 6.2% of people twenty five years and older have a bachelor's degree or higher. Like many other towns in the

Inland Empire, Adelanto has experienced a large wave of immigration from Latin America. The US Census Bureau reports that around 17.4% of the population is foreign-born, though this statistic should be taken with a grain of salt due to the general hesitation of undocumented communities to respond to the census. Around 48.5% of people speak a language other than English at home (*U.S. Census Bureau QuickFacts*, n.d.).

Juan de Lara's analysis of the demographics in this region connects local articulation of race with the spatial impacts of global capital flows. The emerging Latinx population in the Inland Empire generally is composed of folks who moved to the region in order to find jobs and purchase affordable new homes. Wrapped up in this migration inland is the influence of global economic processes and spatial legacies (De Lara, 2018). Namely, global capitalism and neoliberal reforms have taken advantage of this region because of its proximity to the Port of Los Angeles and Port of Long Beach, yet it is a relatively overlooked area in comparison to the City of Los Angeles, paving the way for massive logistics industry developments of warehouses and transportation. The 2,200 acre Southern California Logistics Airport now borders Adelanto[2]. Simultaneously, as jobs in logistics replaced jobs in manufacturing, these manufacturing jobs were outsourced to Latin American countries. Dissatisfied with the low-wage manufacturing jobs, waves of immigrants came from Latin America to the US. Now embedded with the promises of "boom and bust capitalism" (De Lara, 2018, p. 147), the Inland Empire was a place for new Latinx communities to form. Therefore, these driving forces of capitalism at global and

[2] The Southern California Logistics Airport occupies part of the decommissioned George Airforce Base. The George Airforce Base has been exposed for not disclosing environmental hazards, including nuclear testing. The Victorville FCI detention center also occupies this land. Reports of contaminated water and health impacts have come from the incarcerated population and workers at this facility.

the local scales are mutually constitutive of each other, determining what industries and which communities we now see in Adelanto and the Inland Empire.

At this time, former industrial spaces that once provided jobs for middle-class White Americans became devalued, and the region experienced White flight that opened the door for more affordable housing in the region. African American communities moved to the Inland region of Southern California in order to purchase homes that they couldn't otherwise afford in areas such as Los Angeles and Orange County. Along with Latinx and Asian communities, Southern California's low-wage labor demand capitalized on Black bodies (De Lara, 2018). Though affordable housing may have initially been a reason that minority communities moved Inland, a high proportion of Adelanto's population is now housing-burdened, meaning that those with lower incomes may spend a large part of their income on housing, resulting in housing-induced poverty. On the South-side of Adelanto, 27% of the population is housing-burdened and 38% is on the North-side. The OEHHA asserts that housing affordability is an important determinant of health (*CalEnviroScreen 4.0 Indicator Maps*, n.d.).

The racial underpinnings of the City of Adelanto are inseparable from the underpinnings of the potential environmental harms being experienced in the area. Broadly speaking, it is well documented that communities of color are disproportionately impacted by environmental hazards (Bryant & Mohai, 1993). Immigrant communities face environmental injustice as an intersectional issue. As a result of anti-immigration politics in the Inland Empire and in the US at large, the Latinx population has been racialized as a suspect group, regardless of documentation-status. Discourse of this public as criminal and undeserving of state-provided benefits supported the neoliberal agenda of defunding the social welfare state (De Lara, 2018,

p. 151). This dominant ideology has not only left the region void of social services, but also deemed immigrants and US-born Latinxs as illegitimate bodies. Additionally, trends of environmental policy failures in predominantly Black and African American areas (Henderson & Wells, 2021) indicate that the devaluation of bodies on the basis of race is an intersectional issue that may affect multiple communities present in Adelanto. Thus, the racial makeup of Adelanto, in addition to low levels of income and education, are factors that have likely contributed to harmful perceptions of residents as more disposable than majority-White areas. These perceptions pave the way for environmental injustices to go unattended to.

Information that compares indicators of water quality and health between Adelanto and other California towns supports the hypothesis that environmental hazards disproportionately impact this region. According to OEHHA's CalEnviroScreen 4.0 report (expanded upon in Appendix 1), Adelanto's water scores above the 95th percentile for two contaminant categories: 1) Gross Alpha and 2) Maximum Contaminant Level (MCL) Violations & Lead and Copper Rule and Lead Action Level Exceedances. Additionally, Adelanto is in the 66th percentile for Hexavalent Chromium (*CalEnviroScreen 4.0 Indicator Maps*, n.d.). While all three contaminant categories pose negative health impacts, lead and copper contamination from neglected piping is particularly associated with cases of environmental racism, as it continues to affect low-income communities and communities of color at disproportionate levels as a result of state disinvestment (*EPA's Lead and Copper Rule*, 2021). Given the overall dissatisfaction among residents about the lack of investment in their public utilities and infrastructure, exposure to these environmental harms is unfortunately unsurprising.

Rates of common health issues associated with exposure to environmental hazards, such as asthma and cardiovascular disease, are generally higher in Adelanto than a majority of California census tracts. However, the Low Birth Weight indicator is particularly striking. In Adelanto, Low Birth Weight is in (nearly) the 100th percentile for the northern census tract, and in the 93rd percentile for the southern tract (*CalEnviroScreen 4.0 Indicator Maps*, n.d.). Low Birth Weight is a valuable public health indicator and while it may be caused by a variety of factors, it is one health impact shown to be associated with drinking water contamination (Currie et al., 2013) – including PFAS exposure (Verner et al., 2015). Additionally, the proximity of low-income residents to the George Air Force Base Superfund site on the North side of town, where many groundwater threats have been identified, compounds cause for concern.

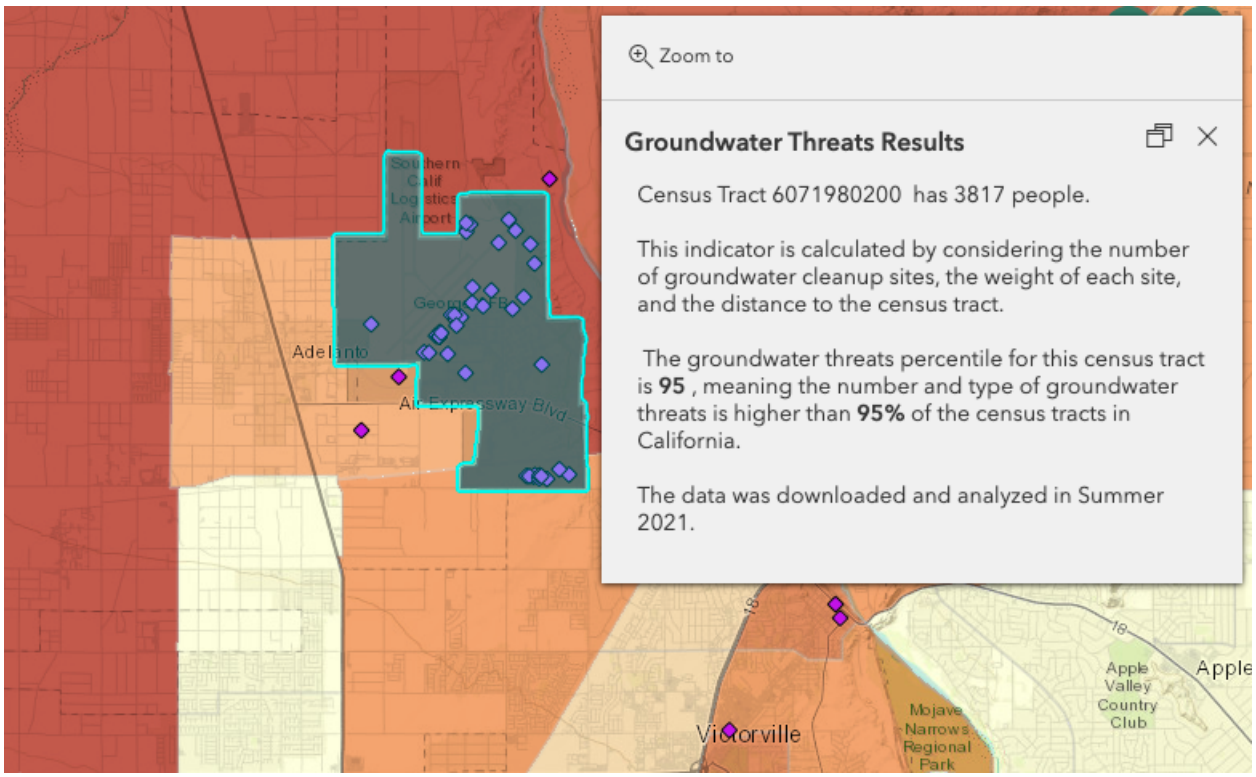

Figure 4: Image of CalEnviroScreen 4.0 Indicator Maps, showing the Groundwater Threats percentile for the census tract East of Adelanto.

It is important to note that a high proportion of Adelanto's people are incarcerated, spread across four prisons and detention facilities. Incarcerated populations are disproportionately impacted by environmental injustices. The FCI Victorville prison that is located on the George Air Force Base is a prime example of the intersections between environmental injustice and incarceration, wherein government negligence of environmental hazards can be clearly linked to serious health issues within the prison's walls (expanded upon in the following section). Prisons themselves are sites of environmental injustice as well. In 2021, the EPA issued a report revealing that the Adelanto Detention Center repetitively misused a pesticide for disinfecting the air, causing those incarcerated to experience nose bleeds and other health complications (Lieu, 2021). While the US EPA was mandated by a 1994 executive order to take federal actions to address environmental justice in minority populations and low-income populations, prisons were excluded from this environmental justice mandate (Pellow, 2017). It is imperative that the incarcerated population in Adelanto's four prisons are included in the fight for achieving water justice. Not only are incarcerated people at a higher risk of exposure to environmental harms, but their voices and actions are an indispensable part of a just present and a sustainable future.

Instances of Water Injustice and Activism in the High Desert

Adelanto is not the first small high desert town to experience issues of water injustice. While Adelanto's water issues are relatively unknown to most, just 45 minutes North is the small town of Hinkley, a place that became popularized as an instance of water injustice and hard-fought legal battle by well-known water activist Erin Brockovich. Hinkley's drinking water was contaminated by power company Pacific Gas and Electric's (PG&E) use of chromium 6 (also

known as hexavalent chromium) in their cooling tower water. The irresponsible discharge of this wastewater caused chromium 6 to enter the groundwater supply (*PG&E Hinkley Chromium Cleanup*, 2022). Lime green water, an oversaturation of illness, dying wildlife and plants, and the purchasing of houses by PG&E for any amount necessary were the first clues that something was unusual in Hinkley. Working as a legal clerk, Brockovich began a multi-year long environmental investigation and lawsuit against PG&E that brought so much attention, a movie named after Brockovich herself was made about it. By valuing local knowledge and observations (despite what “experts'' had said) and by leveraging collective power through relationship-building and community meetings, Brockovich was able to mobilize Hinkley community members (mainly mothers) and settle the case for $333 million, the most ever paid in a direct-action lawsuit at the time.

Erin Brockovich has contributed to efforts for water justice by bringing attention to the prioritization of profit over people by US laws, and the lack of regulation around certain industrially-deposited contaminants. In her recent book *Superman’s Not Coming,* Brockovich states that, “you can only find what you test for” (Brockovich, 2021). In particular, Brockovich has shed light on the presence of chromium 6, and of per- and polyfluorinated substances (PFAS) in drinking water. While it is required by the EPA that the cancer-causing chemical chromium 6 is tested for in water, it is grouped with the naturally-occurring chromium 3, allowing this contaminant to go largely unattended to in drinking water nationwide. Importantly, Brockovich points out that the EPA is still not setting regulations for drinking water PFOA and PFOS, which contaminate water across the nation. The EPA has only a non-enforceable, non-regulatory health advisory for PFOA and PFOS which may cause birth

defects, cancers, liver/immune/thyroid effects, and other health issues (US EPA, 2016). Brockovich urges people to trust their gut when they sense that something is not right with their drinking water. Whether it smells, looks or tastes funny, these reasons are enough to investigate the water. Brockovich advocates for the self-reporting of water quality concerns and GIS mapping as a tool for mobilizing communities to do something about their water.

Even closer to Adelanto is Victorville, where the infamous George Airforce Base superfund site is located. The superfund site is known for its impacts on the health of those who have lived and worked on the base in the past, and currently those who are incarcerated or working at the Victorville Federal Correctional Complex (FCI Victorville) which was built atop the site. Between the years the 5,347-acre George Airforce Base was open from 1941 to 1992, contaminants of potential concern (COPCs) leached into soil and groundwater due to the use and disposal of hazardous materials. The US EPA states that groundwater is contaminated with jet fuel, trichloroethylene (TCE), pesticides, and nitrates (*Superfund Site: George Air Force Base Victorville, CA*, n.d.). However, there are additional reports that nuclear and other radioactive waste may be present as well (*Radioactive Material/Waste Timeline*, n.d.). Individuals who were stationed at the George Air Force Base experienced health problems attributed to the toxicity of the area, and women at the base were warned to not get pregnant due to disproportionately high birth complications and infant mortality rates (Carpenter, 2020). With all this being known, the federal government still chose to build the FCI Victorville prison on the site without adequately addressing the environmental hazards that they had been responsible for creating. It comes with little surprise that the prisoners at FCI Victorville are disproportionately

experiencing health issues such as stomach ulcers, and that recent testing of the water shows PFAS at over 5000 parts per trillion (the EPA threshold is 70 ppt)(Carpenter, 2020; Pellow & Vazin, 2019).

The George Air Force Base Superfund Site has its own website (www.georgeafb.info) where documentation of contamination and information on the site and the contaminants present is available, as well as access to a health registry. This site seems to be the main online source of organized efforts to get justice for those impacted by the superfund site. Additionally, investigation and grassroots activism by the Prison Ecology Project, the Inland Coalition for Immigrant Justice (ICIJ) and the Campaign to Fight Toxic Prisons have mobilized around the FCI Victorville site. In 2016, a coalition that included those formerly incarcerated in FCI Victorville was brought together by 3 days of protest in Washington D.C. (Fight Toxic Prisons, 2016). ICIJ is completing a series of videos that explicitly connect environmental injustice and incarceration in the High Desert region by recording testimonials of those affected (Communications CCAEJ, 2021). Given the proximity of the George Air Force Base Superfund Site to Adelanto and especially to its wells, I explore the potential impacts of the site on the water in more detail in the report (Appendix 1).

