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Dual Plumbing and Onsite Non-Potable Water Systems Study

29 June 2022

Prepared for

City of SACRAMENTO

City of Sacramento
Department of Utilities
1395 35th Avenue
Sacramento, California 95822

KJ Project No. 2270001.00

The Dual Plumbing and Onsite Non-Potable Water Systems Study was prepared for the City of Sacramento by Kennedy/Jenks Consultants, Inc. with major contributions by Roth Ecological Design International, LLC and O'Connor Construction Management, Inc.

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Glossary

Air Gap: A physical break between a supply pipe and a receiving vessel as set forth in the local or state plumbing code.

Blackwater: Wastewater originating from toilets, urinals, and/or kitchen counters (i.e., kitchen sinks and dishwashers).

Condensate: Water vapor collected from air conditioning systems

Cross-Connection: Any physical connection or arrangement between potable water and any source of contamination

Disinfection: A physical or chemical process, including, but not limited to, ultraviolet radiation, ozonation, and chlorination that is used for removal, deactivation or killing of pathogenic microorganisms.

First Flush Diverter: A device or mechanism that diverts a quantity of rainwater collected from a surface following the onset of a rain event.

Foundation Drainage: Nuisance groundwater that is extracted to maintain a building's or facility's structural integrity and would otherwise be discharged to the sanitary or combined sewer system. It does not include groundwater extracted for beneficial use that is subject to the groundwater well regulations

Graywater: Wastewater collected from non-blackwater sources, such as bathroom sinks, showers, bathtubs, clothes washers, and laundry sink

Non-Potable Water: Non-potable water collected from alternate water sources, treated, and intended to be used on the project applicant's site or district-scale project and is suitable for direct beneficial use.

Onsite Non-Potable Water System (ONWS): A system in which water from local sources is collected, treated, and used for non-potable uses at the building to district/ neighborhood-scale, generally at a location near the point of generation.

Rainwater Catchment: Rain that is collected from a building roof or other manmade above ground collection surfaces.

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

List of Acronyms

Acronym	Definition
AFY	Acre-feet per Year
BOD	Biochemical Oxygen Demand
CCR	California Code of Regulations
CPC	California Plumbing Code
COD	Chemical Oxygen Demand
CCH	City and County of Honolulu
CDD	Community Development Department
DPH	Department of Public Health
DOU	Department of Utilities
DDW	Division of Drinking Water
gpd	Gallons per Day
gal/yr	Gallons per Year
GSI	Green Stormwater Infrastructure
LEED	Leader in Energy and Environmental Design
LID	Low Impact Development
LRT	Log Reduction Target
MWD	Metropolitan Water District
MF	Microfiltration
MG	Million Gallons
MGD	Million Gallons per Day
MG/yr	Million Gallons per Year
NPDES	National Pollutant Discharge Elimination System
NSF	National Sanitation Foundation
ONWS	Onsite Non-potable Water Systems
O&M	Operation and Maintenance
Central Valley Regional Board	Central Valley Regional Water Quality Control Board
RW	Recycled Water
ROI	Return of Investment
RO	Reverse Osmosis
ROM	Rough Order of Magnitude
SMUD	Sacramento Municipal Utility District
Regional San	Sacramento Regional County Sanitation District
SFDPH-EH	San Francisco Department of Public Health – Environmental Health
SFPW	San Francisco Public Works
SFPUC	San Francisco Public Utilities Commission
SSO	Sanitary Sewer Overflow
SMURRF	Santa Monica Urban Runoff Recycling Facility
SB	Senate Bill

Acronym	Definition
sq ft	Square Feet
State Water Board	State Water Resources Control Board
SWIP	Sustainable Water Infrastructure Project
SWMP	Sustainable Water Master Plan
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UF	Ultrafiltration
US EPA	United State Environmental Protection Agency
UV	Ultraviolet
WERF	Water Environment Research Foundation
WRF	Water Research Foundation

Executive Summary

In June 2021, Sacramento City Council directed the Community Development Department and the Department of Utilities to evaluate opportunities for expansion of water conservation standards for buildings. The City of Sacramento is considering new approaches to water supply, driven by drastic changes in the water landscape due to drought, climate change, regulations, population growth and economics. The City's Climate Action and Adaption Plan and New Building Electrification Ordinance are initiatives that lay out key elements of the City's sustainability strategies. As a result of these initiatives, the City is considering the development of an ordinance for new non-residential buildings of a certain size threshold to install dual plumbing as part of a non-potable water reuse strategy.

This ***Dual Plumbing and Onsite Non-Potable Water Systems (ONWS) Study*** has been prepared to summarize the feasibility of implementing dual plumbing systems in Sacramento. This Study assesses the feasibility, benefits and implications of implementing an ordinance to pre-plumb new commercial (non-residential) developments with dual plumbing for future non-potable supply with either municipal recycled water or ONWS. This Study will also be used to support stakeholder outreach and solicit feedback from parties that may be impacted by a dual plumbing ordinance. The dual plumbing ordinance is intended to be the first phase in the development of the City's non-potable water reuse strategy. The next phase, which is anticipated to happen by or after 2024, will address water treatment requirements in further detail, including compliance with state mandated requirements for ONWS, operational responsibilities, system protection needs, additional partnerships and engagement, and the cost and funding impacts.

The Department of Utilities and Community Development Department conducted this work in coordination with the Department of Public Works, and the City Manager's Office of Climate Action and Sustainability. Sacramento Regional County Sanitation District and Sacramento County Environmental Health Division were also consulted.

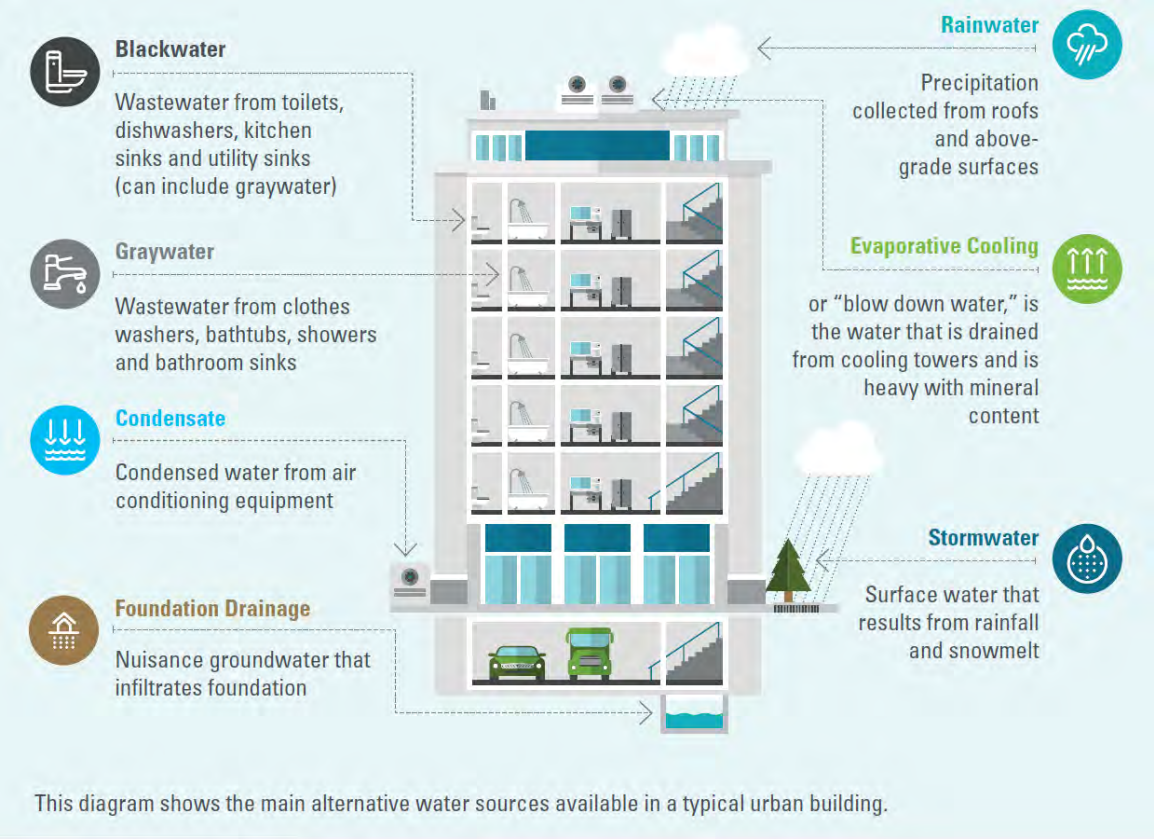
Regulatory Considerations

Throughout California, the use of treated municipal wastewater for non-potable demands (commonly referred to as municipal recycled water) has been growing in popularity during the last century. The production and use of municipal recycled water must adhere to strict regulations stipulating the levels of treatment, allowable types of reuse, and water quality requirements. Regulations related to municipal recycled water production and use have been in place since the 1970s and are contained within Title 17 and 22 of the California Code of Regulations (CCR).

Driven by severe droughts experienced in the state, California continues to develop regulations to support the expansion of municipal recycled water use, as well as the reuse of other alternative (non-potable) water sources, as shown in Figure ES - 1, to offset potable water demands. One method gaining momentum is the collection, treatment, and reuse of alternative water sources for non-potable needs within a building, which relies on dual plumbing and an ONWS. The requirements for dual plumbing systems that use alternative water sources such as those shown in Figure ES - 1 are regulated by the California Plumbing Code (CPC) Chapter 15,

16 and the State Water Resources Control Board - Division of Drinking Water (DDW) for backflow protection. Currently CPC Chapter 15 and 16 specifies minimum water quality requirements for rainwater capture systems to meet indoor and outdoor demands. The CPC also allows for the reuse of graywater to meet indoor and outdoor demands but does not require treatment to minimum levels; instead, CPC specifies that graywater treatment equipment and components meet the material and manufacturing standards of NSF/American Standards Institute (ANSI) Standard 350 (NSF/ANSI Standard 350).

Figure ES - 1: ONWS Alternative Water Sources



Source: *Onsite Non-Potable Water Reuse Practice Guide*, William J Worthen Foundation, 2018

Unlike municipal recycled water and rainwater capture, there are currently no regulations in California regarding treatment standards or water quality limits for non-potable supplies treated by ONWS for reuse. Draft regulations are being developed by DDW for risk-based water quality standards for onsite treatment and reuse of non-potable water for non-potable end uses in multi-unit residential, commercial, and mixed-use buildings. These regulations are expected to be finalized and adopted by December 1, 2022. Any ONWS that are in operation before the effective date of the regulations will be required to comply with the regulations within two years of the effective date.

The City of Sacramento could adopt a dual plumbing ordinance consistent with the CPC, but additional processes would need to be established for ONWS treatment and water quality standards for alternative sources other than rainwater and graywater. Regulating ONWS will

also require the City to coordinate with Sacramento County and others to establish agency jurisdiction and powers of enforcement and regulation.

If the City of Sacramento adopts an ordinance to require dual plumbing supplied by municipal recycled water for indoor use, the local Water Reclamation Permit with the Central Valley Regional Water Quality Control Board (Regional Board) will need to be amended. The current permit, which is held by Sacramento Regional County Sanitation District, does not allow for indoor uses and the City would need to work with Sacramento Regional County Sanitation District to amend the Water Reclamation Permit if indoor use of municipal recycled water is desired within the City of Sacramento.

Technical Considerations

The implementation and use of dual plumbing and ONWS is dependent on the source and end-use of non-potable water. Dual plumbing systems allow for the supply and use of potable and alternate (non-potable) water sources to supply different fixtures and systems within a building or development. Alternative sources that can be used to supply non-potable demands include:

1. **Municipal Treated Recycled Water:** Tertiary treated and disinfected municipal wastewater, or advanced treated recycled water, are suitable for non-potable purpose applications such as landscape irrigation, toilet flushing, industrial non-potable uses like equipment cleaning or cooling systems, and agriculture or for environmental benefits. These treatment systems are typically centrally located with an extensive transmission and distribution system.
2. **Onsite Treated Non-Potable Water:** Alternative non-potable water sources collected and treated onsite to be reused at a building or district scale to supply non-potable needs such as irrigation, toilet flushing and cooling systems. Alternative water sources can include those shown in Figure ES - 1. These systems are decentralized to locally collect and treat alternative sources onsite through an ONWS.

