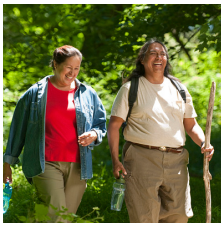
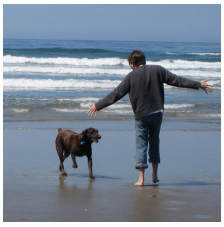
DISCOVERY DOCUMENT

A descriptive exploration of issues and challenges for greater use of non-potable water in the San Diego Region







public health alliance™
of southern california
A Partnership for Healthy Places

May 2019

EXECUTIVE SUMMARY

Advancing Safe, Healthy Non-potable Water Use (Project) for the San Diego Region is a project led by the Public Health Alliance of Southern California, and contracted by the University of California San Diego as part of a larger planning grant under California's Proposition 1. The purpose of the Project is to identify regulatory and other barriers to greater use of non-potable water utilizing a health and equity lens, and propose recommendations, with a focus on issues in under-resourced communities and food production. The jurisdictions participating in this Project include the cities of Chula Vista, Imperial Beach, and San Diego, and the County of San Diego.

The Project consists of three (3) main components:

* Discovery Document (key barriers)
* Recommendations Report (highlighting best practices and providing suggestions)
* Communication and Outreach Strategy

The Discovery Document is the first report of these three work products.

A Public Health Advisory Committee comprised of a diverse range of multi-sector experts provides guidance, feedback, and approval of all products.

The Advisory Committee has unanimously identified seven (7) core values to inform the Project:

◊ Enhance Health and Equity;

◊ Encourage a One Water Philosophy;

◊ Promote the Right Water for the Right Use;

◊ Create an Ethic of Place;

◊ Maximize Water and Regulatory Literacy;

◊ Utilize an Holistic, Ecosystem Approach; and

◊ Prioritize a Positive Community Experience.

After an assessment of the current regulatory landscape, consultation with the Advisory Committee, and key informant interviews, five (5) categories of barriers have been identified. They include:

⌘ Regulatory Barriers,

⌘ Lack of Knowledge and Education,

⌘ Inadequate Access to Accurate Information,

⌘ Inadequate Systems Integration, and

⌘ Competing Economics.

This Discovery Document includes details on these key findings and provides real-world examples to highlight the barriers identified. The next phase of the Project will identify best practices and recommendations to address these barriers in a forthcoming Recommendations Report.

ACKNOWLEDGEMENTS

The Public Health Alliance of Southern California would like to thank all the members of the Public Health Advisory Committee who provided their insights, guidance, and expertise to the development of this document.

We are grateful for City and County officials' reviews of the research on the regulatory landscape and for the practical insights provided by field experts. We gratefully acknowledge the University of California San Diego's Bioregional Center for Sustainability Science, Planning and Design, the City and County of San Diego and the San Diego County Water Authority for administering and supporting these activities

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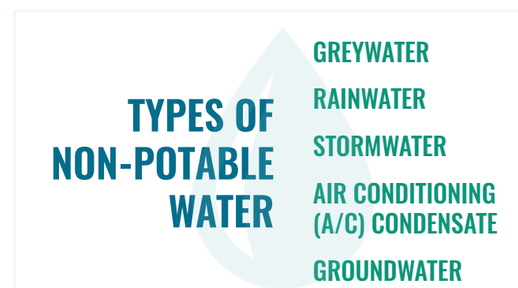
PROJECT DESCRIPTION

Advancing Safe, Healthy Non-Potable Water Use is a project led by Public Health Alliance of Southern California (Public Health Alliance). The Public Health Alliance is a coalition of local health departments, representing 50% of the state's population, advancing healthy communities and equity. The purpose of Advancing Safe, Healthy Non-Potable Water Use is to identify regulatory and other barriers, and propose recommendations to encourage greater non-potable water use, with a focus on under-resourced communities and food production. This Project is part of a larger planning grant led by the University of California San Diego (UCSD) and the San Diego Housing Commission (SDHC). It is funded by the California Department of Water Resources via the Integrated Regional Water Management Program and California Proposition 1 funding. The goal of the larger planning grant is to design safe alternative non-potable water systems and xeriscape/low water landscape designs for sites in disadvantaged communities, as defined and identified by CalEnviroScreen, in the cities of Imperial Beach, Chula Vista, and San Diego.

Advancing Safe, Healthy Non-Potable Water Use (Project) will analyze barriers and recommendations



for the cities of Imperial Beach, Chula Vista, and San Diego, and the County of San Diego.

The Project specifically addresses on-site non-potable water use including the use of greywater, rainwater capture, stormwater, air conditioning (A/C) condensate, and groundwater.

A health and equity lens will be utilized throughout with a special focus on strategies and supports for enhanced and expanded use in under-resourced communities, and use of these water sources in food production.

The Project consists of three main components:

1. The development of a Discovery Document to include: Project Core Values, the State of the Water in San Diego, the Regulatory Framework, and Identified Barriers (this document).
2. A Recommendations Report highlighting best practices and providing suggestions to address the barriers identified in the Discovery Document.
3. A Communication and Outreach Strategy to disseminate key findings.

All of the work of the Project is guided, vetted, and approved by the Public Health Advisory Committee. The Advisory Committee is comprised of a diverse range of experts representing multiple sectors. Expertise within the water field includes local regulators and water-sector leadership, academics, and trade professionals. Additional sectors represented on the Public Health Advisory Committee include professionals in the fields of social justice, housing, public health, food systems, and community outreach. This diverse set of partners provides for the lively inclusion of different perspectives and creative thinking to address the barriers and recommendations for the Project. The full membership list is provided in Appendix A.

CORE VALUES

The Public Health Advisory Committee is comprised of a diverse set of professionals with a wide range of expertise on water and engagement issues. We tapped into this rich repository of knowledge and experience to develop a unanimous set of seven core values to guide the vision and implementation of the Project (Figure 1). These core values will serve as guiding principles throughout the Project to advance safe, healthy, and efficient use of on-site non-potable water with a focus on disadvantaged communities, to ensure health and equity, and community and climate resilience and recovery. These core values will be used to analyze the barriers that are identified, and help guide the selection of best practices and recommendations to address these barriers in the form of a Recommendations Report.

SEVEN CORE VALUES

1. Enhance Health and Equity
2. Encourage a One Water Philosophy
3. Create an Ethic of Place
4. Promote the Right Water for the Right Use
5. Maximize Water and Regulatory Literacy
6. Utilize an Holistic, Ecosystem Approach
7. Prioritize a Positive Community Experience

FIGURE 1: Seven Core Values To Guide The Project

Enhance Health and Equity

Everyone should have the opportunity to live a healthy life. Yet our health is dramatically shaped by community conditions in which we live. In fact, zip-codes are better predictors of life expectancy than genetic codes. Given the impact of social and economic conditions, the Public Health Advisory Committee has identified enhancing health and equity as a core value. This has great importance for water-related issues in under-resourced communities. First, residents in low income communities spend a greater percent of their total annual income on water and are greatly impacted by changes in water costs and concerns of water quality. In addition, during previous drought conditions water restrictions have been implemented across the board, without distinguishing between the use of water for food production versus ornamental turf irrigation. These restrictions lead to stronger financial and health impacts in under-resourced communities, which may be relying on community and residential gardens for food production of healthy produce. Incorporating a core value of health and equity will ensure the benefits of on-site non-potable water systems are intentionally optimized to support the most under-resourced communities throughout the implementation of the Project.

Encourage a One Water Philosophy

The "One Water" philosophy is a transformative approach through which we view, value, and manage water resources in an integrated, inclusive, and sustainable manner.[1] Through the One Water lens, the narrative is framed around water use by contextualizing the natural cycle of water and its integration within the natural ecosystem. This approach positively values water to its full extent and helps connect people with their water supply and use. The Public Health Advisory Committee values the One Water philosophy as it encompasses all sources of water as a resource – potable, non-potable, treated and untreated water, and water in the ecosystem – and helps frame the overall vision of the Project.

Create an Ethic of Place

An ethic of place is a set of principles that respects and values the uniqueness of our region, in terms of the climate, local geology, hydrology, and biodiversity, as well as the cultural diversity of the human residents. Developing a common consciousness around water awareness is a way for neighbors and neighborhoods to enjoy and celebrate their successes in creating thriving landscapes, a beautiful urban environment, and a pride of place. Non-potable water systems earn their rightful place in our home and business environments by providing repurposed water to grow food and habitat for local ecology. By normalizing and celebrating native plant landscapes that support local ecology, our multicultural and socioeconomically diverse community can connect through our shared outdoor experience of San Diego. By promoting an ethic of place, the Public Health Advisory Committee encourages the San Diego Region to respect and value water, support local food production, healthy ecosystem services, the local environment, and the local culture.

Promote the Right Water for the Right Use

Establishing an agreed-upon hierarchy of water use can provide guidance for program prioritization and decision-making. This is particularly helpful during periods of drought and mandatory water restrictions. Promoting the right water for the right use, such as food production over ornamental lawn maintenance, can clarify our regional water strategy and provide multiple community benefits supporting health and equity.

Maximize Water and Regulatory Literacy

Because our water infrastructure is largely hidden from view, whether water is coming into homes from underground pipes, or being carried out to the sea in concrete washes isolated from public spaces, there is a general disconnect among the public about many, if not most, aspects of water literacy. There is a similar concern when it comes to regulatory literacy for the public, as well as water professionals. The Public Health Advisory Committee has identified a core value of maximizing water and regulatory literacy. This core value should help engage, educate, and empower communities on an array of water issues, while ensuring streamlined best practices for regulatory literacy across multiple sectors.

1 US Water Alliance, Advancing One Water Through Arts and Culture: A Blueprint for Action, 2018

Utilize an Holistic, Ecosystem Approach

The Public Health Advisory Committee strongly supports an holistic approach using an ecosystem concept as a core value to achieve the vision of this Project. The integration of systems and the optimization of non-potable water use will provide benefits beyond the conservation and efficient use of water to include multiple benefits. The Advisory Committee noted the importance of utilizing data collection to inform stakeholders on water use and conservation, as well as serving to support informed decision-making to optimize the best outcomes for water harvesting and use in the community and environment. An holistic ecosystem approach has an additional benefit of considering how to integrate other systems to maximize benefits such as food and energy production, health, and equity outcomes to better serve the overarching goals to support healthy, resilient communities.

Prioritize a Positive Community Experience

A positive experience among the community and users of on-site non-potable water systems helps ensure that these systems are used safely and efficiently, and are ultimately promoted by the users themselves. A positive community and user experience is made possible by successfully engaging with community members to co-participate and co-create projects related to these water systems. It will intentionally include strategies for outreach to low income communities and will accommodate a variety of learning styles. The goal of the community engagement is to establish a healthy, respectful, and trustworthy relationship between stakeholders; elevate the experience of the users; and learn from residents, especially with special consideration to engage communities that have been historically disenfranchised.

SUMMARY

The seven core values – enhancing health and equity; encouraging One Water philosophy; creating an ethic of place; promoting the right water for the right use; maximizing water and regulatory literacy; utilizing an holistic, ecosystem approach; and prioritizing a positive community experience – will guide each step of the Project process. The forthcoming Recommendations Report and the Communication and Outreach Strategy will be designed to maximize the core values to unify the vision for the Project.

STATE OF THE WATER IN SAN DIEGO: CHALLENGES AND OPPORTUNITIES

Water Supply in San Diego

The San Diego Region has a range of climates, varying from cold semi-arid for the cities of San Diego, Imperial Beach, and Chula Vista to warm and hot-summer Mediterranean climates in inland areas and in North County San Diego.[2,3] The region is located at the most downstream point of the water sources feeding the Southwestern United States, which makes it highly dependent on imported water. In 2017, the San Diego County Water Authority (SDCWA) reported that imported water accounted for about 78% of the total water supply, with approximately one-fifth[4] of that amount coming from the Bay-Delta State Water Project,[5,6] and the rest coming from the Colorado River – each hundreds of miles away. Local sources currently make up 22% of the total water supply, including 5% from municipal recycled water, 9% from the seawater desalination, 3% from groundwater, and 5% from local surface water sources.[7] Studies have shown that the municipal and industrial sectors consume about 25% of the water supply, and the agriculture sector another 15%. The remaining 60% of the water supply is used for residential applications, with more than half of that directed to irrigate outdoor landscaped areas, according to the San Diego Foundation.[8] In this context, it is easy to understand why efforts are directed towards greater conservation and reuse, especially in residential buildings and outdoor applications. Thus, in the past 10 years, SDCWA witnessed a decrease in total potable water consumption with average consumption dropping from 200 gallons per capita per day (gpcd) to under 120 gpcd, as well as a decrease in the overall water volume consumed from more than 700,000 acre-feet to about 450,000 acre-feet, despite a growing population, as shown in the figure below.[9] In addition, in 2017, according to the Equinox Project, the San Diego Region's average residential water use was estimated at 84 residential gallons per capita per day (RGPCD), with numbers ranging from 54 to 350 RGPCD depending on the water district.[10]

Water use trends at the city-level are similar to those at the county-level. Variability in water use by sector exists on a city-to-city basis; however, among all cities in the San Diego Region, the residential sector remains the largest consumer of water, as compared to other sectors. Figure 3 shows water usage in the cities of San Diego and Chula Vista, broken down by three main sectors: 1) residential sector; 2) commercial, institutional and industrial sector (CII); and 3) commercial landscape irrigation sector.[11]

The water usage for the City of Chula Vista is a combination of data provided by Otay Water District and Sweetwater Authority. Commercial landscape

2 World map of Köppen-Geiger climate classification, http://koeppen-geiger.vu-wien.ac.at/present.htm#GoogleEarth

3 https://www.climate.gov/maps-data/primer/how-do-scientists-classify-different-types-climate

4 The percentages of water sources into San Diego have been estimated based on information and data found on SDCWA and MWD websites, accessible at: http://mwdh2o.com/AboutYourWater/Sources%20Of%20Supply/Pages/Imported.aspx, https://www.sdcwa.org/imported-supplies

5 http://mwdh2o.com/AboutYourWater/Sources%20Of%20Supply/Pages/Imported.aspx

6 https://www.sdcwa.org/imported-supplies

7 https://potablereuse.sdcwa.org/supply-reliability/

8 Report by San Diego Foundation published in 2014, San Diego, 2050 is Calling. How Will We Answer? - https://www.sdfoundation.org/programs/programs-and-funds/climate/

9 Data exclude the use of centralized recycled water - https://www.sdcwa.org/water-use

10 https://energycenter.org/equinox/dashboard/residential-water-consumption

11 Data provided by the City of San Diego and the water retailers (Otay Water District and Sweetwater Authority) for the City of Chula Vista

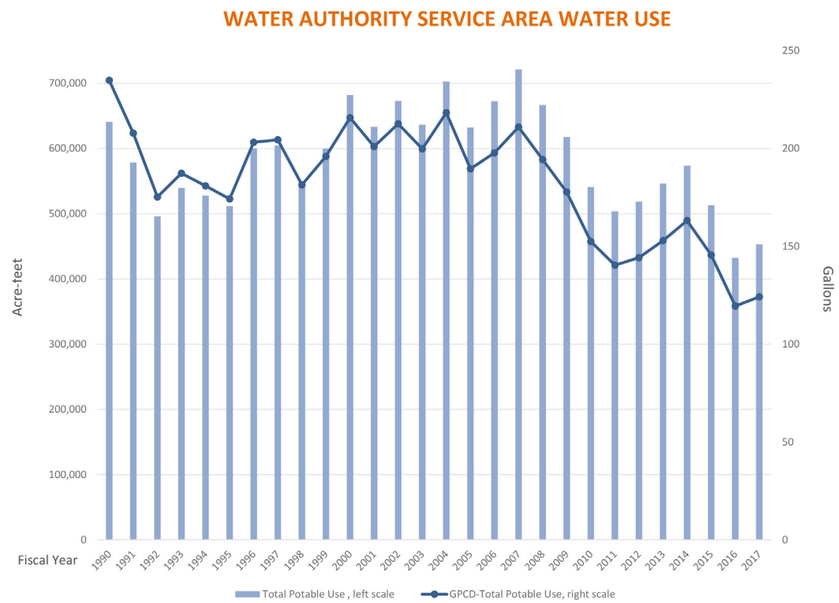
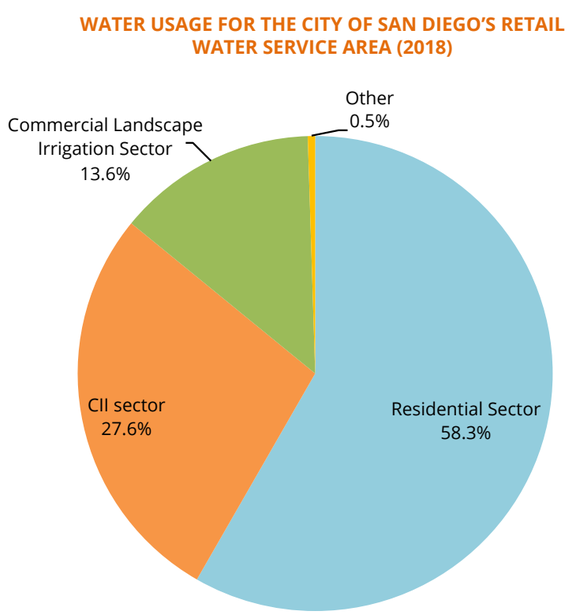


FIGURE 2: San Diego County Water Authority Service Area Water Use from 1990-2017.[9]



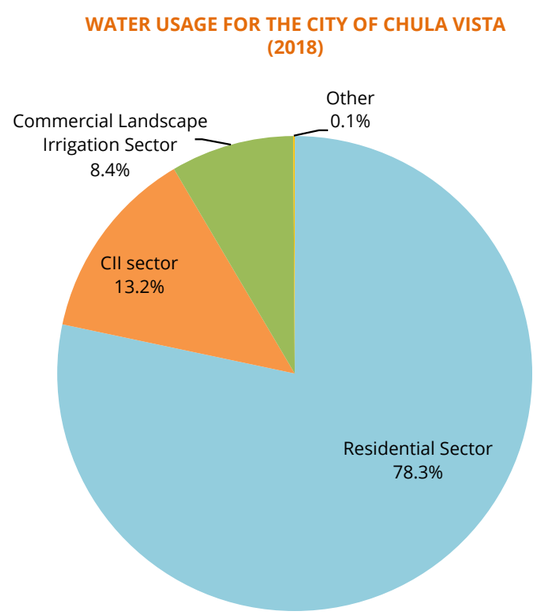


FIGURE 3: Water Usage per Jurisdiction[11]

irrigation includes commercial and public agency sites with 5,000 square feet or more of irrigated landscape as defined by the Otay Water District Chief Assistant Manager. Otay Water District does not have agricultural meters in the City of Chula Vista. Sweetwater Authority does not have specific language for commercial landscape irrigation. The data were extracted from landscape meters installed in public agencies, and commercial and industrial areas.

San Diego Region's Challenges

Reliance on Imported Water

San Diego's extensive reliance on imported water makes the San Diego Region highly vulnerable during drought conditions and water shortages, which have been observed over the last decades. In addition to a changing climate that brings more severe and impactful droughts, San Diego faces two other challenges: 1) balancing a growing urban population with a continued need to reduce water consumption, and 2) an aging water infrastructure.[12] To address these issues, local water agencies and organizations have invested in water source diversification.[13] As shown in Figure 4 below, SDCWA relied on just two water sources in 1991, as compared to seven different water sources in 2017. In addition to agency-led actions to diversify water sources, the statewide water restrictions have made San Diego's population more aware of the need to conserve water.

Rising Rates

Consequently, this high reliance on imported water, and the investment required to diversify the water sources have resulted in increasing water rates, which will also help pay to improve the aging water infrastructure.[14] Higher rates have had a significant impact on the region's cost-of-living, especially low-income families. Those households already living on a tight budget have a more difficult time absorbing the cost of higher water rates, and their water bills account for a higher percentage of their income, even if their consumption remains the same.

12 https://energycenter.org/sites/default/files/Water_System_Losses_San_Diego_County.pdf

13 https://potablereuse.sdcwa.org/supply-reliability/

14 https://www.sandiego.gov/sites/default/files/legacy/water/pdf/rates/ratechangefacts.pdf

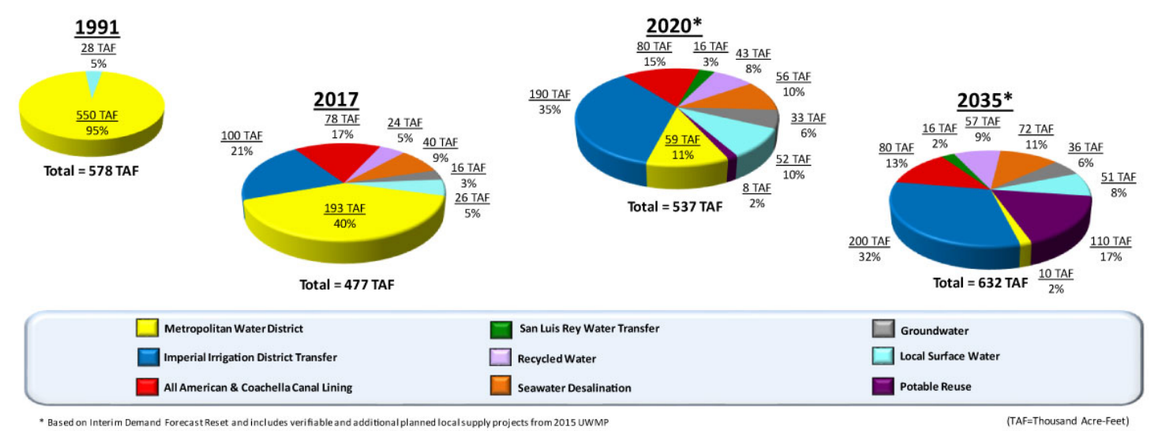


FIGURE 4: San Diego County Water Authority Supply Portfolio[13]

As shown in Figure 5, consumer water rates for the Sweetwater Authority and Otay Water District have increased over the past 8 to 10 years.[15,16] For a typical single-family unit consuming 14 hundred cubic feet (HCF) per month, water bills increased by 33% for Sweetwater customers and 20% for Otay customers between 2014 and 2019. These increased rates have forced households to either reduce water usage or absorb the higher cost of water. For small consumers who have less capacity to further conserve water, a reduction in water use may not be feasible, and any increase in rates places a higher financial burden on consumers, particularly low-income residents who are disproportionately affected by rate hikes.