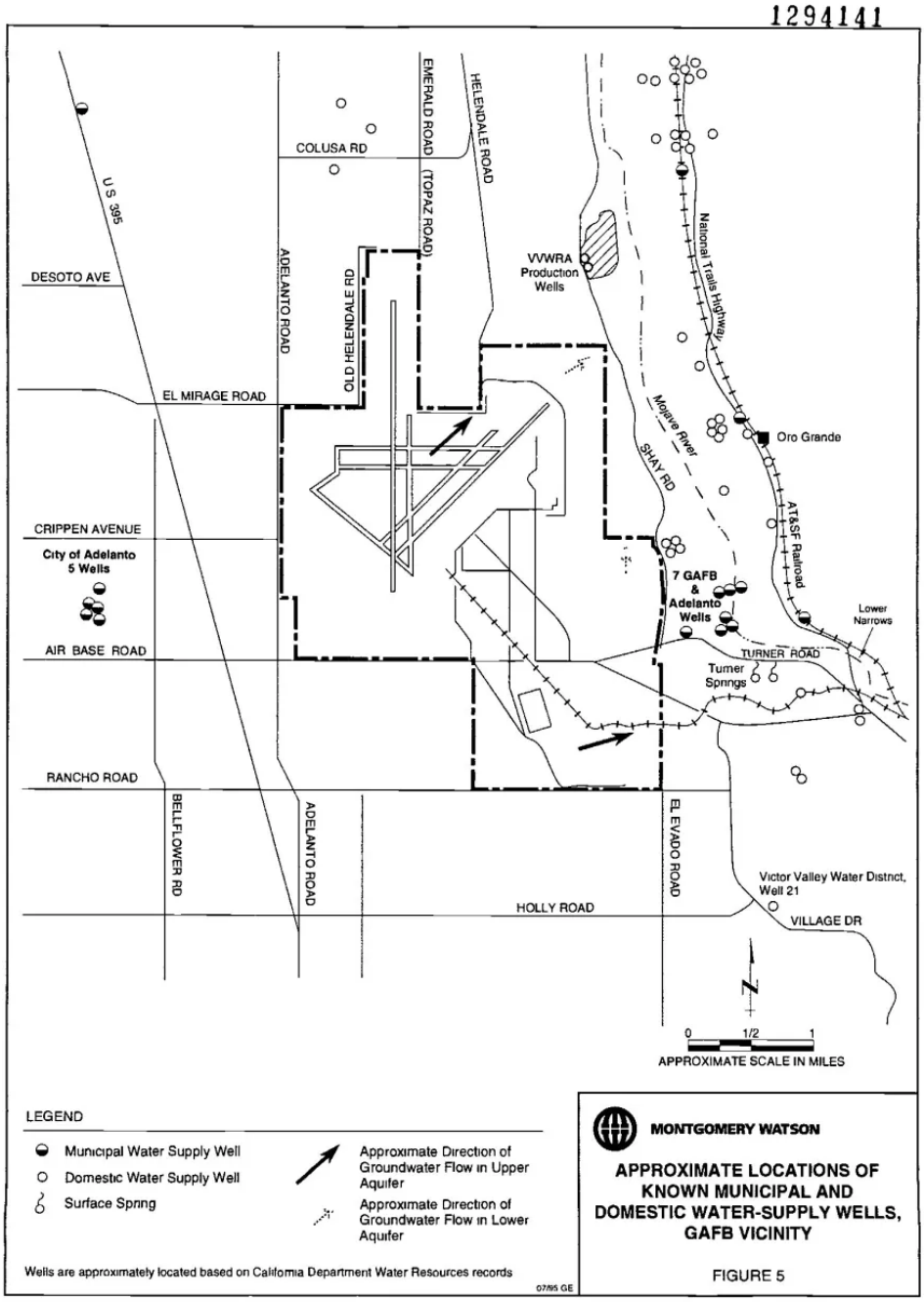

Figure 5: Locations of known municipal and private water supply wells. Provided by https://www.georgeafb.info/

Activism around water justice in Hinkley and Victorville may be drawn upon as sources of empowerment and validation for the water justice efforts in Adelanto. Mobilization for

environmental justice at FCI Victorville is ongoing and closely intertwined with abolitionist struggles. Collaboration with community organizers and residents involved in this struggle addresses the driving forces of injustice both inside and outside the prison: the perception of immigrants as criminal and disposable and the prioritization of profit over people. National recognition aside, the environmental legal battle in Hinkley should be taken as particular inspiration for Adelanto to make claims on their water given the towns' close proximity to each other and similar demographics. Brockovich's logic of trusting one's instincts is an encouraging sentiment for the budding Adelanto water struggle, especially given the risk for concerns coming from the immigrant community to be brushed off due to the stereotyping of mistrust in drinking water among that population in the US. Without discounting the importance of these victories, it should be noted that Hinkley is still in the long process of actually securing uncontaminated water. One possible reason for this, is that the community members themselves lacked the adequate resources, tools and organizational structures necessary to sustain their fight for justice. While Brockovich may have started from humble beginnings, she reached a certain level of mobility and success from winning the case that allowed her to bring these efforts to a national scale, inadvertently leaving the Hinkley fight behind. Brockovich's whiteness may have also contributed to her ability to be heard and eventually to be recognized for her leadership on the issue.

In recognizing the difference in positionality between Brockovich and the community leaders in Adelanto who are nearly all people of color and many of whom are non-English speakers, the fight for water justice will necessarily not be as simple as following the same steps as Brockovich. What still can be learned from the Hinkley struggle? Importantly, continued

efforts to hold officials accountable from those who will still be in the community after the big win are imperative. Thus, this project is informed by the overarching goal to promote continuous, yet adaptable action towards achieving water justice. This means – at minimum – sustainable, community-based water monitoring, accessible resources that don't expire, and generational knowledge holding must be employed in Adelanto if real change is to be made.

All that said, more intentional efforts for solidarity building and knowledge sharing between Adelanto, Hinkley, and Victorville may be beneficial to formulating a greater movement for water justice in the High Mojave Desert region. A multi-scalar approach can connect Adelanto's local water struggle to the larger Southern California region, and eventually struggles may be able to build solidarity across regions for global access to drinkable water. Bringing these fights together under shared goals will emphasize the underlying and interconnected causes of injustice that determine the conditions of our social and environmental lives[3].

The water that comes from the taps

The land that is now called Adelanto has not always been known as a dusty, water parched desert. Looking far back into the history of water in the Mojave Desert, up to 14,000 years ago when temperatures were cooler, it is believed that lakes would form in the Spring from the runoff of the San mountain snowpack (Patterson, 2016). Since time immemorial, the Yuhaviatam/Maarenga'yam (also known as Serrano) and Vanyumé Indigenous groups have resided in the High Mojave Desert. Spanish missionaries entered the scene in 1769, reporting a

[3] There are two other instances of water injustice just outside of the High Desert, but still within the Inland Empire, that have garnered national attention. First, the contamination of water in Rubidoux from the Stringfellow acid waste pit (marking the first Superfund site). Second, the percolate contamination of wells with rocket fuel in the Colton-Rialto Basin and Beumont from multiple corporations (Patterson, 2016).

land abundant with saline springs, grasslands, and a river and swamp. Marketed for its prospective wealth in the land, population in the Inland Empire more generally began spiking beginning in 1870, beginning a period that strained water resources to a new extent. In 1915, E.H Richardson purchased the land that would become Adelanto for $75,000 and began transitioning existing orchards and open space into urban development. Presumably, this development marked the transformation of the water system from one of irrigation to one of underground pipes for municipal needs.

Adelanto currently obtains all of its water from the Mojave River Groundwater Basin, managed by the Mojave Water Agency. This basin is naturally recharged by runoff from the San Berardino and San Gabriel Mountains. The upper portion of the Mojave River seasonally flows with water, while the lower portion has a subterranean flow (below ground). There is very little groundwater recharge from Victor Valley due to low precipitation and high evaporation rates. Thus, recharge is supplemented with imported water from the State Water Project through the California Aqueduct, a project which was extended to service the City of Adelanto in 2020. The project cost $5.1 million, and is funded by the City, the Mojave Water Agency and federal grants.

Information on Adelanto's current water infrastructure and quality is available on the City's website under the Water and Sewer webpage. Water is managed by the Adelanto Water Department and the PERC Water Corporation. The most recent Adelanto Urban Water Management plan is from 2020, and in addition, there is a City of Adelanto Water Shortage Contingency Plan from 2021. These plans were signed by Adelanto's mayor and council members. The City currently pumps from 7 active groundwater wells that meet water quality

standards out of 15 wells total. The groundwater in the basin is recharged by both percolated supplies and imported supplies derived from the State Water Project. In times of emergency, Adelanto imports water from Victorville, which occurred at least once in recent years from July to November in 2020 (*Adelanto 2020 UWMP*, 2021). According to the City's reporting, one of the most likely threats to the supply that would cause Adelanto to experience a water shortage is exceedance of maximum contaminant levels requiring the wells to be removed from service. Arsenic is the primary contaminant of concern listed by these reports that threaten their disuse, followed by Iron and Manganese which have also affected the City's wells (*Adelanto 2021 WSCP*, 2021). The reports detailing Adelanto's water management demonstrate a system in which water is tightly controlled by the City and metrics for its levels of quality and supply are determined by state and federal agencies.

It should be noted that the information available on Adelanto's water is not only compiled in long, technical reports (100+ page PDFs), but they are also written in *English*, while a large portion of Adelanto's water concerns are coming from the Spanish-speaking community. While these reports may be informative if a substantial amount of time is alloted to poke through them and the reader is fluent in English, they are generally inaccessible to Adelanto's population. Not to mention, I have yet to receive an answer to my calls to the City's Water and Sewer phone line, which is apparently active 24/7 for general information and emergencies.

Connections to Climate Change

Global climate change will have local effects on Adelanto's water supply and quality. Severe drought is likely to occur as rising temperatures mean that precipitation is reduced and water in soil evaporates at a faster rate. Drought leads to decreased water quality, in part due to

the concentration of contaminants (Mosley, 2015). The Keck Science Department has prepared the *Climate Vulnerability Assessment City of Adelanto* report, which details the current and future risks of climate change and provides recommendations for climate resiliency adaptations to reduce harm. Since the 1950's, winter temperatures have already warmed over 2.5°F, and summer temperatures have warmed just over 0.9°F (Fan & van den Dool, 2008). By the end of the century, temperatures are projected to increase 5.4 °F and 9.0 °F under a medium emissions scenario and high emissions scenario, respectively (Thomas et al., 2018).

In 2021, the CIty released a Water Shortage Contingency Plan. By natural cycles, the Mojave River is an inconsistent source of water, filling up only when rainfall is abundant. This dominant narrative of scarcity has led to the overbuilding of the watershed basin to create a sustained water supply, which conflicts with these natural cycles and results in overdraft (depletion is faster than recharge) (Stamos et al., 2001). The fear of "running out" of water is not unfounded based on projections of climate change; however, the conversation of water scarcity appears to be leaving little room for the conversation of water quality among city officials.

At the same time, there seems to be inefficiencies in the actual conservation of water. System water loss is the amount of water that was not consumed out of what was produced (through the drawing of groundwater). In 2020, there was a loss of 987 acre feet of water, which is about a fifth of the total water production that year. Combined with the overdraft of groundwater and intensifying drought, water losses can not be afforded. According to the UWMP, the current reasons for water loss are unclear, but the City is working to identify and reduce losses.

Adelanto was required to reduce water use by 20% by 2020 as mandated by the California Water Conservation Act (SBX7-7). The city uses what they call “Conservation Pricing”, which means that water billing rates are heightened to encourage water conservation. In addition to a flat rate, meters determine what users pay in addition to the flat rate. There is minimal public education and outreach about conserving water. While signs such as “Save Water: Live Like a Desert Native” and “Make Every Last Drop Count” are displayed in Adelanto, it seems that high water bills are the main way that the City attempts to reduce water consumption.

Figure 6: Sign in Adelanto by the City of Adelanto and PERC Water Corporation demonstrating the narrative of water scarcity.

Issues of water quality persist due to climate change for two main reasons. First, a decrease in water supply means a decrease in water quality. Second, narratives of water scarcity override immediate calls for water quality, as well as perpetuate the overbuilding of water basins that only furthers overdrawing. As such, global climate change connects local struggles for improving water quality and may serve as a basis for solidarity-building.

Conclusion

The dominant hydrologic discourse and technocratic system, made apparent by the City's past, current and future water management plans, have co-constituted power and water. Water exists as a point of environmental injustice that intersects with other forms of dispossession based on income level, race, histories of immigration, and incarceration status. Multi-scalar linkages, especially those relating to climate change, present opportunities for Adelanto to unite with struggles across Southern California and the world. With 8 out 15 wells deactivated and the 7 active wells threatened by poor water quality and climate impacts, Adelanto's water system is in a state of fragility. From the release of the Water Shortage Contingency Plan to PERC water company's messaging that urges residents to save every last drop of their water, it is clear that the dominant discourse around water among officials is one of scarcity. However, the issue of scarcity is one that has been artificially generated by the overbuilding of river basins. The reports detailing Adelanto's water management demonstrate a system in which water is controlled by the City and metrics for its levels of quality and supply are determined by state and federal agencies. In other words, the system for dealing with water in Adelanto lacks opportunities for community members to participate in the monitoring of

their own water quality. The piped and underground nature of the system means that residents feel largely disconnected from their water supply, and the provided information is inaccessible to many. There does not appear to be a structure set up for self-reporting issues with water that would be directly transparent to the public. Residents have no choice but to operate through the City to make claims on their water supply, which depends on City officials to be more responsive, transparent and accountable than is currently the case.

Chapter 3: Findings of the Research & Project

The project for water justice in Adelanto is ongoing. For this semester, I have completed a report (Appendix 1) to synthesize what we have learned so far and the testimonies from residents. The report includes some background information on Adelanto's water supply, as well as information on the George Air Force Base. Importantly, the report compares the most relevant water quality information from the City with that from the Environmental Working Group, the California Office of Environmental Health Hazard Assessment (OEHHA), the George Air Force Base website, and the results from recent testing completed by the Claremont Colleges Keck Science Department. Each of these sources either tested for a different set of contaminants and/or presented the data in varying ways that influenced what contaminants were highlighted. There were two caveats to analyzing this information. First, no level of a contaminant is "safe" to drink – there are only levels of contamination deemed acceptable. Second, you can only find what you test for. After reviewing these sources, it became apparent that there is misalignment between them – from the potential contamination of per- and polyfluorinated chemicals (PFAS) from the George Air Force Base, to the dangerous levels of Trihalomethanes pointed to by the EWG, to the relatively high lead and gross alpha concentrations from OEHHA reporting, and the concerning levels of Arsenic from the City's own testing.

The results from the Keck Science Department classes indicate that the PERC Water Corporation is under-reporting levels of contaminants in the water. Out of the elements tested, the Advanced Laboratory in Chemistry course found that calcium, magnesium, potassium, and

sodium had the highest concentrations, and were all reported by PERC at lower concentrations (Figure 7). The Integrated Biology and Chemistry class found that total alkalinity and total hardness were both measured at levels higher than reported by the Adelanto CCR. The ranges reported by the CCR would classify Adelanto's water as soft, which seems to contradict the results from both Keck Science classes and the experiences of residents. The students found that 4 of the 12 samples had significant levels of heterotrophic bacteria, which Adelanto is not required to test for and report. While most microbes in this category are benign (safe), some of the species revealed by the results may be pathogenic. UV light and chlorine were found to be effective in killing the bacteria in the samples (Appendix 1.A; Appendix 1.B).

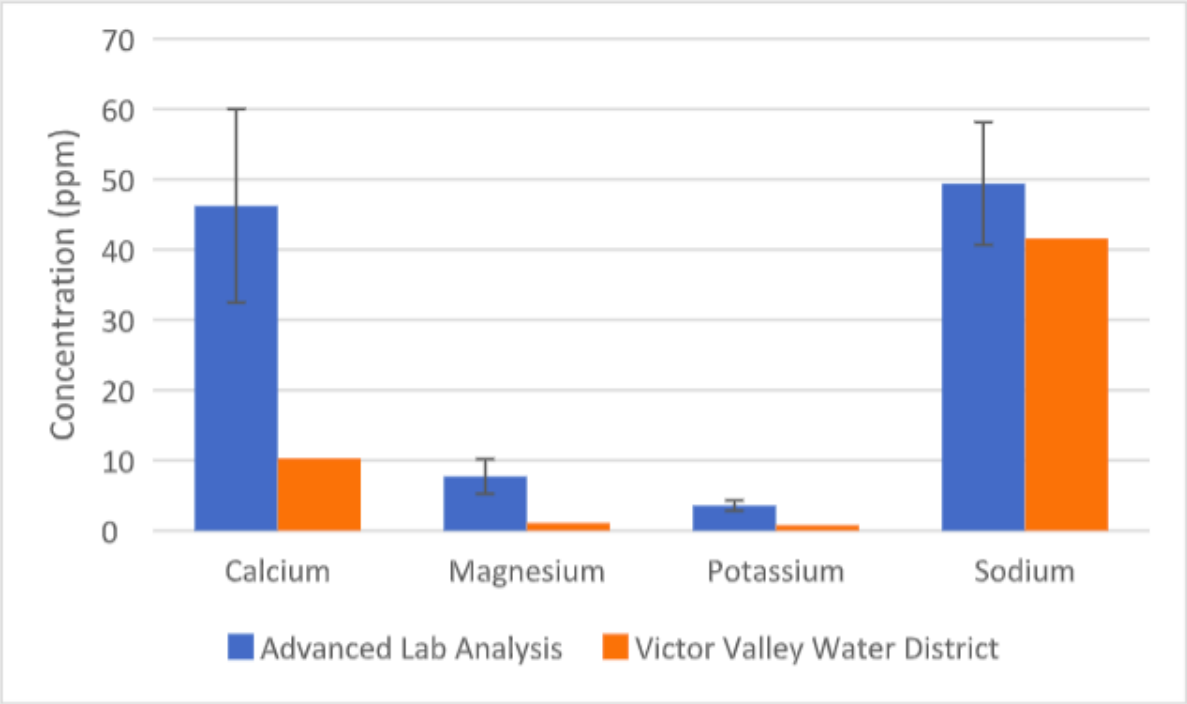

Figure 7: Concentrations of elements found in water samples (n=26) from the City of Adelanto with ICP-OES in comparison to concentrations reported in the City of Adelanto 2020 Consumer Confidence Report.