Non-potable demands in a commercial building include water used for toilet flushing, cooling tower make up water, irrigation systems, drain trap priming and other miscellaneous uses. The requirements for reuse vary based on (1) the source water, (2) the degree of treatment required and (3) the intended use. Generally, when more treatment is provided, the final use of the water is less restricted.

Testing, Inspection, and Public Notification Considerations

Implementation of dual plumbing or ONWS in Sacramento will need to meet strict public health and safety requirements. These include on-going cross-connection testing and inspections to prevent contamination of the potable water supply with non-potable water, as well as notification requirements to make the public, and those working around non-potable water sources, aware of the different water supply systems and restrictions for these systems.

Cross-Connection Testing

Cross-connection refers to any physical connection or arrangement between potable water and any source of contamination. It is critical that no cross-connection exists between a potable and a non-potable water system to protect the quality of drinking water. Cross-connection testing is

required for any dual plumbed system, which uses municipal recycled water or non-potable water from an ONWS, to verify that there is no potential cross-connection between the potable and non-potable water supplies. Cross-connection testing must be overseen by a Certified Cross-Connection Control Specialist.

For dual-plumbed systems, cross-connection inspections must be conducted annually, with testing of the recycled water (municipal and blackwater) systems every four (4) years, per CCR Title 17 and 22. In addition, cross-connection inspections for other alternate water sources (graywater and other onsite water supplies) are required whenever there is a major plumbing alteration.

Signage and Other System Requirements

Signage must be provided for any dual plumbed system that is either using municipal recycled water or non-potable water from an ONWS. Signage must properly indicate if the system is using recycled water or other type of non-potable water and comply with the state regulations (CPC and CCR Title 22).

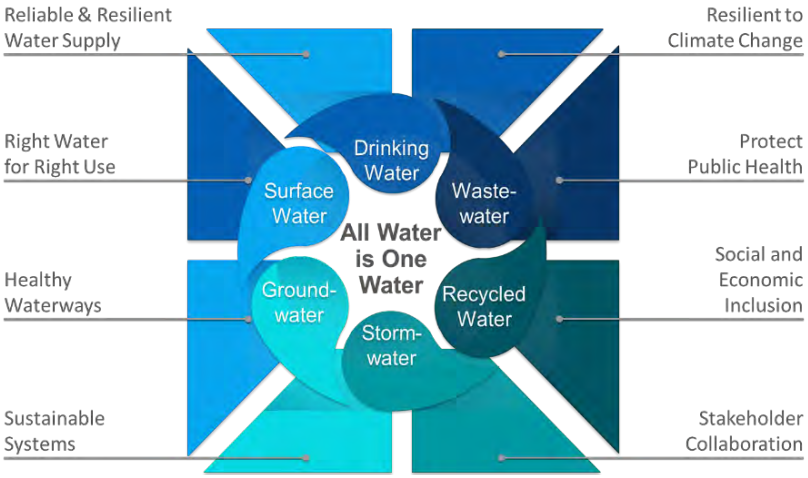
Signage is required at entrances or locations where recycled water is used, like landscape areas or bathrooms where recycled water is used for toilet flushing. Signs must be located such that they are visible to users. Signs must also be included in the equipment rooms visible to workers and identifying the fixtures and equipment using recycled water or non-potable water.

Example Recycled Water Advisory Sign

In addition to signage, there are other specific requirements for irrigation systems using recycled water. This includes providing locking features for valves (except control valves), not allowing hose bibbs on recycled water piping systems, and only using quick coupler valves, which must differ from quick coupler valves used with potable water supply in areas subject to public access. CCR Title 22 also requires that any use of recycled water be confined so that its application does not pose a public health threat with restrictions on places of use and application methods.

ONWS Program Development through One Water Vision

The One Water concept involves a collaborative and comprehensive long-term approach to community-based water management that recognizes all urban water supplies as resources (e.g., surface water, groundwater, stormwater/rainwater, wastewater, graywater, etc.). One Water policies are implemented through integrated planning to meet community and ecosystem needs. The implementation of a dual plumbing ordinance and ONWS projects in the City can be supported through this type of long-term water resource planning. A One Water Vision for the City's Onsite Water Reuse Strategy can guide the development and implementation of an ONWS Program in the context of the City's potable and non-potable water resources. Integral to implementation is the identification of roles and responsibilities to meet regulatory, technical and other program needs.



The One Water approach takes a holistic view of a community's or a facility's multiple water resources

Onsite Non-Potable Water Reuse One Water Vision Framework

Long-term implementation of a dual plumbing ordinance can be supported by the creation of a One Water Vision for the City of Sacramento, which would consist of the scope, vision, and objectives for the City's ONWS program. As part of this Study, a preliminary One Water Vision for the City was developed to support the City's Onsite Water Reuse Strategy. Application to other City programs and activities have not yet been evaluated.

Three relevant case studies were evaluated to understand how dual plumbing implementation is being achieved in other communities and how ONWS fit into the broader One Water framework. These programs were selected based on their similarity to the City of Sacramento criteria for applicable building types, water sources, and uses, as well as the mechanism by which a dual plumbing ordinance is (to be) implemented. While none of these case studies can be directly duplicated to meet the City of Sacramento's goals for implementing dual plumbing or ONWS, the lessons learned can be used to inform the development of the Sacramento dual plumbing ordinance and/or ONWS program.

Case Study 1: The **San Francisco Onsite Water Reuse Program** started in 2012 as a voluntary program before requiring all new buildings over 250,000 sq ft to install dual plumbing and onsite treatment in 2015. The City's first project was the San Francisco Public Utilities Commission (SFPUC) building. Since then, the ordinance has evolved to require all new buildings over 100,000 sq ft to install dual plumbing and ONWS.

Photo: SFPUC Headquarters
Source: SFPUC, San Francisco's Onsite Water Reuse System Projects, September 2021.

Lessons Learned:

- The Onsite Water Reuse Program evolved since its start in 2012, when implementation of ONWS was voluntary. Information gathered from these voluntary projects, including the SFPUC building, informed the update of the program and requirements, which were changed in 2015 to require the implementation of ONWS by new buildings 250,000 sq ft and larger. The current program requires new buildings 100,000 sq ft and larger to implement ONWS.
- In 2013 the program was amended to include district-scale systems. A district-scale project is when two or more buildings within a development share a system.
- The program is administered by one full-time equivalent, funded through the SFPUC operating budget. The program is also supported directly by the San Francisco Department of Public Health, San Francisco Department of Building Inspections, and San Francisco Public Works, which are funded through permitting fees.

Case Study 2: The **City of Santa Monica Recycled Water Ordinance**, adopted March 2022, requires the use of recycled water by: (1) all new developments of 7,500 square-feet or greater, and (2) existing potable water surface irrigation applications within the existing local recycled water service area. The recycled water ordinance is one element of Santa Monica's Sustainable Water Master Plan, first adopted in 2014 and updated in 2018.

Lessons Learned:

- The Recycled Water Ordinance is part of a larger effort by the City of Santa Monica to reduce its dependence on imported water and become water self-sufficient by 2023.
- The City of Santa Monica administers and enforces the requirements of the Recycled Water Ordinance; this effort will be covered through administration fees to be paid by developers at the time of building permit issuance.
- Los Angeles County Department of Public Health is delegated by the State to approve recycled water use and coordinates between applicants and DDW.
- Los Angeles County Department of Public Health administers the Cross-Connection and Water Pollution Control Program and provides cross-connection control and signage regulations. For new applications for recycled water use within the City of Santa Monica, reviews, inspections and conditional use approvals are incorporated into the County's existing processes.

Case Study 3: The City and County of Honolulu (CCH) passed a **One Water Ordinance** in 2020 as a result of the Hawaii Freshwater Initiative to pro-actively address and resolve water supply issues. The ordinance codifies how the city agencies will collaborate on water infrastructure initiatives to build climate resiliency and water security. The Hawaii Freshwater Initiative Council, established in 2016, has conducted studies and pilot projects to inform the development of water quality rules and monitoring requirements for onsite wastewater treatment for indoor recycled water reuse and updates to the plumbing code to provide allowances for non-potable (rainwater and reclaimed water) for both outdoor and indoor reuse.

Lessons Learned:

- The One Water Ordinance outlines principles and procedures for how city departments and agencies work together, including establishing regular interagency meetings and collaboration. Mechanisms to support interested developers are also described; for example, creating easier permitting pathways for projects that are investing in climate resilience infrastructure.
- Pilot studies are being conducted to analyze the potential benefits of different ONWS systems, including stormwater capture and potable water conservation.

Appendix A provides case study summary sheets with key information about each of the programs. The development of the City's One Water Vision and Onsite Water Reuse Strategy benefited from the approaches, tools and lessons learned from these case studies.

An Onsite Non-Potable Water Reuse One Water Vision Framework was developed through a multi-day workshop with City staff representing the Department of Utilities, Community Development Department, the Department of Public Works and City Manager's Office of Climate Action and Sustainability. The outcome was a draft One Water Vision Framework (Appendix C) to guide the formation of the City's dual plumbing ordinance in the context of a long-term water reuse strategy. Key elements of the draft framework are summarized in Table ES -1.

Table ES - 1: City of Sacramento Onsite Non-Potable Water Reuse One Water Vision Framework – Key Elements

VISION STATEMENT	The City of Sacramento's Onsite Non-Potable Water Reuse Program seeks to optimize the use of local water resources and provide reliable and resilient water systems for the future.
PROGRAM GOALS	• Optimize the use of local water resources • Provide reliable/resilient water systems for the future • Balance community needs (e.g., water conservation, economic feasibility of new development, job creation)
PROGRAM OBJECTIVES	• Increase resiliency and adaptability of water and wastewater infrastructure • Establish and sustain communication with community stakeholders • Integrate onsite reuse strategies with land use and other planning efforts (sewer, wastewater treatment, reuse, drainage, etc.) • Provide a favorable economic environment for private investment

Economic Considerations

The potential costs of dual-plumbed systems and ONWS were evaluated as part of this Study to help inform the economic feasibility and financial implications of implementing a dual plumbing ordinance. The estimated cost to install dual plumbing and implement ONWS is intended to inform recommendations for the building sizes and types that would be subject to the dual plumbing ordinance.

Dual Plumbing Construction Cost Comparison

A cost model was developed to compare the costs to install dual plumbing, to conventional single plumbing systems. The cost model reviewed 17 new commercial buildings constructed in California within the last five years and estimated the cost to add dual plumbing to those same buildings based on the number of fixtures that would use non-potable water, additional piping and valves to supply non-potable water to fixtures, backflow preventers and pressure regulators, buffer tanks, pumps, and additional piping and valves to supply the building with non-potable water. The outcomes were used to anticipate the costs and financial impacts to development due to implementation of a dual plumbing ordinance.

Figure ES - 2 and Figure ES - 3 summarize the findings of the cost model for the City of Sacramento.