15 Data provided by Sweetwater Authority

16 Data provided by Otay Water District

Impact of Droughts on Food and Green Spaces

Commercial agriculture is the fifth largest industry in the greater San Diego Region, placing it in the top 20 counties in the United States, generating about $1.7 billion in direct sales in 2017.[17] The San Diego Region counts nearly 6,000 farms[18] and covers approximately 250,000 acres of land including about 50,000 acres used for crop farming. Fruit and nut trees, bushes and vines are the primary crops grown in the region and account for about 68% of the production, followed by nursery and ornamentals, and row crops that use 24% and 8% of land, respectively.[19] The successive droughts experienced by the San Diego Region have impacted this economic sector. The diversification effort in water supply made by SDCWA has been beneficial for the region, but it comes at a price. As explained by the director of the San Diego Farm Bureau in an article for Edible San Diego in July 2018:

"Water is the single largest monthly expense for many farmers. . . With the price of water tripling over the past 12 years and the price of farm products remaining virtually static, farmers are squeezed"[20]

In addition, the San Diego Food System Alliance expresses the unique challenge that San Diego farmers face:

"Producers in San Diego County face a unique and sometimes difficult challenge when dealing with water related issues. Our local growers pay some of the highest prices for water in California. Agricultural water rates can be as high as 30 times those of the Central Valley Project or Imperial Irrigation District."[21]

According to an article by The San Diego Union Tribune published in July 2018:

"The cost of water continues to impact the county's famous avocado crop. Avocado production continues to decrease as smaller growers abandon operations, usually citing the high cost of irrigation."[22]

As the price of water is the main issue for farmers in the San Diego region, SDCWA has put in place a program to help farmers who are willing to take cutbacks in the event of water restriction. Indeed, growers and farmers who voluntarily participate in the Transitional Special Agricultural Water Rate (TSAWR) program are exempt from paying storage and other charges from SDCWA that are intended to maintain water supply reliability, in exchange for receiving a lower level of service and distribution. Farmers thus have the option to either pay the high cost of water and ensure they are served, or they pay a lower cost and take large cuts in water deliveries.[23,24] According to Eric Larson, the Executive Director of the San Diego Farm Bureau, about one-half of the water used by farmers in our region comes through the TSAWR program, thus the other half was not impacted by water reductions during the drought.

During our investigation, community members reported that mandatory water reductions which occurred during the drought of 2015 have impacted their community and urban gardens. Although these testimonials are anecdotal, they are examples of the negative impact of increased water rates on local food production. Significant impacts were also felt at San Diego Housing Commission (SDHC) properties, where landscape irrigation was eliminated in order to meet mandatory water restrictions. This resulted in dead and dying landscapes at many properties, which has led to significant resident complaints and loss of environmental and visual quality at many properties.

Together, higher water rates, a loss of landscape vitality at publicly-managed housing properties, and reduced access to community gardens contribute to growing inequities in low-income family health. These observations put in context the goals of the Project and the importance of solutions that will provide more affordable access to water. In such circumstances, the on-site non-potable water systems appear as a conservation tool by reusing water on-site. Capture of rainwater and air conditioning condensate, and reuse of greywater, can create important and drought-resilient sources of non-potable water at different and potentially lower per-unit costs, supporting the diversification of water supplies and reducing the reliance on centralized water. A number of local water agencies

17 http://tinyurl.com/y2eny54w

18 http://cesandiego.ucanr.edu/files/293157.pdf

19 https://www.sdfarmbureau.org/wp-content/uploads/2018/09/Climate_Friendly_SD.web_.5MB.pdf

20 http://ediblesandiego.ediblecommunities.com/food-thought/san-diego-county-farmers-need-our-help-survive

21 http://www.sdfsa.org/farming

22 https://www.sandiegouniontribune.com/communities/north-county/sd-no-crop-report-20180625-story.html

23 https://www.sdcwa.org/node/4272

24 https://www.rainbowmwd.com/files/46a0198f7/2019+TSAWR+Handbook.pdf

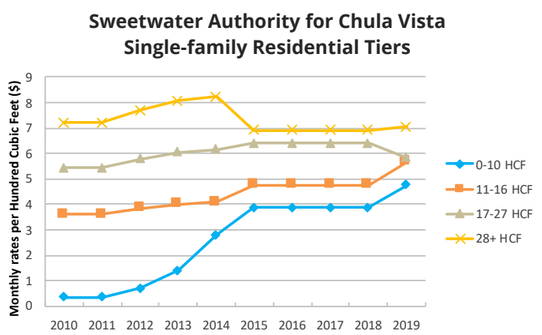


FIGURE 5-A: Sweetwater Authority Single-family Tiered Rates[15]

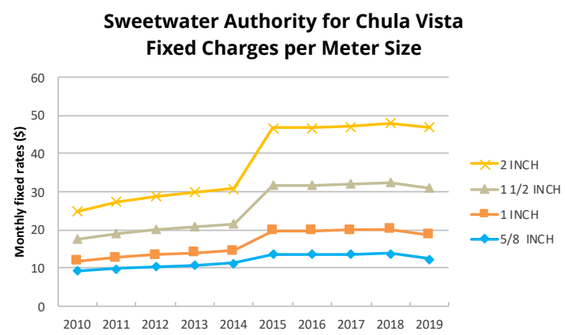


FIGURE 5-B: Sweetwater Authority Fixed Charges (including the water retailer charges and the wholesale provider pass-through charges)[15]

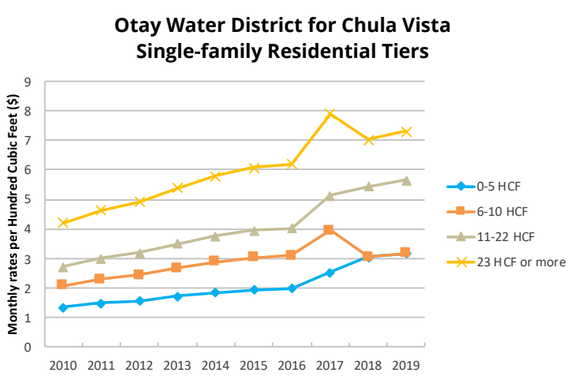


FIGURE 5-C: Otay Water District Single-family Tiered Rates[16]

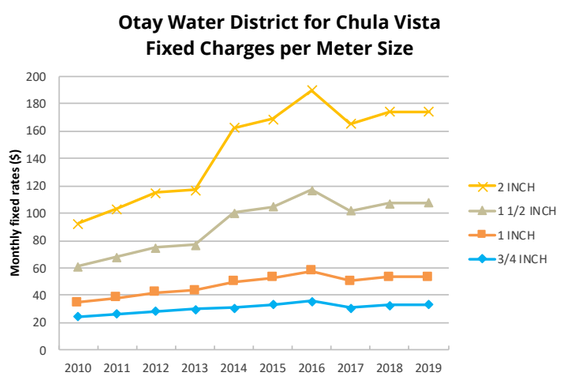


FIGURE 5-D: Otay Water District Fixed Charges (including the water retailer charges and the wholesale provider pass-through charges)[16]

have implemented these conservation programs successfully. The City of Chula Vista WaterSmart Landscaping & Water Reuse Guide and the Water Conservation program put in place by the City of San Diego are two successful examples.[25]

Salton Sea Rehabilitation

The rehabilitation of the Salton Sea is another key issue that the greater San Diego region faces. In March 2017, the state's Natural Resources Agency released a $383 million plan to restore the lake.[26] However, the project struggles to secure the funds for implementation.[27] The nonprofit think tank Pacific Institute has estimated that a lack of commitment to restoring the lake will drastically impact the local communities of the Salton Sea. A failure to rehabilitate the Salton Sea will lead to serious consequences affecting community health and wellbeing in the surrounding area: high dust contamination in the air, lower property values, ecosystem damage, and high rates of respiratory illnesses.[28]

Creating Opportunities

The San Diego Region's challenges have motivated local water agencies, organizations, and communities to find solutions and turn these challenges into opportunities for more resilience.

Looking back at the historical evolution of water management shows how much the mindset around water has evolved throughout time, as described in Figure 6. Starting with stormwater control, which initially regarded water as a threat to be disposed of, water management has evolved towards issues of water quality improvement and then to water conservation and reuse. Recently, this mindset has begun to further evolve towards community and climate resilience.

25 CV-05 in Appendix C

26 https://www.desertsun.com/story/news/environment/2017/03/16/california-has-new-383-million-plan-shrinking-salton-sea/99124850/

27 https://www.waterboards.ca.gov/waterrights/water_issues/programs/salton_sea/

28 https://www.usatoday.com/pages/interactives/salton-sea/california-far-from-solutions-as-salton-sea-crisis-looms/

In the early 1950s, the need for more stormwater discharge control emerged to reduce the impact of flooding in urban areas; the recognition of the importance of water quality improvement and pollution prevention followed. This resulted in the introduction of the federal Clean Water Act in 1973. This forced the State of California and local jurisdictions in San Diego County to implement water management plans that alleviate the impacts of flooding, and control the quality of water that is discharged into the environment. As urban areas expanded with a growing population, water demands further increased, and it became imperative to increase and diversify San Diego water supplies. Thus, water reuse has emerged as a solution with great potential to address both water supply and water pollution control. In San Diego, this shift started in the early 1990s with the implementation of the centralized municipal recycled water distribution. Also known as reclaimed water, the City of San Diego constructed its "purple pipe" non-potable distribution system.[29] This system has proven its reliability for irrigating parks, golf courses, and other landscape features, and for replenishing groundwater. What used to be seen as a waste is now becoming a resource. To further the concept, wastewater treated sufficiently to produce potable water has become another resource. Although in its early stages public opinion was against such a "toilet-to-tap" plan, the public now supports the Pure Water San Diego program. This is a multi-year program that will provide one-third of the City of San Diego's water supply from local sources by 2035, turning wastewater into potable water through advanced treatment with multiple public health safe guards. Currently in the pre-construction phase, the program aims to produce 30 million gallons of purified water per day at the North City Pure Water Facility starting in 2021.[30]

Additional water resources are being developed to continuously diversify the San Diego Region's water supplies. For example, the City of San Diego and

29 https://potablereuse.sdcwa.org/supply-reliability/

30 https://www.sandiego.gov/public-utilities/sustainability/pure-water-sd

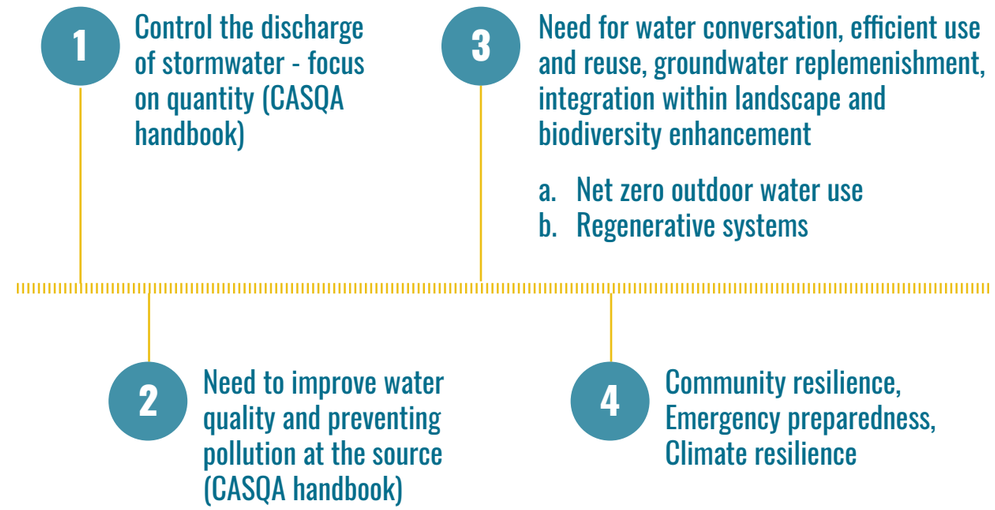


FIGURE 6: Evolution of the Mindset Around Water Management

Sweetwater Authority jointly expanded the Reynolds Groundwater Desalination Plant in 2017, and the San Diego County Water Authority's Carlsbad Seawater Desalination Plan went online in 2015. The latter is currently producing 50 million gallons of water per day.[31]

In addition to these centralized water facilities, decentralized water systems are being implemented and more comprehensively studied to supplement current sources. For example, the San Diego International Airport received the Industrial Environmental Association's 2017 Environmental Excellence Award for two projects that advance water conservation and reuse. The rainwater capture system at the new Terminal 2 Parking Plaza captures 100 percent of the rain that falls on the 7.6-acre structure and is stored for use by the airport's Central Utility Plant. In 2016, the airport's Air Conditioning Condensate Capture and Reuse Program collected an estimated 103,000 gallons of water from 14 passenger boarding bridges. The water was reused in various processes including power-washing sidewalks and the airfield, cleaning vehicles and equipment, scrubbing floors, and construction site dust control. Although on-site water reuse has been associated chiefly with rural areas and small community systems started as a grassroots movement, it has potential to become a viable additional source of water in San Diego's urban setting. Innovative solutions have emerged to reuse on-site water at different levels of treatment. This is also supported by the growing movement of sustainable green buildings and infrastructure through certifications such as the Leadership in Energy and Environmental Design (LEED) certification,[32] the Living Building Challenge certification,[33] the Envision certification,[34] and the Greenroads certification[35] that advocate for more efficient water use at the building scale.

The inter-connections among water, landscape, agriculture, people, and community health calls now for a better integration of water use with the landscape, to enhance the biodiversity, re-establish the

31 https://www.carlsbaddesal.com/

32 https://new.usgbc.org/leed

33 https://living-future.org/

34 https://sustainableinfrastructure.org/

35 https://www.greenroads.org/

natural cycle of water, and replenish the groundwater. The mindset around water is thus evolving towards more inclusive and sustainable design thinking for regenerative systems, leading in turn to more resilience.

In summary, efforts to create new water resources from what used to be seen as disposable have been gaining momentum. A greater use of on-site non-potable water systems requires more understanding and research. In this context, the Project plays an important role to further the safe and efficient use of non-potable water systems. Rainwater capture, greywater, stormwater, and A/C condensate reuse are solutions for the San Diego Region to increase its water resilience. It also supports water affordability with low-cost solutions and programs that can thus improve under-resourced community resilience and health.

CURRENT REGULATORY FRAMEWORK

This chapter discusses the regulatory framework for management of on-site non-potable water use at the state, regional, and local level. Several levels of regulations are involved and it is necessary to consider successively state, regional, and local regulations to understand the framework. Each successive administrative level of government has the authority to enact regulations, as long as these do not conflict with standards set by the higher authority and comply with applicable preemption laws.

State Level

At the state level, the California State Water Resources Control Board and the Department of Water Resources have regulatory authority to adopt statewide measures and to govern statewide water resource programs.

- The California State Water Resources Control Board (SWRCB) oversees the allocation of the state's water resources to various public and private agencies and for uses including agricultural irrigation, hydro-electrical power generation, and municipal water supplies.
- The Department of Water Resources (DWR) manages California's water resources, systems, and infrastructure. DWR, like any other water user, must apply for water rights permits from the State Water Resources Control Board. DWR is in charge of statewide programs such as Integrated Regional Water Management (IRWM), Water Use & Efficiency, and Groundwater Management.

Several state codes regulate the non-potable water sources that are of interest for the Project as described in Figure 7: the California Plumbing Code (Chapters 15 and 16), the California Code of Regulation (Title 22 and 23), and the Sustainable Groundwater Management Act. In addition, the state regulates stormwater through the issuance of National Pollutant Discharge Elimination System permits. Recent changes in state regulation are also discussed as they impact water conservation and reuse.

The California Plumbing Code for Greywater and Rainwater

The California Code of Regulation (CCR), Title 24 is the Building Standards Code that governs the construction of buildings in California and contains the California Plumbing Code (CCR, Title 24, Part 5). The California Plumbing Code (CPC) is an important regulatory framework for this Project as it contains plumbing design and construction standards that regulate the use of greywater, centralized recycled water, on-site treated non-potable water, and the capture of rainwater. Applicable provisions are found in Chapter 15 (Alternate Water Sources for Nonpotable Applications) and Chapter 16 (Nonpotable Rainwater Catchment Systems). In addition, the CPC refers to national standards established by the National Sanitation Foundation and the American National Standards Institute (NSF/ANSI 350) for the on-site water reuse treatment.

NSF/ANSI 350

NSF/ANSI 350 and 350-1 establish standards for on-site residential and commercial water reuse treatment systems for non-potable applications, and standards for on-site residential and commercial greywater treatment systems for subsurface discharge. They establish recommended material, design,

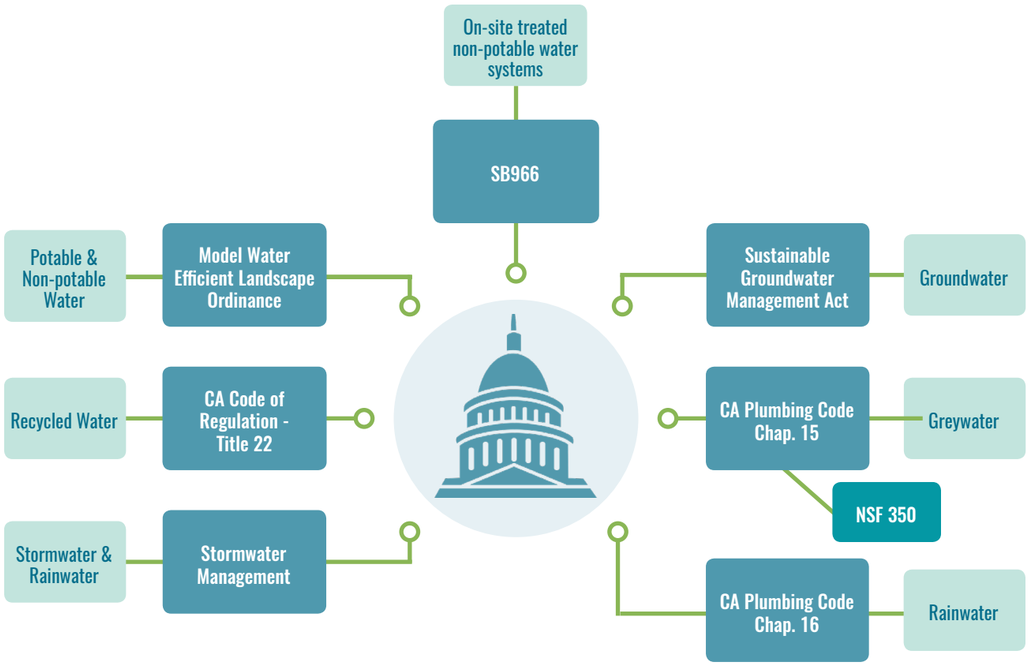


FIGURE 7: State Regulation Framework

construction, and performance requirements for these treatment systems. They also set recommended water quality requirements for the reduction of chemical and microbiological contaminants for non-potable water use. Under these standards, treated wastewater is recommended for restricted indoor water use, such as toilet and urinal flushing, and outdoor unrestricted water use, such as lawn irrigation. NSF-350 standards are used in Title 24 of the California Plumbing Code. Certain aspects of NSF 350 are recognized at the State level as presenting challenges to implementation of on-site reuse. Many stakeholders, both within California and nationally, are working to address these barriers, which will in time facilitate reuse efforts in San Diego.

California Code of Regulation, Title 22 for Centralized Recycled Water

The California Code of Regulation (CCR), Title 22, Division 4 – Environmental Health – regulates the level of required water quality and the allowable use of centralized recycled water, also known as purple pipe water, provided by wastewater treatment plants. Title 22 is widely used and accepted as a reference for water quality standards, and thus is relevant to the on-site water reuse standards in this Project. The relevant chapters of Title 22, Division 4 are Chapter 3 (Water Recycling Criteria), Chapter 15 (Domestic Water Quality and Monitoring Regulations), and Chapter 17 (Surface Water Treatment).

California Code of Regulation, Title 23 for Potable and Non-potable Water in Landscaping Use

The California Code of Regulation (CCR), Title 23 establishes the Model Water Efficient Landscape Ordinance (MWELO) under Division 2, Chapter 2.7. The MWELO provides requirements for an efficient use of potable and non-potable water in landscaping. It was updated in 2015 by the DWR to reflect Governor Brown's Executive Order mandating a

TABLE 1: Summary of State Regulation of Alternative Water Sources

ALTERNATE WATER SOURCES	REGULATION
Greywater	California Plumbing Code and NSF-350
Rainwater	California Plumbing Code
Stormwater	No state code
Groundwater/foundation drainage	No state code

25% reduction in water use due to the unprecedented drought that year.

NPDES permits for Stormwater

Stormwater discharges in California are regulated through National Pollutant Discharge Elimination System (NPDES) permits, a federal program under the Clean Water Act which has been delegated to the State of California for implementation through the State Water Resources Control Board (SWRCB) and its nine Regional Water Boards. In most parts of California, including San Diego County, stormwater flows directly to water bodies through combined or separate storm sewer systems. This is often a major source of pollution for rivers, lakes, and the ocean. However, stormwater may also act as a resource and recharge the groundwater when properly captured and managed. The Regional Water Boards are actively involved in initiatives to improve the management of stormwater as a resource. The NPDES program regulates stormwater discharges from three potential sources: municipal separate storm sewer systems (MS4s), construction activities, and industrial activities. This permitting program is relevant to the Project as it requires the Regional Water Boards and the local jurisdictions subject to these permits to implement a variety of stormwater management plans and programs (Stormwater Pollution Prevention Plan and Stormwater Management Plan), many of which can serve as sources of non-potable water.

In summary, Table 1 shows the alternate water sources related to the Project currently regulated by the state code.

Proposition 218 (1996)

Proposition 218, passed by California voters in 1996, added Articles XIII C (Voter Approval for Local Tax Levies) and XIII D (Assessment and Property-Related Fee Reform) to the California Constitution. Known as the "Right to Vote on Taxes Act," this measure was adopted to *"protect taxpayers by limiting the methods by which local governments exact revenue from taxpayers without their consent."*[36]

California Constitution, Article XIII C, section 2:

> *"(b) No local government may impose, extend, or increase any general tax unless and until that tax is submitted to the electorate and approved by a majority vote."*

Water and wastewater services are subject to Article XIII D, section 2 that defines a *"Property-related service"* as *"a public service having a direct relationship to property ownership."*

It requires that the cost of service reflects the cost of providing that service. In the case of water services, the cost must reflect the cost of water delivery and cannot encompass other charges that would be used for another purpose than water delivery, as explained in the California Constitution, Article XIII D, section 6:

> *"(b) Requirements for Existing, New or Increased Fees and Charges. A fee or charge shall not be extended, imposed, or increased by any agency unless it meets all of the following requirements:*
>
> *(1) Revenues derived from the fee or charge shall not exceed the funds required to provide the property related service.*

36 https://lao.ca.gov/1996/120196_prop_218/understanding_prop218_1296.html#appendixII

(2) Revenues derived from the fee or charge shall not be used for any purpose other than that for which the fee or charge was imposed.

(3) The amount of a fee or charge imposed upon any parcel or person as an incident of property ownership shall not exceed the proportional cost of the service attributable to the parcel."

As a consequence, it restricts solutions that would adjust charges or apply fees that could provide critical supports such as low-income family assistance programs or conservation programs. This proposition creates a challenge in terms of water affordability and equity.

The City of San Juan Capistrano was challenged in court by the Capistrano tax Payers Association when the City decided to apply a tiered rate structure, a commonly accepted method to create an economic incentive for conservation and efficiency. Although the California Court of Appeals did not restrict all tiered water rates, it disallowed arbitrary rate structures. As a consequence, water agencies are required to establish a clear and understandable structure that satisfies the requirements of Proposition 218, and does not exceed the proportional cost of the service.[37,38] This lawsuit has generated a wide debate regarding water affordability and conservation that is still on-going.