Despite all of the available information, Adelanto's residents are still left without a clear picture of what contaminants are in their water and why it looks and tastes the way it does. The action steps proposed in the report address both what the City can do to improve residents' understanding and experiences of water, such as subsidizing water filters and improving information transparency, and what the community can do, such as developing a water monitoring program (Appendix 1). The following section further unpacks the discrepancy between the lived experience of residents and the available water quality information through an analysis of the qualitative data collected during the project.

Adelanto Residents Speak to Their Experiences of Water

Telling the story of water in Adelanto through the investigation of documented information is beneficial for building an argument about the nature of its technical dimensions. However, to gain a fuller insight into the social, cultural, and political dimensions of water, it is imperative to give space to the residents' lived experiences of water. These interviews were conducted with the aim of gaining insight directly from the people of Adelanto into the context and place-specific relationships with water. These interviews served an important role in the report to value the non-scientific forms of knowledge to the same, if not higher, degree as data from water quality testing and City documents. As such, this section honors *the people's* truth about the water, regardless of what test results may come up with.

One of the main concerns about the water from the residents was that it comes out brown, yellow, or a "milky" color. It was noted more than once that water tends to be more discolored from taps where the water has not been used in a while, or water usage is low, and that the water would become clearer if left running long enough. One interviewee who recently

graduated from high school, Jorge, said he sometimes spends “seven minutes just waiting there for water and then it’s still coming out brown.” He explains that this is how it is at the high school in particular, and that he would bring bottled water to school every day because the water was so bad there. Other residents said that they have only experienced brown water once or a few times while living in Adelanto. Mostly, people reported that they have heard of others with brown and yellow water, not that they themselves had consistently had this issue. It was more common for residents to say that they experienced water that looks like milk, which they associated with the chlorine/bleach smell.

Water typically becomes discolored when it contains minerals, rust, or other sediments. It tends to be a sign that pipes are corroding and that pipe materials are entering the water – iron and manganese produce a yellow to brown color, while lead makes the water darker and may include small particles. Water that has been stagnant can build up higher levels of iron and manganese, which is likely why water from unused taps starts out discolored and then becomes clearer over time.

The City has attributed brown and yellow water to their water flushing program. By increasing the speed at which water moves through the pipes to “flush” the sediment from the system, this program aims to improve water quality (*Water Flushing Program*, n.d.). These changes in water pressure may cause brown and yellow water to come out of the tap for a period of time. Flushing is a quick-fix to corroded pipes, which will only worsen over time. Replacing the piping is more costly but prevents discolored water and other water quality issues more effectively in the long run.

Along with discoloration of the water, the majority of residents interviewed complained of the taste and smell of their water. In particular, people reported smells of chlorine or bleach in their tap water. Along these lines, Carmen says, “Before I got the filter it would come out milky. Milk, milk, milk. I wonder if there's a lot of chlorine or something. It really smells like Clorox. Like if I wash my mouth it tastes like Clorox.”

In the US, the EPA requires the chlorination of all public water supplies. Chlorate (which is derived from chlorine) is used in the water supply to disinfect bacteria, parasites, viruses and other microorganisms from the water. Generally, you begin to smell chlorine when it is above one milligram per liter of water (the EPA limit is four milligrams per liter or less). When this chemical interacts with organic matter, the smell of chlorine becomes more prominent. Thus, it is possible that high levels of organic material in the water supply, or possibly that the City is adding a lot of chlorine in the water due to concerns about bacteria.

The hardness of the water in Adelanto was an issue for residents as well. Christine says, “You can feel when it's hard and sometimes when you get out of the shower you still feel dirty and I don’t think that’s right. And with my son being so sensitive skinned as well.” Christine says that her skin breaks out more when she is living in this area, and multiple other residents report feeling like the water was contributing to the dryness and sensitivity of their skin. Groundwater, which Adelanto sources its water from, tends to be harder than surface water.

Much of the concern for the water was not directly related to residents' own experiences with poor quality water, but other people’s in the area. Clearly, the residents in Adelanto are talking about the water. Especially, as it seems, among the Spanish-speaking community. Catalina for example has begun organizing with El Sol because of both her own

experiences with the water and understanding that the issue extends beyond her house. She says that “We hear from everyone that the water here is dirty. I noticed that a lot in my house, the tap water in the bathroom comes out pretty much like sand. It comes out white so the water is clearly dirty. It's like milk.” She explains the inconvenience of having to deal with water like this: she has a filter, but has to change it every five months, and also spends at least 25 minutes traveling to pick up bottled water to drink. Catalina remarks, “Now everybody is noticing. We're talking to her, Leonor, and everyone that lives here is noticing that the water is yellow and has a lot of [sediment] and they are starting to talk about it. The community's talking about it.” She goes on to say that El Sol has played an important role in connecting people who have had similar experiences with their water, which has helped people broaden their perspective to understand that it’s more of a systemic issue. Even those who have not had major issues with their own water are aware of the issue. For example, Malena says, “I've heard that the water comes out a really dirty color and smells bad. And that's what I've heard from neighbors I've talked to.” Malena buys bottled water for this reason. Almost none of the residents had heard anything about the quality of the water directly from City officials or other official sources.

Economic Considerations

When asked what her biggest issues with the City are, Christina says, "Water and probably rent because as much as this is not a very popular area -- it's not like LA or Ontario -- Why should we pay their cost of living? We don't make that much down here at all." Multiple residents commented on their discontent with what they pay for water and rent, conveying a

sense of frustration with the price of living in Adelanto compared to the quality of life. Reporting from the OEHHA reflects this issue – North Adelanto is in the 98th percentile for census tracts that are “housing burdened,” meaning that those who live there are both low income and severely burdened by housing costs (*CalEnviroScreen 4.0 Indicator Maps*, n.d.). The high price of water in Adelanto is related to the City’s “Conservation Pricing” approach, and a broader discourse of water scarcity. In addition to a flat rate, meters determine what each user will pay. Multiple residents reported paying water bills of at least $100 per month.

Joe and Malena share this feeling of unfairness when it comes to water pricing. Joe mentioned that there was one point in time when Adelanto “actually tripled the water rates.” He tells a story of letting his grass die because of the high rates, and replacing it with rocks. Shortly after making this change, he received an exorbitant fine from the city for the way his lawn looked. When asked about the one thing he would like the City to change, Joe exclaims, “don’t raise the rates!”. For the price of water residents are paying, their expectations for the quality of it are not being met. Malena comments "we have also had bad experiences [with the water] and conversations with neighbors of high [water bill] increases and a lot of errors, a lot of errors." Not only did Malena feel frustrated by the high price, but she shared a sense of injustice and her community being taken advantage of.

Multiple interviewees mentioned that they have turned to purchasing bottled water and spending money on filters instead of using the tap water. Carmen says, “We drive to buy a lot of bottles because our kids bring bottles of water to school. And our son was the one who took the water sample from the school because he was saying that at school the water is really bad. He's like, ‘I don't like the water at school.’ We need to take bottled water.” Carmen has also installed

filters for all the water at her house, even to water the grass in the lawn, saying that it cost around $7,000 in total to do. She expresses that her husband in particular was nervous about the water based on what they have heard about getting cancer from poor water quality.

When Miriam was asked whether she has experienced an odd taste and smell of her water, she responded, “Oh yes, and even my daughter bought a faucet from the Home Depot for bathing her kids that has a filter. My husband never uses water when brushing his teeth, he always uses bottled water. We want to buy those filters that we use to filter water but it is very expensive.” Filtering and buying bottled for all the water used seemed to be a common practice among those who could afford it.

The purchasing of bottled water highlights how socially-constructed meanings around water can highly influence actions. Bottled water is often assumed to have a good quality of water. However, this is often not the case. Microplastics from bottling and contaminants from where the water is sourced tend to be present in the water, even if it looks clear and tastes “clean.” Additionally, bottled water is an unsustainable way to acquire drinking water and contributes to harmful extractivist practices by multinational corporations, such as Nestlé. Bottled water’s prominent place in global markets represents one way in which neoliberal globalization has impacted the public water sector.

When water is consumed in bottled form, it becomes an individualized commodity, as opposed to a public good. The need to purchase bottled water and install filters perpetuates the inequitable distribution of drinkable water. The costs of taking these extra steps to access water, on top of the already expensive bills for the public water service, is a large burden even on residents who can afford it. For much of Adelanto’s population that is low-income, there may be

no choice but to drink the tap water. To understand water as a commodity, nevertheless a single-use commodity, disempowers communities and individuals to make claims on water as a public resource.

Epistemological Frameworks: Perceptions of Adelanto and the Self

Interpretations of Adelanto's water quality issues will differ depending on the epistemological framework they are approached with. The dominant hydraulic paradigm sees an area like Adelanto as "water scarce," thereby necessitating that water is managed by the state. The Western knowledge system simplifies water to purely its technical aspects. However, discourse of water in Adelanto, as in any place, is encoded by people's lived experience with it, which is "material, sensory and imaginative" (Linton & Budds, 2014). Simultaneously, the ways in which people understand water also shape the way they understand their identities, especially as it relates to place.

The dryness and dustiness of Adelanto's landscape as a water-parched land was apparent in the way that interviewees identified themselves and their communities. One of the interviewees affectionately called himself and his friends "dust rats," and that his favorite thing about Adelanto is that people have your back. Joe also describes his love for his community on his block, saying he has "the greatest neighbors on the planet." Multiple respondents also mentioned the quietness of Adelanto being one of the reasons they live there. It is Adelanto's location in the arid desert, a place that allows a quiet way of life as it is somewhat barren and removed from the big cities, that draws people here. At the same time, Adelanto is perceived as a lower-income town that is not particularly safe or well kept. Jennifer's comments demonstrate the conflict this creates in her feelings about living there: "I really liked the area. And I like living

here. But we also don't like it. Because they throw a lot of trash and there is not a lot of light in the streets – not a lot of public light.” Multiple residents connected these perceptions to the issues of water in the City.

Anita, for example, moved to Adelanto with her young family three years ago for financial reasons and hopes to move once they can afford it. She doesn’t feel particularly connected to the community here, saying that she and her husband don’t interact much with their neighbors and that she’s been displeased with how the elementary school community has not done enough to address bullying. Anita also mentions a high level of crime in the area, reporting that someone once destroyed her gate while she was gone.

Anita says that she buys bottled water to drink, but will shower in the tap water. When asked why, she states, “the area that I live in, it's not like a higher class neighborhood. You know, it's kind of like poverty. So that's why I feel like the water is not as good." Anitas sentiments about her water reflect an association between the poverty of an area and poor water quality. Further on, she connects the potential for water issues in Adelanto to what she knows about Hinkley, CA, and other places nearby: “I used to live in Barstow for like a year or two. And I know they had water issues, and also heard like the Hinkley out there and really had really bad water. You know, I just pretty much figured that Adelanto's kind of similar to them most likely." These comments show a general perception of the water in the Inland Southern California region as untrustworthy. To add to this, Anita hasn’t received much information about the quality of her water from anyone, saying she feels like it seems like “a big secret.” Anita’s frustration with the lack of information about the water coincides with her sense of the general lack of attention by the City that is given to the quality of life of residents.

Some residents related the water quality issues to the age of the pipes in the City. When Malena was asked about any reasons she had heard for the poor water quality, she responded "We've heard that it's because of the old pipes and that the piping is really old." Carmen, along with others who were interviewed, shared this belief. "About 30 years of old pipage and they haven't changed the tubes and so I would assume that's why it's a lot dirtier than here," Carmen says about the piping in the North side of Adelanto.

Jorge, who works in construction, mentioned that he had seen the water pipes on multiple occasions at work. He stated that the pipes looked, "...worn out, like they haven't replaced it… like they haven't been replaced for a while. Like probably the 90s, 80s, I don't know. But it just looks old." He said that there is often conversation among the other construction workers about how poorly taken care of the pipes are in comparison to other cities they have done construction work in. He seemed pessimistic that the City would ever complete as large an endeavor for its residents as replacing the piping would entail. I often encountered the mindset that the City was likely never going to fix the issue with the pipes, which echoes frustrations that the City does not invest in its infrastructure and residents.

Interviewees tended to show more concern over the water in the North side of Adelanto, which is seen more for its poverty and poor infrastructure than the South side. When Arianna was asked about whether she suspects that the water has impacted her health, she responded, "Up until now no, thank God, but we have heard of people in North Adelanto that have had health problems. And so that's why we're nervous. Because we're very close to them." Carmen echoed these concerns about the North side, attributing their water issues to the old infrastructure. This perception was consistent among some of the respondents in the North,

who shared the frustration that the City did not care or pay much attention to the water, and similarly, to its residents. There may be truth to this narrative of the North side, however, it is a narrative that should be approached with caution. Water seen as “dirty” or “contaminated” can reinforce negative associations people have with themselves and their own communities, or serve as language for those on the South side to “other” those on the North side.

Across interviews, it is apparent that water was the primary issue they would like to see addressed by the City of Adelanto. Interview respondents generally said that they have not heard much from City officials about the water, or that they don’t trust what is being said. As a result, most residents did not know what contaminants may be in their drinking water. Residents who filter or buy bottled water either made that choice based on personal experience with odd taste/smell/appearance, norms in their community, or assumptions of poor water quality based on general perceptions of the region. A sense of frustration with not being satisfied with the water coming from the taps, paired with the high price of the water or inconvenience of filtering or buying bottled water, and lack of transparency about the water from City officials, was shared among many residents. Interview respondents, both from and not from lower-class neighborhoods, connected issues of water quality with the poverty in Adelanto and the poor infrastructure in areas with more poverty.

Ultimately, water in Adelanto has been constructed in the public eye as undrinkable. Tap water is undesired and not to be trusted. Water, which should be a resource that replenishes and revitalizes life, is instead harmful. Regardless of the results of water testing, there are inequalities produced in the distribution of drinkable water due to the costs of filtering and

buying bottled water. Until the residents are able to confidently drink out of the tap when they've spent the day in the dry heat, or to shower off the layer of desert dust from their skin and feel truly clean, there is no water justice.

Having access to water they can trust is more than just a demand about water in Adelanto. Ariana sums up this vision for a future Adelanto:

> I would like Adelanto to be clean. I advocate for a clean Adelanto with healthy water. A good school for the kids so that they can get to university college. We want more parks. We want bicycles. So we can ride our bikes and walk around the city; make it walkable. We want care for our elders. Because right now we don't have anything for them.

Having good water quality is about a good quality of life and the City following through on their responsibilities for creating a healthy and safe place.

Discussion

This project has grown from community members voicing their desires for a better quality of water and of life and represented a unique opportunity for a coalition of actors to come together under this shared vision. In assessing the success of these efforts, I have found that one of the greatest assets of Adelanto's community that has been particularly valuable to this project is their social capital. This social capital is multi-scalar and draws from both pre-existing social networks and newly-built ties. The following section delineates three types of social capital, characterized by Robert Putnam (2000) and Firth et al. (2011), relevant to this project.

The first spoke of social capital is known as “bonding” social capital between individuals in similar socio-demographic situations. The majority of community members I spoke with in Adelanto were Latina mothers, by nature of who we had links to through community partners and of who is talking most about the water. Due to their caregiving roles, these mothers are likely more aware of issues of water in the household. Through close ties and communication, these mothers are also aware of the water issues other mothers’ families in their circles are experiencing, giving them a broader scope of the situation. There seems to be a fair amount of conversation among students at the schools. In informal conversations with youth, they were keenly aware of the water quality and said it is commented on often in social situations. In general, Adelanto seems to have communities that are connected by in-person interactions among those in similar positionalities (hence the increased effectiveness in collecting water samples via going door-to-door than via a social media post). This indicates that on-the-ground efforts to mobilize community members and outreach through interpersonal ties may be a successful way to gain traction in the fight for better water.

The next level, “bridging” social capital, exists between individuals and organizations with more distant ties. This form of social capital exists between those within Adelanto but who may come from different backgrounds or reasons for involvement. Relationships built with community member and councilwoman Stevevonna Evans, who comes from a position of power as an elected official, is a good example of one of these bridges. Another bridge exists between two community organizations, the Inland Coalition for Immigrant Justice (ICIJ) and El Sol Neighborhood Educational Center (El Sol). ICIJ is focused on changing the dominant narrative of immigrants, and has a High Desert sector that has prioritized addressing the

incarceration of immigrants through their “Shut Down Adelanto” campaign, which is intimately connected with issues of environmental injustices within the detention center. El Sol is an educational organization that supports the health (including environmental health) of the immigrant community. Both organizations are committed to a collaborative struggle for water justice as it is connected to achieving their missions.