Figure ES - 2: Cost Per Area ($/sq ft) to Add Dual Plumbing to Commercial Buildings

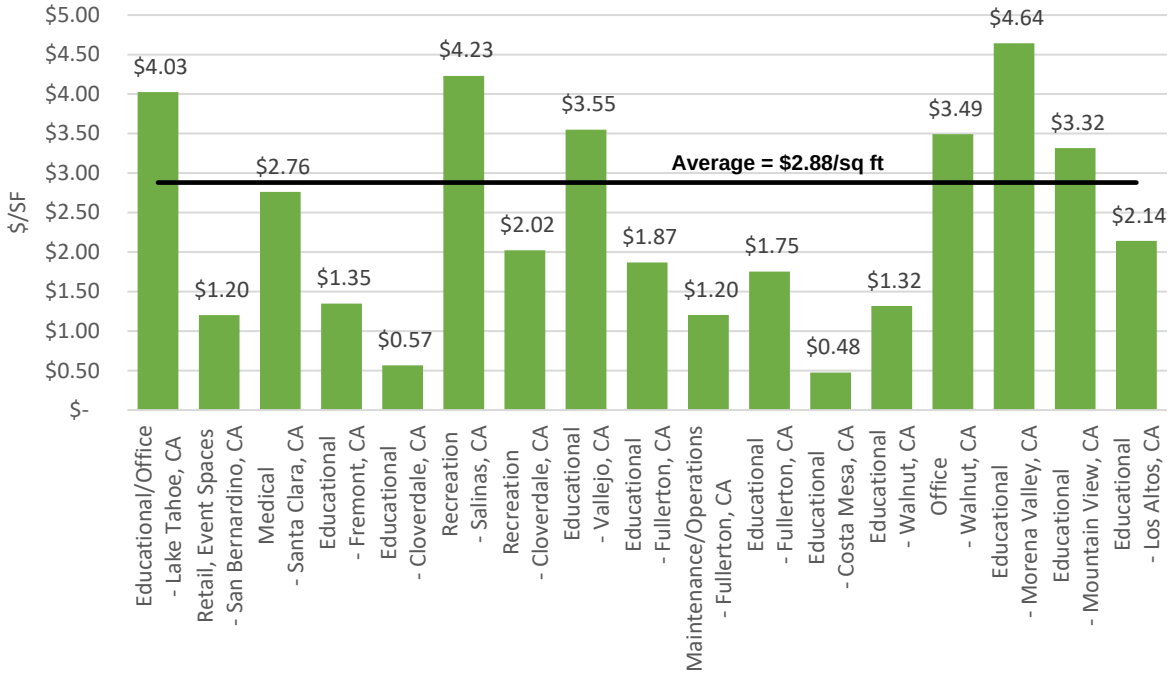
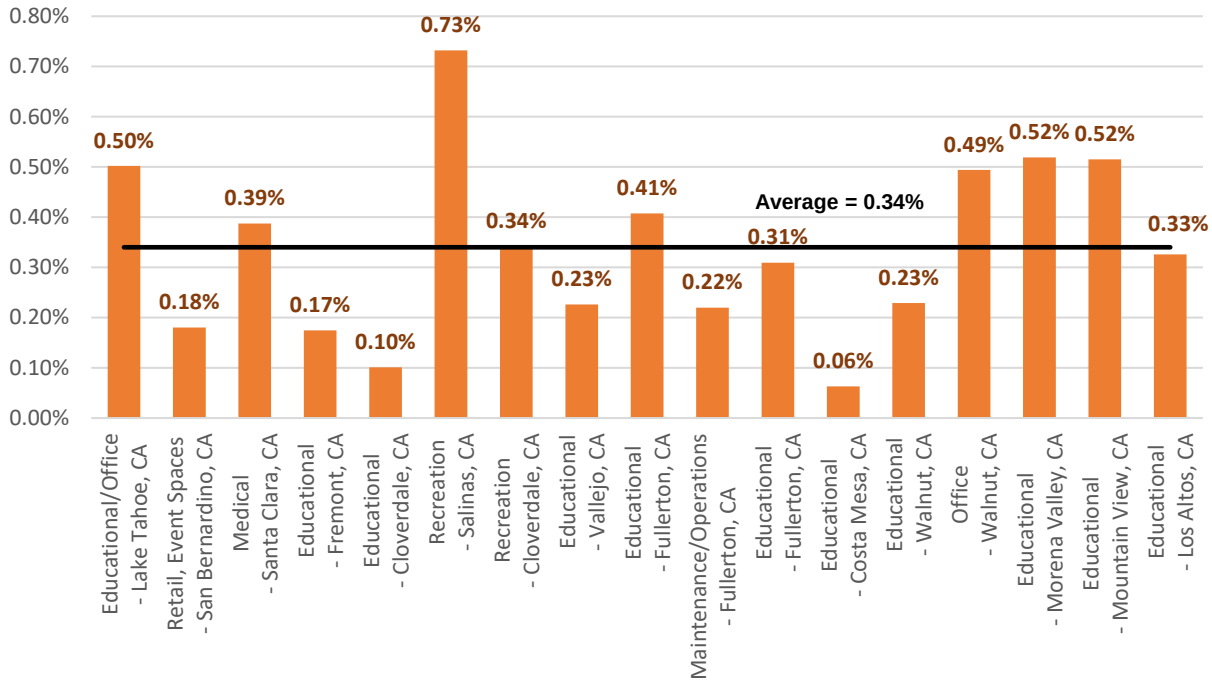


Figure ES - 3: Percent Increase to Total Project Cost to Add Dual Plumbing to Commercial Buildings



Based on the cost model, it was observed that the cost of adding dual plumbing varied according to building size and type, as well as the number of plumbing fixtures per square-foot (sq ft). The cost model found that the average cost to install dual plumbing is $2.88 per sq ft (in April 2022 dollars), per Figure ES - 2, resulting in an average of 0.34% increase in building cost (Figure ES - 3) compared to buildings that are not required to install dual plumbing. This cost represents capital costs only, as the cost model does not account for the maintenance or replacement costs of the dual plumbing systems. Additional details on the dual plumbing cost model, including a description of the types of building, cost assumptions, and construction assumptions, can be found in Appendix D.

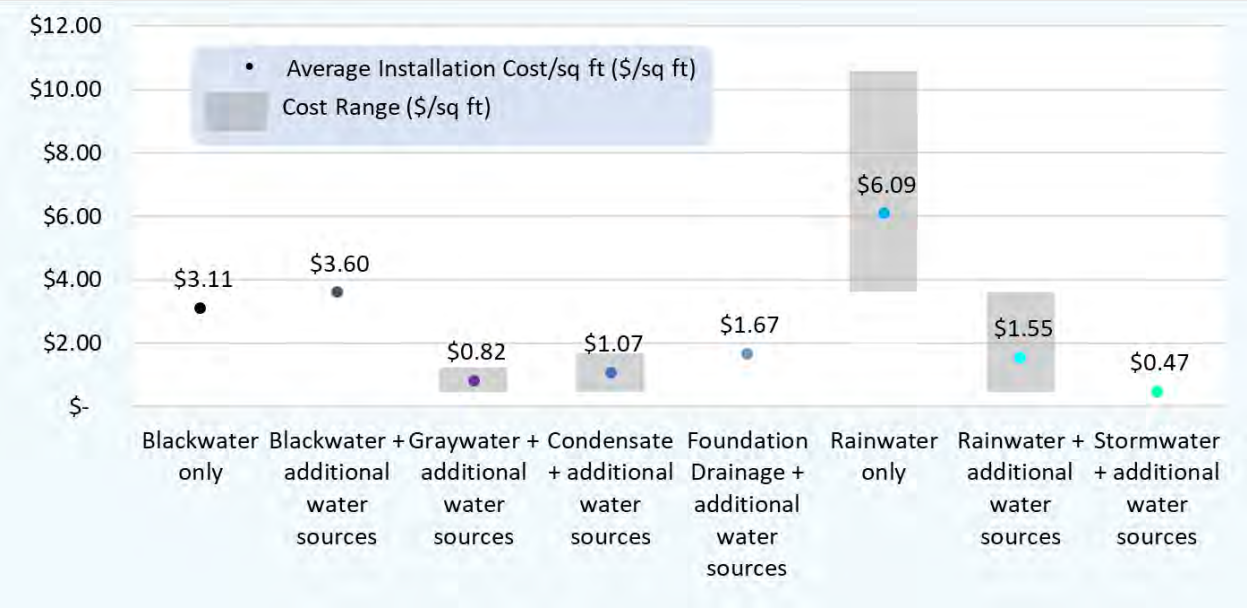
ONWS Treatment and Operations Costs

If a dual plumbed building receives recycled water from a municipal agency, then an ONWS treatment facility would not be required. For all other alternative non-potable water sources collected onsite, treatment facility and operations and maintenance (O&M) costs would be incurred. The cost of treatment installation and O&M for an ONWS is highly variable depending on the (1) source and end use (which impacts treatment level), (2) amount of demand (which impacts storage volume), and (3) technology (which also impacts operations and maintenance costs). Available data from projects implemented under the San Francisco Onsite Water Reuse Program was reviewed to estimate the potential cost impacts to developers and building owners. Evaluation of ONWS treatment and O&M costs included a review of 20 new commercial buildings constructed under the San Francisco Onsite Water Reuse Program.

Based on the 20 buildings evaluated, rainwater systems have the highest unit cost per area, at around 6 dollars per square feet ($/sq ft) to install, blackwater systems fall in the middle at around $3/sq ft and graywater/stormwater systems are the least expensive, under $1/sq ft, as shown in Figure ES - 4. Though blackwater is more expensive to treat, the cost for rainwater systems is higher because it requires significant storage to accumulate sufficient rainwater during the winter season to meet the non-potable demands year-round. The availability of blackwater on a consistent basis does not require additional storage, thus the treatment system can be sized to meet daily demands.

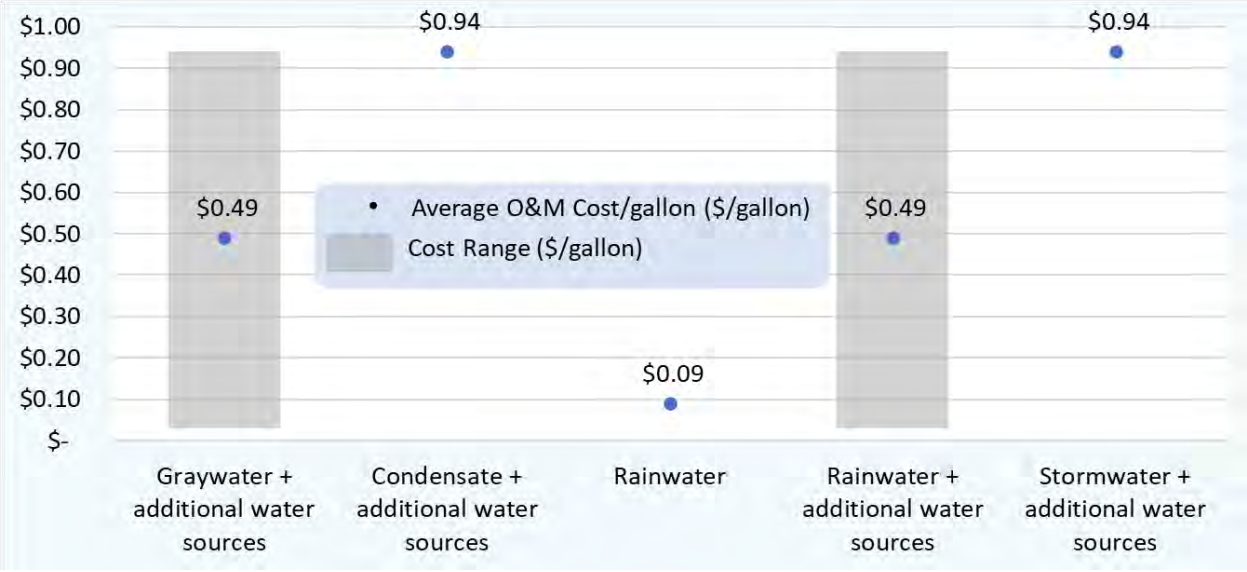
The effects of storage on the cost to install rainwater ONWS is further illustrated in a review of the three (3) projects installed in San Francisco with rainwater as the only reuse supply, where construction costs ranged from about $4/sq ft to $11/sq ft. However, as shown in Figure ES - 5, rainwater systems are the lowest cost to operate and the addition of graywater, concentrate and stormwater can result in an order of magnitude increase in annual O&M costs.

Figure ES - 4: ONWS Installation Costs, $/sq ft



Note: Values based on available data through the San Francisco Onsite Water Reuse Program for 9 projects (non-residential buildings)

Figure ES - 5: Annual ONWS O&M Costs, $/gallons



Note: Values based on available data through the San Francisco Onsite Water Reuse Program for 4 projects

Potential Cost Offsets due to Building Electrification

On June 1, 2021, City Council adopted the New Building Electrification Ordinance. The Ordinance phases in the requirement for all new construction of 1-3 stories to be fully electric by January 1, 2023, and buildings of 4+ stories to be all electric by January 1, 2026, with several limited exemptions. Because it is intended that a dual plumbing ordinance, if adopted, become effective concurrent with the New Building Electrification Ordinance, the City is interested in potential cost trade-offs between dual plumbing (and/or ONWS) and building electrification. A study on the net cost of fully electrifying new non-residential buildings that also install dual plumbing and ONWS was not conducted as part of this Study; however, cost effectiveness studies prepared by California Energy Codes and Standards indicate cost savings for all-electric commercial nonresidential buildings.