Proposition 218 requirements are a significant barrier to equity, and new strategies are needed to address these concerns. There is currently an attempt at the State level to create a water tax, as a mechanism to work around this Proposition to support low-income households. However, the status of this water tax itself remains uncertain.

In comparison, utilities other than water do provide low-income assistance programs. The Senate Bill 1207, section 1, section 739.1, approved in 2012, provides requirements to the California Public Utilities Commission:

"(b) (1) The commission shall establish a program of assistance to low-income electric and gas customers with annual household incomes that are no greater than 200 percent of the federal poverty guideline levels, the cost of which shall not be borne solely by any single class of customer. The program shall be referred to as the California Alternate Rates for Energy or CARE program. The commission shall ensure that the level of discount for low-income electric and gas customers correctly reflects the level of need."

Recent Regulatory Changes

During the recent drought, Governor Brown authorized multiple Executive Orders (EOs) to immediately respond to the severe water conditions in California. Subsequently, the EOs drafted the framework for Senate Bill 606 and Assembly Bill 1668, which both focus on water conservation and ultimately reduce Residential Gallons Per Capita Day (RGPCD), setting the ambitious target of limiting indoor potable water use to an average of to 50 gallons per capita per day by 2030. To incrementally reach this goal, water suppliers are required to implement long-term standards for the efficient use of water by 2022. Water suppliers anticipate a first step goal of 55 RGPCD for indoor use by 2025.

In addition, the adoption of Senate Bill 966 in September 2018 adds requirements to the Water Code for on-site treated non-potable water systems. It requires that California SWRCB, in consultation with the California Building Standards Commission, adopt regulations for risk-based water quality standards for on-site treated non-potable water and its reuse, on or before December 1, 2022. Consequently, any local jurisdiction that would like to establish a program for on-site treated non-potable water systems will have to adopt an ordinance including these risk-based water quality standards. This bill concerns multifamily residential, commercial, and mixed-use buildings but does not address systems serving single-family dwellings. In addition, it does not address untreated greywater and untreated rainwater regulated by the CPC under Chapters 15 and 16, respectively.

37 https://www.foleymansfield.com/newsroom/capistrano-taxpayers-association-v-city-san-juan-capistrano-what-appellate-courts-ruling-means/

38 https://www.foleymansfield.com/files/6314/2981/5878/SanJuan.pdf

More importantly, these regulatory updates should be taken into account in the Project's recommendations for risk-based water quality standards for on-site water treatment, in order to ensure they are implemented properly.

Regional Level

Regional agencies coordinate regional efforts and implement state requirements for water management. The San Diego Regional Water Quality Control Board (RWQCB) is responsible for and regulates the watersheds that include rivers draining east to west from the Laguna Mountains to the Pacific Ocean and north to south from Laguna Beach to the Mexican border.

Under the umbrella of the California DWR, the San Diego IRWM Program began in 2005 to support regional efforts towards more water supply reliability. In 2007, the San Diego County Water Authority, City of San Diego, and County of San Diego formed the Regional Water Management Group to fund, guide, and manage development of the IRWM Plan. A truly interdisciplinary effort, the San Diego IRWM also engages stakeholders through the formation of a Regional Advisory Committee, which includes water utilities, wastewater, stormwater, and flood management agencies, watershed groups, business communities, tribes, agricultural interests, and non-governmental organizations to improve water resources planning in the San Diego Region.

Regional Stormwater Management Plans

The important regulatory plans at the regional level concern stormwater management. Following the State Water Board regulation, San Diego RWQCB

has promulgated NPDES permits that regulate wastewater discharges and discharges from municipal separate storm sewer systems (MS4s) in the San Diego Region. The San Diego Regional NPDES MS4 Permit covers Co-permittees within San Diego County, Orange County, and Riverside County; the Phase II Small MS4 Permit covers entities such as the University of California San Diego, San Diego State University, Metropolitan Transportation System, and other "non-traditional" permittees; and CalTrans has its own NPDES Permit.

Through the Regional MS4 Permit, co-permittees identify and address the highest priority water quality issues of their regions. This process is reflected in watershed-specific Water Quality Improvement Plans (WQIP). These WQIPs are developed through a collaborative effort by the co-permittees in each Watershed Management Area, including representatives from the San Diego Water Board. There are several WQIPs relevant to this Project:

- WQIP for the Mission Bay Watershed Management Area,
- WQIP for the San Diego Bay (Pueblo San Diego, Sweetwater, and Otay) Watershed Management Area,
- WQIP for the San Diego River Watershed Management Area, and
- WQIP for the Tijuana River Watershed Management Area.

In addition to approving these WQIPs, the RWQCB requires each local jurisdiction to adopt a Jurisdictional Runoff Management Plan (JRMP) including a Best Management Practice Design Manual to regulate stormwater due to impacts from new development and redevelopment runoff. Other regulatory provisions, including adopted Total Maximum Daily Load (TMDL) plans, direct co-permittees to construct stormwater practices that capture and treat runoff from existing impervious surfaces. As these WQIPs and JRMPs regulate stormwater discharges and mitigation in the San Diego Region, it is important to reflect both the requirements and design standards for the on-site reuse of stormwater, and the opportunity represented by these requirements to capture non-potable water for beneficial on-site uses.

Local Jurisdictions

The local jurisdictions involved in this Project are the cities of Chula Vista, Imperial Beach, and San Diego, as well as the County of San Diego. These municipalities have the authority to provide guidance and adopt local ordinances in accordance with state and regional regulation and requirements. Each jurisdiction differs in size and population, and thus their structures will vary. Additional details about each local jurisdiction are provided below:

- The City of Imperial Beach (See Table 2) is the smallest jurisdiction of the four. The Community Development Department is the most relevant department to the Project. It houses the Building Division that oversees all construction and regulation of permits and standards, the city planners, and code enforcement. In addition, the Imperial Beach Public Works Department oversees the Environmental Division in charge of stormwater, including compliance with the Regional MS4 Permit, and conservation programs.
- The City of Chula Vista Development Services Department is in charge of building standards, permits, and land development. The Public Works Department operates and maintains the sewer and storm drain system. In addition, the city has created an Office of Sustainability as part of the Economic Development Department. It is a collaborative effort and it is responsible for providing solutions to environmental issues impacting the city. The Department of Engineering and Capital Projects Wastewater Engineering Section manages the sewer system and drainage, and the Storm Water Management Section is responsible for compliance with the Regional MS4 Permit. (See Table 3)
- The City of San Diego (See Table 4) has several departments that are important to consider for the Project:
  - The Public Utilities Department is responsible for water supply, wastewater, and water conservation programs
  - The Transportation and Stormwater Department is primarily responsible for MS4 management and BMPs implementation. This department also funds the rainwater harvesting rebate program and works in collaboration with the Public Utilities Department on programs related to water runoff.
  - The Development Services Department is the enforcing agency. They enforce the Building and Zoning Codes.
  - The Sustainability Department is in charge of Climate Action Plan compliance.
- The County of San Diego has several departments under the Land Use and Environment Group including Environmental Health, Public Works, and Planning and Development Services. The Watershed Protection Program, which is in charge of stormwater planning and regulations is under the Department of Public Works. The Advance Planning Division of Planning and Development Services is tasked with Climate Action Plan compliance. (See Table 5)

In compliance with state and regional requirements, each jurisdiction has adopted Jurisdictional Runoff Management Plans and included Stormwater Best Management Practice Design Manuals, as well as adopted local ordinances for Water Efficient Landscape Design and Watershed Protection.

Review of the Regulatory Landscape

The current regulatory landscape appears to be a major roadblock to greater use of on-site non-potable water systems. The regulatory framework does not

TABLE 2: City of Imperial Beach Relevant Departments

COMMUNITY DEVELOPMENT DEPARTMENT	PUBLIC WORKS DEPARTMENT
Building Division	Environmental Division (stormwater management and conservation programs)
City Planning	
Code Enforcement	

TABLE 3: City of Chula Vista Relevant Departments

DEVELOPMENT SERVICES DEPARTMENT	PUBLIC WORKS DEPARTMENT	ECONOMIC DEVELOPMENT DEPARTMENT	ENGINEERING AND CAPITAL IMPROVEMENTS DEPARTMENT
Building standards	Wastewater	Office of Sustainability (conservation programs)	Stormwater management section
Permit issuance and enforcement	Stormwater Drain System		Wastewater/stormwater engineering
Land development			

TABLE 4: City of San Diego Relevant Departments

PUBLIC UTILITIES DEPARTMENT	TRANSPORTATION AND STORMWATER DEPARTMENT	DEVELOPMENT SERVICES DEPARTMENT	SUSTAINABILITY DEPARTMENT
Water Service	Stormwater management	Enforcing agency	Climate Action Plan compliance
Wastewater Service			
Potable Reuse			
Conservation programs			

TABLE 5: County of San Diego Relevant Departments

LAND USE AND ENVIRONMENTAL GROUP		
DEPARTMENT OF ENVIRONMENTAL HEALTH	DEPARTMENT OF PUBLIC WORKS	DEPARTMENT OF PLANNING AND DEVELOPMENT SERVICES
Recycled water and greywater program	Watershed Protection Program(Rain Barrel program for rainwater)	Advance Planning Division (Climate Action Plan Compliance)

appear to be easily understood, and presents gaps that will be discussed in the next chapter. This has created uncertainties and raised questions and issues for many people including residents, landscape and building designers, and municipal and county staff. In addition, variability between adjoining municipal jurisdictions adds uncertainty, and makes it more difficult for businesses to provide greywater and related systems as they need to be well aware of and to comply with permitting standards for different jurisdictions. These regulatory barriers slow down the process of design and implementation of non-potable water systems and prevent them from becoming part of safe and efficient "mainstream" approaches to landscape, building, and water system design.

Methodology of the Review

The first step in our research was to review city and county websites to gather available information and understand what is missing. We also reviewed applicable state and regional codes. We then summarized our research by jurisdiction and vetted it with city staff representatives. We also added other well-known guidelines for comparison, including the Los Angeles County Department of Public Health's guidelines and the National Blue Ribbon Commission guidebooks on a risk-based framework for decentralized non-potable water systems. These two documents provided valuable insight and best practices for the Project.

This review identifies multiple water sources, including rainwater, stormwater, greywater, A/C condensate, groundwater, centralized recycled water, and wastewater. The research and stakeholder team recognize the vital importance of "all" water, including reclaimed wastewater effluent, "purple pipe" centralized distribution systems, and on-site wastewater treatment systems, to the full discussions of water literacy, public health, and resilience. The scope of this inquiry is focused particularly on systems that have direct and immediate implications for augmenting supply as part of site and building design, and that are commonly applied in existing, built urban settings: Rainwater harvesting, laundry greywater, landscape based stormwater capture and A/C condensate.

Definitions for each of these water sources are provided in the following:

- *Rainwater*: Precipitation from rain events that is collected and diverted directly from a roof surface located above ground.

- *Stormwater*: Precipitation from rain events that flows over land and/or impervious surfaces (e.g., streets, parking lots) rather than infiltrating or being taken up by natural processes. Stormwater includes runoff from surfaces located at or below grade surface.
- *Greywater*: Untreated wastewater which has not come into contact with toilet waste. It includes used water from bathroom sinks, bathtubs, showers, and clothes washers, but does not include wastewater from toilets, kitchen sinks, dishwashers, or laundry water from soiled diapers, or similarly contaminated clothes, bed sheets and towels due to potential health issues. Table 6 summarizes the possible connections and restrictions that apply among jurisdictions.
- *Air conditioning (A/C) condensate*: Water that condenses on air conditioning system pipes when hot air from a building comes into contact with the cold coil pipes, and cools down.
- *Centralized recycled water*: Water that has been treated at the highest level required by the California Department of Health Services for water not intended for human consumption as defined by California Code of Regulation, Title 22. "Recycled water" is sometimes referred to as "reclaimed water" or "purple pipe water." It is provided by a regulated recycled water agency via a centralized reclamation facility.
- *Blackwater*: Wastewater originating from toilets and/or kitchen sources (e.g., kitchen sinks and dishwashers).
- *Wastewater*: Water produced by human activities. It includes both greywater and blackwater.
- *Groundwater*: Water beneath the surface of the ground. This Project specifically addresses groundwater caused by an underground source unexpectedly surfacing on a property. It includes nuisance groundwater that is extracted to maintain the integrity of a building and would otherwise be discharged to the sewer system (i.e. foundation drainage).

Rainwater use is better described by the methods implemented to harvest it, either actively or passively. Active rainwater harvesting[39] is defined as the diversion of rainwater from roofs into rainwater tanks. It relies on rain barrels and cisterns, both above ground and below ground to store rainwater for later distribution. The stored water can be used outdoors to irrigate vegetation or indoors for non-potable (toilet flushing, laundry washing) and potable (with extensive filtration and disinfection) uses. Active water harvesting systems are especially important in a climate like San Diego where precipitation only occurs in the winter months. Stored rainfall can offset imported demand during the dry season for outdoor irrigation. Passive rainwater harvesting[40] is

39 https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Quick%20Resouce-%20Active%20WH%20%28final%29.pdf

40 https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1564.pdf

TABLE 6: Sources Generating Greywater as Defined per Jurisdiction

	BATHTUBS/ SHOWERS	BATHROOM SINKS	LAUNDRY	TOILETS	KITCHEN SINKS	DISHWASHERS
City of Chula Vista	Yes	Yes	Yes	No	No	No
City of San Diego	Yes	Yes	Yes ('no soiled laundry from diapers' is explicitly specified)	No	No	No
County of San Diego	Yes	Yes	Yes	No	No	No

TABLE 7: Summary of the Outdoor and Indoor Non-potable Water Use

OUTDOOR USES	INDOOR USES
Subsurface irrigation	Toilet flushing
Drip irrigation	Laundry washing
Spray irrigation	Cooling tower make-up
Community garden irrigation	
Commercial agriculture irrigation	
Vehicle washing	
Street sweeping and dust control	

+ Irrigation types have been separated during the regulatory landscape review due to specific requirements that apply to each of them

the practice of slowing water down and storing it in soil and biomass. With simple land contouring (often called "earthworks") that catch and direct stormwater runoff, stormwater can be used beneficially, encouraging plant growth in landscapes and natural areas, healing erosion cuts, and can even replace the need to irrigate with imported water. Passive water harvesting systems consist of a catchment area, a distribution system and a landscape holding area. Runoff is directed from the catchment area to the holding area where water can be immediately used by landscape plants. Catchment areas include soil surfaces, roofs, roads, and sidewalks. A landscape holding area can consist of a basin, swale, or terrace, where water is able to soak in instead of run off. Passive water harvesting can be used along with a rainwater storage system ("active rainwater harvesting") or can be used alone.

Water "end uses" are defined by outdoor and indoor applications. Outdoor uses include subsurface, drip and spray irrigation, community garden and commercial agriculture irrigation, vehicle washing, street sweeping, and dust control. Indoor uses include the reuse of water for toilet flushing, laundry washing, and cooling tower make-up. A distinction is also made between the on-site use of treated versus untreated water.

Additional criteria include building size and type (including residential, multi-family, commercial, and municipal buildings); volume of water that is captured, stored, or discharged; and surface area of landscape irrigated.

This review provides guidance on how to help streamline the process, address public health issues, and improve safe use of non-potable water, focusing on the following questions:

- What are the current regulations that address each water source and water end use?
- Who are the overseeing departments in each jurisdiction?
- What is the permitting process, through what requirements and what permitting agencies?
- How easy is the implementation process? Is it streamlined, cost-efficient, and time-efficient?
- What are the requirements and guidelines for design, implementation, operation, maintenance, and repair?
- What are the requirements for water quality and pollution control of the water sources?

These requirements shape the design of water systems and frame specific water uses that are important to consider in the Project. They also help address questions related to risks of human exposure, safe water use, and cross-connection issues. The full review of the regulatory workshop is available by following this link.[41]

Finally, this review highlights available and missing information, as well as the ease of finding this information. It shows how the information is disseminated to the public and trade businesses and if the format and communication strategy help or hinder with understanding the information.

Findings of the Regulatory Landscape

The review shows that the wide variety of water sources and uses for on-site non-potable water systems have mainly led the jurisdictions to address each potential water supply (i.e. greywater, rainwater harvesting, condensate capture, stormwater capture) piece-by-piece, resulting in a lack of coordination with the actual specifications of a site (i.e. whether it is a building or a landscape area). The need for more integrated designs will be discussed in greater detail in the next chapter. In addition, depending on the end use of the water, each source of water requires adherence to different quality standards. It requires a good understanding of the water sources and the public health risks to ensure that the correct level of regulation is provided without requiring excessive treatment that would make the system implementation too complicated or too expensive, thus limiting the advantages of using non-potable water systems. This review also provides a comparison of the four jurisdictions showing variations and similarities, as well as cases of missing or confusing information.

Different Level of Requirements Depending on the Water Source

Each source of water contains a different level of contamination, and different types of contaminants. The Safe Drinking Water Act defines the term "contaminant" as meaning any physical, chemical, biological, or radiological substance or matter in water.[42]

As described by the United States Environmental Protection Agency (US EPA), the following are general categories of drinking water contaminants and examples of each that are also relevant to non-potable water:

- *Physical contaminants*: Particles that primarily impact the physical appearance or other physical properties of water. Examples of physical contaminants are sediment or organic material suspended in the water of lakes, rivers, and streams from soil erosion.
- *Chemical contaminants*: Elements or compounds that may be naturally occurring or man-made. Examples of chemical contaminants include nitrogen, bleach, salts, pesticides, metals, toxins produced by bacteria, and human or animal drugs.
- *Biological contaminants*: Organisms in water. They are also referred to as microbes or microbiological contaminants. Examples of biological or microbial contaminants include bacteria, viruses, protozoa, and parasites.
- *Radiological contaminants*: Chemical elements with an unbalanced number of protons and neutrons resulting in unstable atoms that can emit ionizing radiation. Examples of radiological contaminants include cesium, plutonium, and uranium.

Water contaminants have different impacts on human and ecological health depending on their type and concentration. For example, non-harmful physical contaminants (e.g., salts) may often be detected in relatively high concentrations in a water source with relatively low or no resulting effects on human health, while it can have a long-term impact on the environment. On the other hand, the presence of certain pathogens or chemicals, even in low concentrations, may have the potential to cause

41 https://phasocal.org/wp-content/uploads/2018/12/RegulatoryLandscape_DiscoverDocument-Dec2018.xlsx

42 https://www.epa.gov/ccl/types-drinking-water-contaminants

serious harm. In the context of this Project, the public health risk will vary with the source and use of non-potable water, the size, and the plumbing complexity of the buildings.

Rainwater coming from the roof of a single-family home that is well maintained and regularly cleaned will typically present a lower risk of contamination than stormwater flowing at the ground level, containing oil, grease, and other pollutants. Greywater coming from most laundry loads and showers will, on the whole, contain fewer dangerous pathogens than blackwater from toilets and kitchen sinks. Thus, each water source and its specific uses are addressed differently. For example, rainwater can be used in a garden on any plants, while greywater is not allowed "to irrigate root crops or food crops where the edible parts of food crop touch the soil" as explained in the County of San Diego guidelines.[43]

Different Level of Requirements Depending on the Water Use

Outdoor applications have been addressed more easily by each jurisdiction as these uses do not necessarily require pre-treatment of non-potable water sources to protect human or ecological health. In these cases, the regulation is more streamlined and easier to find. The cities of Chula Vista and San Diego as well as the County of San Diego have programs in place for outdoor use. However the City of Imperial Beach does not provide guidance on their website; when contacted they direct residents to the City and County of San Diego websites and guidelines. Conversely, indoor use requires a higher level of treatment than outdoor use. As the risk of exposure to pathogens and contaminants increases, more treatment or other barriers to exposure are required. Treatment systems are more difficult to handle and require a more stringent permitting and inspection process. For indoor applications, jurisdictions provide nearly no information online and default to state codes such as the California Plumbing Code, which requires a high standard of treatment regardless of the end use,[44] and is not aligned with a risk-based approach as required by Senate Bill 966.

State Level Requirements and Variations in Local Communication

At the state level, the California Plumbing Code (CPC) provides requirements to install rainwater capture systems and greywater systems.

- Rainwater capture systems (described in Chapter 16 of the CPC) do not require permits for tanks smaller than 5,000 gallons. For larger volumes, permits are required. However, the CPC does not provide guidance on how to permit these larger tanks. Those permits are left to the municipal jurisdiction and county discretion. This lack of guidance has led to a barrier that is discussed in the following chapter based on the actual experience of rain tank installers.
- Greywater systems are described in the Chapter 15 of the CPC (Alternate Water Sources for Nonpotable Applications). Greywater systems are separated into three categories depending on the volume that is discharged and the complexity of the systems:
  1. Clothes washer system: This is a simple connection to laundry, also known as laundry-to-landscape system. The installation, change, alteration, or repair of the system does not include a potable water connection or a pump and does not affect other building, plumbing, electrical, or mechanical components including structural features, egress, fire-life safety, sanitation, potable water supply piping, or accessibility. This system does not require a construction permit per CPC requirements.
  2. Simple system: This system is defined in section 1502.1.2 as a system which *"exceed[s] a clothes washer system and shall comply with the following: (1) The discharge capacity of a gray water system shall be determined by section 1502.8. Simple systems have a discharge capacity of 250 gallons per day or less. (2) Simple systems shall require a construction permit, unless exempted from a construction permit by the Enforcing Agency. (3) The design of simple systems shall meet generally accepted gray water system design criteria."* A simple system requires a permit per CPC requirements.
  3. Complex system: This system is defined per section 1502.1.3 of the CPC. *"Any gray water system that is not a clothes washer system or simple system shall comply with the following: (1) The discharge capacity of a gray water system shall be determined by section 1502.8. Complex systems have a discharge capacity over 250 gallons per day. (2) Complex systems shall require a construction permit, unless exempted from a construction permit by the Enforcing Agency."* A complex system requires a permit per CPC requirements.

Jurisdictions have implemented guidelines and permit processes following these CPC requirements. The City of San Diego describes the greywater system requirements and guidelines in two separate documents[45,46] as does the County of San Diego.[47,48] The City of Chula Vista describes the laundry-to-landscape system in one brochure.[49]

TABLE 8: Departments Having Authority in Each Jurisdiction to Issue and Enforce Greywater System Permits

JURISDICTIONS	DEPARTMENTS HAVING AUTHORITY
City of San Diego	Development Services Department
City of Imperial Beach	Community Development Department
City of Chula Vista	Development Services Department
County of San Diego	Department of Environmental Health

Per section 1502.13.1 Future Connection of the CPC, *"Gray water stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping."* However, it has been found that the requirement to include stub-out can vary between jurisdictions. For example, the City of Chula Vista has been proactive in encouraging greywater use as most single-family homes and duplexes built after June 2013 are pre-plumbed for a laundry-to-landscape system. In contrast, the City of San Diego does not provide information about such installation in their documents. The variation in communication may impact the widespread adoption of greywater systems and has led to barriers in the effectiveness of installing greywater systems, which are discussed in greater detail in the following chapter.