The third type is “linking” social capital, which is cultivated between individuals and institutions in dissimilar situations. Linking social capital characterizes the relationship between the actors involved from Pitzer College and those in Adelanto. Professors from the Keck Science Department have been actively involved in the planning and discussion of water sampling, and students from their classes analyzed the water samples from Adelanto. The Robert Redford Conservancy and the Community Engagement Center at Pitzer have also had supporting roles and contributed valuable resources to this project.

This project brings together a broad and diverse group of individuals and institutions – from community members, university and high school students, local grassroots community organizations, Pitzer’s institutional organizations, and a city official. Generating social capital establishes norms of reciprocity and trustworthiness among actors (Firth et al., 2011), which accumulates into solidarity and potential for collective action. It is important to note that these categories are not mutually exclusive or exhaustive – for example, there is bonding social capital between myself and Olivia, the other Pitzer student working with ICIJ on this project, but our social capital within Adelanto is of the linking variety. This list of the folks, organizations and institutions involved in the struggle around water justice in Adelanto is dynamic and expanding.

While there was solidarity between the individuals and leaders of the organizations already involved, there was not much capacity at this time to develop a collective sense of solidarity between members of the communities into forms of action. I regret that we were unable to effectively plan a community meeting with a broad group of individuals from Adelanto. I believe that community meetings may be a way for those to share their concerns and cultivate a sense of togetherness in their struggles. Moving forward, building upon collective power through social capital would provide a resource that could be mobilized for making claims to water as a public good.

Due to unplanned challenges inherent in any project, we were not able to complete everything we had desired within the time-frame of this thesis. A Public Records Request submitted by ICIJ to the City of Adelanto has yet to be returned with information regarding the locations of active wells and age of water pipes. Additionally, we just recently obtained home-tests for PFAS chemicals that will help us overcome this barrier in understanding what contaminants are present in the water.

Another limitation of this project was its ability to integrate conversations of water quality with the issue of water shortage and climate change. While the City is primarily concerned with water supply, the residents and community organizations are concerned with water quality. These two issues are intimately connected, and there is room for improvement to achieve a more interconnected, whole system discursive approach to water justice in Adelanto. Deepening connections between the organizing happening around water, climate, immigration and incarceration would likely be beneficial to this work, as they all intersect to impact community and environmental health in Adelanto.

It remains to be determined what the long-term effects of this project will be. The ability for this project to make change depends on its sustainability and the continuation of this work by those who will continue to stay in the Adelanto community. Towards the very end of this semester, I had the wonderful opportunity to tag along to Adelanto's Toxic Tour, which brought together speakers from the community to bring attention to the intersecting forms of injustice present in Adelanto. The event left me feeling inspired and optimistic about the community action around these issues that is to come. One of the final asks of El Sol was for us to work together to prepare leaders in the community to speak directly with state and city officials to make demands for water justice. My hope for this project is that it furthers these community efforts towards water justice, as well as the agency community members feel regarding their water and how it is distributed.

I plan to continue the project over the summer in order to make the results of this research more accessible, educational, and empowering. I would like to focus greater time and effort in creating maps using GIS software. GIS mapping is one way in which complex water issues may be conceptualized and visualized with greater clarity. Using mapping, it may be possible to set up a community-based water monitoring project, in which residents are able to self-report issues with their water and share that information in a user-friendly, easy to understand format. I envision a map in which each point where someone experiences water that seems "off," there would be a pop-up with a place for a photograph and description of the concern. This way, organizers may be able to provide greater evidence to City officials and identify patterns in water quality based on location and fight for the equitable distribution of drinkable water as a public good.

Figure 8: Community members, organizers, students and guest speakers gather as ICIJ's Lizbeth Abeln speaks outside of the Adelanto Detention Center during the Toxic Tour.

Conclusion

All people deserve to understand their water system, drink from the tap, take a shower and come out feeling clean, and feel connected to local water. Envisioning water justice in Adelanto requires that we define water not just by its technical dimensions but by its social, cultural and political dimensions to show how drinkability is determined by factors that extend beyond test results.

Discourses of water flow at local, regional, and global levels to reproduce relationships between power and water. The narrative of scarcity in Adelanto is not unfounded, because the amount of water supply is and should be of extreme importance, but the reasons for scarcity and proposed solutions are misguided. Technocratic control over water has been built upon Western knowledge systems that assert that humans have control over nature. This dominant, globalized discourse has constructed water that is piped and unseen is known as a sign of being highly developed. The influence of this knowledge system is reinforced by our current state of global capitalism, which has taught society that it can settle on any land and receive the same resources with enough control of the hydrological and agricultural environments, and engagement with global commodity markets.

When municipalities obtain control over the flow of a life-giving resource, they gain power over people. As one might imagine in a monopoly, this power is able to be held regardless of the *quality* of the resource provided. Control over water centralizes power in a society, and a discourse of water scarcity may be appropriated to maintain this control. Those in

positions of power are able to ignore issues of water, while those who have been dispossessed of public resources are unable to do so.

More involvement in the control over water can provide a sense of agency and belonging to communities that have been previously disempowered or denied public services. Models of communal governance of water may also benefit the ecological sustainability of water systems by resisting the tendencies of extractivism and basin overbuilding by centralized water control. There is potential for communities in Adelanto, particularly immigrant communities who have been denied public services, to find citizenship not through the state but through making claims on public resources. Community-based monitoring can be used as a tool for people to have political standing in a place that attempts to take it away.

Communal governance of water and state governance of water need not be at opposite ends, but it takes work to achieve collaboration between the two. Whether it is the corroding water pipes, over-sanitization of water, flushing of sediments or something else, the City of Adelanto has not done enough to address the concerns of its people. The voices of the BIPOC, immigrant, low-income and incarcerated communities have been quieted for too long on the matter. The neglect of water and neglect of the residents has gone hand in hand. The effects of the technocratic discourse on separating flows of knowledge between the City and its residents is reflected in community-member's comments of frustration. Across the board, residents are unhappy with the quality of their water, yet the City continues to insist that it is safe to drink. Residents deserve to know with certainty what contaminants (even if at low levels) are in their water, and why their water looks, smells and tastes the way it does (even if it is still considered safe by EPA regulations).

Water injustice on the local scale may be connected to each larger scale. The similarity in context between Adelanto and neighboring towns in the Inland Empire form an opportunity to connect struggles regionally. If California is to deal with water issues at a state level, consideration must be given to how local relationships with water fit into the greater water system. Just because Adelanto's water is not drinkable, doesn't mean that residents are drinking less water. Bottled water comes from somewhere, and that somewhere has its own relationship to water. Beyond California, Adelanto's water issues exist at the intersections of climate change, global capitalism, and immigration. Because water injustice is underpinned by the local implications of global processes, it is connected to other water struggles globally. As such, increasing multiscalar connectivity between struggles has the ability to shift the power and knowledge relations that produce water injustice.

Local knowledge provides important and relevant details on the actual lived experience of the water. Equitable, safe and trustworthy access to water can be achieved through the valuing of this knowledge in decision-making. Sustainable change will mean ensuring that those who will be in Adelanto in the long run have the tools to continue efforts for water justice. This may be achieved through developing water monitoring systems and empowering the people to make collective political claims. Furthermore, fostering intimate connections with water among residents will resist a dominant discourse approach to water that creates separation between water and people. The water in Adelanto is undrinkable, and until it becomes drinkable, there is no justice. Reimaginings of communities' relationships to water has the power to bring forth this justice.

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Appendix 1

Adelanto Community Water Report

May 2021

Prepared by Ella Meyer

[DRAFT]

Table of Contents

Executive Summary

Members of the Adelanto community have reported concerns over the quality of water coming out of their taps. Residents are experiencing water that appears discolored and smells or tastes odd. There are concerns over the lack of communication between residents and the City's Water and Sewer Department and the PERC Water Corporation about the safety of the water quality. The project for which this report was created addresses these concerns by bringing together a group of individuals, organizations and community leaders in an attempt to *really* understand Adelanto's water and to provide information for making political claims to improve the quality of this public resource. As such, this report compiles contextual information relevant to Adelanto's water, as well as shares the results from additional water quality analysis by the Keck Science Department at the Claremont Colleges. Water samples were collected from resident's homes and tested by students in the Advanced Laboratory in Chemistry and INSERT NAME courses during the Spring of 2022 semester. Alongside technical information, this report highlights the first-hand narratives of community members in their experiences with the water. The report finishes with a list of recommendations for the City to take initiative in improving the quality of water, as well as for the community to make claims on this public resource. The aim of this report is to facilitate sustained community-based efforts to secure equitable access to safe and drinkable water.

What is "Water Justice"?

Water (in)justice implies that water-related issues, such as drought and access to clean water, impact the health and livelihood of certain communities in disproportionate ways. In other words, unjust water systems exist when the management of water resources widens the gap between the "haves" and the "have-nots." Calling for water justice requires that we consider the ways in which water-related inequalities both relate to broader systems of domination, and are situated in local contexts. Oftentimes, water-related issues intersect with each other to produce complex problems to solve. Additionally, achieving water justice means that we must define water not just by its technical dimensions, but also by its cultural, political, economic and material dimensions. A just water system equitably distributes safe and drinkable water that is retrieved from ecologically sustainable and ethical sources. Water justice relies on the participation of impacted communities in decision-making processes and the valuation of local knowledge.

Background on Adelanto's Water Supply

The land that is now called Adelanto has not always been known as a dusty, water parched desert. Looking far back into the history of water in the Mojave Desert, up to 14,000 years ago when temperatures were cooler, it is believed that lakes would form in the Spring from the runoff of the San

mountain snowpack (Patterson, 2016). Since time immemorial, the Yuhaviatam/Maarenga'yam (also known as Serrano) and Vanyumé Indigenous groups reside in the High Mojave Desert. Spanish missionaries entered the Inland Southern California region in 1769, reporting a land abundant with saline springs, grasslands, a river and swamp. Marketed for its prospective wealth in the land, population in the Inland Empire more generally began spiking beginning in 1870, beginning a period that strained water resources to a new extent. In 1915, E.H. Richardson founded Adelanto and began transitioning existing orchards and open space into urban development. Presumably, this development marked the transformation of the water system from one of irrigation to one of underground pipes for municipal needs.

Adelanto currently obtains its water from the Mojave River Groundwater Basin, managed by the Mojave Water Agency. This basin is partially recharged by runoff from the San Berardino and San Gabriel Mountains. The upper portion of the Mojave River seasonally flows with water, while the lower portion has a subterranean flow (below ground). There is very little groundwater recharge from Victor Valley due to low precipitation and high evaporation rates. Climate change impacts have further strained the water supply. Recharge of the basin is supplemented artificially with imported water from the State Water Project through the 444-mile long California Aqueduct, a project which was extended to service the City of Adelanto in 2020. The project cost $5.1 million, and is funded by the City, the Mojave Water Agency and federal grants.

Information on Adelanto's current water infrastructure and quality is available on the City's website under the water and sewer page. The most recent Adelanto Urban Water Management plan is from 2020. This plan is signed by Adelanto's mayor and council members. The City currently pumps from 7 active groundwater wells that meet water quality standards out 15 wells total. While maps exist of all Adelanto's wells, it is unclear which of them are active. In times of emergency, Adelanto imports water from Victorville, which occurred at least once in recent years from July to November in 2020 (*Adelanto 2020 UWMP*, 2021). According to the City's reports, one of the more likely causes of water shortage would be the need to deactivate more wells due to contaminant levels that reach levels higher than what is allowed (also known as exceeding the Maximum Contaminant Level). Arsenic is the primary contaminant of concern listed by these reports that threaten their disuse, followed by Iron and Manganese which have also affected the City's wells (*Adelanto 2021 WSCP*, 2021).

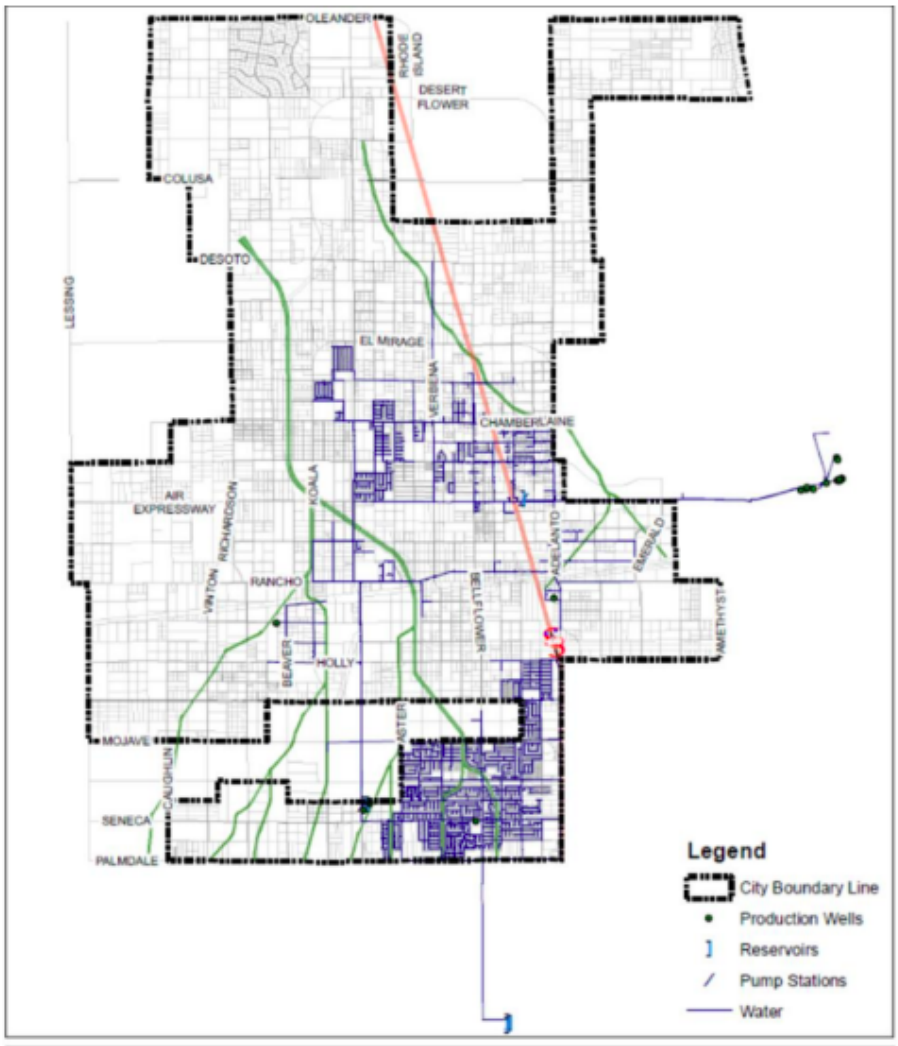

Figure 1: City of Adelanto Water Service Area. Provided by the Urban Water Management Plan.

With 8 out 15 wells deactivated and the 7 active wells threatened by poor water quality and climate impacts, Adelanto's water system is in a state of fragility. The reports detailing Adelanto's water management demonstrate a system in which water is controlled by the City and metrics for its levels of quality and supply are determined by state and federal agencies. In other words, the system for dealing with water in Adelanto lacks opportunities for community members to participate in the monitoring of their own water quality. The piped and underground nature of the system means that residents feel largely disconnected from their water supply. There does not appear to be a structure set up for self-reporting issues with water that would be directly transparent to the public. Residents have no choice but to operate through the City to make claims on their water supply, but this depends on City officials that are responsive, transparent and accountable.

Issues of Special Concern

The George Air Force Base

The George Air Force Base Superfund site is located just on the other side of Adelanto's North-East border. A Superfund site is an area with a high concentration of toxic chemicals that the federal government has directed funds towards cleaning up. Research shows that negative health impacts generally occur within 1.8 miles of Superfund sites. Coupled with this, lower priced and subsidized housing is more likely to exist adjacent to Superfund sites. Trends demonstrate that the locations of toxic waste sites are often nearest to communities of color (Mascarenhas et al., 2021; Taylor, 2022).