ONWS Market Assessment

To understand the scale of future commercial developments that could be candidates to install dual plumbing systems, a review of recently constructed and planned commercial and industrial developments of 100,000 sq ft or greater was conducted. Figure ES-6 shows the locations of 14 non-residential developments that have submitted building permit applications for buildings over 100,000 sq ft. This figure also shows the location of the Sacramento Regional County Sanitation District current recycled water pipeline and proposed expansion phases.

Based on the City's Building Data, since 2010 there have been:

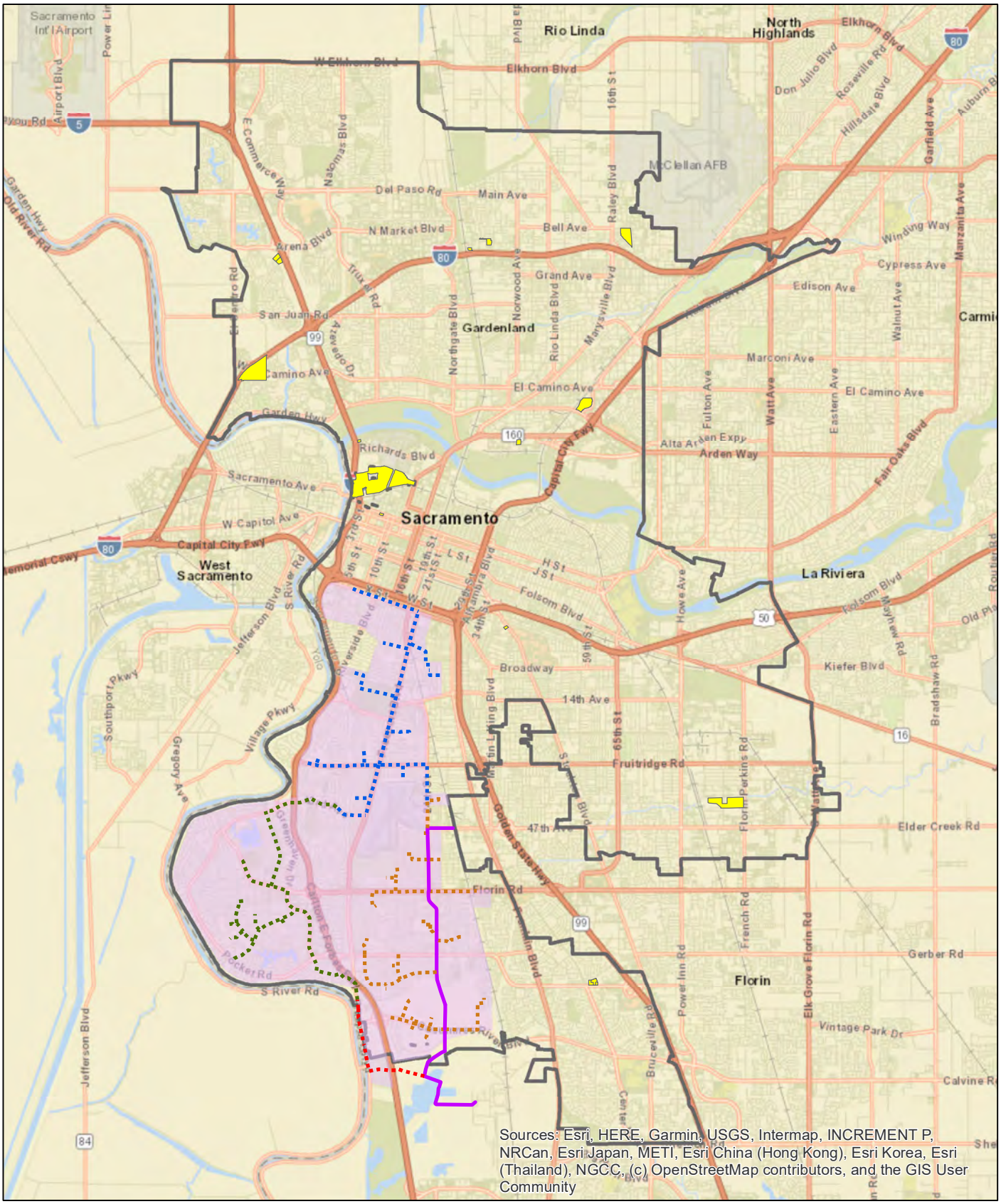
- 8 new commercial or industrial developments with habitable areas greater than 100,000 SF
- 5 new commercial or industrial developments with habitable areas greater than 250,000 SF

Based on the City's past rate of development and anticipated future developments, it can be assumed that there will be limited commercial developments located near enough to take advantage of the existing or future Sacramento Regional County Sanitation District recycled water distribution system (municipal recycled water). Thus, the majority of future developments with dual plumbing would need to be supplied through an ONWS.

ONWS Program Administration Resources

In addition to the cost impacts to developers and commercial building owners, the implementation of an onsite water reuse program will also require City resources to administer the program. A review of the agency coordination and staffing requirements for the San Francisco Onsite Water Reuse Program case study provides an indication of the potential City of Sacramento resources needed to implement an onsite water reuse program:

- Additional staff resources to start up the ONWS program (advertise, develop guidance and outreach materials, meet with developers and other stakeholders), with these resource commitments reducing to administer the ONWS Program
- Support from the Community Development Department (Building and Planning Divisions) and Public Works to provide reviews of dual plumbing plans, conduct inspections, approve installations, and issue construction and other permits
- Coordination with County of Sacramento or other water quality regulator to issue and enforce treatment requirements



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Legend

Proposed Recycled Water Pipelines

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5

Proposed Recycled Water Area

City Limits

Planned Commercial Properties for Development

N

Kennedy/Jenks Consultants

City of Sacramento
OnSite Non-Potable Water Reuse Strategy

ONWS Opportunity Areas

K/J Project Number
2270001*00

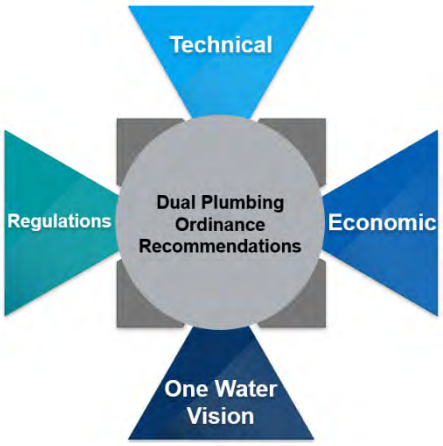
Figure ES-6

Pilot projects are one way the City of Sacramento can investigate the potential costs and resources needed to administer and enforce a dual plumbing ordinance with or without ONWS. For projects that will be owned by a public entity, grants may be available to fund the construction of pilot projects. The US Bureau of Reclamation's CALFED Water Use Efficiency Grant Program funds water use efficiency activities such as small, publicly owned recycled water and reuse projects. Historically, grant application solicitations are released annually.

Although the City of Sacramento is not anticipated to see as large or as many commercial developments as the City of San Francisco, the City of Sacramento will need to commit resources to the administration of an ONWS program and enforcement of the dual plumbing ordinance, if the ordinance were to be implemented. Responsibilities related to the enforcement of the dual plumbing ordinance will need to be defined within the City, as well as other roles and authorities for enforcement between the County of Sacramento or other local Jurisdiction with Authority. Similarly, the added costs to carry out these responsibilities will need to be evaluated for their impact to existing programs and City budgets.

Dual Plumbing Ordinance Development Options

As stated previously, the goal of this Study is to evaluate the potential for the adoption of a dual plumbing ordinance with phase 2 to include installation of water reuse systems onsite. Regulatory, technical, and economic considerations, as well as the broader One Water Vision, contributed to the development of ordinance options.



At this stage of the City's efforts, there are multiple options available to the City to guide the adoption, enforcement and modification of the dual plumbing ordinance:

1. **Do not adopt** a dual plumbing ordinance at this time. Continue to develop the City's One Water Vision and Onsite Water Reuse Strategy with the intent of adopting a dual plumbing ordinance in the future.
2. **Adopt** a local dual plumbing ordinance which allows new buildings to **voluntarily** install dual plumbing with or without a non-potable water source.
3. **Adopt** a local dual plumbing ordinance **requiring** new **buildings within the vicinity of existing and planned Sacramento Regional County Sanitation District pipelines** and meeting other eligibility criteria to install dual plumbing and connect to municipal recycled water when it becomes available. At this time, Sacramento Regional County Sanitation District has no plans on expanding recycled water service within the City of Sacramento, but this may change in the future.
4. **Adopt** a local dual plumbing ordinance **requiring all new buildings** meeting the eligibility criteria (e.g., commercial, non-residential of 100,000 sq ft or greater) to install dual plumbing. After the state adopts water quality standards for ONWS, the City can then incorporate these standards for buildings to collect, treat, and reuse water onsite.
5. **Adopt** a local dual plumbing ordinance **requiring all new buildings** meeting the eligibility criteria (e.g., commercial, non-residential of 100,000 sq ft or greater) to also install ONWS.

After the state adopts water quality standards for ONWS, the City can update the ordinance as needed.

Consideration of each of the above options should include weighing the regulatory, technical, and economic needs to implement a dual plumbing ordinance and should also reflect the priorities of the One Water Vision for the City's Onsite Water Reuse Strategy.

To aid the City in determining the next actions needed to develop a dual plumbing ordinance (with or without an ONWS program), the recommended next steps include:

Engage stakeholders in a review and comment process for the draft dual plumbing ordinance to get buy-in early on and include considerations for building types and sizes based on stakeholder recommendations.

Identify public and private partners and work with them to develop and implement pilot ONWS projects to trace out the City's process for reviewing permits, applications, and plans, as well as to understand better the needs of developers and building owners.

Define the One Water Vision for the City's Onsite Water Reuse Strategy to guide the development and implementation of an ONWS Program and identify roles and responsibilities, program needs, and next steps.

As part of Phase 2 of the City's Onsite Non-Potable Water Reuse Strategy, the City should:

Establish a small group to champion and facilitate the development of the City's ONWS Program. The core group should consider including representatives from the public health department, planning and building officials, and water/wastewater utilities.

Using existing guidelines and examples from other locations, draft the ONWS Program to define the alternate water sources to be used, the allowable non-potable end uses, the type and scale of developments required to install dual plumbing systems, the applicable rules and regulations, sampling requirements, fees, and incentives.

Track the implementation and adoption of the water quality standards for ONWS expected to be released by the State Water Resources Board in 2022 and review the draft risk-based regulations once released.

Section 1: Introduction and Background

The Dual Plumbing and Onsite Non-Potable Water Systems Study (Study) was prepared to summarize the feasibility of implementing dual plumbing systems as part of a non-potable water reuse strategy. This Study will inform the preparation of a potential ordinance to pre-plumb new commercial (non-residential) developments with dual plumbing for future supply with either municipal recycled water or Onsite Non-Potable Water Systems (ONWS).

1.1 Study Background

This Study was initiated against a backdrop of two City Council actions:

- On June 1, 2021, City Council adopted the New Building Electrification Ordinance, requiring new construction of 1-3 stories to be fully electric by January 1, 2023, and buildings of 4+ stories to be all electric by January 1, 2026.

- City Council adopted a resolution on June 1, 2021, directing staff to evaluate opportunities for the expansion of water conservation standards for buildings in advance of the New Building Electrification Ordinance effective dates.

Sacramento's City Council has accelerated City efforts to mitigate the local contribution to climate change and prepare for its effects. Building on recommendations of the Mayors' Commission on Climate Change, the City Council prioritized several urgent climate initiatives for implementation in Fall of 2020. The City's 2021 Climate Implementation Work Plan identified water reuse as part of the City's near-term and long-term strategy to meet water conservation objectives, while also supporting implementation of the New Building Electrification Ordinance and the "Just Transition" from local gas pipefitting work to green infrastructure.