- As explained above, the CPC provides detailed requirements for greywater system installation, use, repair, and maintenance. Sections of Chapter 15 (such as §1502.5 Plot Plan Submission, §1502.7 Drawings and Specifications, §1502.8.2 Commercial, Industrial and Institutional Occupancies to name a few) refer to the "Authority Having Jurisdiction" (AHJ) when requirements must be verified and/or implemented by the local jurisdictions. For example, §1507.2 specifies that the *"Authority Having Jurisdiction may require the following information to be included with or in the plot plan before a permit is issued for a gray water system, or at a time during the construction thereof."* This indicates that some variations may occur between jurisdictions. For a greater use of greywater, easily identifying the AHJ is

43 COSD-07 in Appendix C

44 NSF 350 standards

45 SD-02 in Appendix C

46 SD-03 in Appendix C

47 COSD-01 in Appendix C

48 COSD-02 in Appendix C

49 CV-05 in Appendix C

important. For single-family dwelling outdoor use, the AHJs have been identified in Table 8.

Variations Across Jurisdictions Leading to Confusion

Local jurisdictions follow state and regional requirements for indoor and outdoor use of non-potable water. However, each jurisdiction has the ability to adopt higher level requirements to their specifications, creating variations. As explained above, the CPC provides standards and details the installation and use of greywater systems, which are separated into three categories for any type of buildings (residential, commercial, industrial, and institutional): 1) clothes washer systems (connecting a single laundry machine to the landscape area) for which no permit is required, 2) simple systems connecting bath tubs and bath sinks in addition to laundry machines which are projected to discharge less than 250 gallons of greywater per day, and 3) complex systems exceeding the two previous systems in number of connections which are projected to discharge 250 gallons of water per day or more. The last two categories of systems require a permit per CPC requirements. The CPC permitting process of these three categories is currently followed by the four jurisdictions that have been investigated.

It is interesting to note that in 2013, San Diego City Council member Sherri Lightner became interested in greywater and decided to campaign to city council to reduce restrictions by changing the language in the City of San Diego code to include simple shower systems in the "no permit required" zone.[50,51] Although this was well intentioned, political factors restricted the effectiveness, so the language from 2013 to 2018 is different in two documents. One document (Bulletin 208) was consistent with today's language which is consistent with state code, while another "Greywater Fact Sheet" had some ambiguous language that indicated a shower greywater system using less than 250 gallons a day might not need a permit. During this period neither tradespeople nor enforcing agencies were clear about how this would be enforced, resulting in it not being addressed. Tradespeople did not pursue shower greywater systems, and the enforcing agency in the city did not realize there was any issue. This historical variation had created confusion amongst trade professionals as to how to effectively take this change into account. Since the beginning of this project, the city's documents have been updated to clarify this issue and new guidelines are now available to the public.[45,46]

50 https://www.kpbs.org/news/2013/may/01/graywater-rules-eased-san-diego/

51 https://www.kpbs.org/news/2013/apr/30/san-diego-approves-new-graywater-rules-for/

Existing Regulations to Build More Integration

The state-level Model Water Efficient Landscape Ordinance has been implemented by each of the four jurisdictions. This ordinance addresses the use of potable and centralized recycled water for landscaping, detailing the type of soil and plants to use for an efficient use of water. This ordinance helps integrate the use of water with landscape and supports conservation initiatives. Each jurisdiction has included it in their local municipal code with some variations. The County of San Diego and City of Chula Vista have used this ordinance to include alternative water use, such as greywater and rainwater use, to further promote the reuse and conservation of water.

The City of Chula Vista included the use of greywater and rainwater in the Landscape Water Conservation Ordinance,[52] Chapter 20.12:

> *Section 20.12.010 Purpose "F. Conserve water by capturing and reusing rainwater and gray water wherever possible and selecting climate-appropriate plants that need minimal supplemental water after establishment."*
>
> *Section 20.12.100 Landscape construction plan. "The landscape construction plan shall include all elements of hard landscape, paving, storm water management and drainage not shown on civil engineering plans. It shall include physical layout, specifications and details. The landscape construction plan shall include plans, details and specifications of any water features that comprise the overall landscape improvements. Implementing storm water best management practices into the landscape and grading design plans to minimize runoff and to increase on-site rainwater retention and infiltration are encouraged."*
>
> *Section 20.12.200 Recycled water and gray water. "Newly constructed and rehabilitated landscapes for public agencies and private development projects with a landscape area equal to or greater than 2,500 square feet including, but not limited to, industrial, commercial, cemetery, public, quasi-public, institutional and multifamily residential development shall use recycled water or gray water for irrigation purposes where it is available."*

52 CV-03 in Appendix C

Below is an excerpt of the County of San Diego's Water Conservation in Landscaping Ordinance,[53] Ordinance No: 10427 amending Title 8, Division 6, Chapter 7:

> *Section 86.701. Purpose.*
>
> *"(c) Promote the use, when available, of tertiary treated recycled water and graywater for irrigation landscaping . .*
>
> *(e) Encourage proper planning, design, installation, management, and maintenance of landscapes that will achieve the conservation and efficient use of water in landscapes by:*
>
> *. . . (3) Conserving water by capturing and reusing rainwater and graywater wherever possible and selecting climate appropriate plants that need minimal supplemental water after establishment."*
>
> *Section 86.703. Applicability.*
>
> *". . . (b) The following projects for which the County issues a building permit or a discretionary permit may comply with the performance requirements of this ordinance, or conform to the Prescriptive Compliance Option set forth in this chapter, unless otherwise required through discretionary review to submit a Landscape Documentation Package:*
>
> *. . . (2) Any lot or parcel within a project with less than 2,500 square feet of an aggregate landscaped area that meets the Estimated Total Water Use (ETWU) requirements, found in Section 86. 713 entirely with treated or untreated graywater, or through stored rainwater captured on site. These projects need only comply with the requirements of Section 86.722(a)(5) & (6)."*
>
> *Section 86.707. Landscape Documentation Package*
>
> *"(c) The Landscape Documentation Package required by subsection (a) shall contain the following: (1) A project description that includes the date, project applicant, project location identified by address or parcel/lot number, total landscaped area in square feet, project type (e.g., new, modified, public, private, cemetery), water supply type (e.g., potable, recycled, well, graywater), checklist of all documents included in the Landscape Documentation Package, and project contacts for the applicant and property owner if different."*
>
> *Section 86.720. Graywater Systems*
>
> *"(a) Graywater systems promote the efficient use of water and are encouraged to assist in on-site landscape irrigation. All graywater systems shall conform to the California Plumbing Code (Title 24, Part 5, Chapter 16)."*
>
> *Section 86.721. Stormwater-management and rainwater retention*
>
> *"(a) Stormwater management practices minimize runoff and increase infiltration which recharges groundwater and improves water quality. Implementation is encouraged for stormwater best management practices in the design of landscape and grading plans in order to minimize wet weather runoff, to increase harvest and use through on-site rainwater retention and to increase infiltration."*

53 COSD-08 in Appendix C

In addition, the County of San Diego cross-references landscape design greywater use guidelines in the document "Graywater Systems for Outdoor Irrigation Design and Procedures Manual."[54] This is the only local jurisdiction that integrates this water source with a specific use.

Accessing Information Varies Across Jurisdictions

- The City of San Diego Public Utilities Department has dedicated a Water Conservation program to address the need

54 COSD-02 in Appendix C

for water conservation in the city. This program provides information to the public about greywater reuse, rainwater harvesting systems, and residential and commercial turf replacement programs. The Public Utilities Department provides guidelines for each type of non-potable water source accessible from one webpage.[55] The web visitor can then access further information per water sources. For example, the City of San Diego lays out its greywater program and policy accessible from one webpage even though they have been written by two different departments:

1) *Graywater Rebate and Systems Information,*[56] provided by the Public Utilities Department; and 2) *Graywater Systems Information Bulletin 208,*[57] provided by the Development Services Department. The web visitor can also apply for the rebate using the online application form.[58] The information is consolidated in one section of the website. If contacting the appropriate department (Public Utilities Department or Development Services Department) seems confusing at first, the City of San Diego's Public Utilities Department has a dedicated office staff and field staff which can provide personal service to each customer.

- The City of Chula Vista provides brochures containing information about rainwater and greywater for its residents via guidelines available on the City's website, by visiting the water section of the Chula Vista CLEAN Group.[59] The brochures are primarily tailored to homeowners. Implementation of systems for larger buildings requires a direct contact with the Building Division in the Development Service Department regarding plumbing codes and permits. According to the City staff, the wastewater group would also get involved during the permitting process to review the discharge of rainwater and greywater to the sewer. Our review was not able to determine if the permitting and implementation process is easy to do.

- The City of Imperial Beach is smaller than the other jurisdictions and their capacity to promote greywater and rainwater systems is more limited, as explained by a city representative during the Project's investigation. In compliance with the California Plumbing Code, the city allows the reuse of greywater and capture of rainwater. They direct their residents to City of San Diego and County of San Diego guidelines, as no information about these two sources is made available on the City of Imperial Beach's website. In addition, it is important to note that the water supplier for the City of Imperial Beach, California American Water, does not have a wholesale purchase contract with the San Diego County Water Authority as a member agency of the Metropolitan Water District (MWD), while San Diego Public Utilities and the two water retailers serving the City of Chula Vista do. The City of San Diego wholesales the water to California American Water. This difference is important for the public as rebates for rainwater harvesting and landscape conversion through the SoCal Water$mart program are funded primarily by MWD; thus Imperial Beach residents do not have access to rebates through the Landscape Transformations program. Currently, California American Water does not offer rebates to the residents of the City of Imperial Beach as explained on their website,[60] only water conservation commercial rebates are available.[61]

55 https://www.sandiego.gov/public-utilities/sustainability/water-conservation

56 SD-02 in Appendix C

57 SD-03 in Appendix C

58 SD-01 in Appendix C

59 https://www.chulavistaca.gov/departments/clean/conservation/water-conservation-reuse

60 https://amwater.com/caaw/conservation/district-resources/san-diego/other-rebates

61 https://dnnh3qht4.blob.core.windows.net/portals/2/Conservation%20and%20Rebates/Conservation/Commercial_Rebate_Application_SD.pdf?sr=b&si=DNNFileManagerPolicy&sig=EpXWYYU3456RHfdbttwAd5W8o5W5Us%2FQyfLSo5yUSaA%3D

- The County of San Diego has also created specific guidelines for rainwater and greywater reuse for residents, making the information available on their website. Information about rainwater catchment can be found by visiting the Department of Public Works (DPW).[62] The watershed protection program is hosted under the Environment tab of the main page of DPW. This webpage summarizes the information for residential, industrial, and commercial areas and also leads to rain barrel information.[63] Residents can thus learn how to use and maintain rain barrels as well as access resource documents.[64,65,66,67] A search on the county's website for "greywater" will take the visitor to the main page summarizing the greywater system information.[68] This page is also accessible by visiting the Environmental Health webpage. This page hosts a section on water (accessible from their dropdown menu) that addresses greywater. Following the CPC requirements, the County of San Diego provides the guidelines and requirements for greywater systems in two documents: 1) *Graywater System Requirements for a Single Clothes Washer*[69] and 2) *Graywater Systems for Outdoor Irrigation Design and Procedures Manual.*[70] The second document includes a section for indoor reuse with the requirements to meet NSF 350 standards or the California Department of Public Health statewide uniform criteria for tertiary disinfected recycled water, and the requirements of section 1604 of the CPC, "On-site Treated Nonpotable Graywater Systems." The County of San Diego also provides a summary of alternative water supplies to irrigate gardens.[71] These documents are found on the "Graywater Systems" page.

Mismatch Between Stormwater Management and On-site Reuse

Both the interpretation of regulations, and an agency or area's overall philosophy about how certain "kinds" of water should be engineered and managed, can affect the implementation of water reuse. In the case of stormwater management, regulations in the San Diego Region require on-site capture, filtration, and either infiltration or significantly delayed release of stormwater. The most straightforward means of meeting these requirements are typically on-site bioretention or underground treatment systems, which, while effective in reducing pollutants and ameliorating flooding, typically do not lead to other on-site uses of water uses such as landscape irrigation or capture for interior, non-potable use. The County of San Diego has recently studied the feasibility of different types of stormwater capture. This study looked at different means of retaining stormwater including practices to reuse stormwater on-site and help augment site-level supplies. This report will be further used in the forthcoming recommendations report as it describes on-site water reuse practices and methods to cycle water back to the natural environment or to wastewater treatment plants for further centralized reuse.[72]

Missing Information

- Regulations around the indoor use of non-potable water is a major missing piece in the regulations across all jurisdictions, which is not surprising as the risk for public health is higher and greater treatment and design oversight is generally required. Information was only found in the guidelines provided

62 https://www.sandiegocounty.gov/content/sdc/dpw/watersheds.html

63 https://www.sandiegocounty.gov/content/sdc/dpw/watersheds/residential/RainBarrelInformation.html

64 https://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/sw_2013_rb_resources.pdf

65 COSD-04 in Appendix C

66 COSD-05 in Appendix C

67 COSD-06 in Appendix C

68 https://www.sandiegocounty.gov/content/sdc/deh/lwqd/lu_graywater_systems.html

69 COSD-01 in Appendix C

70 COSD-02 in Appendix C

71 COSD-07 in Appendix C

72 http://www.projectcleanwater.org/download/tac-meeting-5/

by Los Angeles County and the National Blue Ribbon Commission. This is a current area of exploration at the state and among local jurisdiction's guidelines.

- The Project addresses groundwater caused by an underground source unexpectedly surfacing on a property. During our review, no information was available providing guidance on what to do in this circumstance, yet our stakeholders have revealed several examples of this happening around the San Diego Region. This unexpected occurrence can be viewed as an opportunity for on-site reuse. For example, a construction project in Encinitas required the diversion of groundwater that was surfacing on the property which prevented the completion of the construction. Consequently onsite contractors installed a sump pump diverting the groundwater to a nearby creek. Yet, homeowners wanted to use the water, so contractors with non-potable water reuse experience were brought in. They installed a 700 gallon underground tank with a desalination unit and tied the water into irrigation and a drinking water station. The overflow from this system was directed to a swale element with salt-tolerant planting.

  In another example, groundwater surfaced during the installation of a 5,000 gallon underground rainwater cistern and ran through the project. In this case, a screen element was installed to capture some of this water into a sump. Water was then pumped to the rainwater cistern as needed for irrigation. The use of this resource would benefit from guidelines to address it safely and efficiently.

This review of the regulatory framework of on-site non-potable water systems highlights the disconnect between water sources and uses, the lack of information, and areas of possible misinterpretation that can lead to confusion and lost opportunities. It provides a foundation to explore barriers in more detail in the following chapter.

BARRIERS

INTRODUCTION

Several categories of barriers to water reuse were identified, and are illustrated in Figure 8.

The immediate types of barriers encountered while reviewing the regulatory landscape for non-potable water use include: Regulatory barriers, lack of knowledge and education, and inadequate access to accurate information. As these categories were further analyzed it became apparent the two other overarching system barriers were also contributing, and even reinforcing these barriers. These include an overarching lack of system integration and an inequitable set of competing economics. The remainder of this chapter will provide more detailed information of these barriers and highlight some real-world examples to help illustrate these barriers.

It is important to mention that many of the barriers have been identified through the stakeholder interviews. Although some examples provided in this chapter may be perceived as anecdotal, they are actual, field experiences encountered by residents and trade professionals. The issues raised by these examples are often time not reported and this in itself is a barrier to assess accurately the installation and use of non-potable water systems. These examples are reported here to help identify the lessons learned and build better, more efficient, and adaptable practices. Ideally a region-wide survey and more research would provide valuable data and help measure the efficiency of rules and policies for on-site non-potable water reuse systems.

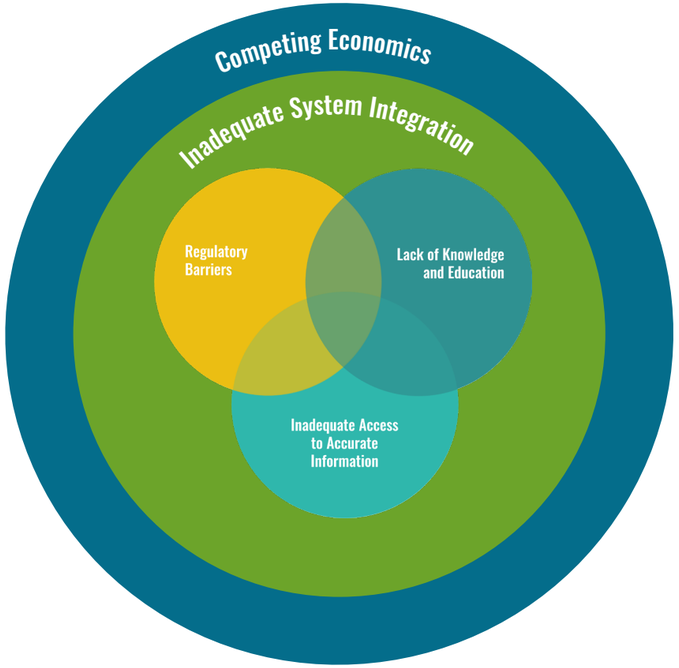


FIGURE 8: Main Categories of Barriers

Regulatory Barriers

- Regulatory Gaps and Inconsistencies
- Multiple Siloed Departments
- Mismatched Regulatory Framework
- Lack of Clarity
- Regulatory Thresholds Appear Arbitrary
- Lack of Consistency Across Jurisdictions
- Lack of Distinction Between End Uses

Regulatory Barriers

During the review of the regulatory framework for non-potable water reuse from state to local levels, as described in Chapter 4, we identified several barriers to mainstreaming strategies for non-potable reuse that are specific to the language and status of regulations. We highlight real examples of these barriers to help characterize the kinds of issues that limit more widespread understanding and use of non-potable water supplies. These examples are not meant to denigrate any jurisdictions but are captured here in the spirit of aiming this Project toward the solutions phase.

Regulatory Gaps and Inconsistencies

A regulatory gap is missing information in the regulatory structure. This is observed throughout the layers of state to local government. As seen in the examples below, gaps can cause uncertainty for regulators and homeowners in how to proceed with non-potable reuse systems.

- Example 1a: A/C Condensate Mentioned but Not Described.

A/C condensate is mentioned as a source for landscape irrigation in all Jurisdictional Runoff Management Programs and Best Management Practices (BMPs) manuals for the City of San Diego, County of San Diego, City of Chula Vista, and City of Imperial Beach. However, requirements for how to store it or types of treatment needed are not specified here or in any other part of the jurisdictional codes.

Here is a quote from City of Chula Vista JRMP, updated January 2018, Chapter 3, § 3.2.3 Control measures for controlled permitted non-storm water discharge categories:

> *"4. Discharges of non-storm water to the MS4 from the following categories are allowed on the condition that the discharge is addressed by the following BMPs, which are also discussed in the City's Minimum BMPs for Residential, Industrial, Commercial, and Municipal Sites/ Sources in Appendix C; otherwise, they will be addressed as illicit discharge.*
>
> *a. Air conditioning condensation – The discharge of air conditioning condensation should be directed to landscaped areas or other pervious surfaces, or to the sanitary sewer, where feasible."*[73]

- Example 1b: A/C Condensate Not Mentioned.

Furthermore, in the Landscape Standards Manual for the City of San Diego, there is mention of alternative irrigation systems which include rainwater and greywater; however, no mention of A/C condensate is made.

> *"2.3 DESIGN STANDARDS*
>
> *2.3-13.13 Alternative irrigation systems that may be used to augment water for landscape purposes include:*
>
> - *Graywater systems may be used when installed consistent with the Department of Water Resources Graywater Guide and upon permit approval and inspection by San Diego County Department of Environmental Health.*
> - *Rain water harvesting may be used to augment irrigation systems provided that the systems used to harvest and store the water are designed to prevent intrusion of trash, insects, and animals."*[74]

- Example 2: Inconsistencies Between State and Local Codes.

73 CV-12 in Appendix C

74 https://www.sandiego.gov/sites/default/files/dsdldc_landscapestandards_2016-04-05.pdf

An example of an inconsistency between the state and local jurisdiction concerns rainwater harvesting. At the state level, the Model Water Efficient Landscape Ordinance (MWELO) indicates that landscape design plans at a minimum shall identify any applicable rain harvesting or catchment technologies.

> *MWELO, §492.6 Landscape Design Plan: "(b) The landscape design plan, at a minimum, shall:*
>
> *. . . (11) identify any applicable rain harvesting or catchment technologies (e.g., rain gardens, cisterns, etc.);"*[75]

However, within the City of Imperial Beach municipal code on water efficient landscape there is no reference to rain harvesting.[76]

Yet, the State Department of Water Resources clearly states that by December 1, 2015:

"To comply, a local agency must perform one of the following actions:

- *Adopt by reference Sections 490-495, Chapter 2.7, Division 2, Title 23 in the California Code of Regulations*
- *Adopt the MWELO in detail - Sections 490-495, Chapter 2.7, Division 2, Title 23 in the California Code of Regulations*
- *Amend an existing or adopt a new Local Ordinance or Regional Ordinance to meet the requirements contained in the regulations*
- *Take no action and allow the MWELO to go into effect by default."*[77]

There are many instances where there is no specific reference for non-potable water sources. Most residents and trade professionals accessing this information may not know that it is the state code and not the local jurisdictional code that must be followed and would not think to access the state code to find more information. Local jurisdictions should incorporate all state codes into their local guidelines except where they choose to override them. All four jurisdictions have adopted the state requirements for greywater and rainwater systems in full with no additional restrictions.

Table 9 shows the requirements at the regional level that apply to stormwater and A/C condensate through the stormwater management plan.