The George Air Force Base Superfund site has impacted the health of those who had lived and worked on the base in the past, and currently those who are incarcerated or working at the Victorville Federal Correctional Complex (FCI Victorville) which was (knowingly) built right on top of the site. Additionally, the Southern California Logistics Airport was built on the site, which has its own list of potential contaminants from the airport that could be entering into groundwater (*Southern California Logistics Airport (SCLA) Specific Plan Amendment (PLAN19-00004)*, 2020).

Between the years the 5,347-acre George Airforce Base was open from 1941 to 1992, contaminants of potential concern (COPCs) leached into soil and groundwater due to the use and disposal of hazardous materials. The US EPA states that groundwater is contaminated with jet fuel, benzene, trichloroethylene (TCE), pesticides, and nitrates (*Superfund Site: George Air Force Base Victorville, CA*, n.d.)[4]. However, there are additional reports that nuclear and other radioactive waste may be present as well (*Radioactive Material/Waste Timeline - George AFB, CA*, 2011). Individuals who were stationed at the George Air Force Base experienced health problems attributed to the toxicity of the area, and women were warned to not get pregnant due to disproportionately high birth complications and infant mortality rates (Carpenter, 2020).

The George Air Force Base informational site (georgeafb.info) has made information available on the water quality results from testing done by the Air Force. Specifically, these records provide useful information about the unregulated contaminants perfluoroalkyl and polyfluoroalkyl substances (PFAS), a man-made chemical used in firefighting foam. Further investigation is needed to determine whether the area tested impacts Adelanto's water supply.

The Air Force tested private and city groundwater wells at the George Air Force Base in 2016, and found that all wells that were tested had levels of PFAS. At least one well (located on 18399 Shay Road) exceeded 5,000 ppts of PFAS, far surpassing the EPA's health advisory of 70 ppt. Only a quarter mile away, the landfill (Landfill-1) where the firefighting foam was disposed is positioned upstream from old drinking water supply wells for Adelanto, meaning that groundwater from this area would flow

[4] All contaminants of concern are: Asbestos-Containing Materials (ACM) / Friable Asbestos, Aviation [Avgas], Benzene, Chlordane, Diesel, Explosives (UXO, MEC) [Unexploded Ordnance (UXO) / Munitions and Explosives of Concern (MEC)], Gasoline, Heating Oil / Fuel Oil, MTBE / TBA / Other Fuel Oxygenates, Munitions Debris (MD), Nitrate, Other Insecticides [Aldrin / Dieldrin] / Pesticide / Fumigants / Herbicides, Other Petroleum, Other Solvent Or Non-Petroleum Hydrocarbon, Polychlorinated Biphenyls (PCBs), Polynuclear Aromatic Hydrocarbons (PAHs), Radioactive Isotopes, Tetrachloroethylene (PCE), Toluene, Trichloroethylene (TCE), Vinyl Chloride, Waste Oil / Motor / Hydraulic / Lubricating, Xylene

towards the wells. According to the Air Force, firefighting foam was no longer being disposed of by the late 1970's, and yet these contaminants persist in the water (*Final Perfluorinated Compounds Determination at Multiple BRAC Bases Site Investigation Report*, 2016). The EPA states that health effects from PFAS include birth defects (**low birth weight**, accelerated puberty, and skeletal variations), cancer, liver effects, immune effects, thyroid effects and more. The EPA still has not set regulations for PFAS in drinking water, only a non-enforceable, non-regulatory health advisory (US EPA, 2016).

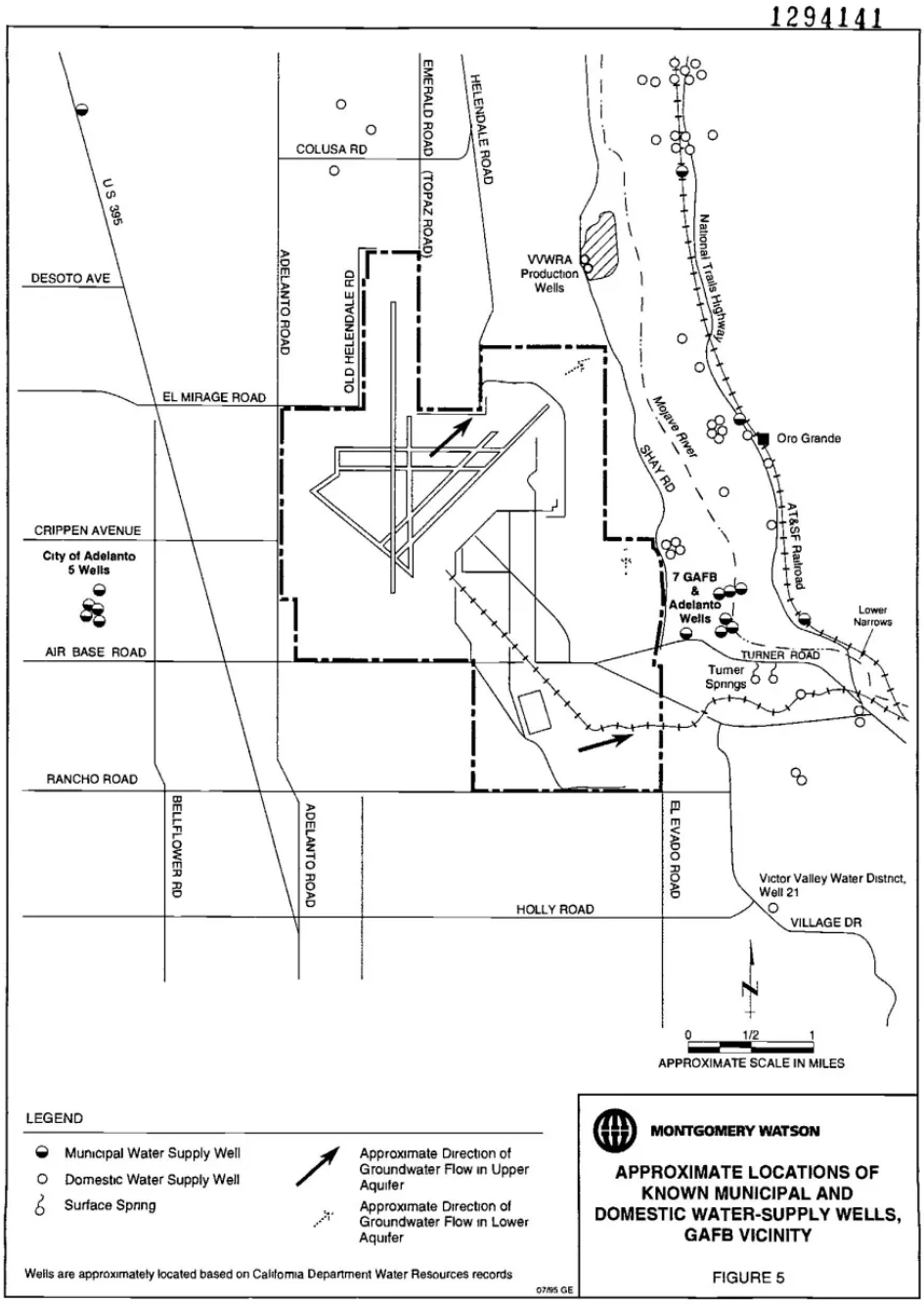

Figure 2: Locations of known municipal and private water supply wells. Provided by https://www.georgeafb.info/

Low Birth Weight

The California Office of Environmental Health Hazard Assessment (OEHHA) releases what is called the CalEnviroScreen 4.0 Indicators Map. The map provides a more complete look at the potential environmental health injustices of an area by comparing rates of common health issues associated with exposure to environmental hazards across census tracts. In Adelanto, Low Birth Weight is in (nearly) the 100th percentile for the northern census tract (closest to the Superfund site), and in the 93rd percentile for the southern tract. Low Birth Weight is a valuable public health indicator and while it may be caused by a variety of factors, it is one health impact shown to be associated with drinking water contamination (Currie et al., 2013) – including PFAS exposure (Verner et al., 2015).

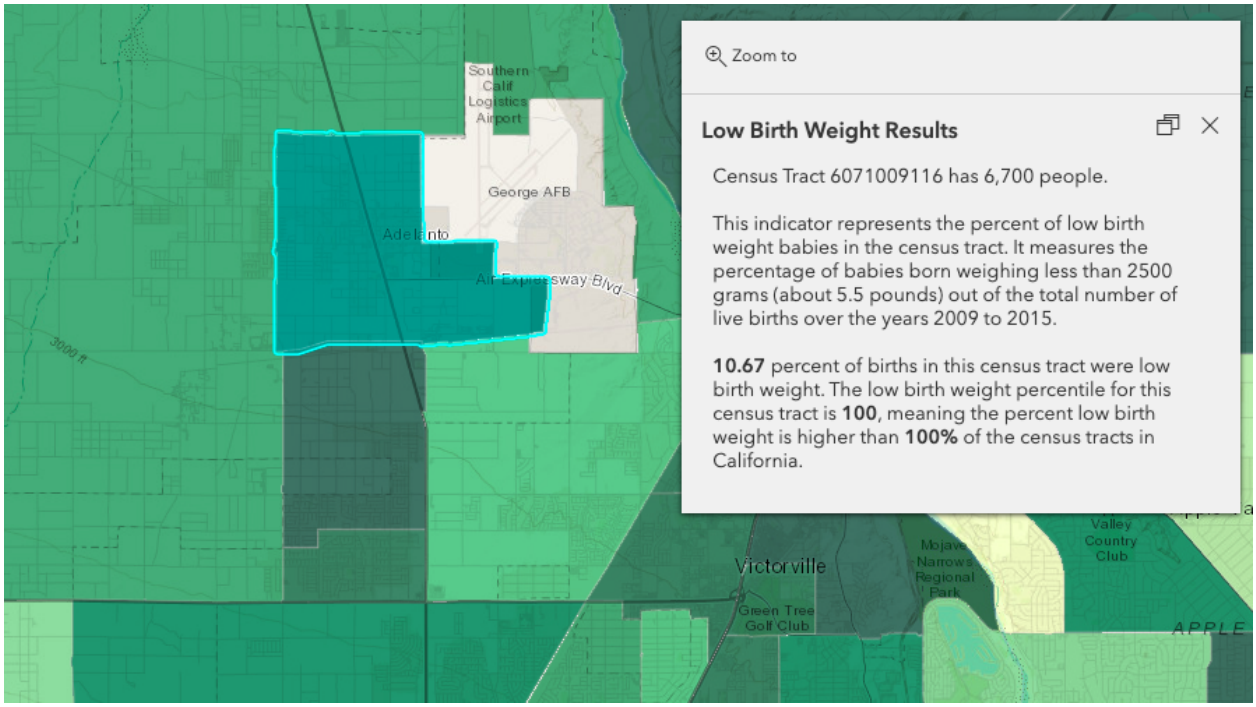

Figure 3: Image of CalEnviroScreen 4.0 Indicator Maps showing the Low Birth Weight percentile in Adelanto.

Presence of Disproportionately-Impacted Communities

Broadly speaking, it is well documented that communities of color and low-income people are disproportionately impacted by environmental hazards (Bryant & Mohai, 1993). Adelanto is a minority-majority town with a high proportion of immigrants and low-income community members (*U.S. Census Bureau QuickFacts*, n.d.). Immigrant communities face environmental injustice as an intersectional issue. As a result of anti-immigration politics, the Latinx population has been racialized as a suspect group, regardless of documentation-status. These perceptions have not only left the region void

of social services, but also deemed immigrants and US-born Latinxs as illegitimate bodies. Additionally, trends of environmental policy failures in predominantly Black and African American areas (Henderson & Wells, 2021) indicate that the devaluation of bodies on the basis of race is an issue that may affect multiple communities present in Adelanto. Thus, the racial makeup of Adelanto, in addition to low levels of income and education, are factors that have likely contributed to harmful perceptions of residents as more disposable than majority-White areas, which pave the way for environmental injustices to go unattended to.

It is important to note that a high proportion of Adelanto's people are incarcerated, spread across four prisons and detention facilities. Incarcerated populations are disproportionately impacted by environmental injustices. The FCI Victorville prison that is located on the George Air Force Base is a prime example of the intersections between environmental injustice and incarceration, wherein government negligence of environmental hazards can be clearly linked to serious health issues within the prison's walls. In 2021, the EPA issued a report revealing that the Adelanto Detention Center was misusing a pesticide for disinfecting the air, causing those incarcerated to experience nose bleeds and other health complications. While the US EPA was mandated by a 1994 executive order to take federal actions to address environmental justice in minority populations and low-income populations, prisons were excluded from this environmental justice mandate (Pellow, 2017). It is imperative that the incarcerated population in Adelanto's four prisons are included in the fight for achieving water justice. Not only are incarcerated people at a higher risk of exposure to environmental harms, but their voices and actions are an indispensable part of a just present and a sustainable future. Council Member Stevevonna Evans summarizes this point well. In response to whether the issue of prisons is separate from that of water injustice, she states, "I don't personally think that they're separate, right? Because, to me, the folks in that detention Center are still my residents…. So for me it doesn't matter if the water is [bad] on the South side, the North side, in a detention center, the correctional facility, or wherever," (53:33).

Qualitative Results: Adelanto Speaks on their Water

Interviews were conducted with the aim of gaining insight directly from the people of Adelanto into their place-specific relationships with water. These interviews served an important role in the report to value the non-scientific forms of knowledge to the same, if not higher, degree as data from water quality testing and City documents. As such, this section honors *the people's* truth about the water, regardless of what test results may come up with.

Odd appearance, taste, smell, and feel of water

One of the main concerns about the water from the residents was that it comes out brown, yellow, or a "milky" color. It was noted more than once that water tends to be more discolored from taps where the water has not been used in a while, or water usage is low, and that the water would become clearer if left running long enough. One interviewee who recently graduated from high school, Jorge, said he sometimes spends "seven minutes just waiting there for water and then it's still coming out

brown." He explains that this is how it is at the high school in particular, and that he would bring bottled water to school every day because the water was so bad there. Other residents said that they have only experienced brown water once or a few times while living in Adelanto. Mostly, people reported that they have heard of others with brown and yellow water, not that they themselves had consistently had this issue. It was more common for residents to say that they experienced water that looks like milk, which they associated with the chlorine/bleach smell.

Water typically becomes discolored when it contains minerals, rust, or other sediments. It tends to be a sign that pipes are corroding and that pipe materials are entering the water – iron and manganese produce a yellow to brown color, while lead makes the water darker and may include small particles. Water that has been stagnant can build up higher levels of iron and manganese, which is likely why water from unused taps starts out discolored and then becomes clearer over time.

The City has attributed brown and yellow water to their water flushing program. By increasing the speed at which water moves through the pipes to "flush" the sediment from the system, this program aims to improve water quality (*Water Flushing Program | Adelanto, CA*, n.d.). These changes in water pressure may cause brown and yellow water to come out of the tap for a period of time. Flushing is a quick-fix to corroded pipes, which will only worsen over time. Replacing the piping is more costly but prevents discolored water and other water quality issues more effectively in the long run.

Along with discoloration of the water, the majority of residents interviewed complained of the taste and smell of their water. In particular, people reported smells of chlorine or bleach in their tap water. Along these lines, Carmen says, "Before I got the filter it would come out milky. Milk, milk, milk. I wonder if there's a lot of chlorine or something. It really smells like Clorox. Like if I wash my mouth it tastes like Clorox."

In the US, the EPA requires the chlorination of all public water supplies. Chlorate (which is derived from chlorine) is used in the water supply to disinfect bacteria, parasites, viruses and other microorganisms from the water. Generally, you begin to smell chlorine when it is above one milligram per liter of water (the EPA limit is four milligrams per liter or less). When this chemical interacts with organic matter, the smell of chlorine becomes more prominent. Thus, it is possible that high levels of organic material in the water supply, or possibly that the City is adding a lot of chlorine in the water due to concerns about bacteria.

The hardness of the water in Adelanto was an issue for residents as well. Christine says, "You can feel when it's hard and sometimes when you get out of the shower you still feel dirty and I don't think that's right. And with my son being so sensitive skinned as well." Christine says that her skin breaks out more when she is living in this area, and multiple other residents report feeling like the water was contributing to the dryness and sensitivity of their skin. Groundwater, which Adelanto sources its water from, tends to be harder than surface water.