There are few active ONWS programs in the United States, with San Francisco as one of the oldest and robust. According to the National Blue Ribbon Commission[1], only a handful of states are advancing regulations supporting ONWS; these include California, Minnesota, Colorado, Washington, Oregon, and Hawaii. Washington and Oregon are basing their regulations on California's Senate Bill (SB) 966 which directs the state to develop risk-based water quality standards for ONWS. There are city-level ONWS programs in various stages of development in Honolulu, Hawaii, New York City, and Austin, Texas, and there are single building ONWS installations scattered throughout the country. If an ONWS program is implemented, the City of Sacramento would be joining the ranks of a small but growing number of agencies to utilize this water conservation tool.

This Study is intended to evaluate the feasibility and cost effectiveness of dual plumbed systems to inform City efforts for developing a dual plumbing ordinance to pre-plumb certain types of new commercial (non-residential) construction with dual plumbing systems that allow for future installation of onsite non-potable water systems or supply with locally produced municipal recycled water. The dual plumbing ordinance is intended to be the first phase of the

[1] "Highlights and Accomplishments, March 2016-April 2019." National Blue Ribbon Commission for Onsite Non-potable Water Systems.

development of the City's non-potable water reuse strategy. The next phase, which is anticipated to happen by or after 2024, will address water treatment requirements in further detail, including compliance with state mandated requirements for ONWS, operational responsibilities, system protection needs, additional partnerships and engagement, and the cost and funding impacts.

This Study was spearheaded by the City's Department of Utilities (DOU) and Community Development Department (CDD). DOU is responsible for providing and maintaining drinking water, sewage collection, storm drainage and flood control services for over 500,000 residents and businesses within the City's service area. CDD led the New Building Electrification Ordinance and will use the results of this Study to develop the anticipated dual plumbing ordinance.

1.2 Project Stakeholders

The DOU and CDD conducted this work in coordination with multiple City Departments (Department of Public Works, City Manager's Office, and the Mayor's Office), Sacramento Regional County Sanitation District (Regional San), and Sacramento County. Virtual meetings were held to present issues and considerations related to the implementation of a dual plumbing ordinance. These meetings were also used to facilitate discussion of concerns and solicit feedback from these coordinating groups.

During this Study, the City also maintained regular communication and outreach to other community members with interests in the dual plumbing ordinance, including local trade groups, local land developers, and California State Water Resources Control Board staff. In addition, a page[2] was added to the City's website to allow the general public to access resources and subscribe for updates on the Study.

1.3 Study Organization

This Study provides considerations for feasibility and cost effectiveness of installing dual plumbing systems in new commercial developments for future supply with ONWS or municipal recycled water. The Study summarizes findings from national literature, examples of dual pluming and ONWS programs in California, availability of alternative water sources locally, impacts and costs for developers to install dual plumbed systems, stakeholder considerations, and implementation requirements. This Study is organized into the following sections:

- Section 1: Introduction and Background – briefly describes the Study purpose, as well as provides the context and setting for the City's dual plumbing ordinance and ONWS feasibility evaluation.

- Section 2: Implementation Considerations for Onsite Water Reuse Dual Plumbing – summarizes the regulatory, technical, monitoring and testing requirements that the City

[2] https://www.cityofsacramento.org/Community-Development/Planning/Major-Projects/General-Plan/About-The-Project/Climate_Change/Onsite-Water-Reuse-Study

must address in the development of a dual plumbing ordinance and onsite water reuse program.

- Section 3: One Water Vision for the City's Onsite Water Reuse Strategy – presents the scope, vision, and objectives for implementing the City's Onsite Water Reuse Strategy and identifies partners and needs, opportunities, and next steps. This section will also summarize three case studies relevant to the development of an onsite water reuse program.

- Section 4: Economic Considerations – summarizes a dual-plumbing cost model that compares the added cost to dual-plumb a commercial building versus using potable water system in the same building. This section also summarizes potential operations and maintenance costs based on information available from existing systems, as well as reviews the potential scale of application to future development in the City of Sacramento.

- Section 5: Dual Plumbing Ordinance and ONWS Program Feasibility and Next Steps - describes an appropriately sized program for the City that implements dual-plumbing, considering the scale of the project (building size, type of building, location(s)), available water sources, and cost estimates. This section will identify the critical path and next steps to advance the City's Onsite Water Reuse Strategy.

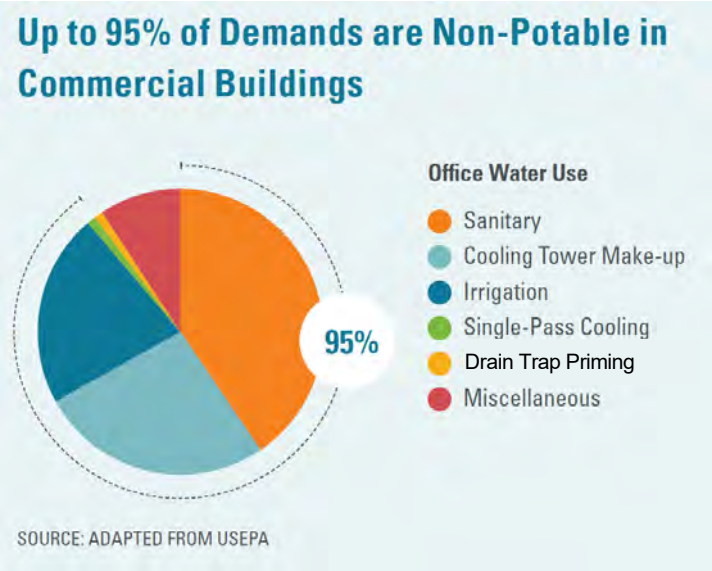
Section 2: Implementation Considerations for Onsite Water Reuse Dual Plumbing

The following section describes dual plumbing and ONWS and summarizes the regulatory and technical considerations for these systems, as well as presents testing and inspection requirements.

2.1 Dual Plumbing Systems

Dual plumbing systems allow for the supply and use of potable and non-potable water sources to supply different fixtures and systems within a building or development. Traditionally fixtures in a building are all supplied with potable water from a connection to the municipal potable water system. However, according to the United States Environmental Protection Agency (US EPA), about 95% of the water demands in commercial buildings do not require potable water (see Figure 2-1). Non-potable demands in a commercial building include water used for toilet flushing, cooling tower make up water, irrigation systems, drain trap priming, and other miscellaneous uses.

Figure 2-1: Non-Potable Demands in Commercial Buildings



Source: Onsite Non-Potable Water Reuse Practice Guide, William J Worthen Foundation, 2018

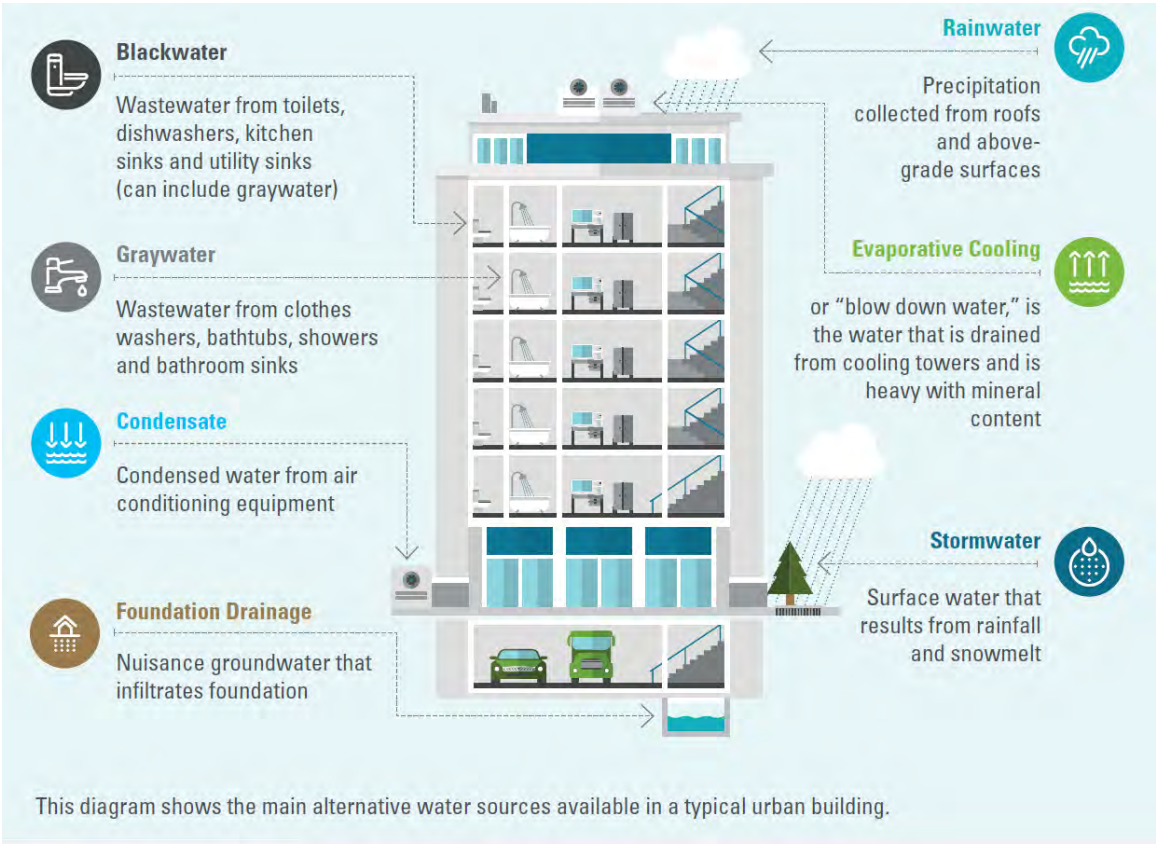
By installing a dual plumbed system, the potable water demand by new developments can be significantly reduced, preserving potable water supplies for human consumption, and supplying non-potable needs with alternative water sources. Alternative sources that can be used to supply non-potable demands include:

1. **Disinfected Tertiary Recycled Water:** Non-potable reuse of recycled water refers to the use of tertiary treated municipal wastewater for a specific purpose other than drinking such as landscape irrigation, industrial uses, and agriculture or for

environmental benefits. Non-potable reuse requires an independent “purple pipe” distribution system for conveying recycled water separate from the potable supply. Recycled water systems have strict regulations for not entering the waterways, including over spray such that it can enter storm drains. In California, non-potable reuse has been ongoing throughout the state for the last century and regulations for non-potable reuse have been in place since the 1970s.

2. **Onsite Treated Non-Potable Water:** Alternative non-potable water sources collected and treated onsite to be reused at a building or district scale to supply non-potable needs such as irrigation, toilet flushing and cooling systems. Alternative water sources can include rainwater collected from buildings roofs, stormwater collected from runoff in landscape areas, foundation drainage, condensate from cooling systems, graywater from washing machines, and blackwater from toilets (see Figure 2-2). These systems that collect and treat alternative sources onsite are considered ONWS.

Figure 2-2: ONWS Alternative Water Sources



Source: Onsite Non-Potable Water Reuse Practice Guide, William J Worthen Foundation, 2018

2.2 Onsite Non-Potable Water Systems

Traditional developments collect rainwater, stormwater, and municipal wastewater and convey it to the municipal sewer and/or storm drain system as applicable, and all water demands are met through a potable water or municipal recycled water source. ONWS would instead collect and

treat rainwater, stormwater, and/or wastewater onsite to a level of quality that allows for safe use of these sources for specific non-potable uses. ONWS use similar technology and water quality targets as used to treat water and wastewater in municipal systems but at a smaller scale. Treatment systems can vary considerably depending on the sources of water collected (rainwater, graywater, blackwater) and the intended end uses (irrigation, cooling systems, toilet flushing). Additional considerations for treatment are discussed in Section 2.4.