Multiple Siloed Departments

It is generally recognized by regulators across the state that there is a lack of coordination and communication across different jurisdictions and agencies involved in regulating water management when it comes to the use of non-potable water supplies. This is highlighted in the "Safe Use of Alternate Water Survey" (CCDEH survey) conducted by Public Health Alliance of Southern California in 2016 with the California Conference of Directors of Environmental Health, the state-level professional trade organization of Environmental Health Directors. In this CCDEH survey, the majority of the respondents indicated that there is a lack of

75 https://water.ca.gov/LegacyFiles/wateruseefficiency/docs/MWELO09-10-09.pdf

76 Imperial Beach Municipal Code, Title 16, Chap.12: Water Efficient Landscape Regulations. http://qcode.us/codes/imperialbeach/

77 https://water.ca.gov/LegacyFiles/wateruseefficiency/landscapeordinance/docs/2015%20MWELO%20Guidance%20for%20Local%20Agencies.pdf

TABLE 9: Application of the Model BMP Design Manual San Degio Region and Jurisdictional Runoff Management Plans

REGIONAL LEVEL	CITY OF IMPERIAL BEACH	CITY OF CHULA VISTA	CITY OF SAN DIEGO	COUNTY OF SAN DIEGO
Stormwater	Adopted in full	Adopted in full	Adopted in full +	Adopted in full
A/C condensate	Adopted in full	Adopted in full	Adopted in full	Adopted in full

+ Additional restrictions apply as described in BMPs and JRMPs. These details are also reiterated by the Think Blue program

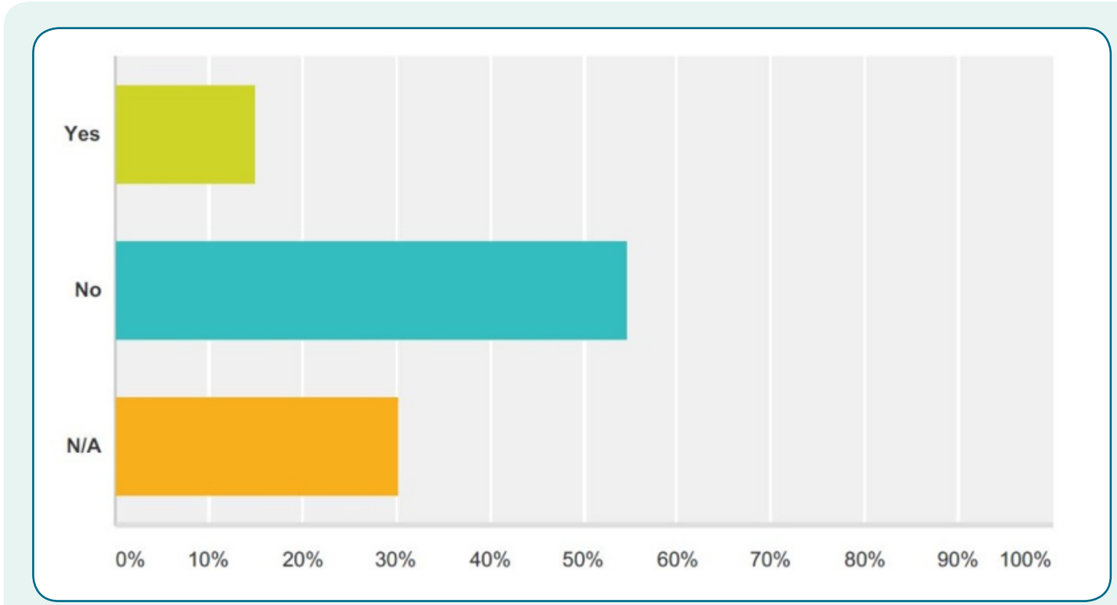


Figure 9: "In your jurisdiction, do you think there is satisfactory coordination and communication between Cities and County Environmental Health where alternate water is concerned?" (SOURCE: Survey conducted by Public Health Alliance of Southern California: Safe Use of Alternate Water: A Survey of California Environmental Health Directors. Question 9)

coordination and communication between cities and county-level governments on key issues related to greater use of alternative (non-potable) water (Figure 9).

This lack of coordination across departments is also evident in the San Diego Region. As issues around the benefits and risks of non-potable water straddle most segments of water policy, there are missed opportunities for resolving many layers of issues from water conservation to stormwater management to alleviating wastewater burdens. Each department regulates or promotes specific aspects of the water's end use, but a lack of integration makes it difficult for users to determine appropriate technology and challenging for departments to permit or regulate an holistic plan for a site. An holistic and integrated plan will take into account and address the different non-potable sources as well as the many different potential end uses. It is thus very important for departments' information, programs, and direction to the public (end users) to be fully integrated to promote and streamline the implementation of projects that are safe and useful.

Mismatched Regulatory Framework

Regulations for non-potable water use often are drawn from different sets of existing regulations, notably on-site wastewater and stormwater, both of which generally focus on separating people and spaces from contact with "contaminated" water. Moving towards holistic on-site capture and use requires thinking about water as a resource, and developing regulations intended to balance the objective of greater capture and use with the need to ensure proper system function, ecological conditions, and protection of public health.

Another example of the disconnect in treating a problem without leaving room in the regulation for opportunities is in wastewater disposal and treatment.

While most On-site Wastewater Treatment System (OWTS) ordinances might mention greywater, the primary focus of the ordinance is treating and disposing of wastewater, without any focus on reuse. Although this report does not focus on blackwater, the overall framework of water as a resource rather than a waste might inform a different method of regulating OWTS, which should include greywater. OWTS systems can separate treatment of shower, sink, and laundry water as a priority, while managing toilet water at a different level. From this high level we can consider how to implement blackwater systems that cycle water back into useful purposes more directly.

Regulatory frameworks designed only to mitigate or reduce problems miss opportunities to utilize all water as a resource. As San Diego embraces the One Water philosophy, imagining the variety of applications across water quality thresholds allows us to explore and adapt creative solutions that will enhance our communities.

Lack of Clarity

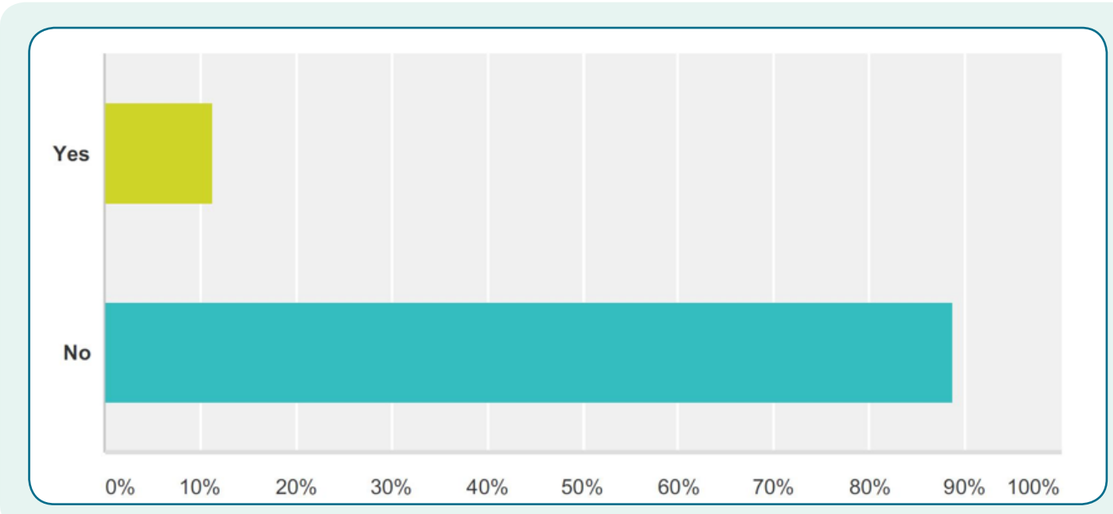


Figure 10: "In your jurisdiction, are you confident that there is regulatory clarity for businesses and project proponents where alternate water is concerned?" (SOURCE: Survey conducted by Public Health Alliance of Southern California: Safe Use of Alternate Water: A Survey of California Environmental Health Directors. Question 10)

Lack of regulatory clarity can make it difficult for business and project proponents to move forward on implementing non-potable reuse projects. In the CCDEH survey, almost 90% of regulatory respondents were not confident that there is regulatory clarity for businesses and project proponents where alternative water is concerned, as shown in Figure 10.

This lack of clarity is seen in the San Diego Region. Regulations for non-potable use often draw from similar applications in the regulatory framework, yet lack necessary distinctions for the appropriate variation in water quality or end use, leading to complicated, overregulated, or inappropriate application of rules. This results in lack of clarity for practical applications by regulators, professionals, and end-users.

Often, community gardens and other educational resource centers may not have a septic or wastewater system. There is no clear guidance on addressing on-site water reuse opportunities that arise in these situations, like vegetable washing or hand washing stations. Yet these scenarios are perfect opportunities for on-site non-potable reuse. Due to lack of specification in the code and a lack of clear understanding about feasible applications of these potential resources, regulators apply a case-by-case determination. That approach relies on the individual's knowledge of effective non-potable reuse strategies, and solutions may sometimes be implemented in less effective ways. For example, the surge tank shown in Figure 11 is from a community space in the County of San Diego that required a sink, yet had no existing septic system. The county inspector gave permission to implement the sink as a "greywater" system if a surge tank was included, and this system received approval. Unfortunately, this system has presented an ongoing maintenance issue because without a simple mechanism to clean out the surge tank, it often gets clogged with grease and emits odors. This example highlights that the addition of a surge tank to a greywater system is not routinely accompanied by information about maintenance.

For permitting, greywater factors for dispersal zone are based on rules for on-site wastewater system design related to the number of bedrooms and thus design flow. See Figure 12, an example from the County of San Diego. This approach does not account for upgraded showerheads, reduced consumption by conservation-minded households, or different numbers of occupants in the dwelling.[78]

Certainly, it is important to regulate to the worst case scenario in case the system changes ownership. However, regulating a system from the perspective of the initial system inception to its maturity may present a different way to determine discharge or perhaps a time model could be used to generate water reuse potential. Lack of clarity around practical application leads to underutilization of resources, potential health risks due to misunderstanding of application of regulations, and challenges in widespread use and understanding of non-potable water use strategies.

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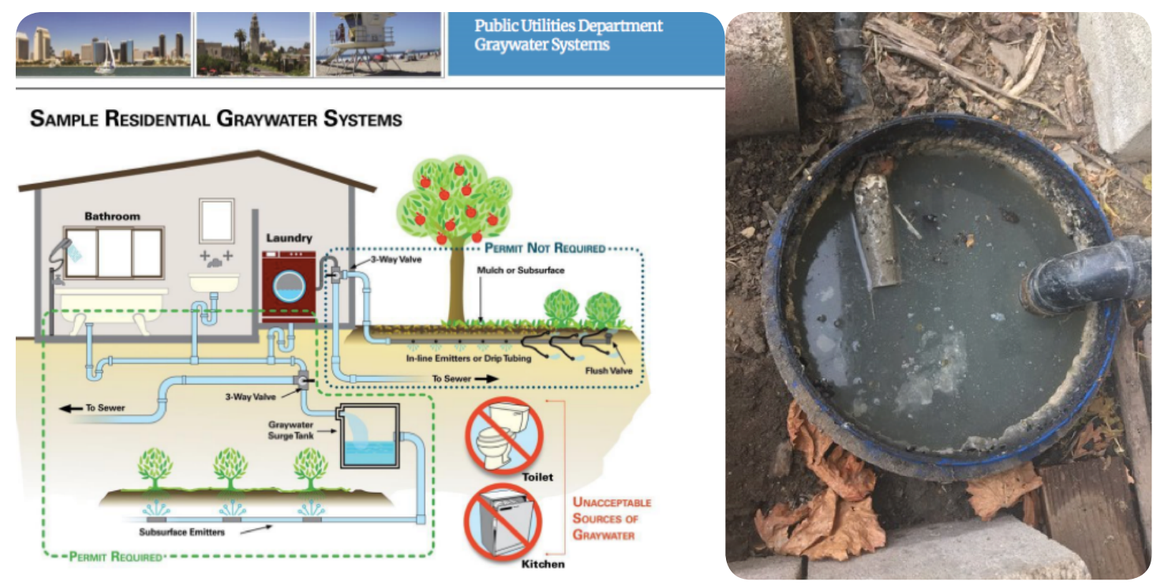

FIGURE 11: Surge Tank Examples

Left: Schematic of a greywater system with a surge tank (image courtesy of the City of San Diego)

Right: Actual surge tank with no maintenance becomes a health risk

Determining Discharge Volume

The graywater discharge for a single or multi-family dwelling is calculated using estimates of graywater use. These estimates can be based on water use records, calculations of local daily per person interior water use, or by using the following procedure:

1. **The number of occupants of each dwelling unit shall be calculated as follows:**
   - **First Bedroom — 2 occupants**
   - **Each additional bedroom — 1 occupant**
2. **The estimated graywater flow of each occupant shall be calcuated as follows where GPD = gallons per day and LPD = liters per day:**
   - **Showers, bathtubs, and wash basins — 25 GPD (95 LPD)/occupant**
   - **Laundry — 15 GPD (57 LPD)/occupant**
3. **The total number of occupants shall be multiplied by the applicable estimated graywater discharges as provided.**

Figure 12: Example of Greywater Factors for Dispersal Zone

Regulatory Thresholds Appear Arbitrary

Water quantity is often a targeted regulatory strategy, but some thresholds appear to be out of context.

- Example 1a: For example, the California Plumbing Code (CPC, section 1601.3 Permit) exempts from permitting rainwater storage systems under 360 gallons to be discharged as spray irrigation with no treatment of the water required. It is unclear why 360 gallons is the threshold. Yet, as shown in this study by Chemical Engineer, Richard Hill, spray irrigation has the potential to spread pathogens and should always be filtered appropriately:

  "Of more concern is the possibility of inhalation of pathogenic bacteria like Legionella spp *which are commonly found in rainwater. Aerosols formed during spray irrigation may be a source of infection from rain water so contaminated. Consequently a risk assessment should always be undertaken for any rain water system."*[79]

The threshold, and the way it is applied, does not mitigate the potential public health risk that spray irrigation from a smaller storage system with no treatment may present.

Although the CPC 16 (CPC, section 1601.6 Minimum Water Quality Requirements) mentions water quality requirements, it is unclear how to apply these to standard rainwater harvesting scenarios without collecting data from existing systems over time. When considering water quality, the number of gallons stored is not as relevant as the amount of time and the conditions in which it is stored.

- Example 1b: Aside from water quality issues, this threshold seems irrelevant when considering that a smaller system would be less likely to be discharged using a pressurized irrigation system for financial feasibility reasons than would a much larger system.

It remains unclear why the threshold of 360 gallons is used. Without context explaining what the threshold is in place for, it is hard to understand why this rainwater harvesting threshold has been allocated.

- Example 2: In another example, the CPC exempts rainwater storage systems less than 5,000 gallons from requiring a permit (see excerpt below). However, it is unclear what happens when storage exceeds this limit, or whether this limit is for one tank or total on-site capacity.

79 http://www.whitewaterlimited.com/BacterialActivityinHarvestedRainWater.pdf

TABLE 10: Summary of the Different Thresholds Defined per the CPC and/or Local Jurisdiction.

TYPE OF WATER	THRESHOLD	JURISDICTION	NOTES
Greywater	Laundry only	Per CPC	No permit required, followed by cities of Chula Vista, Imperial Beach, and San Diego and County of San Diego
	More than laundry + <250 gallons/day of water discharge	Per CPC	Permit required, followed by cities of Chula Vista, Imperial Beach, and City and County of San Diego
	More than laundry + ≥250 gallons/day	Per CPC	Permit required, followed by cities of San Diego, Chula Vista, Imperial Beach, and County of San Diego
Rainwater	Cistern size of less than 5,000 gallons	Per CPC	No permit required
	Cistern size of 5,000 gallons or more	Per CPC	Permit required but no requirements given by CPC Threshold seems arbitrary as these questions are unresolved: What is the baseline issue? How was this baseline defined?
	<360 gallons of storage capacity for spray irrigation	Per CPC	No permit required, no requirements in term of water quality
	≥360 gallons of storage capacity for spray irrigation	Per CPC	Permit required, minimum water quality: *Escherichia coli*: <100 CFU/100 mL + Turbidity: <10 NTU Threshold seems arbitrary as these questions are unresolved: What is the baseline issue? How was this baseline defined?

CPC Chapter 16, section 1601.3: "A permit is not required for exterior rainwater catchment systems used for outdoor non-spray irrigation where a maximum storage capacity of 5000 gallons of rainwater where the tank is supported directly upon grade and the ratio of height to diameter does not exceed 2 to 1 and it does not require electrical power or a makeup water supply connection."

In one instance known to the Advisory Committee, a homeowner asked her local jurisdiction if she could install two 5,000 gallon tanks. The jurisdiction determined that the code specifies any 5,000 gallon tank triggers a permit requirement. The jurisdiction was unclear on how to authorize a permit, so to avoid complication and the added expense associated with obtaining a permit, the homeowner then installed two 4,950 gallon rainwater tanks.

Meanwhile, there was a potential issue with the citing of the tank due to the septic system's location, yet because there was no trigger for the local jurisdiction, there was no way for officials to guide the homeowner toward a safe, practical installation.

In some instances, a 5,000 gallon tank on a flat, compacted location might create no safety issues, but a 1,000 gallon tank installed on a leveled area on a hillside might create a real safety concern. These kinds of nuances are not addressed by the threshold included in the California Plumbing Code above.

In another example, a threshold of 250 gallons per day (GPD) is applied in both the City of San Diego and the County of San Diego greywater ordinances, as seen in Figure 14 showing an excerpt of the County of San Diego greywater manual[80]. This threshold derives from the CPC Chapter 15. The issue with this threshold is that a system discharging 250 gallons per day will have different impacts depending on the site conditions. For example, a residential site using an older laundry machine that discharges 50 gallons per load, more than five times

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in a day would still not require a permit because it is a "clothes washer system," even though it is discharging 250 gallons or more in one day. Yet a single person showering once a day for five minutes with a low flow showerhead would generate only 10 gallons per day, requiring a permit. In each case, the relative amount of pervious area and the percolation of the soil are important in determining how much water will be appropriate to discharge for a healthy system, neither of which is addressed by this threshold. Although there are charts and formulas for applying water usage and soil percolation in the CPC Chapter 15, determining these factors can be much more situational and requires more information to make educated decisions than is readily available. This arbitrary threshold can therefore cause problems for residents who are installing systems without a permit (clothes washer) yet are unknowingly exceeding the threshold and may not have the soil type or area amenable to such a large volume.

These examples demonstrate the importance of ensuring that our regulatory framework corresponds to the pertinent recommendations and qualifications for ensuring public health and safety. Broadening the lens of how to apply techniques to a variety of situations safely and appropriately, by using a risk based approach, will help establish effective regulations and help end users better understand how to apply the regulation. Permitting can be an important way for regulators and end users to review plans and site conditions carefully, and ensure good design and installation. Language in the code and in documents detailing the guidelines should encourage this dialogue by creating context for any limitations so end users have complete information and can seek guidance when needed.

Lack of Consistency Across Jurisdictions

Although local jurisdictions have the authority to implement variable approaches to regulating non-potable water use, the presence of stark differences in regulation among jurisdictions within San Diego County's relatively small geographic area do not support a "business-friendly" climate for trade

Figure 13: Installation of Two 5,000 Gallon Cisterns

SIMPLE SYSTEM

A simple system exceeds a clothes washer system and has a discharge capcity less than 250 gallons per day (gpd). Simple systems shall comply with the following:

1. **A construction permit is required for the installation of a simple system. No construction permit shall be issued until a plot plan with appropriate data to allow for a design review is submitted and approved by DEH.**
2. **The discharge capacity of a graywater system shall be determined as described in the "Discharge Volume" section on page 4 of this guideline.**
3. **A simple system shall meet the design criteria found in Chapter 16 of the CPC.**

COMPLEX SYSTEM

Any graywater system that discharges ≥ 250 gpd is considered a complex system, and shall comply with the following:

1. **A construction permit is required for the installation of a complex system. No construction permit shall be issued until a plot plan with appropriate data to allow for a design review is submitted and approved by DEH.**
2. **The discharge capacity of a graywater system shall be determined by using the "Discharge Volume" section on page 4 of this document.**
3. **A complex system shall meet the design criteria found in Chapter 16 of the CPC and be designed by a person who can demonstrate competence to the satisfaction of the Enforcing Agency.**

Figure 14: Excerpt of the County of San Diego Greywater Manual[80]

professionals and can create confusion. Additionally, lack of communication between jurisdictions that share water resource management also has potential to result in confusion, diminish the potential for more widespread use, and lead to missed opportunities for collaboration.

While the California Plumbing Code specifically allows greywater stubouts during construction of a dwelling with no permit required,[81] local jurisdictions have the authority to defer to that code or create their own language about the inclusion of stubouts during construction.

> *CPC, Chapter 15, §1502.13.1: "Future Connections. Gray water stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping."*

The following example shows different regulation for greywater stubouts. In this example we are highlighting Chula Vista's regulations, as well as regulations from two jurisdictions that are in our region, but not explicitly part of our study area, for illustrative purposes.

In Encinitas, in 2015, Chapter 23.12.110[82] was amended to include:

> *"Graywater systems. Newly constructed single-family dwelling units shall be pre-plumbed for a graywater system permitted and constructed in accordance with Chapter 15 of the California Plumbing Code and including a stub-out in a convenient location for integration of the graywater system with landscape irrigation systems and accepting graywater from all sources permissible in conformance with the definition of graywater as per Section 14876 of the California Water Code."*[83]

Although this regulation went into effect in September 2015, it was not being enforced until 2017 because neither developers, nor the people permitting new dwellings, knew how to implement these stubouts. Although this code change is a big move in the right direction of mainstreaming non-potable water reuse, the language implies that homes have to use all the greywater in the home and use it

81 2016 California Plumbing Code 1502.13.1: "Future Connections. Gray water stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping"

82 http://www.qcode.us/codes/encinitas/view.php?topic=23-23_12-23_12_110

83 https://law.justia.com/codes/california/2016/code-wat/division-7/chapter-22/section-14876

from a single stubout. By the limiting language of this code, it may be impossible for residents to install a greywater system in the future due to the complicated nature of a whole house greywater system.

At the same time, Chula Vista mandated greywater stubouts, but only for effluent from washing machines, or all new construction.[84]

> *"15.28.020 Residential graywater stub-out.*
>
> *All new detached single-family dwellings and duplexes shall include a single-source clothes washer graywater outlet and an outside stub-out to allow the later installation of a clothes washer graywater irrigation system that complies with the requirements of Section 1502.1.1 of the 2016 California Plumbing Code. The outlet and stub-out shall be installed in accordance with the Chula Vista clothes washer graywater pre-plumbing and stub-out for new residential construction or an equivalent alternate method and/or material approved by the Building Official."*

Laundry greywater is much easier to implement as a retrofit without a stubout due to the general location of washing machines near an outside wall, and the ability to tap into the pump on the washing machine. Generally for most homes with a newer water efficient washer, the volume of water generated from a laundry machine is not as significant as from a shower, especially if there are multiple people in a household. These are the primary reasons laundry greywater does not require a permit throughout California.

These two stubout regulations require very different approaches and achieve very different relative effects. In either location, and throughout San Diego, there have been many implementations of stubouts by builders that do not facilitate true ease of greywater use after building. More readily available information on appropriate stubout implementation is required to ensure this resource can be tapped into in the future.

Other jurisdictions in the San Diego Region defer to CPC 1502.13.1. The plumbing code states:

> *"Gray water stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping."*

A Solana Beach homeowner recently reiterated their rights per the plumbing code, yet the inspector asserted that stubout plumbing is not allowed, although this is not specified in the Solana Beach code. Below is an excerpt from the homeowner's letter sent to the Solana Beach City Council:

"Our city does not allow graywater "stub-out" without first receiving an approved and paid for permit for the entire system. So, old people like me are less likely to bother going thru the process of designing and waiting for approval of a graywater plan - and so future owners will not be practically able to re-use this water ... ever."

Through collaboration and integration, water agencies and agencies that manage building and development permitting can capitalize on streamlined approaches that benefit consumers and regulators by creating a larger group of potential users who understand both system design considerations, and the rules across jurisdictions.