Much of the concern for the water was not directly related to residents' own experiences with poor quality water, but other people's in the area. Clearly, the residents in Adelanto are talking about the water. Especially, as it seems, among the Spanish-speaking community. Catalina for example has begun organizing with El Sol because of both her own experiences with the water and understanding that the issue extends beyond her house. She says that "We hear from everyone that the water here is dirty. I noticed that a lot in my house, the tap water in the bathroom comes out pretty much like sand. It comes out white so the water is clearly dirty. It's like milk." She explains the inconvenience of having to deal

with water like this: she has a filter, but has to change it every five months, and also spends at least 25 minutes traveling to pick up bottled water to drink. Catalina remarks, “Now everybody is noticing. We're talking to her, Leonor, and everyone that lives here is noticing that the water is yellow and has a lot of dust and they are starting to talk about it. The community's talking about it.” She goes on to say that El Sol has played an important role in connecting people who have had similar experiences with their water, which has helped people broaden their perspective to understand that it’s more of a systemic issue. Even those who have not had major issues with their own water are aware of the issue. For example, Malena says, “I've heard that the water comes out a really dirty color and smells bad. And that's what I've heard from neighbors I've talked to.” Malena buys bottled water for this reason. Almost none of the residents had heard anything about the quality of the water directly from City officials or other official sources.

Figure 4: Photograph taken of water from the Adelanto High School. Water became clearer after letting it run, demonstrated by the difference in samples moving left to right.

High price of water

When asked what her biggest issues with the City are, Christina says, "Water and probably rent because as much as this is not a very popular area -- it's not like LA or Ontario -- Why should we pay their cost of living? We don't make that much down here at all." Multiple residents commented on their discontent with what they pay for water and rent, conveying a sense of frustration with the price of living in Adelanto compared to the quality of life. Reporting from the OEHHA reflects this issue – North Adelanto is in the 98th percentile for census tracts that are “housing burdened,” meaning that those who live there are both low income and severely burdened by housing costs (*CalEnviroScreen 4.0 Indicator Maps*, n.d.). The high price of water in Adelanto is related to the City’s “Conservation Pricing” approach. In addition to a flat rate, meters determine what each user will pay. Multiple residents reported paying water bills of at least $100 per month.

Joe and Malena share this feeling of unfairness when it comes to water pricing. Joe mentioned that there was one point in time when Adelanto “actually tripled the water rates." He tells a story of letting his grass die because of the high rates, and replacing it with rocks. Shortly after making this change, he received an exorbitant fine from the city for the way his lawn looked. When asked about the one thing he would like the City to change, Joe exclaims, “don’t raise the rates!." For the price of water

residents are paying, their expectations for the quality of it are not being met. Malena comments "we have also had bad experiences [with the water] and conversations with neighbors of high [water bill] increases and a lot of errors, a lot of errors." Not only did Malena feel frustrated by the high price, but she shared a sense of injustice and her community being taken advantage of.

Purchasing bottled water and filters

Multiple interviewees mentioned that they have turned to purchasing bottled water and spending money on filters instead of using the tap water. Carmen says, “We drive to buy a lot of bottles because our kids bring bottles of water to school. And our son was the one who took the water sample from the school because he was saying that at school the water is really bad. He's like I don't like the water at school. We need to take bottled water.” Carmen has also installed filters for all the water at her house, even to water the grass in the lawn, saying that it cost around $7,000 in total to do. She expresses that her husband in particular was nervous about the water based on what they have heard about getting cancer from poor water quality.

When Miriam was asked whether she has experienced an odd taste and smell of her water, she responded, “Oh yes, and even my daughter bought a faucet from the Home Depot for bathing her kids that has a filter. My husband never uses water when brushing his teeth, he always uses bottled water. We want to buy those filters that we use to filter water but it is very expensive.” Filtering and buying bottled for all the water used seemed to be a common practice among those who could afford it.

The purchasing of bottled water highlights how socially-constructed meanings around water can highly influence actions. Bottled water is often assumed to have a good quality of water. However, this is often not the case. Microplastics and contaminants from where the water is sourced tend to be present in the water, even if it looks clear and tastes clean. Additionally, bottled water is an expensive and unsustainable way to acquire drinking water. When water is consumed in bottled form, it becomes an individualized commodity, as opposed to a public good. To understand water as a commodity, nevertheless a single-use commodity, does not empower communities and individuals to make claims on water as a public resource.

Water Pipes

Some residents related the water quality issues to the age of the pipes in the City. When Malena was asked about any reasons she had heard for the poor water quality, she responded “We've heard that it's because of the old pipes and that the piping is really old.” Carmen, along with others who were interviewed, shared this belief. “About 30 years of old pipage and they haven't changed the tubes and so I would assume that's why it's a lot dirtier than here” Carmen says about the piping in the North side of Adelanto.

Jorge, who works in construction, mentioned that he had seen the water pipes on multiple occasions at work. He stated that the pipes looked, "..worn out, like they haven’t replaced it… like they haven't been replaced for a while. Like probably the 90s, 80s, I don't know. But it just looks old.” He said that there is often conversation among the other construction workers about how poorly taken care of the pipes are in comparison to other cities they have done construction work in. He seemed pessimistic

that the City would ever complete as large an endeavor for its residents as replacing the piping would be. I often encountered the mindset that the City was likely never going to fix the issue with the pipes, which echoes frustrations that the City does not invest in its infrastructure and residents.

Perceptions of Adelanto and One's Self

The ways in which people understand water also shape the way they understand their identities, especially as it relates to place. This section reviews the perceptions residents have of themselves, their communities and the City and draws connections between these perceptions and the meanings attached to water.

The dryness and dustiness of Adelanto's landscape as a water-parched land was apparent in the way that interviewees identified themselves and their communities. One of the interviewees affectionately called himself and his friends "dust rats," and that his favorite thing about Adelanto is that people have your back. Joe also describes his love for his community on his block, saying he has "the greatest neighbors on the planet." Multiple respondents also mentioned the quietness of Adelanto being one of the reasons they live there. It is Adelanto's location in the arid desert, a place that allows a quiet way of life as it is somewhat barren and removed from the big cities, that draws people here. At the same time, Adelanto is perceived as a lower-income town that is not particularly safe or well kept. Jennifer's comments demonstrate the conflict this creates in her feelings about living there: "I really liked the area. And I like living here. But we also don't like it. Because they throw a lot of trash and there is not a lot of light in the streets – not a lot of public light." Multiple residents connected these perceptions to the issues of water in the City.

Anita, for example, moved to Adelanto with her young family three years ago for financial reasons, and hopes to move once they can afford it. She doesn't feel particularly connected to the community here, saying that her husband and her don't interact much with their neighbors and that she's been displeased with how the elementary school community has not done enough to address bullying. Anita also mentions a high level of crime in the area, reporting that someone once destroyed her gate while she was gone.

Anita says that she buys bottled water to drink, but will shower in the tap water. When asked why, she states, "the area that I live in, it's not like a higher class neighborhood. You know, it's kind of like poverty. So that's why I feel like the water is not as good." Anitas sentiments about her water reflect an association between the poverty of an area and poor water quality. Further on, she connects the potential for water issues in Adelanto to what she knows about Hinkley, CA, and other places nearby: "I used to live in Barstow for like a year or two. And I know they had water issues, and also heard like the Hinkley out there and really had really bad water. You know, I just pretty much figured that Adelanto's kind of similar to them most likely." These comments show a general perception of the water in the Inland region as untrustworthy. To add to this, Anita hasn't received much information about the quality of her water from anyone, saying she feels like it seems like "a big secret." Anita's frustration with the lack of information about the water coincides with her sense of the general lack of attention by the City that is given to the quality of life of residents.

Interviewees tended to show more concern over the water in the North side of Adelanto, which is seen more for its poverty and poor infrastructure than the South side. When Arianna was asked about

whether she suspects that the water has impacted her health, she responded, “Up until now no, thank God, but we have heard of people in North Adelanto that have had health problems. And so that's why we're nervous. Because we're very close to them.” Carmen echoed these concerns about the North side, attributing their water issues to the old infrastructure. This perception was consistent among some of the respondents in the North, who shared the frustration that the City did not care or pay much attention to the water, and similarly, to its residents. There may be truth to this narrative of the North side, however, it is a narrative that should be approached with caution. Water seen as “dirty” or “contaminated” can reinforce negative associations people have with themselves and their own communities, or serve as language for those on the South side to “other” those on the North side.

Summary

Across interviews, it is apparent that water was the primary issue they would like to see addressed by the City of Adelanto. Interview respondents generally said that they have not heard much from City officials about the water, or that they don’t trust what is being said. As a result, most residents did not know what contaminants may be in their drinking water. Residents who filter or buy bottled water either made that choice based on personal experience with odd taste/smell/appearance, norms in their community, or assumptions of poor water quality based on general perceptions of the region. A sense of frustration with not being satisfied with the water coming from the taps, paired with the high price of the water or inconvenience of filtering or buying bottled water, and lack of transparency about the water from City officials, was shared among many residents. Interview respondents, both from and not from lower-class neighborhoods, connected issues of water quality with the poverty in Adelanto and the poor infrastructure in areas with more poverty.

Ultimately, water in Adelanto has been constructed in the public eye as undrinkable. Tap water is undesired and not to be trusted. Water, which should be a resource that replenishes and revitalizes life, is instead harmful. Regardless of the results of water testing, there are inequalities produced in the distribution of drinkable water due to the costs of filtering and buying bottled water. Until the residents are able to confidently drink out of the tap when they’ve spent the day in the dry heat, or to shower off the layer of desert dust from their skin and feel truly clean, there is no water justice.

Having access to water they can trust is more than just a demand about water in Adelanto. Ariana sums up this vision for a future Adelanto:

> I would like Adelanto to be clean. I advocate for a clean Adelanto with healthy water. A good school for the kids so that they can get to university college. We want more parks. We want bicycles. So we can ride our bikes and walk around the city; make it walkable. We want care for our elders. Because right now we don't have anything for them.

Having good water quality is about a good quality of life and the City following through on their responsibilities for creating a healthy and safe place.

Quantitative Data: Comparison of Sources on Water Quality

There are multiple sources of information available on Adelanto's water quality. This section will compare the most relevant water quality information provided by the Adelanto Consumer Confidence Report, the Environmental Working Group, the California Office of Environmental Health Hazard Assessment, the George Air Force Base website, and the results from recent testing completed by the Claremont Colleges Keck Science Department. Each of these sources tests for a different set of contaminants and/or presents the data in varying ways that influence what contaminants are highlighted. Two points should be considered while viewing the following information:

1) **No level of a contaminant is "safe" to drink. There are only levels of contamination deemed acceptable.**
2) **You can only find what you test for.**

Consumer Confidence Report

A Consumer Confidence Report (CCR) is required by the EPA, under the Safe Drinking Water Act, to ensure that drinking water meets quality standards. The CCR is produced by the PERC Water CorporationThis report is useful for providing basic information on levels of contaminants regulated by the EPA and includes some educational components, such as definitions of terms and general information on Adelanto's water system. The report is not useful for understanding Adelanto's water quality relative to other cities.

The CCR for Adelanto highlights the presence of Arsenic in the water supply, mainly affecting the usability of the wells. While the contaminant is naturally occurring, it is still a serious contaminant that may cause cancer, skin damage and circulatory problems. The report also states that filtration treatment is to be used for at least four of the wells that contain high levels of Iron and Manganese (*City of Adelanto 2020 Consumer Confidence Report*, 2020).

Environmental Working Group (EWG)

The EWG has created their own health guidelines on what should be considered safe levels of contaminants in drinking water. The EWG points out that legal limits for contaminants have not been updated for 20 years, and that legal does *not* equal safe. The EWG uses data from the public water utility, provided by the California State Water Board. The health guidelines they set for each contaminant are determined in peer-reviewed studies by EWG and represent a one-in-one-million lifetime cancer risk level. A useful aspect of this source are the easy-to-understand descriptions of each contaminant that is present.

According to this database, Total trihalomethanes (TTHMs)† are present in Adelanto's water at 189x the EWG's health guidelines. Trihalomethanes are contaminants that result from water treatment with chlorine and other disinfectants, and are known to cause cancer. Arsenic is present at 130x and

Dibromoacetic acid is at 121x EWG's health guidelines (EWG, 2019). Dibromoacetic acid is another contaminant formed when chlorine or other disinfectants are used to treat drinking water, and increases the risk of cancer and pregnancy-related health issues. Additionally, the water was apparently tested for Perfluorohexane sulfonate (PFHXS) in 2019, scoring at 47 ppt (EWG, 2019). Per- and polyfluorinated chemicals will be expanded upon in the section on testing by the George Air Force Base.

California Office of Environmental Health Hazard Assessment (OEHHA) CalEnviroScreen 4.0

The OEHHA has created an online mapping tool for visitors to easily compare environmental health data between cities. This source is most useful for placing Adelanto's water issues in a broader context because the data is presented as a percentile. It is less useful for understanding what the specific contaminant levels are and the reasons why a contaminant is present.

According to the CalEnviroScreen 4.0 report, Adelanto's water scores above the 95th percentile for two contaminant categories: 1) Gross Alpha and 2) Maximum Contaminant Level (MCL) Violations & Lead and Copper Rule and Lead Action Level Exceedances. Additionally Adelanto is in the 66th percentile for Hexavalent Chromium (*CalEnviroScreen 4.0 Indicator Maps*, n.d.). While all three contaminant categories pose negative health impacts, lead contamination in particular is associated with cases of environmental racism, as it continues to affect low-income communities and communities of color at disproportionate levels as a result of state disinvestment (*EPA's Lead and Copper Rule*, 2021). Overall, the drinking water contaminant percentile for Adelanto is 49, meaning it contains more contaminants than 49% of census tracts in California. This number is not particularly striking, however, the census tract to the East of Adelanto (where the George Air Force Base is located) scores in the 95th percentile for the Groundwater Threats indicator (*CalEnviroScreen 4.0 Indicator Maps*, n.d.).

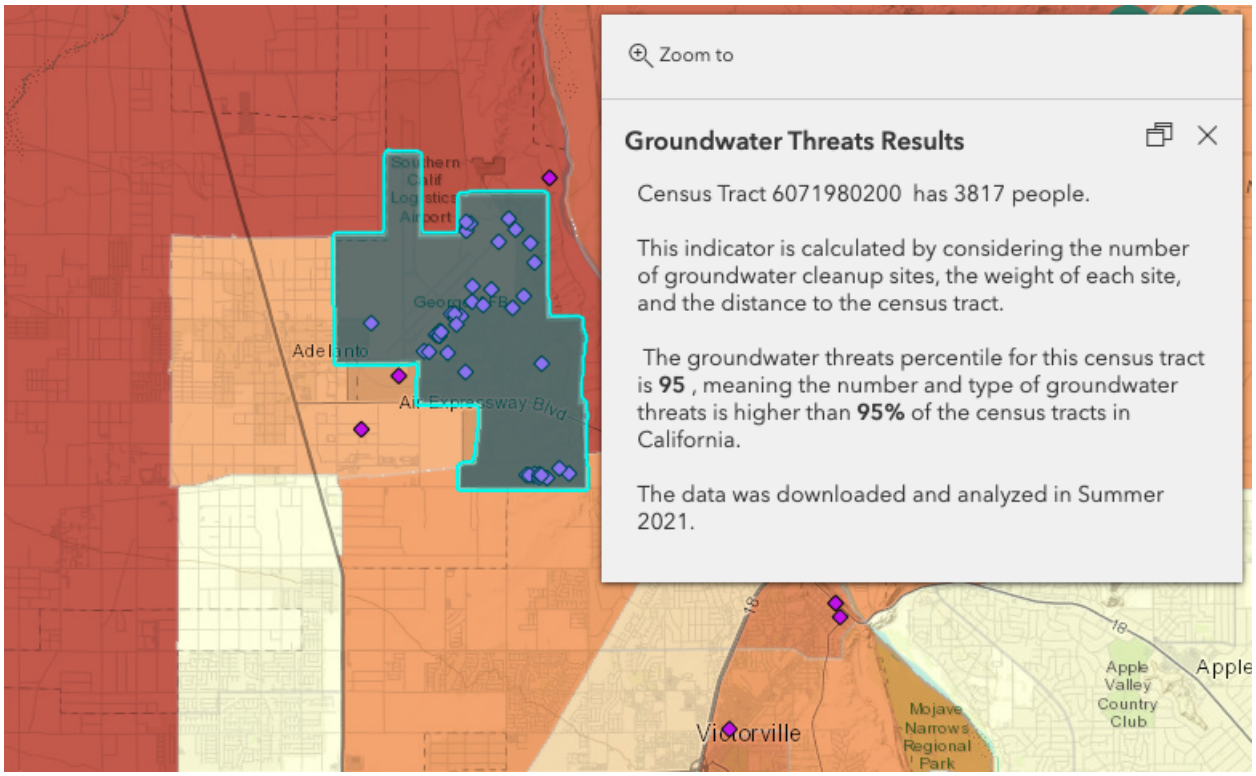

Figure 5: Image of CalEnviroScreen 4.0 Indicator Maps, showing the Groundwater Threats percentile for the census tract East of Adelanto.