ONWS are one tool available to address long-term water supply reliability strategy. Benefits of an ONWS include reducing potable water use for non-potable needs, maximizing resiliency of water and wastewater infrastructure, reducing costs of expanding water and sewage infrastructure for new developments, diversifying water supply portfolios, and supporting projects aiming to achieve green building certifications or net-zero energy and water use. In case the onsite treatment system is not operating properly or is not sized to supply all non-potable demands in a development, potable water should be available to use as a backup source or to complement other demands. However, dual plumbing systems need to ensure that potable and non-potable sources are not cross-connected to prevent contamination of potable supplies, as described in more detail in Section 2.5.

2.3 Regulatory Considerations

One of the most important aspects of a water reuse system is the adherence to the regulations set forth by local, state, and federal guidelines aimed to protect public health. Throughout California, non-potable reuse of municipal recycled water has been ongoing for the last century, and regulations have been in place since the 1970s. The regulations for water reuse are different for using disinfected tertiary (municipal) recycled water or onsite treated non-potable water.

2.3.1 Recycled Water Regulations

There are no federal regulations governing water reuse in the United States, thus regulations (or guidelines) for water reuse are developed and implemented at the state government level. In the State of California, municipal recycled water requirements are administered by the Division of Drinking Water (DDW) from the State Water Resources Control Board (State Water Board), formerly under California Department of Public Health, and individual Regional Water Quality Control Boards. The regulatory requirements for municipal recycled water projects in California are contained in California Code of Regulation (CCR) Title 22 and Title 17.

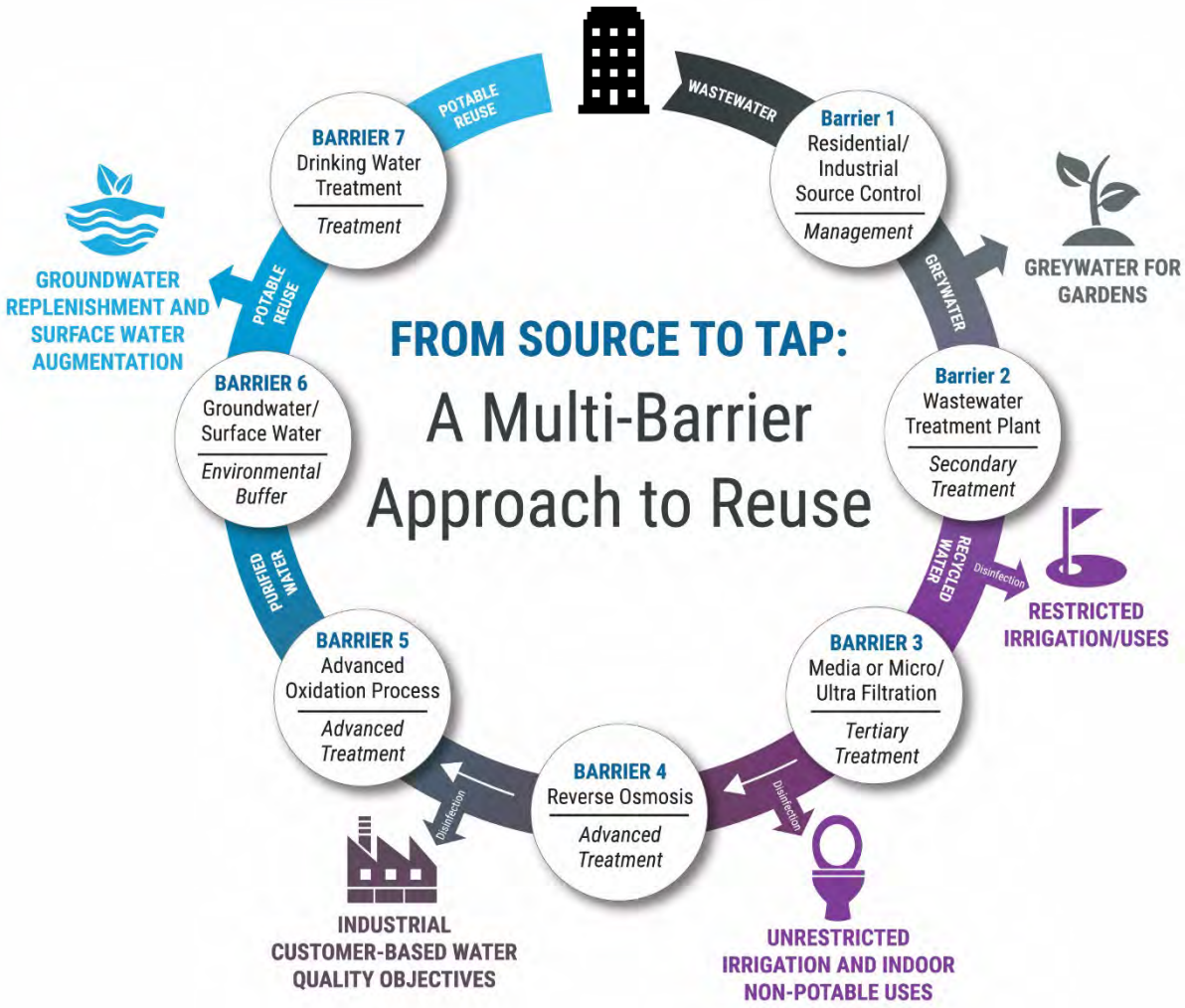
2.3.1.1 CCR – Title 17

Title 17 of the CCR focuses on the protection of drinking (potable) water supplies through control of cross-connections with potential contaminants, including non-potable water supplies such as municipal recycled water. Title 17 specifies the minimum backflow protection requirements to prevent any potential for cross contamination of the potable water supply with other non-potable sources.

2.3.1.2 CCR – Title 22

Title 22 of the CCR stipulates the treatment and water quality requirements for drinking water as well as municipal recycled water and the allowed uses for municipal recycled water. Municipal recycled water begins as wastewater and undergoes a series of treatment steps, using a multi-barrier approach, to remove organic matter and pollutants. The production and use of municipal recycled water must adhere to strict regulations stipulating the levels of treatment, allowable types of reuse and water quality requirements. The multi-barrier approach to reuse highlights the increasing level of treatment necessary to produce the right quality of water for the right use as shown in Figure 2-3. Title 22 also provides the requirements for sampling and monitoring of municipal recycled water.

Figure 2-3: Multi-Barrier Approach to Reuse



Local requirements vary by county and city and typically provide additional guidance to meet local health agency or public water supplier guidelines and permit/code requirements. These include local requirements for municipal recycled water for landscape use, graywater, and stormwater.

2.3.1.3 State Recycled Water Policy

The State Water Board adopted a Recycled Water Policy (RW Policy) in 2009 (amended in 2013), to establish more uniform requirements for water recycling throughout the State and to streamline the permit application process in most instances. The RW Policy includes a mandate that the State increase the use of recycled water over 2002 levels by at least 200,000 acre-feet per year (AFY) by 2030. Also included are goals for stormwater reuse, conservation, and potable water offsets by recycled water. The onus for achieving these mandates and goals is placed both on recycled water purveyors and potential users.

2.3.1.4 Statewide General Order

On June 7, 2016, the State Water Board adopted Water Reclamation Requirements for Recycled Water Use[3] (General Order). Similar to the RW Policy, the intent of the General Order is to streamline the permitting of municipal recycled water use statewide and encourage the use of municipal recycled water as a valuable resource. The General Order is used to permit non-potable municipal recycled water distribution and use. The production of municipal recycled water at a wastewater treatment facility would require separate coverage under a Regional Water Quality Control Board permit. As of May 2022, the Central Valley Regional Board, which issues water reclamation permits for the region that includes the City of Sacramento, does not allow the use of non-potable water for indoor uses.

2.3.2 California Plumbing Code

The California Plumbing Code assigns authority to the Authority Having Jurisdiction, and it is up to the City to define who the Authority Having Jurisdiction is. The Authority Having Jurisdiction is to review the proposed and completed work and to decide whether a plumbing system conforms to the code requirements. As a public servant, the Authority Having Jurisdiction enforces the code in an unbiased, proper manner.

Chapter 15 of the CPC provides the requirements for construction, alteration, discharge, use and repair of alternative water source systems for non-potable applications. Chapter 15 outlines the permitted uses (where approved by the Authority Having Jurisdiction) for recycled water and graywater. This chapter also lists requirements for testing, inspection, and maintenance of alternate water source systems, including requirements for signage and cross-connection testing.

Chapter 16 of the CPC outlines the requirements for installation, construction, alteration, and repair of non-potable rainwater catchment systems, including inspection and testing requirements. This chapter outlines the minimum water quality standards for using rainwater for different applications such as car washing, irrigation (surface, subsurface, drip, spray), toilet

[3] http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2016/wqo2016_0068_ddw.pdf

flushing, washing machines, trap priming, ornamental fountains and cooling tower makeup water.

2.3.3 ONWS Regulations

Current state regulations in California regarding treatment standards or water quality limits for non-potable supplies treated by ONWS for reuse are limited to rainwater capture systems and graywater equipment and components. Draft regulations are being developed by the State Water Board for risk-based water quality standards for onsite treatment and reuse of non-potable water for non-potable end uses in multifamily residential, commercial, and mixed-use buildings. These regulations are expected to be finalized and adopted by December 1, 2022. The risk-based water quality standards will not address untreated graywater systems for subsurface irrigation or untreated rainwater systems used exclusively for surface, subsurface, or drip irrigation. Any ONWS that are in operation before the effective date of the state regulations will be required to comply with the state regulations within two years of the effective date. ONWS in operation prior to the implementation of the state regulations will have to comply with all local regulations.

To develop an ONWS program requires understanding, in addition to the applicable regulations, of other site-specific considerations that can include:

1. Discharge restrictions related to water quality, storm and sewer tie-ins, sewer overflow mitigation, existing discharge permit compliance, and stormwater runoff requirements.

2. Sensitive areas susceptible to flooding or wildlife corridors.

3. Authorities Having Jurisdiction including local, regional, or state public health agencies, building departments, State Water Board and Regional Boards and local sewer and utility agencies.

4. Employees completing certification for managing ONWS.

In general, building codes dictate how non-potable ONWS are built and used. Rainwater and graywater reuse is regulated by CPC Chapter 15 and 16 as described in the following section. In the absence of state or national standards some cities are developing their own standards and guidelines to promote onsite reuse while assuring public and environmental health protection. Some jurisdictions also use standards set by the National Sanitation Foundation (NSF), which certifies graywater and wastewater reuse treatment systems. The NSF standards are performance based. NSF developed their own standards for toilet flushing (NSF-350) and subsurface irrigation (NSF-350-1) based on survey of national and international water reuse standards.

2.4 Technical Considerations

Water quality requirements vary for each source of alternate water and its end use. This section summarizes the requirements and recommendations for treatment for different alternate water sources.

2.4.1 Recycled Water Treatment Standards

The forms of non-potable recycled water use that are permitted in California vary based on (1) the degree of treatment required and (2) the intended use of the recycled water. Generally, when more treatment is provided, the final use of the water is less restricted. The levels of treatment, from the lowest level (with the highest restrictions) to the highest level (with the lowest restrictions), per the regulatory classifications (CCR Title 22) are:

- Undisinfected secondary recycled water
- Disinfected secondary – 23 recycled water
- Disinfected secondary – 2.2 recycled water
- Disinfected tertiary recycled water

Disinfected secondary – 23 recycled water and disinfected secondary – 2.2 recycled water differ in the degree of disinfection required to achieve different total coliform bacteria concentrations after disinfection.