Lack of Distinction Between End Uses

Currently, water use guidance for water quality, landscape irrigation planning, and drought restrictions does not attempt to differentiate between end uses like turf versus food production. Since one of the aims of this Project is to support food production, this lack of distinction can in fact be detrimental to food production, which is an important health benefit, especially in low-income communities. Drought conditions can further trigger restrictions that can harm opportunities for more resilient water, soil, and ecosystems. Additionally, landscape frameworks throughout the jurisdictions, including water conservation information and codes pertaining to landscape development, describe plants and designs that use "less water" but not always landscapes that use water more productively.

During drought periods, there is a distinct disconnect between the genuine lack of water security and regulations that do not address appropriate use of a decreased water supply. For example, as of 2016, Sweetwater Authority resumed Level 1 Drought restrictions. One of the restrictions that remains in place is

"Customers are encouraged to limit landscape irrigation with sprinklers to no more than 3 days per week between the hours of 6:00 pm and 9:00 am. A 30 day grace period is extended to customers establishing new lawns."[85]

Any number of questions about optimal water use are raised by blanket restrictions of this nature, and the specific call-out of "new lawns." First of all, it would be more efficient to restrict implementation of new lawns during this period. Secondly, growing food in backyards may require more frequent watering than three days a week but contributes ultimately to a lower water footprint when food can be grown and utilized on site.

Another example is from the City of San Diego's Landscape Manual which states:

> *"All new development with a landscape area of 500 square feet or greater must demonstrate compliance with a MAWA Water Budget unless exempted in Section 2.6-2."*

This is an important method for implementing new plantings, but it does not allow for or acknowledge the potential for growing food plants or plants that might need more water (such as newly-planted trees), but provide ecosystem services, or that could rely in whole or in part on alternate water sources. Although the state ordinance allows this, the local ordinance does not specify anything and does not specifically state that it is deferring to state ordinance, so a professional or resident unfamiliar with the state code would not know to look beyond this local code.

Additionally, calculations for loading rates for non-potable reuse in landscape applications fail to take into account transpiration of water by plant material, and soil improvement by plant material and mulch over time.

84 https://www.codepublishing.com/CA/ChulaVista/#!/chulavista15/ChulaVista1528.html

85 https://www.sweetwater.org/353/Water-Waste-Prohibitions

DESIGN OF SIX TYPICAL SOILS		
TYPE OF SOIL	MINIMUM SQUARE FEET IRRIGATION/ LEACHING AREA PER 100 GALLONS OF ESTIMATED GRAYWATER DISCHARGE PER DAY	MAXIMUM ABSORPTION CAPACITY OF GALLONS PER SQUARE FOOT OF IRRIGATION/ LEACHING AREA FOR A 24-HOUR PERIOD
Coarse sand and gravel	20	5.0
Fine sand	25	4.0
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand and gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8

For SI units: 1 square foot = 0.0929 m2, 1 gallon per day = 0.000043 L/s

Figure 15: Loading Rates Provided by the California Plumbing Code, Chapter 15, Table 1502.10

Lack of Knowledge and Education

- Gaps in Knowledge
- Misleading Information
- Lack of Cultural Sensitivity
- Poor Community Engagement
- Lack of Evidence-based Research
- Lack of Understanding of Prioritization

Lack of Knowledge and Education

There is a widespread lack of knowledge and familiarity around non-potable water reuse. Part of this is specific to this niche area of non-potable water, and part of it is linked to a broader lack of holistic water literacy. Broader water literacy includes knowledge about water sources, water management, and water-related issues. A deeper regional water literacy is crucial in order to inform strategies for more efficient and effective approaches to water-related implementation that are specific and appropriate in our local built environment. Water literacy is also important to assure practical water care for our regional ecosystems and watersheds. Most people have an isolated understanding of water as it pertains to their specific usage or profession. This results in water waste, watershed contamination, and inequalities in access to resources among social and economic divides. Without a more contextualized understanding of where water in our region comes from, and at what cost, what impacts water and development policies have on water supply and watershed health for our region, how our daily choices directly impact future access to water, and how we collectively impact the health and well-being of the ecosystems that support our existence, we cannot adequately create policies that will ensure a sustainable future for our communities.

The examples below highlight instances where lack of knowledge and education creates barriers to more widespread use of non-potable water strategies.

Gaps in Knowledge

Gaps in knowledge occur across a wide range of actors. These include regulatory authorities, contractors and developers, commercial and residential property owners, and residents.

Regulatory Authorities: It may be surprising, but regulatory authorities themselves recognize that some practitioners in their field have gaps in knowledge. Results from a survey of the California Conference of Environmental Health Directors (CCDEH) show that 63% of Environmental Health directors in California identified insufficient expertise internally to be an important obstacle in alternate water regulation.[86]

Regulatory authorities can sometimes be misinformed, or under-informed, about non-potable reuse strategies, thus limiting their capacity to inform inquiring members of the public. To help illustrate this point, we provide some anecdotes from the field. Researchers on this Project have heard water agency leaders in Southern California (but not in the San Diego region) announce publicly that laundry to landscape with greywater systems was strictly and absolutely prohibited due to public health concerns, as recently as September 2018. Although this was factually inaccurate, it had a chilling effect for those attending the meeting interested in utilizing these systems.

Sometimes a lack of regulatory authority knowledge may be contributing to extra permitting fees. Local contractors sought a permit in Chula Vista for a 3,000 gallon underground rainwater tank system. The staff in the Chula Vista Planning and Building Department detailed $8,000 in special advisory fees to get a permit for the system, presumably because they were unfamiliar with the requirements to permit this type of system. This would have more than doubled the cost of the project, so the contractors and homeowner decided to continue with the project

86 Survey conducted in 2016 by Public Health Alliance of Southern California: Safe Use of Alternate Water: A Survey of California Environmental Health Directors. Question 11: Under the current standards-based (i.e., NSF 350, Title 22) regulatory approach, what do you see as the most important obstacles to effective regulation?

but forgo the permit. The contractor applied best practices required in permitting of such projects in other parts of San Diego County. This could have been an opportunity for the jurisdiction to benefit from the contractor's experience and also connect with other jurisdictions that already had these types of systems on the books. Rather, the whole conversation was shut down by prohibitive cost.

There are instances when the jurisdictional point person disseminating regulatory guidance on the phone is not the person with the expertise needed to provide accurate and effective guidance. For instance, at a certain point in the process of searching for information on the website, a resident will often be directed to ". . . contact the city or county offices." Phone-based inquiries are not always directed to a single delegated official with a detailed knowledge and understanding of all the many aspects of non-potable water use. In most cases, no guiding "script" has been developed to uniformly communicate information to callers. Therefore, the information that is communicated varies and is variable depending on who answers the call and their level of knowledge and expertise. This can result in mixed messages to the public about the validity of different non-potable opportunities and the details to implement, or who to contact or where to go for accurate information.

An installer shared details from an incident when they were trying to get an inspection for a greywater permit in the County of San Diego.

"I called into the County of San Diego inspection hotline to schedule an inspection, but they couldn't schedule a greywater permit inspection through that hotline, so I was transferred twice and ended up leaving a message on a machine that I hoped would get me an appointment for inspection. Finally, I called a resource I had directly in Land and Water Quality. He said he would help me if the message I left didn't result in an appointment."

This shows that although greywater permits are offered, they are not sent through the same stream as general building permits, and in fact are not well understood by many of the people answering phones, nor is the automated system ramped up to deal with greywater permitting. Local jurisdictions are the front lines of information dissemination and are key to providing the right information to the public. It is essential that information related to non-potable reuse can be shared more consistently and accurately across all levels of jurisdictional responsibility. More consistency will promote a greater and safer use of non-potable water systems.

Contractors and Developers: Builders rely heavily on code and compliance when designing water systems for construction, while trying to maintain profit margins. Yet, without well understood benefits from implementation of alternate water systems, property owners that request additions of non-potable water elements are faced with added cost rather than cost offsets should a set of practices that reduce material and labor be used. Regulation that supports well informed regional water literacy will ensure that contractors and developers can implement community-conscious designs that include non-potable water use and landscape elements that add benefit to the community.

Commercial Property Owners and Managers: There are few benefits for Commercial Property Owners to create holistic green spaces at commercial sites. Conservation generally adds cost to commercial projects because of the lack of clear regulation around creating non-potable water systems, parking lots and streets that harvest stormwater and grow plants, landscaped areas that grow food or grow plantings with stormwater, A/C condensate, or other forms of non-potable reuse. Permitting alternative systems that deviate from current well-understood guidelines is a barrier for commercial property owners to adopt new strategies and is generally avoided.

Local zoning regulations and landscape codes, especially "low water use" guidelines, can also discourage or even prohibit the installation of holistic spaces.

Without commonplace knowledge and understanding of non-potable reuse strategies, our collective community has little to no perception of maintenance requirements for such systems. Property managers may perceive anything out of the ordinary as burdensome, particularly if it requires specialized knowledge and training among a sector that often has turnover.

"The San Diego Housing Commission is exploring non-potable water use for landscape irrigation as an important step to support the agency's goals for continuing to reduce water use while maintaining quality environments for our residents. Among the challenges is identifying sufficient vendors in the market capable of providing cost-effective, efficient, ongoing maintenance of non-potable water systems to serve multifamily rental housing developments." – San Diego Housing Commission.

Homeowners: There are many ways in which a lack of water education prevents homeowners from effectively using non-potable water sources. Below are some examples:

- Many people think greywater can be used to water turf lawns. This demonstrates a lack of understanding about greywater water quality and the impacts of indoor habits of using detergent, bleach, and other cleaning products on that water quality. There is a disconnect for many between using this water and what goes into managing it once it leaves their property.
- Most people also do not know how much rainwater comes off their roofs and may think capturing it is a waste of effort, when most residential roofs shed thousands, if not tens of thousands, of gallons per year in average rainfall. This lack of knowledge, coupled with a lack of awareness related to the volume of water landscaping uses, means that non-potable water strategies are undervalued.
- Also, most residents do not know how much water they use when taking showers or washing laundry. While someone may opt to install a rain barrel to conserve water, they may simultaneously have an old showerhead in use, generating far more water waste daily than a rain barrel will capture in one day.

It is important for all people to understand, and benefit from, the value of implementing conservation strategies. When water education and literacy have practical and ethical applications in the built environment, conservation will produce returns on investment. Water knowledge will help ensure that our communities are developed in ways that value our water supply and watersheds, while also supporting human habitation and overall ecosystem health.

Misleading Information

At times, educational materials themselves can be misleading. In one example (Figure 16), the main landing page for greywater systems at the Department of Environmental Health for the County of San Diego shows a greywater picture demonstrating irrigated areas within a lawn.[87] Unfortunately, this picture is not very clear and can be interpreted by inexperienced users in ways that are not a good match for laundry greywater. The lawn in the picture is distracting. Some people might think this is a cross section of the lawn. They may misinterpret the image as communicating that using greywater on lawns is

87 https://www.sandiegocounty.gov/content/sdc/deh/lwqd/lu_graywater_systems.html

Figure 16: Confusing Image of Greywater Syste[87]

good, whereas the volume of water generated from a washing machine is not a good match for a lawn. If the interpretation is that this is not a lawn area but a mulched planting area, it is unclear if the water is being applied to the surface or discharged below the surface.

Another example demonstrates how information that is meant to help inform can result in barriers. The City of San Diego's Rainwater Harvesting Guide is a very thorough guide to water budgeting and planning a rainwater catchment system.[88] However, visuals used in guidelines can be sometimes confusing and misinterpreted by readers. For example, barrels shown in Figure 17 are not specifically made for rainwater catchment and could be seen as repurposed barrels. This could be a source of confusion for people completely new to the topic that do not know what all the options are or for people who rely on visuals rather than on document content, especially if the language of the document is not their primary language. Generally, repurposed materials create more of a maintenance issue and have less longevity than tanks made specifically for potable water storage. This information is essential if jurisdictions are posing as educational resources for consumers. Examples of rain tanks specifically designed for rainwater storage are shown in Figure 18.[89,90]

Municipal code and guidance documents throughout the region should have consistent definitions of cisterns, barrels, and tanks, while using these terms appropriately throughout any reference material. Improved water literacy would ensure that all residents can discuss strategies using terminology consistent within the regulatory arena.

88 SD-05 in Appendix C

89 http://www.bushmanusa.com

90 https://www.plastic-mart.com/category/232/rainwater-tanks

Figure 17: Barrels and Totes Not Specifically Designed for Rainwater Catchment[88]

Figure 18: Collections of Tanks Designed Specifically for Potable Water/Rainwater Storage[89,90]

Lack of Cultural Sensitivity

The current practice of water policy development does not adequately provide authentic opportunities to engage communities and get buy-in by people of different backgrounds and lived experiences. This is particularly true in historically underrepresented communities which might have distinct concerns, needs, and solutions around water.

Often, water policy stems from applying broad conservation strategies at a state or citywide level. Without understanding what people (particularly those in especially underserved communities) value and need, there is a significant missing piece to the feedback loop. These communities are often more attentive to valuing essential resources and preventing unnecessary costs. Sometimes there may be a complete lack of landscape, while other times there may be abundant food growth, often with greywater collected from sinks and showers to ensure every drop of water maximizes benefit to the resident.

Regional water education literacy will consider not only environmental issues, but include the assets, gaps, and barriers within the communities with the smallest water footprint in our region. Policy that embraces the needs of these communities and engages in healthy dialogue with appropriate cultural sensitivity, language access, information supplied across multimedia formats, and access to school and other public places as educational resources will benefit all of us. Inclusion of a feedback loop where end-users inform policy and policy informs end-users is also more adaptable and resilient to changing conditions over time.

Poor Community Engagement

Local agencies have educational programs to increase water literacy, but few introduce non-potable reuse as a viable resource. Literature available throughout San Diego County is helpful to engage community members at all levels of water literacy, yet pictures and language in the available materials do not always facilitate understanding of fundamental concepts.

- County of San Diego

The Water$mart Landscape, as one example, is a program of San Diego County Water Authority. They offer classes on how to convert turf/lawn using water saving strategies. This program includes no reference to greywater or rainwater use.[91]

- City of San Diego

The City of San Diego authored a brochure to be handed out at public events for rain barrel rebates. Although the program specifically says no homemade barrels qualify, all the pictures and diagrams are of barrels from other industries that have been repurposed for water capture. None of the pictures or diagrams display a proper rainwater harvesting setup with a debris excluder and a first flush diverter as well as a properly sized overflow (3").[92]

The City of San Diego Public Utilities Department links users interested in conserving water in their garden to the Turf Replacement Program[93] which is a program under the Metropolitan Water District.[94] The aim of the program is to reduce turf through water wise plantings, efficient irrigation, and rainwater capture. No mention is made of greywater use, which is understandable because Metropolitan delivers water widely across Southern California while each agency that receives water from Metropolitan has different variations on greywater policy.

- City of Imperial Beach

A search on the web for City of Imperial Beach water conservation leads a user to a flyer from California American Water. California American Water delivers water throughout the state, so there is no information specific to Imperial Beach or San Diego County at all.[95] From here users are directed to the California American Water website for more information about rebates and water conservation. Eventually a user will find a link to "Landscape Irrigation: System Evaluation and Management" from Cal State San Marcos, which has no information about using rainwater or greywater for landscaping and is strictly related to irrigation methods and calculations for landscapes.[96]

- City of Chula Vista

Chula Vista has great information about their efficient landscape and water conservation programs, which all include information about greywater and rainwater harvesting, as seen in Figure 19.[97] There is no information about reusing A/C condensate and some of the information about rainwater limits users to 55 gallon recycled barrels, but overall the outreach materials are cohesive and inclusive.

There are many organizations that educate about water conservation within San Diego. We will highlight these organizations more in our recommendations sections as potential partners for rolling out a larger water literacy campaign. In order to facilitate community engagement, these partners will be essential. At this point, most of the existing programs do not deal with greywater or rainwater or other non-potable reuse strategies, or they have only very elementary information available. For example, the Solana Center is a well-known organization that people all over San Diego County rely on for composting and other sustainability classes. Their website specifies:

"Solana Center offers recurring workshops on a variety of water topics, including: rainwater harvesting techniques, greywater systems, sustainable landscapes, manure management, and composting - to conserve, preserve and protect our water."[98]

91 https://www.watersmartsd.org/sites/default/files/2015_06_25_how_to_guide_final_sm_0.pdf

92 https://www.sandiego.gov/sites/default/files/legacy/thinkblue/pdf/rainbarrelbrochure_112514.pdf

93 http://www.BeWaterWise.com

94 http://www.bewaterwise.com/assets/mwd_residential-landscape-transformation.pdf

95 https://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/CA-SD_ConservRebates-flyer_FINAL.pdf

96 http://cesandiego.ucanr.edu/files/219742.pdf

97 https://www.chulavistaca.gov/home/showdocument?id=17773

98 https://www.solanacenter.org/resources/conserve-protect-water/rainwater-harvesting

Figure 19: Outreach Material Provided by the City of Chula Vista via the Nature Scape Program[97]

Yet, when we reached out to the Solana Center, they explained that the funding for many of their greywater, rainwater, and sustainable landscape programs, which comes from the County of San Diego Watershed Protection Program, is no longer available and they currently only offer 55 gallon rain barrels for sale with videos and information about installing and using those barrels. They do not have classes or information on more holistic rainwater harvesting or landscape water budgeting classes, nor do they have classes on greywater. It is unclear how they source their information and if they are promoting the most up-to-date principles of their funding agency. If they do not have programs running and they are not redirecting people, this is a gap for supporting community awareness.

Water agency representatives at public events often have extensive information about indoor fixtures – e.g., "fix your leaks," rain barrel rebate programs, waterwise landscape - but limited information on simple stormwater retention strategies for homeowners, large rainwater storage, or greywater. There is rarely, if ever, information about using A/C condensate as a resource or educating homeowners about how much greywater is produced from different fixtures in their home, and how this resource might relate to different kinds of landscape elements.

Additionally, multifamily residential and commercial property owners are unlikely to find information online about using these resources in multifamily sites, and often do not have information about their current water supplier, since bills and notices go directly to the property owner. Outreach and public education is critical for these projects, as on-site systems are operated and maintained by property managers and residents.

Lack of Evidence-based Research

- Underutilized, Existing Research

There are instances where research and literature exists; however it may be under-utilized.

Two examples, resulting in underrepresented opportunities for water reuse are A/C condensate and kitchen sink water.

- ***A/C condensate:*** Generally, residents and local officials have limited knowledge about how much condensate is generated daily, or annually, and how that resource may relate to reuse opportunities. Yet there is information and data to draw from. For example, the Alliance for Water Efficiency[99] has detailed information about A/C condensate production rates for residential and commercial, as well as water quality information that can inform jurisdictions on both regulation and education. If this information was more widely available and promoted by the water policy community, there would likely be a greater focus on utilizing this water resource, with proper practices and guidelines.
- ***Kitchen sink water:*** Kitchen sink water is considered "black water" by California code, and therefore unusable. Yet in Oregon[100] and Arizona, kitchen sink water is considered greywater and proper usage is described in public bulletins and resources as shown in Figure 20.

For many homeowners on a slab, kitchen sink water is one of the few opportunities to access on-site non-potable water for reuse. However, few homeowners have a clear understanding about how much water goes down the kitchen sink drain daily, and few recognize the environmental consequences of what goes down the drain. Naming the consequences of what goes down the drain and how much water is being used can elevate the significance of personal choices, particularly when applied to the larger perspective of a whole community sending large quantities of contaminated water to a centralized treatment facility. Instead of educating residents more about the consequences of what goes down the drain (though many sewer utilities provide information on keeping grease and fats out of the drain) and how much water is used in the sink, the use of kitchen sink

99 http://www.allianceforwaterefficiency.org/Condensate_Water_Introduction.aspx

100 https://www.oregon.gov/deq/FilterPermitsDocs/GWgenPublic.pdf

Graywater Reuse and Disposal Systems

- Graywater will contain whatever you put down the drain
- It's not toilet water, but it's not drinking water either!

Showers & baths	Bathroom sinks	Laundry	Kitchen sinks
• Relatively clean • Predictable volume and frequency	• Higher concentrations of hair, toothpaste, shaving cream, etc. • Low volume	• Predictable volume and frequency • Easy to retrofit • High concentration of lint and fiber • Detergents can be hard on plants. • Alkaline pH and B can affect plants	• No dishwashers or garbage disposals • "Dirtiest" source of graywater • May contain fats, oils, grease, and solids • May contain bacteria, viruses, and other microorganisms • Requires special plumbing for use

Figure 20: Excerpt from Greywater Reuse Requirements and Guidelines Provided in Oregon[100]

water in non-potable on-site reuse is largely banned, and opportunities for reuse are curbed.

- Need for New Clarifying Research

There are also a variety of instances where new data collection, analysis, and research are needed. Deeper research on the benefits and impacts of decentralized systems as compared to centralized systems is one of many areas ripe for further investigation.

Lack of Understanding of Prioritization

Variations on water quality and quantity discharged from different sources are not generally well understood. There is little agreement about what application of a gallon of water is most useful for individuals and for the larger community, which includes the ecosystem. This creates confusion about how to prioritize reuse strategies.

For example, many homeowners think it is a good idea to flush their toilets with greywater. But for most homeowners, the cost/benefit of greywater systems is greater when the quantity and quality of water is understood to be a better match for landscape basins that include trees and shrubs. If the trees and shrubs provide food for the homeowner, or services to the ecosystem (like pollination), there is even greater benefit/cost ratio. For greywater use in the landscape, treatment and pressurization is not necessary, or minimally so. Alternatively, homeowners often want to apply greywater on their lawns or vegetables without treatment, which can present health risks due to bacteria.

"Many studies have measured the level of pollution in a variety of sources that make up greywater. The findings show that some greywater sources contain fewer pollutants than the total greywater stream. The sources of greywater that contained the least amount of pathogens and toxic chemicals were bathrooms (hand washing sinks, showers, and bathtubs) and clothes washing machines in homes without children living in them. All untreated greywater sources contain increased levels of pollutants to the extent that they are not suitable for direct exposure like washing cars, toilet flushing, and spray irrigation. However, subsurface irrigation could be an acceptable use for untreated greywater."[101]

Cleaning water to the degree where it becomes sanitary enough (and free from solids) for use on vegetables and lawns requires additional filtration and maintenance and may eliminate the potential for a gravity fed system, meaning addition of a pump. The difference in cost associated with these additions may price many homeowners out of the greywater market. Whereas if homeowners understand that they should focus greywater on other landscaping, they may see a more reasonable return on investment and be encouraged to implement the system. Local installers explain that a simple shower gravity greywater system to trees/shrubs can cost $1,500-$2,500. When adding the need to filter the water to apply drip irrigation subsurface to a field of vegetables, or to subsurface irrigation fields for a lawn, or even further filtration to allow for surface irrigation, it can cost $4,500-$10,000.

Better information for end users about how much water is being discharged from various non-potable sources, applied in ways that are tangible for homeowners to understand, will help ease the appropriate application of these sources. Additionally, creating more awareness about water quality being

101 https://www.doh.wa.gov/portals/1/Documents/Pubs/337-108.pdf

discharged from different sources will help the community become better stewards of our ecosystem as they learn how to safely use and improve water of varying quality.