Keck Science Department

The Keck Science Department at the Claremont Colleges completed independent water quality testing analysis in collaboration with this project during the Spring of 2022. In the Advanced Laboratory in Chemistry course, taught by Katie Purvis Roberts, students majoring in Chemistry and Biochemistry analyzed 20 water samples collected from homes in Adelanto. Additionally, 6 samples used as preliminary testing were tested by A & R Laboratories, and were included in the analysis. Testing was specifically done to find elements in the water, finding that calcium, magnesium, potassium, and sodium had the highest concentration. In particular, the presence of calcium and magnesium indicate that the water is hard. Importantly, the analysis compares these results to those detailed in the Adelanto CCR, and demonstrates that the CCR consistently reported lower concentrations of these elements than found by the Keck Science Department (Appendix 1).

The Integrated Biology and Chemistry class, taught by Jason Tor, tested 12 water samples. The students measured water hardness, alkalinity, chlorine, chromium (VI), and the occurrence of microorganisms. Total alkalinity and total hardness were both measured at levels higher than reported by the Adelanto CCR. The ranges reported by the CCR would classify Adelanto's water as *soft*, which seems to contradict the results from both Keck Science classes and the experiences of residents. Some people using hard water notice they have drier skin or eczema. The students found that 4 of the 12 samples had significant levels of heterotrophic bacteria, which Adelanto is not required to test for and report. While most microbes in this category are benign (safe), some of the species revealed by the

results may be pathogenic. UV light and chlorine were found to be effective in killing the bacteria in the samples (Appendix 2).

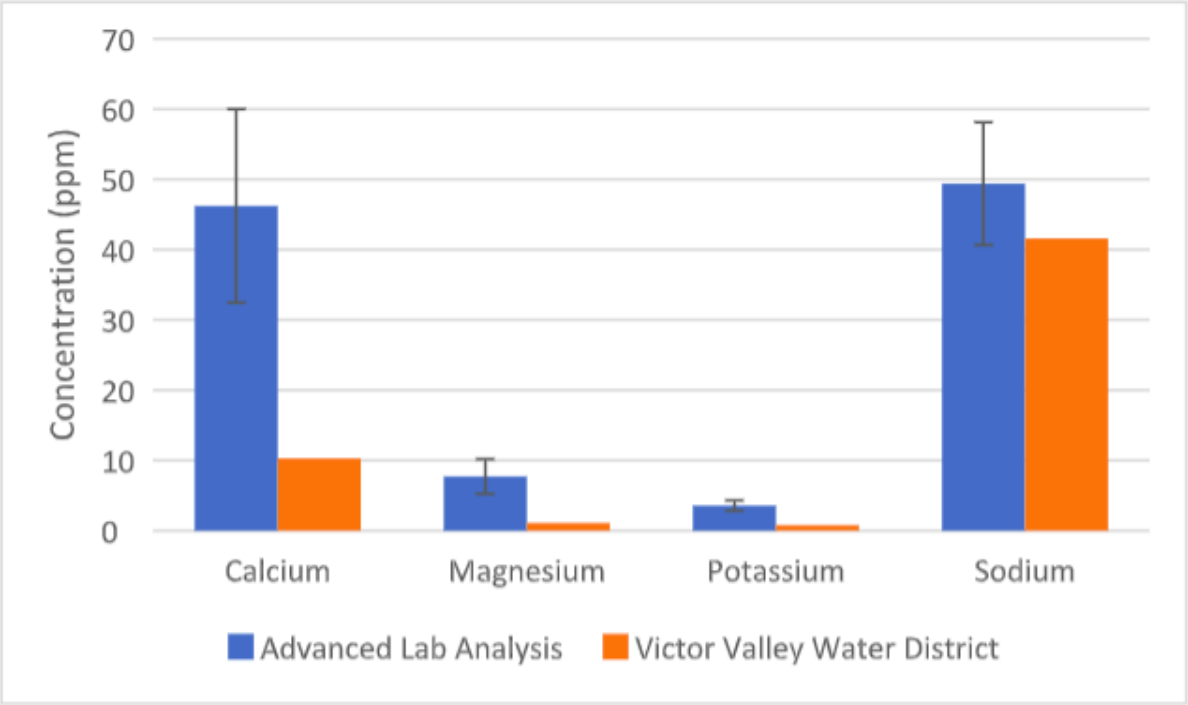

Figure 6: Concentrations of elements found in water samples (n=26) from the City of Adelanto with ICP-OES in comparison to concentrations reported in the City of Adelanto 2020 Consumer Confidence Report.

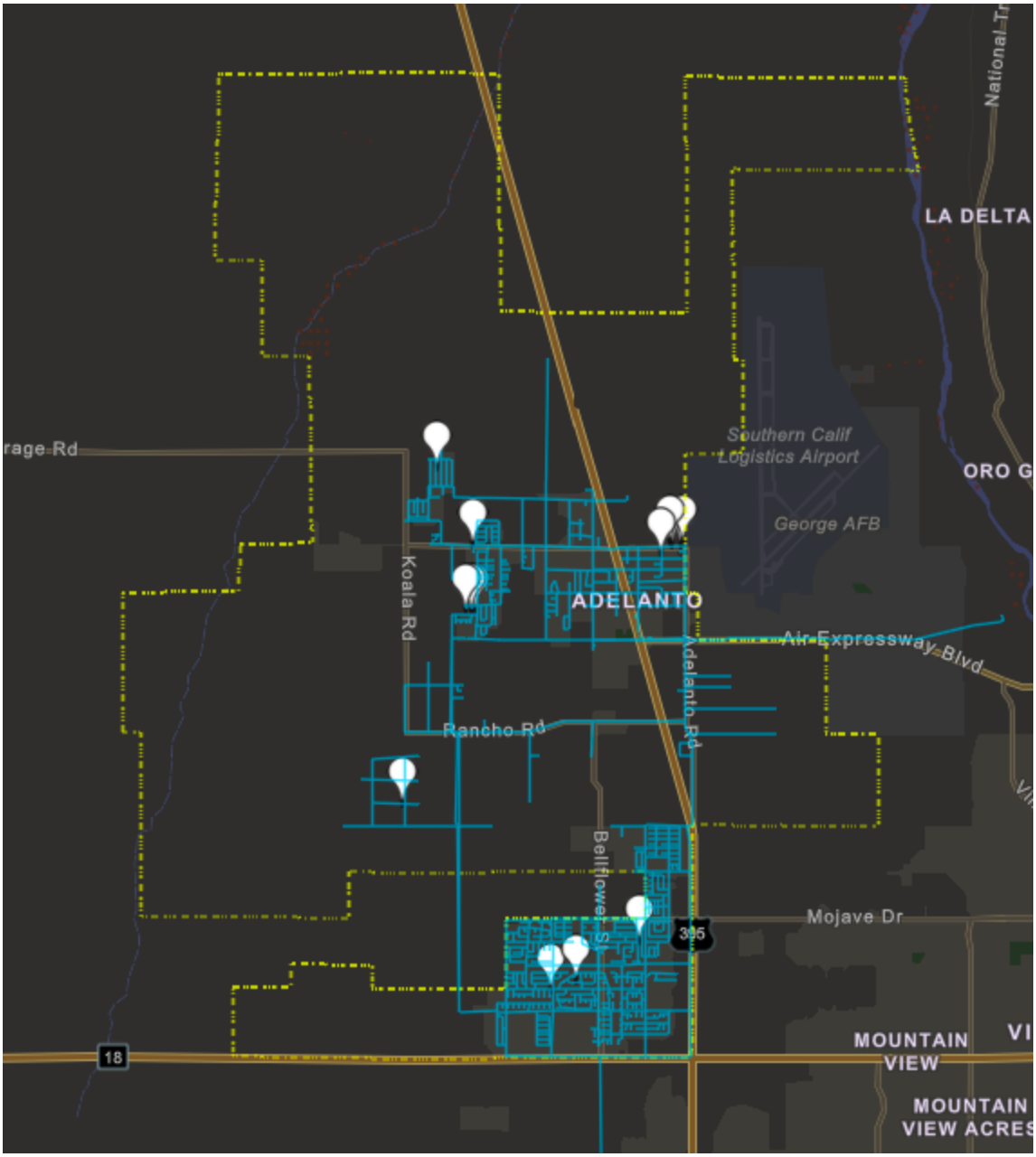

Figure 7: Locations of samples collected and provided to Keck Science Department for testing, layered with the water pipe system for the City of Adelanto.

Summary

Even after reviewing water quality data from the CCR, the OEHHA, the EWG, and recent testing from the Keck Science Department, it remains unclear what exactly is in Adelanto's water. There is misalignment between which issues are highlighted by each informational source – from the potential contamination of PFAS from the George Air Force Base, to the dangerous levels of Trihalomethanes pointed to by the EWG, to the relatively high lead and gross alpha concentrations from OEHHA

reporting, and the concerning levels of Arsenic from the City's own testing. Furthermore, findings from the Keck Science Department that highlights the discrepancy between the low levels of certain contaminants reported by the CCR and the high levels found by recent testing is especially concerning. Despite all of the available information, Adelanto's residents are still left without a clear picture of what contaminants are in their water and why it looks and tastes the way it does.

Considering Climate Change and Water Shortage

Global climate change will have local effects on Adelanto's water quality. Severe drought is likely to occur as rising temperatures mean that precipitation is reduced and water in soil evaporates at a faster rate. Drought leads to decreased water quality, in part due to the concentration of contaminants (Mosley, 2015). Students from the Global Climate Change course offered by the Keck Science Department have prepared a Climate Vulnerability Assessment, which details the current and future risks of climate change and provides recommendations for climate resiliency adaptations to reduce harm (*Climate Vulnerability Assessment City of Adelanto*, 2022). Since the 1950's, winter temperatures have already warmed over 2.5°F, and summer temperatures have warmed just over 0.9°F (Fan & van den Dool, 2008). By the end of the century, temperatures are projected to increase 5.4 °F and 9.0 °F under a medium emissions scenario and high emissions scenario, respectively (Thomas et al., 2018).

In 2021, the City released a Water Shortage Contingency Plan. By natural cycles, the Mojave River is an inconsistent source of water, filling up only when rainfall is abundant. The overbuilding of the watershed basin to create a sustained water supply conflicts with these natural cycles, resulting in its overdraft (depletion is faster than recharge) (Stamos et al., 2001). The fear of "running out" of water is not unfounded based on projections of climate change; however, the conversation of water scarcity appears to be leaving little room for the conversation of water quality among city officials.

At the same time, there seems to be inefficiencies in the actual conservation of water. System water loss is the amount of water that was not consumed out of what was produced (through the drawing of groundwater). In 2020, there was a loss of 987 acre feet of water, which is about a fifth of the total water production that year. Combined with the overdraft of groundwater and intensifying drought, water losses can not be afforded. According to the UWMP, the current reasons for water loss are unclear, but the City is working to identify and reduce losses.

Adelanto was required to reduce water use by 20% by 2020 as mandated by the California Water Conservation Act (SBX7-7). The city uses what they call "Conservation Pricing," which means that water billing rates are heightened to encourage water conservation. In addition to a flat rate, meters determine what users pay in addition to the flat rate. There is minimal public education and outreach about conserving water besides signs such as "Save Water: Live Like a Desert Native" and "Make Every Last Drop Count" that scatter Adelanto. Thus, it appears that increasing water bills is the main way that the City attempts to reduce water consumption. This approach places the burden of climate change and groundwater overdraft on individuals and households, and subsequently poor water quality, rather than taking accountability for the lack of foresight in the governance of water resources.

Figure 8: Sign in Adelanto by the City of Adelanto and PERC Water Corporation demonstrating the narrative of water scarcity.

Findings and Conclusions

Through the review and analysis of water quality information and testimonies from residents, this report finds that the water system in Adelanto produces injustices in the distribution of safe and drinkable water. The managerial approach to water supply and quality values technical knowledge over local experience-based knowledge. Across the board, residents are unhappy with the quality of their water, yet the City continues to insist that it is safe to drink. Residents deserve to know with certainty what contaminants (even if at low levels) are in their water, and why their water looks, smells and tastes the way it does (even if it is still considered safe by EPA regulations). Sentiments shared across interviewees about the lack of clarity and transparency regarding the quality of Adelanto's water is echoed by the variation apparent in the available information on what contaminants are present and are of most concern.

In addition, the water-related risks associated with climate change are projected to intensify drastically if widespread measures are not taken. It is important that focus on conserving the water

supply does not take away from ensuring the water is drinkable in the first place, nor should it shift the main responsibility of water shortage onto individuals. The EPA supports research findings that disproportionate harm from climate impacts falls on underserved communities – particularly, African American and Latinx communities (US EPA, 2021). Due to the interconnectedness of water quality and climate impacts on water supply, it is imperative to consider the equitability of approaches to conservation.

First-hand narratives from community members and leaders support that the people of Adelanto envision a water system that delivers reliably safe and drinkable water, and that is managed with values of transparency and accountability. This vision is an integral part of achieving a high quality of life for everyone in Adelanto, regardless of income, race or citizenship status. Knowledge shared between Adelanto's Water and Sewer service and the public must be a two-way street. On one hand, the inclusion of local knowledge in decision making provides important and relevant details on the actual lived experience of the water. On the other hand, residents would like to know (and trust) consistently garnered information from the City on the status of the water quality.

It is imperative that those who plan to be in Adelanto in the long-run are empowered and have the tools to continue this project. The following section provides a list of recommendations for both the City of Adelanto and the community organizations and leaders to take the next steps towards achieving water justice. These goals will be achieved when water becomes *drinkable* in Adelanto.

Recommendations

Recommendations for the City and/or PERC water company

1. Subsidize water filters
    a. Reverse Osmosis filter with integrated Granular Activated Carbon (GAC)
        i. Reverse osmosis will reduce contaminant levels of contaminants of highest concern in Adelanto (arsenic, hexavalent chromium, Bromodichloromethane, Total trihalomethanes, etc.)
        ii. A Reverse Osmosis system with a GAC will reduce levels of chlorine byproducts in drinking water, mitigating the intense "bleach-like" smell and taste
    b. Whole House or Showerhead filter
        i. Improves skin and hair related impacts of poor water quality (i.e. eczema, dermatitis, dryness, etc.)
2. Replace old water infrastructure
    a. Replacing older piping will ensure that water users are not exposed to material flaking into the water supply from corroding pipes, such as lead, copper, iron and manganese. New piping will decrease the need for flushing from hydrants, which is likely the cause of resident's complaints regarding water discoloration.
3. Increase the spread of bilingual information on water quality

   a. Residents deserve to not only be told, but to *understand* the reasons why their water is discolored or has an odd taste or smell, even if it is considered "safe" by the EPA's regulatory standards. Increasing the spread of information and educational materials will increase a sense of transparency and build resident's trust in the water system. Instructions on what to do if you think your water is contaminated should be included in these materials.
   b. The time when residents are most aware of their water is when they pay their water bills. Sending out water quality information with water bills could be an effective way to educate residents about the water.
4. Implement more just water conservation measures
   a. Focus conservation efforts on reducing water losses and monitoring large water users. While individuals and households share responsibility for conserving water at this time of extreme drought, this responsibility should be instilled by educational initiatives to reduce water use instead of increasing water bills. Responsibility and costs shared equitably should be of top priority when striving to meet reduction requirements by California's Water Conservation Act (SBX7-7).
5. Enforce stricter pollution standards to ensure future quality of water
   a. Ensuring that Adelanto has good water quality in the future means holding pollutants responsible for their impacts on water now. Enforcement of environmental regulations on Adelanto's industries should be paramount, especially as drought concentrates any pollutants in the water supply.