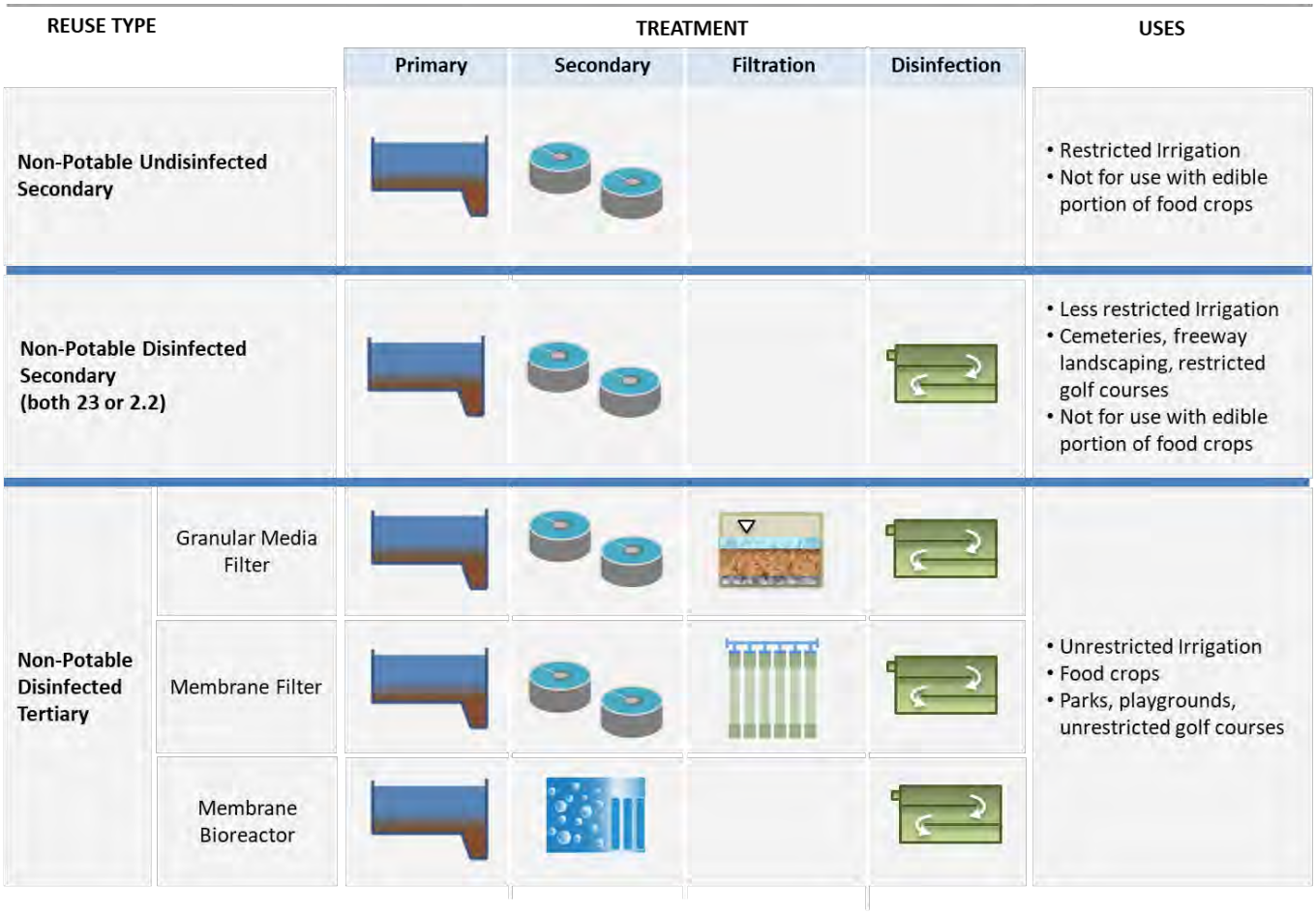
2.4.1.1 Recycled Water Treatment for Non-Potable Uses

Wastewater from a sanitary sewer undergoes primary and secondary treatment. Primary treatment removes large solids, scum and debris, and heavier sludge that settle out in primary holding tanks. Secondary treatment utilizes micro-organisms and oxygen to break down and consume organic matter. Together these processes produce secondary effluent to meet land discharge or National Pollutant Discharge Elimination System (NPDES) requirements for discharge to a waterway, bay, or the ocean.

Additional treatment is typically required to produce recycled water for non-potable reuse. Tertiary treatment provides filtration to remove suspended solids and other pollutants using sand or media filtration or membrane filters. Disinfection serves to destroy bacteria or viruses through the addition of chemicals (such as chlorine) or ultraviolet (UV) light. Disinfection may follow secondary or tertiary treatment, depending on the intended reuse type.

Figure 2-4 provides a summary of the non-potable recycled water irrigation options with the associated treatment required.

Figure 2-4: Types of Non-Potable Reuse and Associated Treatment Processes



2.4.1.2 Additional Considerations for Indoor Use of Recycled Water

Non-irrigation uses, such as toilet and urinal flushing and cooling towers that are dual plumbed with an internal purple pipe system to separate potable water from municipal recycled water (non-potable) may have water quality objectives beyond meeting CCR Title 22 objectives. For aesthetic reasons, it is preferable that recycled water used for toilet and urinal flushing is odorless and colorless. This is generally recommended by professionals in the water reuse industry. Organic and inorganic compounds in recycled water can cause discoloration and odor. Oxidizing agents such as chlorine, ozone, and hydrogen peroxide can be used for removal of color and odor, and UV light may also contribute to the removal of color. Hydrogen peroxide (H_2O_2) is an oxidant commonly used in water treatment and wastewater reclamation for eliminating color and odor; it is less effective than ozone but easier to implement. Chlorine is less effective for odor and color removal compared to ozone and hydrogen peroxide and therefore is not specifically used for this purpose.

Cooling towers prefer receiving a water source with a consistent water quality to achieve specific water quality requirements that align with operational and maintenance practices. Variable water quality can be a challenge as it impacts the number of cycles and chemical requirements; additionally, ammonia concentration is of greatest concern due to the potential for corrosion. Removal of salinity and ammonia may be desirable to meet cooling tower water quality objectives. It is not uncommon for cooling towers to have small package Reverse Osmosis (RO) plants to manage water quality from potable water sources. Thus, if cooling towers are selected as use for the non-potable recycled water it would be important to work closely with their operators to understand the elements of the specific cooling system and their current practices and needs.

2.4.2 Proposed Treatment Standards for ONWS

Since there are limited regulations for treatment for ONWS, the National Blue Ribbon Commission was founded to advance management practice to support the use of privately owned and maintained ONWS for buildings or at a local scale. One of the Commission's goals is to provide policy guidance for the management of ONWS including water quality criteria, monitoring and reporting requirements, and operational and permitting strategies. The Commission developed the *Guidebook for Developing and Implementing Regulations for On-site Non-potable Water Systems* to guide local jurisdictions in developing and implementing the regulations and oversight programs for ONWS that are protective of public health. The guidebook refers to the recommendations from the Water Research Foundation (WRF) study *Risk Based Framework for the Development of Public Health Guidance for Decentralized Non-potable Water Systems (Sharvelle et al., 2017)* which establishes a risk-based approach for pathogen removal and/or inactivation targets defined as "log reduction targets" (LRTs). The LRTs indicate the targets for inactivation or removal of viruses, protozoa and to reduce the annual risk of infection to less than 10^{-4} per person per year, which was determined as a stringent risk goal to protect public health. Using log removal as treatment criteria is the accepted practice for both drinking water and non-potable reuse.

ONWS should treat alternate water sources to meet or exceed the LRTs as summarized in Table 2-1. This will require employing onsite licensed/certified operators to ensure compliance. For stormwater, two levels of dilution are assumed for potential fecal contamination in stormwater from urban environments. Some contamination is likely from sewer leaks or sewer overflows into stormwater.

Table 2-1: Log Reduction Targets for 10^{-4} per person per year for ONWS

Water Use Scenario	Enteric Viruses	Parasitic Protozoa	Enteric Bacteria
Domestic Wastewater or Blackwater			
Unrestricted Irrigation	8.0	7.0	6.0
Indoor Use	8.5	7.0	6.0
Graywater			
Unrestricted Irrigation	5.5	4.5	3.5
Indoor use	6.0	4.5	3.5
Rainwater/Roof Runoff			
Unrestricted Irrigation	N/A [1]	No Data [1]	3.5
Indoor use	N/A [1]	No Data [1]	3.5
Stormwater (10^{-1} dilution)			
Unrestricted Irrigation	5.0	4.5	4.0
Indoor use	5.5	5.5	5.0
Stormwater (10^{-3} dilution)			
Unrestricted Irrigation	3.0	2.5	2.0
Indoor use	3.5	3.5	3.0

1. Not Applicable

Other wastewater treatment parameters like Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solids (TDS), and nutrients (nitrogen and phosphorus) may be important to monitor and treat for depending on the alternative water source and the end use.

Treatment systems for alternate water sources would need to be designed to meet the LRTs. Typical treatment systems include microfiltration (MF), ultrafiltration (UF), membrane biological reactors (MBR) ultraviolet light (UV) disinfection, ozone disinfection, and chlorination. There are accepted pathogen crediting frameworks for validation, field verification, and monitoring of treatment performance. Table 2-2 provides pathogen credits for common treatment processes.

Table 2-2: Treatment Process Log Reduction Credits

Treatment Process	Log10 Reduction Credits Virus/Protozoa/Bacteria
Microfiltration (MF) or Ultrafiltration (UF)	0/4/0
Membrane Biological Reactor (MBR)	1.5/2/4
Reverse Osmosis	2/2/2
UV Disinfection	6/6/6
Chlorine Disinfection	5/0/5 (CT dependent[1])
Ozone Disinfection	4/3/0 (CT dependent[1])

1. CT = Concentration x Contact Time

2.4.2.1 Treatment Processes for Alternate Water Sources

Successful non-potable water reuse systems include three basic steps: primary, secondary, and tertiary, as referenced in Section 2.4.1.1. For ONWS the primary treatment step is required for all alternate water sources to remove coarse biological material and large solids. Most alternate sources require secondary treatment to remove organic material which involves biological treatment and chemical oxidation to degrade organic matter. Tertiary treatment is usually required based on the use and water source and it includes additional filtration and disinfection. The filtration step for tertiary treatment can be an MF, UF, and can also include RO system for removal of dissolved solids. The disinfection step can be UV disinfection, chlorination, or ozone. The combinations of primary, secondary and tertiary treatment systems for different alternate water sources based on the end use are summarized in Table 2-3.

Table 2-3: ONWS Treatment Processes for Different End Uses

	Treatment						
	Primary		Secondary	Tertiary			
Water Source Type	Screen	Flow Equalization	Bio Treatment or Chemical Oxidation	Filtration (MF, UF)	RO	Disinfection (Chlorine, UV, Ozone)	End Uses
Condensate							• Subsurface Irrigation
Rainwater	●	●					
Stormwater	●	●					
Foundation Drainage	○		○				
Graywater	●	●	○	○			
Blackwater	●	●	●	●		○	
Condensate				●		○	• Toilet Flushing • Decorative Fountains • Car Washing • Surface Irrigation
Rainwater	●	●		●		○	
Stormwater	●	●		●		●	
Foundation Drainage	○		○	●		●	
Graywater	●	●	○	●		●	
Blackwater	●	●	●	●	○	●	

	Treatment						
	Primary		Secondary	Tertiary			
Water Source Type	Screen	Flow Equalization	Bio Treatment or Chemical Oxidation	Filtration (MF, UF)	RO	Disinfection (Chlorine, UV, Ozone)	End Uses
Condensate				●		●	
Rainwater	●	●		●		●	
Stormwater	●	●		●		●	• Cooling Towers • Boilers
Foundation Drainage	○		○	●		●	
Graywater	●	●	○	●	○	●	
Blackwater	●	●	●	●	●	●	

● Typically Required

○ Project Specific

The following sections provide examples of treatment approaches for different alternate water sources that have been successfully implemented ONWS in cities like San Francisco, New York, and other international locations. Specific examples of case studies in other locations are presented in Section 3.1.

2.4.3 Treatment Systems for Alternate Water Sources

2.4.3.1 Rainwater

Rainwater refers to rainfall that is collected from a building roof or other manmade above ground collection surface before it reaches the ground. Rainwater collection systems start with a screening or filter to remove debris such as leaves or branches. Then, a first flush diverter is used to discharge the first flow of rainfall following the onset of a rain event, which is assumed to have potential for fecal matter from birds and other animals. After the first flush, the rainwater collected is stored in a tank. The size for the storage tank is based on local rainfall patterns, the intended uses for the rainwater, structural design, and space available at the site. If rainwater is used for toilet flushing or surface irrigation, then a disinfection step is added after the storage tank prior to pumping the treated rainwater into the non-potable distribution system or irrigation system.