Inadequate Access to Accurate Information

- Lack of Easily Accessible Information
- Non-integrated Information Sources
- Language Barriers

Inadequate Access to Accurate Information

Because the topic of non-potable reuse is often not well understood by the general public, we have found non-potable reuse strategies underrepresented, misrepresented, and misinterpreted in communications by governmental agencies, educators, and end users.

Lack of Easily Accessible Information

Simple searches online for general or specific information about greywater, rainwater, and A/C condensate throughout the jurisdictions resulted in little, vague, or misleading information. It is not always apparent where to find information about codes, restrictions, or rebates at the local level for non-potable water strategies.

For example, on the City of Imperial Beach's website, there is no information available when online searches for "greywater" or "rainwater" are performed. However, when we asked city officials directly about their greywater and rainwater policies, they refer to guidelines provided by the City of San Diego and the County of San Diego. The lack of an easily accessible, single source of information in this situation could deter residents, property owners, or those in business trades from implementing non-potable water systems.

When it is difficult to find information on how to implement non-potable water strategies, there cannot be widespread implementation of these systems.

WATERSHED PROTECTION PROGRAM - EMAIL LIST SERVE BULLETINS

Publication Date	Bulletin Topic
November 5, 2018	Draft 2018 County BMP Design Manual Has Been Posted
October 18, 2018	Discounted Rain Barrel Sales Event
October 17, 2018	Draft 2018 County BMP Design Manual
October 2, 2018	Construction & Development: Are Your BMPs Ready for the Rainy Season?
September 26, 2018	Residential: Are You Ready for the Rainy Season?
September 26, 2018	Industrial/Commercial/Equestrian: Are Your BMPs Ready for the Rainy Season?
September 26, 2018	Helix Water District to Host WaterSmart Landscape Makeover Series Classes
September 5, 2018	WaterSmart Landscape Makeover Series

Figure 21: Excerpt of County of San Diego Newsletters

Non-integrated Information Sources

A variety of different information sources are currently utilized to distribute information. These sources include: websites, newsletters, direct mail, newspapers, workshops, flyers, online resources, and displays at public events. Undoubtedly many different strategies are needed to ensure that all populations have access to information. Yet outdated information presents challenges that can result in confusion for professionals and property owners about what is, or is not, allowed.

There are a wide variety of newsletters available from the County of San Diego on a range of subjects and across all sectors from residents to commercial applications. Newsletters are a great way to disseminate current information, yet only the people who subscribe to these newsletters have access to this information. Because this information is often not updated routinely throughout the county databases and online media, the remainder of residents accessing information can potentially be accessing outdated information. A recent excerpt, as seen in Figure 21, shows a sample of updates that may be missing within the greater county website.

People have different types of learning styles, and some methods may be more culturally appropriate than others. Depending on the audience and water use, physical visuals, descriptions of personal experiences, and demonstration sites can help deliver relevant information. For instance, an appropriate and integrated approach to water use, water conservation, and landscape design is better understood when one physically visits a site with a functional, accurate, and attractive example. Unfortunately, we have found that many demonstration sites across the county do not provide completely accurate, or the most practically useful strategies, as described in the following example. Some contain design flaws, which represent lost opportunities for residents and local contractors to learn best practices.

In the example to the right, a rain barrel demonstration is installed at a local community

Figure 22: Rain Barrel Demonstration

center. This is a great opportunity to access a wide array of homeowners. However, this installation is susceptible to mosquito infiltration, does not address what happens when the barrel overflows (which can be a real problem for most homeowners who do not have concrete or adequate grading around their homes), and does not address water quality in the barrel, making this an inadequate demonstration of rain barrel installation. Furthermore, the continuous use of rain barrels as an example for rainwater harvesting technology does not promote the true wealth of rainwater as a resource in the community, since few people might see any real water or financial savings related to this type of small system. We have found many excellent examples of bulletins and information dispersed by different entities, both inside the county and outside the county, which walk residents through a design process that begins with assessment of how much water is available from rainfall running off of roofs followed by an assessment of how much water is needed by a landscape area. Oversimplifying these demonstrations denies residents from being able to make well-educated decisions about stepping into the conservation conversation.

Keeping information updated and relevant, especially in an era where techniques and technologies are evolving quickly is challenging, but imperative. Without adequate tracking of information dissemination, including systems in place for maintaining the latest and most relevant information, it will be difficult to manage best practices across a large population.

Language Barriers

In addition to a general lack of accessibility to relevant information for non-native English speakers, some non-potable water strategies may have details that are lost in translation if not carefully considered.

For example, City Heights boasts the most diverse community in the county.[102]

"More than 30 languages and 80 dialects are now spoken in City Heights."[103]

This community is a perfect place for us to begin to consider how to better accommodate a more widespread approach to non-potable reuse. This is particularly important as many low-income residents utilize growing food as a source of affordable, healthy meals, and in some cases a source of needed revenues. People in this community need access to information in their primary language in order to be positioned to make choices and take actions on these strategies. In developing public outreach for the Pure Water San Diego program, San Diego Public Utilities and its consultant, Katz & Associates, conducted extensive and well-documented investigations, and subsequent outreach, to many communities in the City. Pathways for information and specific information needs were identified, and outreach has been conducted in upwards of two dozen languages. This highly successful effort will be further investigated for lessons learned and outreach/information strategies on other alternative non-potable water sources, as part of the forthcoming recommendations report.

We do not currently have research on the variety of attitudes toward alternative water supplies within the City Heights community, but extensive work has been done in the healthy food arena in this community. Applying some of those resources to this issue could help uncover some of the ways we can begin to encourage and enhance these communities through non-potable reuse.

102 https://socialinnovation.usc.edu/files/2013/05/Gembrowski.2001c.pdf

103 https://www.environmentalhealth.org/index.php/en/where-we-work/local/city-heights

Inadequate System Integration

- Lack of Integrated Risk-based Approach
- Neglected Nexus of Water, Energy, and Food
- Lack of Clear Critical Paths
- Regulatory Silos Inhibit Use of New, Innovative Practices
- Lack of Data to Fully Evaluate Non-potable Water

Inadequate System Integration

Water regulation and decision-making processes are often done in isolation. The current standards-based approach to setting the standards for various uses of water does not provide an adequate or integrated regulatory framework to effectively address non-potable water reuse. This conclusion is supported by the survey of California Environmental Health Directors. When asked to identify the most important obstacles to effective regulation of the current standards-based approach (NSF 350 and Title 22), 73% of respondents indicated the lack of an adequate regulatory framework, while 52% also identified the lack of industry-wide performance standards.[104] The lack of system integration can result in missed synergies which can provide for more efficient water systems, improved public health, and healthier ecosystems.

Highlights of five key areas that contribute to inadequate system integration are described below.

Lack of Integrated Risk-based Approach

The current regulatory system does not use a public health risk-based approach to regulate non-potable water as defined by the National Blue Ribbon Commission. A public health risk-based approach is a framework that sets appropriate performance criteria for on-site water reuse systems ensuring the water quality is adequate for its use. This framework also develops a structure to manage, monitor, and permit these systems.[105] The current standards-based approach consists of a series of different codes that describe the mechanics of the water systems, but does not focus on the value of end uses and associated water quality needs. Water systems are regulated through either a plumbing approach of bringing potable water in as a resource and sending non-potable water out as waste, or through an irrigation approach which generally relies on potable or centralized recycled water. There are many instances where regulation of non-potable water systems borrows from existing wastewater regulation without reassessing nuances in water quality or embracing a resource and beneficial use framework rather than a waste management and regulation viewpoint. For example, greywater system loading rates derive from septic systems, which aim to dispose of blackwater safely underground.[106] However, the quality of greywater is different than wastewater and can be used to benefit the soil and the plants.

The stakeholder interviews also revealed specific requirements when it comes to rainwater use in school gardens and farms. This example showcases the experience of the founder of Encinitas Union School District's Farm Lab, Mim Michelove. As part of her endeavors to create an educational food and nutrition program for kids, she envisioned school gardens and farms that would teach children how to grow food and that would produce vegetables for nine school cafeterias. As Michelove explained:

"I had all of our school gardens and farms certified by the County of San Diego Department of Environmental Health (DEH) so we could incorporate produce grown in each of the nine school garden into all nine school cafeterias. To me, this step is vital when engaging students in the garden and in their lunch, and in educating teachers and administrators about the importance of garden education as well as driving home the connection between healthy kids and academic success – never mind getting kids excited to make healthier choices in all areas of their lives."

The school studied the possibility to use rainwater on-site to conserve water, and provide education on alternative practices of irrigation. However as the public health risks increase with the size of the rainwater systems, additional safeguards are required to ensure the students' safety. The U.S. Food and Drug Administration provides guidance to minimize microbial food safety hazards for fresh fruits and vegetables that require strict best management practices be implemented in farms and large scale food production.[107] These guidelines are used by the DEH to review, approve, and permit the use of non-potable water systems. In this example, the rainwater capture system was already built when the DEH inspector reviewed the site, and he determined that the system did not adequately prevent contamination of the stored water. Correcting this would have required a modification of the installation, leading to time delays and additional costs, so the school chose not to pursue the use of recaptured rainwater. This example shows the challenges in implementing new, alternative engineering practices that use a risk-based approach to safeguard public health.

Without an overarching public health risk-based approach, the regulating strategies cannot easily shift to finding uses for lower quality water as keeping people, animals, and watersheds safe remains a priority.

Neglected Nexus of Water, Energy, and Food

Water, energy, and food are linked together, and we are reliant on all these elements. Yet our regulatory approach considers each of these elements separately. A balance between these elements is essential to our communities, just as they are in other ecosystems, and there is a clear nexus between them that is presently undervalued.

Evidence shows that 20% of energy in California is needed to transport, treat, and heat water,[108] and 90% of all electricity generation is water intensive.[109] In addition, water is a critical resource for food production, yet the water footprint of our imported and locally grown food is not assessed when evaluating how to prioritize water use in our communities. Conserving water is often seen as the ultimate goal at the local level, though that may come at the cost of opportunities to use limited water resources to promote food, energy, and ecosystem services that return our investment by helping to create water efficiencies in other ways.

Our communities need to more adequately integrate how we manage energy, water, and food supply to assure resilience and create sustainability, as we experience the direct impacts of climate change and seek to develop effective climate action plans. Addressing the opportunities at the nexus of these elements will help leverage benefits well beyond water conservation.

Lack of Clear Critical Paths

A critical path is the sequence of stages to design and implement a project. It provides standardization and requirements, and guides the project milestones. Without clear critical paths that include an integration of human and ecological health impacts, the full range of beneficial opportunities provided by non-potable water strategies are not always identified. The limited perceived value of these strategies can thereby limit applications.

Many non-potable reuse strategies are new to our region, so critical paths are not widely available and cannot be informed by an adequate feedback loop that considers all sectors of human health and habitation and ecological health. The installation and permitting process for these systems is perceived as

104 Survey done in 2016 by Public Health Alliance of Southern California: Safe Use of Alternate Water: A Survey of California Environmental Health Directors. Question 11: Under the current standards-based (i.e., NSF 350, Title 22) regulatory approach, what do you see as the most important obstacles to effective regulation?

105 National Blue Ribbon Commission, Final Report, Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems, 2017

106 California Plumbing Code, Chapter 15, §1502.08 and §1502.10.2

107 U.S. Food and Drug Administration, Guidance for Industry, Guide to Minimize Microbial, Food Safety Hazards for, Fresh Fruits and Vegetables, 1998

108 Public Policy Institute of California, Energy and Water, October 2016. https://www.ppic.org/content/pubs/report/R_1016AER.pdf

109 https://www.watercalculator.org/water-use/the-water-footprint-of-energy/

complicated and costly for both small scale and larger scale systems.

"Real Estate Operations staff prefer the efficiency of applying a documented work path. That is one of the reasons why developing work paths is important to the success of new initiatives, such as non-potable water strategies." – San Diego Housing Commission

Furthermore, due to the lack of critical paths, there is an insufficient understanding about how decentralized water systems supplement and/or replace those that are centralized. While there are overlaps in opportunities to use non-potable water, there are some specific differences in availability. Depending on the building type, the area, and the demand for water, some systems may better fit the water use, enhancing its value. Understanding how decentralized systems can be integrated to supplement and support the centralized water system is key to successfully designing systems, buildings, and infrastructure that are efficient in water use.

Defining the critical paths through the lens of this Project is currently missing and would support a more cohesive approach to strategizing toward the highest and best use of water.

Regulatory Silos Inhibit Use of New, Innovative Practices

As observed during this study, the water-related regulatory framework is separated into four main spheres: 1) water supply, 2) stormwater, 3) wastewater, and 4) water conservation. Many agencies and departments of local jurisdictions oversee the use of non-potable water. These include, but are not limited to, zoning and development review officials, building code officers, departments of environmental health, water utilities/providers, public works departments, stormwater departments and managers, water conservation program staff, and the Division of Drinking Water of the California State Water Resources Control Board. These different players complicate the integration of non-potable water into a shared framework that considers it an asset, particularly as part of a broader approach to improved community health. For example, strategies for indoor use of water in large buildings require treatment systems where implementation involves several departments. This process can be tedious, if not impossible, when departments are not well integrated, as experienced by developers seeking a sustainable building certification such as the Living Building Challenge.[110] Fresh approaches and innovation can be difficult to envision and implement in an atmosphere of non-integration and siloed authority.

This is also expressed by the San Diego Housing Commission:

"Greater collaboration among agencies and more widespread use of non-potable water strategies will encourage opportunities for innovation that can lead to effective, standardized water-wise approaches for multifamily rental housing." – San Diego Housing Commission

Lack of Data to Fully Evaluate Non-potable Water

- Lack of Data to Fully Assess Externalized Benefits

The Water Environment & Reuse Foundation (WERF) is a major player in studying, researching, and evaluating water use and management. Economic and ecological benefits of non-potable water use have been reported on several occasions.[111,112,113,114] Although these reports discuss the ecological services provided by water resources and possible methods for including them in management analyses, there are several challenges in translating ecological value to economic value (economic and ecological sources of uncertainty, irreversibility and cumulative incremental effects, and issues of fairness, such as intergenerational equity, discounting, and environmental justice) as explained in the report by WERF "Moving Towards Sustainable Water Resources Management: A Framework and Guidelines for Implementation."[115]

Moreover, the benefit-cost analysis is region-dependent, as explained in the report on "Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits." A more comprehensive set of data in the San Diego Region is needed to understand the impacts of non-potable water systems on individuals, community health and well-being, and ecosystems in order to evolve correct interpretations of regulation. The recommendations report will call out these suggestions in larger detail.

For example, strictly assessing water quality or water savings related to a greywater system ignores the externalized benefits. Externalities such as a reduced water footprint from local food production, tree shade, and potential energy savings in air conditioning, soil health, benefits of urban greening, and reduction in centralized waste water treatment maintenance and expansions are often not considered when assessing and budgeting projects. By expanding the collection of data and analyses to include the potential range of benefits as well as impacts, we can more accurately discern how non-potable reuse fits into our overall strategies to provide safe and healthy communities for all.

- Lack of Complementary Assessment of Centralized and Decentralized Systems

The impact of widespread greywater reuse on centralized wastewater systems is a widely published topic. As discussed in a report by the National Academies of Sciences, Engineering, and Medicine (2016), the need for data to assess impact on wastewater pipe flow from sites where large volumes of greywater are redirected is essential to ensure both centralized and decentralized systems complement each other.[116] Frequently, wastewater engineers raise concerns that greywater reuse deprives pipes of adequate flow volume to flush solids through the line. This concern was locally raised during a conversation with an Otay Water District Assistant Chief of Engineering.[117] Consequently, this point was discussed with a representative of San Diego Public Utilities regarding the impact on the treatment facility Pure Water San Diego. This representative indicated that although the on-site reuse of blackwater in large commercial buildings can potentially impact the centralized facility, the reuse of greywater at the residential scale is not a concern from the utility's perspective. The actual impact of greater wastewater reuse in large buildings on the functioning of Pure Water San Diego is still an area of study. This study will require an holistic approach in data analysis to assess the complementary use of this facility and on-site wastewater systems.

Another discussion with the City of San Diego's Recycled Water Program manager indicated that concerns were raised regarding the discharge of brine to the sewer due to on-site water treatments.[118] The following example shows the interconnectedness between centralized and decentralized systems and the need for complementary assessments:

"A golf course mixes potable water and recycled water in a pond and pumps it for irrigation. Their summer peak usage is 1 million gallons a day with a 50/50 blend ratio. Over time the salts from recycled water have accumulated in the pond and on the golf course primarily made of hard clay soils. To address this problem, the golf course is looking into an on-site treatment of the recycled water to reduce the salt content and use 100% recycled water. The issue for the City is how

110 Living Building Challenge is a certification provided by International Living Future Institute. This certification requires a building to be Net Positive Water.

111 National Academies of Sciences, Engineering, and Medicine 2016. Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits. Washington, DC: The National Academies Press. https://doi.org/10.17226/21866.

112 WERF and Coalition for Alternative Wastewater Treatment (CAWT), 2008. Institutional Challenges and Opportunities: Decentralized and Integrated water resource infrastructure. http://ndwrcdp.werf.org/documents/04-DEC-5SG/04DEC5WPInstitutional_Challenges.pdf

113 WERF and CAWT, 2008. New Approaches in Decentralized water infrastructure. http://www.decentralizedwater.org/research_project_04-DEC-5SG.asp

114 WERF, 2006. Moving towards Sustainable Water Resources Management: A Framework and Guidelines for Implementation, Technical Report. https://www.werf.org/a/ka/Search/ResearchProfile.aspx?ReportId=00-WSM-6

115 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5663018/

116 National Academies of Sciences, Engineering, and Medicine 2016. Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits. Washington, DC: The National Academies Press. https://doi.org/10.17226/21866.

117 Based on a conversation with Otay Water Authority engineering manager during the investigation of this Project, December 12th, 2018

118 http://cweawaternews.org/dealing-with-declining-flows/

to manage the brine discharge that will be generated by the treatment system. If the brine is discharged to the sewer it will put a strain at the downstream wastewater/recycling plant. As on-site treatment systems become more affordable and are being installed to reduce end users water demands, an accounting of the capacity/cost of brine management by the centralized wastewater plants will be required."

Looking at different data sets is becoming more and more important as decentralized small-scale systems are being implemented. In a local San Diego Region example, we can look at the San Luis Rey Water Treatment Facility which serves Oceanside, Vista, and Rainbow. If every single-family household in this area redirected their laundry greywater to their landscape, 1.31 million gallons of water per day would be diverted from the wastewater treatment facility. Instead, in 2001, the treatment facility spent over $52 million and took three years to add an additional capacity of 2.8 million gallons per day. Soon after the expansion plant came online, it had to be shut down because during drought conditions, conservation went up and the need for the expansion plant ceased to exist.[119] This example highlights how expensive back-up plans are not always the most effective and emphasizes the lack of integration between centralized and decentralized systems.

As the landscape of water systems and water treatments is diversifying and becoming more complex, the need for comprehensive data sets is increasing. These data will help measure the actual impact, quantify costs, and guide the implementation of solutions, ensuring that both centralized and decentralized systems are effectively used and working in complementary ways. Implementation of residential non-potable reuse systems are not only about water conservation, but also about residents having a better understanding of how to prioritize water use for things that are beneficial like edible plants, native plants that provide pollen or food for local wildlife, or trees that provide shade to decrease the heat island effect. Finding assessment methods that take into account the broader scope of an ethic of place and the comprehensive benefits associated with non-potable reuse and the micro and macro scale will be a complex but rewarding imperative.

119 https://www.wwdmag.com/treatment/triple-threat

Competing Economics

- ▶ Preference for Large Infrastructure Projects
- ▶ Advantages for Centralized Versus Decentralized Infrastructure
- ▶ Externalized Costs and Benefits Not Assessed
- ▶ Lack of Financial Safety Net for Low-income Water Users

Competing Economics

The current structure of competing economics serves as a barrier to greater non-potable water use and supports for low-income communities. Key areas that contribute to these barriers include:

- Preference for large infrastructure projects
- Advantages for centralized versus decentralized infrastructure
- Externalized costs and benefits not assessed
- Lack of financial safety net for low-income water users

Preference for Large Infrastructure Projects

Investments in large, centralized infrastructure projects have been undertaken to diversify local water sources and ensure reliability of local water supplies. These include the nine reservoirs owned and operated by the City of San Diego that serve as stormwater capture for thousands of acres of acres of upland, undeveloped land. The San Diego Public Utilities (SDPU) work hard to ensure that the land is conserved and protected to enhance water quality going to these reservoirs. Other large infrastructure projects include treatment facilities that recycle wastewater into safe, high-quality drinking water. These investments provide critical support to diversify our local water supply portfolio. An example of this type of facility is Pure Water San Diego. Stakeholder interviews reported that staff from water agencies commonly raise concerns that widespread use of residential greywater reuse can prevent obtaining adequate pipe volumes to make wastewater recycling plants financially viable. Stakeholders report this commonly vocalized concern has a chilling effect in terms of promoting and increasing greywater reuse. When this issue was discussed with a high-level SDPU representative, it was clarified that greywater reuse at the residential scale does not challenge the volume needed to ensure that the investment in Pure Water San Diego is viable. In addition, the SDPU representative explained that the reuse of greywater by residents is even encouraged to further conserve water. However, the on-site reuse of blackwater in large existing developments would impact and thus compete with the planned production levels of the treatment facility. It will be important to ensure that all level of staff at water agencies are aware of this assessment so as to avoid unintended consequences that might limit greywater reuse.

The type of infrastructures and programs are region-dependent and require an holistic assessment to promote the most adequate solutions.

Advantages for Centralized Versus Decentralized Infrastructure

Costs for centralized infrastructure expenses are embedded within water rates. Water rates are paid and distributed across the population of all water users. This sets up a financial advantage to fund large centralized infrastructure projects, since the costs are distributed, and the resources are ensured. In contrast, costs for implementing decentralized systems must be borne solely by individual property owners. There is a competitive advantage supporting centralized infrastructure that is not provided for decentralized systems. This requires a higher burden for decentralized systems to provide a return on investment. Few local jurisdictions recognize the burden to property owners and are providing partial rebates to encourage rainwater harvesting, landscape conversion, and laundry to landscape infrastructure investments. Although these programs are very helpful, they often offset only a small portion of the upfront investment costs experienced by property owners.

For example, the City of San Diego offers rebates for laundry-to-landscape systems ranging from $150 to $250, and a permit system may be rebated up to $1,000 for materials and permitting fees as explained in the fact sheet provided by the San Diego Public Utilities Department.[120] The city also offers rebates on rainwater capture systems: $1 for every gallon of rainwater storage capacity, up to 400 gallons and $400 per property, for barrels up to 200 gallons.[121]

Sweetwater Authority, which delivers water to residents in parts of Chula Vista, National City, and San Diego, offers a $75 rebate for greywater systems parts.[122]

In addition, The Metropolitan Water District of Southern California offers rebates through its SoCal Water$mart program to residential and commercial areas.[123] For example a rebate of $2.00 per square foot, up to 5,000 square feet of converted yard per year, is available via their Turf Replacement Program, a multi-pronged approach to maximize water utilization and conservation.[124] Metropolitan also offers rebates for rain barrels and cisterns of up to $350. Only residents supplied by participating water agencies are entitled to these rebates and rebates may vary depending on the local water providers.