Recommendations for Community Organizations and Leaders

1. Develop a community-based water monitoring project
   a. Case studies on community-based research and water quality monitoring indicate that there are positive impacts of increased community participation in decision-making related to water (García & Brown, 2009; Wilson et al., 2018).
   b. Community-Based Monitoring (CBM) is a way to improve the accountability and quality of social services through public oversight. CBM is driven by local information needs and community values. Additionally, involving community members in testing procedures will likely increase trust in water quality test results.
   c. One method of CBM is through the development of a self-reporting system, in which community members would be able to post their water quality concerns directly to a central database. Compiling this information through GIS mapping may be a way to identify patterns of water quality issues locationally. As an example, Erin Brockovich has spearheaded a national self-reporting project using mapping that can be viewed at *https://www.communityhealthbook.com*.
   d. Another model of CBM can integrate educational goals by involving the local high school. High school labs may have the correct equipment to conduct water quality testing. A curriculum that integrates testing of local water would not only provide hard data for

monitoring purposes, but could also improve STEM training for high school students. The sampling procedure for water quality testing may even benefit from this type of project, as students may be able to cover a larger sample area by collecting samples from their homes. Additionally, testing at the high school would shorten the time frame between when the sample is taken and when it is tested, providing more accurate results.

2. Provide civic engagement trainings and workshops
    a. Continue mobilizing for the city council meeting public comment segment. It is the job of the council member to listen and act on their constituents' needs and demands. This is accomplished mainly through the public comment section of a city council meeting, which is a part of the regulatory process during which the community's voice on matters affecting them is sought. Greater participation in public comment improves the efficiency and transparency of projects, policies and laws put in place by the City, which includes those that deal with the water system. Holding frequent public comment training will help community members feel prepared and empowered to speak up for their concerns. Public comment can unfortunately be an intimidating experience, especially for undocumented and non-English-speaking folks. Holding context-specific training will help folks feel validated in their concerns and informed about how to present information to make demands. Receiving community support before and during public comment can increase participation.
    b. Holding workshops on letter writing and making phone calls to elected officials will also serve to uplift the voices of community members and empower them with group support.

Appendix 1: Resources

National database for self-reporting water concerns:

https://www.communityhealthbook.com

Resources on Water Quality

CalEnviroScreen 4.0 Indicator map

https://experience.arcgis.com/experience/ed5953d89038431dbf4f22ab9abfe40d/

Water quality information from the Environmental Working Group (EWG):

https://www.ewg.org/tapwater/system.php?pws=CA3610001

PFAS contamination map:

https://www.ewg.org/interactive-maps/pfas_contamination/map/

California maps on groundwater quality from the State Water Board GAMA Program and the U.S. Geological Survey:

https://www.waterboards.ca.gov/water_issues/programs/gama/online_tools.html

Climate change projection for Adelanto:

https://cal-adapt.org/tools/local-climate-change-snapshot

George Air Force Base Information:

https://www.georgeafb.info/

Military Bases with PFAS Contamination:

https://www.ewg.org/interactive-maps/2020-military-pfas-sites/map/

City of Adelanto Resources:

Water and Sewer service

https://www.ci.adelanto.ca.us/214/Water-Sewer

Urban Water Management Plan

https://www.ci.adelanto.ca.us/DocumentCenter/View/1781/Adelanto-2020-UWMP

Water Shortage Contingency Plan

https://www.ci.adelanto.ca.us/DocumentCenter/View/1782/City-of-Adelanto-2021-WSCP

Water Filter Guide:

https://www.ewg.org/tapwater/water-filter-guide.php#findfilter

Questions to ask elected officials about water:

https://www.ewg.org/tapwater/contact-local-government.php

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Appendix 1.A

Adelanto Water Samples Analyzed by Advanced Laboratory in Chemistry (CHEM127L) at the W.M. Keck Science Department of Claremont McKenna, Pitzer, and Scripps Colleges

The Chemistry and Biochemistry majors in the Advanced Laboratory in Chemistry course analyzed 20 water samples taken at various homes in the city of Adelanto, California. Students analyzed the concentration of different elements in the tap water with Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES). In order to calculate actual concentrations of the elements present in the water samples, students made standard solutions of 1, 50, and 100 parts per million (ppm) of the target elements, which is also equal to a milligram per L in water (mg/L). The standard solutions included the following elements: aluminum, barium, bismuth, boron, calcium, cadmium, chromium, cobalt, copper, gallium, indium, iron, lead, lithium, magnesium, manganese, nickel, potassium, silver, sodium, strontium, thallium, and zinc.

An additional 6 water samples were analyzed by ICP-OES in December 2021 by A&R Laboratories, Inc. The same target metals were included in the analysis, with the added analysis of mercury. No mercury was identified in these samples, so it was not included for analysis for the Advanced Laboratory students.

All 26 water samples were used for data analysis. The elements observed at the highest concentration included calcium, magnesium, potassium, and sodium (figure 1 & table 1). These metals are unregulated, meaning that human health exposure at these concentrations is not a concern. The Advanced Lab results are compared to the concentrations reported by the Victor Valley Water District in the City of Adelanto Consumer Confidence Report for 2020 and the values are in a similar range.[1] During certain months of the year, water is imported from the Victor Valley Water District to the City of Adelanto.

No bismuth, cadmium, cobalt, indium, iron, lead, lithium, manganese, nickel, silver, strontium, and thallium were detected in the samples. Barium (0.04 +/- 0.03 ppm) and vanadium (0.021 +/- 0.001 ppm) were detected in the A&R Laboratory analyzed samples at very small concentrations. Other elements were observed in the Advanced Laboratory analysis at very low concentrations that were below the concentrations of the standards for our methods, including aluminum, boron, chromium, copper, gallium, and zinc. These results are not reliable with the method used for analysis. Chromium and copper are regulated elements in drinking water so additional analyses could be done to confirm the results of the City of Adelanto 2020 Consumer Confidence Report, but chromium and copper were not detected in the samples analyzed by A&R Laboratories.

According to the Advanced Laboratory Analysis, the water samples are safe for consumption with regards to elemental analysis. The high concentrations of magnesium and calcium mean that the water is hard, so calcium carbonate solid could deposit on faucets, sinks, bathtubs and shows. The high concentrations of calcium and magnesium could also impact the performance of personal care products like soap and shampoo.

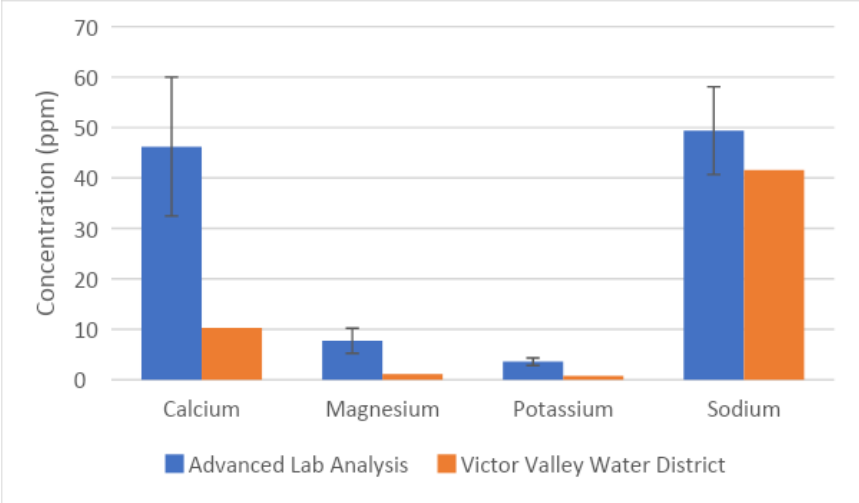

Figure 1 Concentrations of elements identified in water samples (n=26) from the City of Adelanto with ICP-OES in comparison to concentrations reported in the City of Adelanto 2020 Consumer Confidence Report.

Table 1 Elements Observed in City of Adelanto Water Samples

Element	Advanced Lab Analysis Average concentration (ppm)	Standard Deviation (ppm)	City of Adelanto Concentration (ppm)
Calcium	46.22	13.77	10.3
Magnesium	7.72	0.47	1.11
Sodium	49.39	8.70	41.6
Potassium	3.57	0.73	0.8

1. City of Adelanto 2020 Consumer Confidence Report. https://www.ci.adelanto.ca.us/ArchiveCenter/ViewFile/Item/85. Accessed 3 May 2022.

Appendix 1.B

Adelanto Water Samples Analyzed by Integrated Biology & Chemistry (BIOL/CHEM 042L) at the W.M. Keck Science Department of Claremont McKenna, Pitzer, and Scripps Colleges

The students in the Integrated Biology & Chemistry course analyzed 12 water samples collected in January 2022 from various homes in the city of Adelanto, California. This report is a summary of those findings and when appropriate an indication of their significance is provided.

Following the protocols for water analysis outlined in Standard Methods for the Examination of Water and Wastewater (1999), students measured water hardness, alkalinity, chlorine, and chromium (VI). In addition, the occurrence of microorganisms was assessed using the standard heterotrophic plate count with R2A agar and MacConkey growth media for the detection of enteric microorganisms. The effectiveness of chlorine and UV treatment was assessed against the microorganism in the water. Finally, a characterization of the microbial community was conducted from enriched samples grown on R2A media.

Total Alkalinty

Alkalinity relates to the pH buffering capacity of the water or more generally the capacity of the water to resist a change in pH. Typical drinking water has a range of 20 – 200 mg $CaCO_3$/L. In the City of Adelanto 2020 Consumer Confidence Report an average alkalinity value of 70 mg $CaCO_3$/L is reported with a measured range of 67 – 73 mg/L. Whereas the average value students measured was 171 mg/L with a range of 142 – 190 mg/L. In the case of Adelanto's water, the alkalinity appears to arise from bicarbonate (HCO_3^-), which likely originates from carbonates that have dissolved from the underlying rocks the groundwater comes in contact with before treatment and distribution. From a safety perspective the higher values are desirable because it decreases the risk of corrosion in the water distribution system. However, increased scaling in faucets and sinks is also common.

Total Hardness

Water hardness is the sum of the concentrations of calcium and magnesium ions dissolved in water. These two ions are the major hardness constituents, and although some other salts may contribute to hardness, their concentrations in natural waters are typically so much smaller that their significance as hardness is considered negligible. From an aesthetic perspective, values around 150 mg $CaCO_3$/L are generally ideal. In the City of Adelanto 2020 Consumer Confidence Report an average hardness value of 86 mg $CaCO_3$/L is reported with a measured range of 73 – 96 mg/L. Whereas the average value students measured was 202 mg/L with a range of 168 – 232 mg/L, indicating *hard* to *very hard water*. The ranges reported by the City of Adelanto would classify it as *soft water*, which seems to contradict the experiences of residents reporting scaling and the buildup of soap scum, a common occurrence with *hard water*. While most complaints about hardwater are considered aesthetic (e.g. scaling, soap scum), some people using hard water notice problems with dry skin and potentially eczema. There are no known health concerns associated with drinking hard water. While calcium and magnesium are essential nutrients, hard water is not a significant source to meet dietary needs.

Residual Chlorine

The presence of free chlorine (also known as residual chlorine) in drinking water indicates that: 1) a sufficient amount of chlorine was added initially to the water to inactivate the bacteria and some viruses that cause diarrheal disease; and 2) the water is protected from recontamination during storage. The presence of free chlorine in drinking water is correlated with the absence of most disease-causing organisms, and thus is a measure of the potability of water (CDC). While free chlorine levels at the tap can vary widely, the WHO recommends free chlorine levels of approximately 0.2-0.5 mg/L. In the City of Adelanto 2020 Consumer Confidence Report chlorine levels were reported with an average of 0.53 mg/L and a range of 0.2 – 1.11 mg/L. The average value recorded by IBC students was 0.09 mg/L and a range of 0 – 0.84 mg/L. Although our measured values are below recommended levels, it is difficult to draw conclusions because of the time that passed between sampling and analysis. Measurement of free chlorine is best conducted within hours of water collection, which was not possible in this case. The occurrence of some residual chlorine is reassuring but further analysis is warranted get more accurate results.

While the importance of chlorine in controlling for the growth of potentially pathogenic bacteria can not be emphasized enough, it does sometimes come with undesirable aesthetic side effects, such as taste and odor biproducts. Some residents have raised concerns about taste and odor in their water and while the City of Adelanto 2020 Consumer Confidence Report indicates that the measured concentration of disinfection by products and odor are within legal allowable limits. IBC students did not conduct these analyses, but they could potentially be included in future studies.

Chromium (VI)

Chromium is an odorless and tasteless metallic element primarily found in chrome-iron ore ($FeO{\cdot}Cr_2O_3$). Through rock weathering it can be found naturally in sediments, plants, animals, soil, and volcanic dust. Chromium also becomes available in the environment through mining operations and industrial processes, where it is used in alloys, electroplating, and pigments. Chromate compounds frequently are added to cooling water for corrosion control. There are demonstrated instances of chromium being released to the environment by leakage, poor storage, or inadequate industrial waste disposal practices. In the environment, chromium primarily exists in two valence states, trivalent chromium (Cr^{3+}) and hexavalent chromium (Cr^{6+}); these two forms of chromium can convert back and forth in water (and in the human body), depending on environmental conditions. Whereas Cr^{3+} is an essential human dietary element and can be found in many vegetables, fruits, meats, grains, and yeast; Cr^{6+} been shown to be carcinogenic by inhalation and are corrosive to tissue.

EPA has a drinking water standard of 0.1 mg/L (or 100 parts per billion) for total chromium (Cr^{3+} & Cr^{6+}). In the City of Adelanto 2020 Consumer Confidence Report chromium was not detected in the Adelanto water. However, the Victor Valley Water District supplemented the town of Adelanto's water supply for a period of time and their water report indicated an average total chromium value of 0.1 ppb (range: 0 – 11 ppb) and chromium (VI) at 5.6 ppb (range: 0 – 19 ppb). These values are well within legal limits. The students did not detect any chromium (VI) in the water samples.

Microbial Contaminants

The heterotrophic plate count (HPC) is a procedure for estimating the number of live, culturable heterotrophic bacteria in water. Heterotrophic bacteria are those that use organic nutrients for growth. They are ubiquitous in the environment, being present in all types of water, food, soil, vegetation, and air. This is a very broad definition, capturing all manner of microbes, most of which are benign, but some are bacterial pathogens, including coliforms (e.g. Escherichia, Klebsiella, Enterobacter, Citrobacter, Serratia). Although it is a useful tool for assessing drinking water quality or measuring changes during water treatment and distribution, most municipalities, including the City of Adelanto, are not required to test and report HPC values. The students in IBC found that 4 of the 12 samples had significant numbers of heterotrophic bacteria with an average of 8.9×10^4 bacteria/ml and a range of $1.5 \times 10^3 – 3.0 \times 10^5$ bacteria/ml. A follow up analysis using growth media specifically designed to detect coliforms indicated their absence across all samples.

An additional analysis of the microbial community in the drinking water was conducted by cultivating bacteria that may exist in nominal quantities followed by extraction of their DNA and genetic analysis to determine their species. This advanced analysis is not conducted by municipal water supplies, so to the best of our knowledge this was the first occurrence of such tests on Adelanto drinking water. The results revealed bacteria from X major families, including the Sphingomonadaceae, Comamonadaceae, Enterobacteriaceae, Moraxellaceae, Pseudomonadaceae, Erythrobacteraceae, and Microbacteriaceae. While the vast majority of the bacteria in these families are considered benign and common in soil, sediment, and water; a few species of the Enterobacteriaceae, Moracellaceae, and Pseudomonadaceae are known to be pathogenic, thus warranting continued monitoring of residual chlorine concentrations in drinking water to control for their occurrence.

Because the quantity of heterotrophic bacteria in some samples was concerning, as well as the presence of potentially pathogenic microorganisms, the students did a follow-up study to assess the effectiveness of disinfectants on killing the bacteria in these samples. Both UV light and chlorine were effective at killing 99% of the bacteria present. Chlorination at the water treatment facility is important for controlling the occurrence of bacteria. However, if it is not present at high enough concentrations, the growth of bacteria in the home plumbing system is possible.

City of Adelanto 2020 Consumer Confidence Report. https://www.ci.adelanto.ca.us/ArchiveCenter/ViewFile/Item/85. Accessed 3 May 2022.

Clesceri, L.S., A.E. Greenberg, and A.D. Eaton (eds). 1999. Standard Methods for the Examination of Water and Wastewater. 20th Edition. American Public Health Association, American Water Works Association & Water Environment Federation.