Externalized Costs and Benefits Not Assessed

Externalized costs and benefits to centralized and decentralized systems have been studied by several research entities, such as the WERF.[125,126,127,128] For example, potable and wastewater handled by a centralized system does not participate in restoring the natural cycle of water while the use of greywater puts water back into the soil, helping replenish the ecosystem. However, the full financial assessment and its incorporation into the current financial system or decision-making process are still lacking. This arrangement tends to favor centralized systems. Although ecosystem resilience is a key strategy in climate adaptation efforts, these ecological benefits derived from a greywater system are not financially valued, quantified, incentivized, or rewarded. As addressed in the previous section, Inadequate System Integration, the need for more and better data sets are needed to understand not only the benefits of the decentralized systems, but the costs and impacts as well. A large body of research already exists on greywater and stormwater quality as well as the potential impact to human health and ecological risks[129] and will serve as a good resource for recommendations of best practices.

Lack of Financial Safety Net for Low-income Water Users

Mandates imposed by California Proposition 218 (Prop 218) disallow low-income rate assistance. According to Prop 218, water agencies are required to charge property owners water fees that solely

120 SD-01 https://www.sandiego.gov/sites/default/files/graywater_fact_sheet.pdf

121 https://www.sandiego.gov/public-utilities/sustainability/water-conservation/rebates/rain-barrels

122 https://www.sweetwater.org/DocumentCenter/View/1343/SWARebateAPP18-19

123 http://socalwatersmart.com

124 http://socalwatersmart.com/en/residential/rebates/available-rebates/turf-replacement-program/

125 National Academies of Sciences, Engineering, and Medicine 2016. Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits. Washington, DC: The National Academies Press. https://doi.org/10.17226/21866.

126 WERF and Coalition for Alternative Wastewater Treatment (CAWT), 2008. Institutional Challenges and Opportunities: Decentralized and Integrated water resource infrastructure. http://ndwrcdp.werf.org/documents/04-DEC-5SG/04DEC5WPInstitutional_Challenges.pdf

127 WERF and CAWT, 2008. New Approaches in Decentralized water infrastructure. http://www.decentralizedwater.org/research_project_04-DEC-5SG.asp

128 WERF, 2006. Moving towards Sustainable Water Resources Management: A Framework and Guidelines for Implementation, Technical Report. https://www.werf.org/a/ka/Search/ResearchProfile.aspx?ReportId=00-WSM-6

129 National Blue Ribbon Commission, 2017. Risk-based Framework for the development of Publuc Health Guidance for Decentralized Non-Potable Water Systems. https://sfwater.org/Modules/ShowDocument.aspx?documentID=10493

reflect the direct cost of the water services. This requirement limits funding options for public water utilities to subsidize low-income rate assistance since rate revenues cannot be used to fund them.[130]

This is unique to the water sector, as other utilities in California do provide assistance to support low-income communities.

SUMMARY

The next phase of this Project will shift from the identification of barriers into the researching best practices. These best practices will be vetted by the Public Health Advisory Committee and a set of high-impact recommendations with be advanced in a forthcoming Recommendations Report.

130 http://efc.web.unc.edu/2018/05/02/californias-legislative-effort-to-address-drinking-water-affordability/

APPENDIX A

FULL MEMBERSHIP OF PUBLIC HEALTH ADVISORY COMMITTEE

George Adrian, P.E.
Long-Range Planning and Water Resources Division
Public Utilities Department
City of San Diego

Elly Brown
Exeuctive Director
San Diego Food System Alliance

Amelie Catheline, Ph.D.
Project Coordinator
Public Health Alliance of Southern California

Robert Coleman
Sustainability Specialist/LEED Green Associate
Office of Sustainability, Economic Development Department
City of Chula Vista

Tracy Delaney, Ph.D.
Executive Director
Public Health Alliance of Southern California

Lesley Dobalian
Principal Water Resources Specialist
San Diego County Water Authority

Jeffrey Eisert
Environmental Health & Safety Specialist
University of California San Diego

Beth Gentry, P.E.
Senior Civil Engineer
Department of Engineering & Capital Projects
City of Chula Vista

Richard Gersberg, Ph.D.
Environmental Health Professor
School of Public Health
San Diego State University

Kristen Goodrich
Coastal Training Program Coordinator
Tijuana River National Estuarine Research Reserve

Chris Helmer
Environmental and Natural Resources Director
Public Works Department
City of Imperial Beach

Goldy Herbon
Senior Water Resources Planner
San Diego County Water Authority

Juli-Beth Hinds, AICP
Staff Research Associate & Instructor
Urban Studies and Planning Program, Bioregional Center for Sustainability Science, Planning & Design
University of California San Diego

Kelsey Lindner
Community Engagement and Research Translation Specialist, Superfund Research Center, and Bioregional Center for Sustainability Science
Planning and Design Manager
University of California San Diego

Jamelle McCullough
Supervising Environmental Health Specialist
Land and Water Quality Division, Department of Environmental Health
County of San Diego

Claire Norberg
Graduate School Intern
San Diego State University

Josh Robinson
Director
San Diego Sustainable Living Institute

Brandan Ryel
Owner
Ryel Landscape

Brook Sarson
Chief Executive Officer
CatchingH2O

Amanda Sousa
Asset Manager
Portfolio Management Department
San Diego Housing Commission

René A. Vidales, P.E.
Program Coordinator
Watershed Protection Program, Department of Public Works
County of San Diego

Paul Watson
President/Chief Executive Officer
The Global Action Research Center (ARC)

Lan Wiborg
Deputy Director
Long-Range Planning and Water Resources Division, Public Utilities Department
City of San Diego

Richard Winkler
Co-Director
Victory Gardens San Diego

APPENDIX B

DEFINITIONS & ACRONYMS

DEFINITIONS

Air conditioning (A/C) condensate: Water that condenses on air conditioning system pipes when cooling air.

Alliance: Public Health Alliance of Southern California.

Blackwater: Wastewater originating from toilets and/or kitchen sources (e.g., kitchen sinks and dishwashers).

California Conference of Directors of Environmental Health: Professional trade organization for Environmental Health directors.

Cistern: Container that can store 200 gallons of water or more.

Critical path: The sequence of stages to design and implement a project. It provides standardization and requirements and guides the project milestones.

Discovery Document: First report of the Project describing the barriers to on-site non-potable water use.

Ecosystem: A dynamic complex of a community of organisms (plants, animals, micro-organisms and human beings) and its non-living environment (air, water, mineral, soil) interacting as a functional unit.

Ecosystem services (also called ecological services): Benefits human beings obtain from ecosystems. They are grouped into four broad categories: provisioning, such as the production of food and water; regulating, such as the control of climate and disease; supporting, such as nutrient cycles and oxygen production; and cultural, such as spiritual and recreational benefits.

Educators: Professionals educating the public and disseminating information. It includes professionals working for public utilities, water agencies, water conservation departments, and outreach organizations (Tijuana River National Estuarine Research Reserve, The Global ARC).

End-users: People who will install, operate and/or use non-potable water systems including homeowners, residential building managers (multi-family buildings), and professionals (gutters, contractors, plumbers, landscape designers, landscape architects, landscape installers, architects, civil engineers, and wastewater engineers).

Ethic of Place: An ethic of place is a set of principles that respects and values the uniqueness of our region, both in terms of the environment and the cultural diversity.

Externalities: Positive or negative impacts that cannot be priced in market, and thus, that are not taken into account when assessing financial viability of projects.

Greywater: Untreated wastewater which has not come into contact with toilet waste. It includes used water from bathroom sinks, bathtubs, showers, and clothes washers, but does not include wastewater from toilets, kitchen sinks, dishwashers, or laundry water from soiled diapers due to potential health issues.

Groundwater: Water beneath the surface of the ground. This Project specifically addresses groundwater caused by an underground spring unexpectedly surfacing on a property. It also includes nuisance groundwater that is extracted to maintain the integrity of a building and would otherwise be discharged to the sewer system (foundation drainage).

Hundred cubic feet: Unit used by water suppliers that represents 748.05 gallons.

Laundry to landscape system: System discharging greywater of a laundry machine to a mulch basin area for irrigation purposes. Discharge of water is lower than 250 gallons a day.

Non-potable water strategies: Strategies include the use of stormwater, rainwater, and groundwater (springs), and the reuse of greywater and A/C condensate. This is defined as such for the purposes of the Project.

One Water: A transformative approach to view, value, and manage water resources in an integrated, inclusive, and sustainable manner. One Water San Diego uniquely addresses the issues around water supply and water cycle in the San Diego Region.

Pure Water San Diego: Program recycling and purifying wastewater to produce potable water, using a centralized water system. The City of San Diego's phased, multi-year program will provide one-third of San Diego's water supply locally by 2035.

Policy makers: Professionals tasked with creating new policy including state and local legislature, Governor, City Council, and Board of Supervisors.

Project: "Advancing Safe, Healthy Non-Potable Water Use" led by Public Health Alliance of Southern California.

Public health risk-based approach: A framework that sets appropriate performance criteria and develops an appropriate structure to manage, monitor, and permit on-site water reuse systems.

Rainwater: Precipitation from rain events that is collected and diverted directly from a roof surface located above ground.

Rainwater harvesting: The capture of rainwater for reuse. Two types of method can be distinguished:

> **Active rainwater harvesting:** Diverting rainwater from roofs into rainwater tanks.
>
> **Passive rainwater harvesting:** The practice of slowing water down and storing it in soil and biomass.

Recycled water: Water that has been treated at the highest level required by the California Department of Health Services for water not intended for human consumption as defined by California Code of Regulation, Title 22. "Recycled water" is sometimes referred to as "reclaimed water" or "purple pipe water." It is provided by a regulated recycled water agency via a centralized reclamation facility.

Regulators: Professionals who enforce existing codes and write new codes. It includes building inspectors, engineers and professionals who work in building departments, departments of land and water quality, and departments of environmental health.

Researchers: Professionals who search data and evaluate impacts of water use on the environment and the population. Organizations such as Equinox Center, San Diego Foundation, and universities are referred as research centers.

Stormwater: Precipitation runoff from rain events that flows over land and/or impervious surfaces (e.g., streets, parking lots). Stormwater includes runoff from roofs with frequent public access.

Trade professionals: Professionals who design irrigation, water capture systems, and landscapes. It includes greywater system installers, plumbers, gutter professionals, landscape architects, and designers.

Water footprint: The amount of fresh water utilized in the production or supply of the goods and services used by a particular person or group.

Wastewater: Water produced by human activities. It includes both greywater and blackwater.

Water budget: A water budget is an accounting of all the water that flows into and out of a project area. This term is used in this document to represent the inputs of non-potable water (rainwater, greywater, stormwater, and A/C condensate) available on a site over a specified period of time, and the landscape or indoor needs of a site. With a better understanding of this concept, landscapes and water use can be planned to better match existing resources.

Water literacy: Knowledge about water sources, water management, and water-related issues.

Watershed: Geographical area that drains to a specified point on a water course, usually a confluence of streams or rivers. Can also be known as drainage area, catchments, or a river basin.

ACRONYMS

ANSI: American National Standards Institute

BMPs: Best management practices

CalEPA: California Environmental Protection Agency

CAWT: Coalition for Alternative Wastewater Treatment

CCDEH: California Conference of Directors of Environmental Health

CCR, Title 22, Div. 4, Chapter 15: Domestic Water Quality and Monitoring Regulations

CCR, Title 22, Div. 4, Chapter 17: Surface Water Treatment

CCR, Title 22, Div. 4, Chapter 3: Water Recycling Criteria

CCR, Title 22, Div. 4: Environmental Health of California Code of Regulation

CCR, Title 23, Div.2, Chapter 2.7: Model Water Efficient Landscape Ordinance

CCR, Title 24, Part 5: California Plumbing Code

CCR, Title 24: Building Standards Code

CCR: California Code of Regulation

COWA: California Onsite Wastewater Association

CPC, Chapter 15: Alternate Water Sources for Nonpotable Applications of California Plumbing Code

CPC, Chapter 16: Nonpotable Rainwater Catchment System of California Plumbing Code

CPC: California Plumbing Code

DWR: Department of Water Resources

Global ARC: The Global Action Resource Center

gpcd: Gallons per capita per day

HCF: Hundred cubic feet

IRWM: Integrated Regional Water Management

ILFI: International Living Future Institute

JRMP: Jurisdictional Runoff Management Plan

LA County DEH: Los Angeles County Department of Public health

LEED: Leadership in Energy and Environmental Design

MS4: Municipal Separate Storm Sewer System

MWD: Metropolitan Water District

MWELO: Model Water Efficient Landscape Ordinance

NBRC: National Blue Ribbon Commission

NPDES: National Pollutant Discharge Elimination System

NSF: National Sanitation Foundation

RGPCD: Residential gallons per capita day

RWQCB: Regional Water Quality Control Board

SB966: Senate Bill 966 relative to Onsite Treated Nonpotable Water Systems

SDCWA: San Diego County Water Authority

SDHC: San Diego Housing Commission

SDSU: San Diego State University

SGMA: Sustainable Groundwater Management Act

SWRCB: California State Water Resources Control Board, often named State Water Board

TRNERR: Tijuana River National Estuarine Research Reserve

TSAWR: Transitional Special Agricultural Water Rate program

UCSD: University of California San Diego

WERF: The Water Environment & Reuse Foundation

WMA: Watershed Management Area

WRF: The Water Research Foundation

WQIP: Water Quality Improvement Plan

APPENDIX C

LIST OF RESOURCES

The following are the resources accessed for the Discovery Document's regulatory landscape review.

CITY OF SAN DIEGO

SD-01: City of San Diego, Graywater Systems Rebate online application
https://publicutilities.wufoo.com/forms/graywater-systems-rebate/

SD-02: City of San Diego, Residential Graywater An Irrigation Alternative
https://www.sandiego.gov/sites/default/files/graywater_guidelines.pdf

SD-03: City of San Diego, Information Bulletin 208: Gray Water Systems
https://www.sandiego.gov/sites/default/files/gray_water_systems.pdf

SD-04: City of San Diego, Guidelines for Residential and Multi-Family Rain Barrel Rebate
https://www.sandiego.gov/sites/default/files/rain_barrel_guidelines_fy_19.pdf

SD-05: City of San Diego, Rainwater Harvesting Guide
https://www.sandiego.gov/sites/default/files/legacy/water/pdf/conservation/rainwaterguide.pdf

SD-06: City of San Diego, Storm Water Standards
https://www.sandiego.gov/sites/default/files/storm_water_standards_manual_oct_2018.pdf

SD-07: City of San Diego, Directions for filling out the Industrial use - Discharge Permit Application
https://www.sandiego.gov/sites/default/files/legacy/mwwd/environment/iwcp/pdf/iu_application.pdf

SD-08: City of San Diego, Food Establishment Wastewater Discharge (FEWD) Program
https://www.sandiego.gov/public-utilities/sewer-spill-reduction/fewd

SD-09: San Diego Municipal Code, Chap.6 Art. 4 Div. 7: Food Establishment Wastewater
http://docs.sandiego.gov/municode/MuniCodeChapter06/Ch06Art04Division07.pdf

SD-10: San Diego Municipal Code, Chap.6 Art. 4 Div.8: Water Reclamation and Ocean Monitoring
http://docs.sandiego.gov/municode/MuniCodeChapter06/Ch06Art04Division08.pdf

SD-11: City of San Diego, Rules and Regulations for Recycled Water Systems
https://www.sandiego.gov/sites/default/files/recycled_water_rules_and_regulations_june_2016_final.pdf

SD-12: City of San Diego, Residential Graywater System Rebate Application
https://www.sandiego.gov/sites/default/files/graywater_appl.pdf

SD-14: San Diego Municipal Code, Chap.14 Art. 2 Div 4: Landscape Regulations
http://docs.sandiego.gov/municode/MuniCodeChapter14/Ch14Art02Division04.pdf

SD-15: San Diego Municipal Code, Chap.4 Art. 3 Div 3: Stormwater Management and Discharge Control
https://www.sandiego.gov/sites/default/files/final_ordinance_2015.pdf

SD-16: City of San Diego, Jurisdictional Runoff Management Plan
https://www.sandiego.gov/stormwater/plansreports/jrmp

CITY OF CHULA VISTA

CV-01: Chula Vista, City Operations Sustainability Plan
https://www.chulavistaca.gov/home/showdocument?id=9725

CV-02: Chula Vista, Climate Action Plan
https://www.chulavistaca.gov/home/showdocument?id=15586

CV-03: Chula Vista, Landscape Water Conservation
https://www.codepublishing.com/CA/ChulaVista/#!/ChulaVista20/ChulaVista2012.html#20.12

CV-04: Chula Vista, Water Stewardship Plan
https://www.chulavistaca.gov/Home/ShowDocument?id=14439

CV-05: Chula Vista, WaterSmart Landscaping & Water Reuse Guide
https://www.chulavistaca.gov/home/showdocument?id=5365

CV-06: Chula Vista, BMP Design Manual
https://www.chulavistaca.gov/home/showdocument?id=11881

CV-07: Chula Vista, BMP Design Manual - Appendices
https://www.chulavistaca.gov/home/showdocument?id=12099

CV-08: Chula Vista, Municipal Code Chap.14.20: Stormwater Management and Discharge Control
https://www.codepublishing.com/CA/ChulaVista/#!/ChulaVista14/ChulaVista1420.html#14.20

CV-09: Chula Vista, Sewer System Management Plan
https://www.chulavistaca.gov/departments/public-works/asset-management/sewer-system-management-plan

CV-10: Chula Vista, wastewater collection system master plan
https://www.chulavistaca.gov/departments/public-works/master-plans/wastewater-master-plan

CV-11: Chula Vista, Sewers, Title 13 Chap. 02
https://www.codepublishing.com/CA/ChulaVista/#!/ChulaVista13/ChulaVista1302.html#13.02

CV-12: Chula Vista, Jurisdictional Runoff Management Plan
https://www.chulavistaca.gov/home/showdocument?id=10060

CITY OF IMPERIAL BEACH

IB-01: Imperial Beach, Jurisdictional Runoff Management Plan
http://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/Imperial_Beach_JRMP_Complete_10-13-15.pdf

IB-02: Imperial Beach, BMP Design Manual
https://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/IB_Final_BMP_Design_Manual_Feb2016_-_Chapters-Copermittee.pdf

IB-03: Imperial Beach, BMP Design Manual, Appendices
https://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/IB_Final_BMP_Design_Manual_Feb2016_-_Appendices-Copermittee.pdf

IB-04: Imperial Beach, Retrofitting and Rehabilitating Areas of Existing Development
http://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/Municipal_Storm_Water_BMPs_and_Retrofits_to_Protect_Water_Quality.pdf

IB-05: Imperial Beach, Sewer System Management Plan (SSMP)
http://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/Complete_2016_Audit_Report_Sewer_System_Management_Plan.pdf

IB-06: Imperial Beach, Sewer System Management Plan - SSMP 5-15-17
https://www.imperialbeachca.gov/index.asp?Type=B_BASIC&SEC={874D5355-3313-46B7-BC31-D324699336AC}

IB-07: Imperial Beach, Sewer System Management Plan, Appendices C-J
https://www.imperialbeachca.gov/vertical/sites/%7B6283CA4C-E2BD-4DFA-A7F7-8D4ECD543E0F%7D/uploads/Appendices_C-J.pdf

COUNTY OF SAN DIEGO

COSD-01: County of San Diego, Graywater System Requirements for a Single Clothes Washer
https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/LU_Clothes_Washer_System_Handout.pdf

COSD-02: County of San Diego, Graywater System for Outdoor Irrigation Design and Procedures Manual
https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/LU_Design_and_Procedures_Manual_for_Graywater_Systems.pdf

COSD-03: County of San Diego, Graywater Frequently Asked Questions
https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/LU_Graywater_FAQ.pdf

COSD-04: County of San Diego, Rain Barrel Resource Document
https://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/sw_rainbarrel_fact_sheet-9-2010.pdf

COSD-05: County of San Diego, Rain Barrel & Mosquitoes Fact Sheet
https://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/sw_rainbarrel_mosquitoes_nov_2013.pdf

COSD-06: County of San Diego, Do-it-yourself: How to Make a Rain Barrel
https://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/sw_rainbarrel_how_to_make.pdf

COSD-07: County of San Diego, Guidelines for the Use of Alternative Water Supplies to Irrigate Gardens
https://www.sandiegocounty.gov/content/dam/sdc/deh/fhd/food/pdf/publications_altwateruse_guidelines.pdf

COSD-08: County of San Diego, Water Conservation in Landscaping Ordinance
https://www.sandiegocounty.gov/content/dam/sdc/cob/ordinances/ord10427.pdf

COSD-09: County of San Diego, Design Manual for Onsite Wastewater Treatment Systems
https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/Design_Manual_for_OWTS_3-22-10.pdf

COSD-10: County of San Diego, Code of Regulatory Ordinances, Title 6 Div. 8 Chap. 3: On-site Wastewater Treatment Systems and Improper Disposal of Sewage
http://library.amlegal.com/nxt/gateway.dll/California/sandregs/title6healthandsanitation*/division8unifiedprogramsewageandsolidwas/chapter3on-sitewastewatertreatmentsystem?f=templates$fn=default.htm$3.0$vid=amlegal:sandiegoco_ca_mc$anc=JD_68.301

COSD-11: County of San Diego, Recycled Water Plan Check and Inspection Manual (DEH 2001 Edition)
https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/recycled%20water%20manual-all.pdf

COSD-12: County of San Diego, Code of Regulatory Ordinances, Title 6 Div. 7 Chap. 5: Water Recycling
http://library.amlegal.com/nxt/gateway.dll?f=templates&fn=default.htm&vid=amlegal:sandiegoco_ca_mc

COSD-13: County of San Diego, Water Efficient Landscape Design Manual
https://www.sandiegocounty.gov/dplu/docs/POD_08-016_Landscape_Design_Manual.pdf

COSD-14: County of San Diego, An Ordinance to amend sec.67.801 et seq. relating to Watershed Protection
https://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/WPO.pdf

COSD-15: County of San Diego, Best Management Practice Design Manual
https://www.sandiegocounty.gov/content/sdc/dpw/watersheds/DevelopmentandConstruction/BMP_Design_Manual.html

COSD-16: County of San Diego, Jurisdictional Runoff Management Plan
http://www.projectcleanwater.org/download/county-of-san-diego-jurisdictional-runoff-management-program-2015/?wpdmdl=6795&ind=1547668473229

COSD-17: County of San Diego, Best Management Practice Design Manual, Appendices
https://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/Dev_Sup/County_BMPDM_App.pdf

COSD-18: County of San Diego's Stormwater Capture and Use Feasibility Study - Draft
http://www.projectcleanwater.org/download/tac-meeting-5/?wpdmdl=6709&ind=1536792170494

SAN DIEGO COUNTY WATER AUTHORITY

SDCWA-01: San Diego County Water Authority, Sustainable Landscapes Guidelines
https://sustainablelandscapessd.org/wp-content/uploads/SLP-Guidelines-Book-updated-January-2018.pdf