The limitations of ONWS that only include collection of rainwater (or even stormwater) is that the water source is limited to weather conditions, in areas like Sacramento, rainfall capture is limited to a few storm events in the winter season requiring large storage tanks to accumulate enough rainwater and store it long term for use either in the irrigation season (holding the water until summertime) or to meet indoor demands until the next rain event. Rainwater systems require a potable water supplied to the storage tank as a backup supply as well as an overflow system. Potable water is supplied to the storage tank using an air gap, which is a physical break

between a supply pipe and a receiving vessel. The backup potable supply allows for filling the storage tank with potable water to use when rainwater is depleted.

Other considerations for designing a rainwater treatment system include treatment for color or odors that can be caused if the system has a green roof, and the influent water may be collecting organic material. In these cases, filtration with media and/or activated charcoal can be added, in addition to chlorine for disinfection. In addition, blending rainwater into ONWS systems would prevent its ability to be permitted to enter storm drain systems. Sacramento currently has a combined storm and sewer system, which would need to be taken into consideration when designing a rainwater treatment system.

Per the CPC Chapter 16, the minimum water quality requirements for rainwater treatment systems are summarized in Table 2-4.

Table 2-4: Rainwater Treatment Systems Water Quality

Application	Minimum Treatment	Minimum Water Quality
Car Washing	Debris screening (100 micron for drip irrigation)	N/A
Surface, Subsurface and Drip Irrigation	Debris screening (100 micron for drip irrigation)	N/A
Spray Irrigation (Storage < 360 gallons)	Debris screening and disinfection	N/A
Spray Irrigation (Storage > 360 gallons)	Debris screening	• E. Coli < 100 CFU/100 ml • Turbidity < 10 NTU
Toilet Flushing, Clothes Washing, Trap Priming	Debris screening (100 micron for drip irrigation)	• E. Coli < 100 CFU/100 ml • Turbidity < 10 NTU
Decorative Fountains	Debris screening	• E. Coli < 100 CFU/100 ml • Turbidity < 10 NTU
Cooling Tower Make-up Water	Debris screening (100 micron for drip irrigation)	• E. Coli < 100 CFU/100 ml • Turbidity < 10 NTU

N/A: Not Applicable
CFU: Colony Forming Units
ml: milliliters
NTU: Nephelometric Turbidity unit

2.4.3.2 Stormwater

Stormwater refers to precipitation runoff from rain or snowmelt events that flows over land and/or impervious surfaces (i.e., streets and parking lots). Stormwater usually requires higher level of treatment than rainwater due to the potential for additional contamination from urban environments from sediment, oils, debris in parking lots, trash, organic or fecal contamination in soil or from sewer leaks or sewer overflows into stormwater drain systems. Currently, there are no water quality requirements for stormwater defined in the CPC.

2.4.3.3 Graywater

Graywater is wastewater that is collected from non-blackwater sources, such as bathroom sinks, showers, bathtubs, clothes washers, and laundry sinks. Graywater typically requires

secondary biological treatment, filtration and disinfection with a chlorine residual. Currently, there are no water quality requirements for graywater defined in the CPC.

2.4.3.4 Blackwater Treatment

Blackwater is wastewater that originates from toilets, urinals, and/or kitchen counters (i.e., kitchen sinks and dishwashers). Blackwater requires the highest level of treatment, tertiary treatment and disinfection, equivalent to the level of treatment provided for recycled water production to protect public health. Water quality requirements for blackwater are the standards provided in the CCR Title 22 for recycled water, as summarized in Section 2.4.1; however, there are currently no water quality requirements for blackwater defined in the CPC.

2.4.3.5 Other Alternate Water Sources

Other potential alternate water sources include condensate water which is vapor collected from air conditioning systems, and foundation drainage, which is nuisance groundwater that is extracted discharged to the sanitary or combined sewer system. It does not include groundwater extracted for beneficial use that is subject to the groundwater well regulations. Currently, there are no water quality requirements for other alternate sources defined in the CPC.

2.5 Testing and Inspection Requirements

Testing and inspection requirements are outlined in different guidelines. California Code of Regulations and California Plumbing Code detail certain requirements for ONWS.

2.5.1 Cross-Connection Testing

Cross-connection refers to any physical connection or arrangement between potable water and any source of contamination. It is critical that no cross-connection exists between a potable and a non-potable water system to protect the quality of drinking water. Cross-connection testing is required for any dual plumbed system that is either using municipal recycled water or non-potable water from an ONWS, to provide evidence that there is no potential cross-connection between the potable and non-potable water supplies. Cross-connection testing must be overseen by a Certified Cross-Connection Control Specialist.

For dual-plumbed systems, cross-connection inspections must be conducted annually, with testing of the recycled water (municipal and blackwater) systems every four (4) years, per CCR Title 22. In addition, other alternate water sources (graywater and other onsite water supplies) cross-connection inspections are required whenever there is a major plumbing alteration.

Typically cross-connection testing will involve a two-way shut down, which will consist of turning off the potable water supply and verifying that any potable water connection, such as fixtures within buildings and bathrooms, water fountains, or irrigation areas that will remain on potable water, do not have running water; then, the water system will be restarted and the non-potable water supply will be shut down to verify that none of the irrigation or non-potable fixtures connected to the municipal recycled water or ONWS have running water. Additionally, there is a manual test of the backflow equipment to ensure the valves are seating correctly.

Per the CPC Chapter 15, an initial visual system inspection must be conducted prior to beginning the cross-connection test. In this test:

- Meter locations of the alternate water source and potable water lines shall be checked to verify that no modifications were made and that no cross-connections are visible.
- Pumps and equipment, equipment room signs and exposed piping in equipment room shall be checked.
- Valves shall be checked to ensure that the valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

The current steps for testing are outlined in the CPC and are subject to change over time. The steps required from the CPC in 2022 for a cross-connection test are:

- The potable water system shall be activated and pressurized. The alternate water source system shall be shut down, depressurized, and drained.
- The potable water system shall remain pressurized for a minimum period specified by the Authority Having Jurisdiction while the alternate water source system is empty. The minimum period the alternate water source system is to remain depressurized shall be determined on a case-by-case basis, considering the size and complexity of the potable and the alternate water source distribution systems, but in no case shall that period be less than 1 hour.
- The drain on the alternate water source system shall be checked for flow during the test and fixtures, potable, and alternate water source, shall be tested and inspected for flow. Flow from an alternate water source system outlet indicates a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the alternate water source system.
- The potable water system shall then be depressurized and drained.
- The alternate water source system shall then be activated and pressurized. When an alternate water source is not available for the initial cross-connection test, a temporary connection to a potable water supply shall be required. At the conclusion of the initial cross-connection test, the temporary connection to the potable water supply shall be disconnected.
- The alternate water source system shall remain pressurized for a minimum period specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.
- Fixtures, potable, and alternate water source shall be tested and inspected for flow. Flow from a potable water system outlet indicates a cross-connection. No flow from an alternate water source outlet will indicate that it is connected to the potable water system.

- The drain on the potable water system shall be checked for flow during the test and at the end of the test.

- Where there is no flow detected in the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

2.5.2 Signage and other System Requirements

Signage must be provided for any dual plumbed system that is either using municipal recycled water or non-potable water from an ONWS. Signage must properly indicate if the system is using recycled water, which is reserved for municipal supplies and not ONWS, or other type of non-potable water and comply with the state regulations (CPC and CCR Title 22).

2.5.2.1 Recycled Water Systems Identification

Recycled water signs and fixtures using recycled water must be purple and visibly marked with back lettering stating “CAUTION: RECYCLED WATER, DO NOT DRINK” on a purple background, according to CPC Chapter 15 (see Figure 2-5). Signage is required at entrances or locations where recycled water is used like landscape areas or bathrooms where recycled water is used for toilet flushing. Signs must be located such that they are visible to users.

In addition to signage, there are other specific requirements for irrigation systems using recycled water such as providing locking features for valves, except control valves, hose bibbs are not allowed on recycled water piping systems and only quick coupler valves can be used and must differ from quick coupler valves used with potable water supply in areas subject to public access.

Figure 2-5: Example Recycled Water Advisory Sign

2.5.2.2 ONWS Identification

According to CPC Chapter 15, signs for ONWS should include text indicating the intended use to inform the public such as: “TO CONSERVE WATER, THIS BUILDING USES ONSITE TREATED NON-POTABLE WATER TO FLUSH TOILETS AND URINALS”

Signs must also be included in the equipment rooms visible to workers and identifying the fixtures and equipment using recycled water or non-potable water. Signs should include notification to workers such as: “CAUTION: ONSITE TREATED NON-POTABLE WATER, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

Signage and proper ONWS identification must be inspected prior to finalizing a permit to operate an ONWS project.

2.5.2.3 Other Public Health Protections

CCR Title 22 also requires that any use of recycled water be confined so that its application does not pose a public health threat with restrictions on places of use and application methods. These restrictions include:

- Conditions that must be met for the use of recycled water for irrigation within 50 feet of a domestic water supply well.
- No impoundment of recycled water within 100 feet of a domestic water supply well.
- No use of disinfected secondary – 23 recycled water or disinfected secondary – 2.2 recycled water within 100 feet of a domestic water supply well.
- No irrigation or impoundment of undisinfected secondary recycled water within 150 feet of a domestic water supply well.
- No unauthorized recycled water irrigation runoff outside the recycled water use area.
- No spray, mist, or runoff of recycled water can enter dwellings, designated outdoor eating areas, or food handling facilities or come into contact with drinking water fountains.
- Only disinfected tertiary recycled water can be used for spray irrigation within 100 feet of a residence, park, playground, schoolyard, or other place of similar use.

2.6 Developing an ONWS Program

The San Francisco Public Utilities Commission (SFPUC), in partnership with WRF and the Water Environment Research Foundation (WERF) partnered to develop a *Blueprint for Onsite*

Water Systems A Step-by-Step Guide for Developing a Local Program to Manage Onsite Water Systems. The guide includes general steps for developing an ONWS program:

1. Create a small group to facilitate the development of the local program.
2. Select the alternate water sources that will be permitted within the program.
3. Identify the specific end uses for the non-potable water in the program.
4. Establish water quality standards for each alternate water source and/or end use.
5. Integrate the program into local building practices through construction requirements and building permit processes.
6. Establish monitoring and reporting requirements for water quality.
7. Create the permit process for initial and ongoing operations.
    a. Define which agency is responsible for: administering operating permits, reviewing monitoring data, reviewing and approving engineering and design reports, and having the authority to shut down systems that do not comply with permit requirements.
    b. Permit phases that should be considered: pilot systems, startup permit, temporary use permit, final permit, and continuing operation permit.
8. Publicize the program and provide direction for the project sponsors and developers.
    a. Define the design, construction, and operation processes for project sponsors and developers. Educational materials, such as brochures or guidebooks, that highlight the objectives and requirements of the program should be developed. Identify champions of the program and how they can support. Support can be a general resolution, a specific ordinance, or a planning policy.

Steps 1 through 8 help guide the development of an ONWS program and Steps 9 and 10 are concerned with growing the ONWS program.

9. Evaluate the program and advance the best practices for ONWS. Evaluation criteria can include: effectiveness, accomplishments, adjustments that may be necessary, updates to the program based on treatment technologies and/or regulations, and data collection.
10. Promote the growth of the program by finding opportunities to expand onsite water systems. Growth can include: increasing water sources, allowing other non-potable uses, adjusting the scale, and increasing financial incentives.

Section 3.1.1 reviews the San Francisco Onsite Water Reuse Program, which serves as a model for the 10 steps above. The City of Sacramento can use this guide to develop its own ONWS Program, with this Study presenting the topics and identifying the decisions and

information needed in order to fulfill each step. By initiating this Study, the City has already embarked on Step 1 of this guide.

2.7 Development of an ONWS Ordinance

The National Blue Ribbon Commission for Onsite Non-potable Water Systems included in their *Guidebook for Developing and Implementing Regulations for Onsite Non-potable Water Systems,* a template to develop a local ordinance to implement an ONWS program

There are multiple pathways to implementation of an ONWS ordinance including: development of regulations by state and implementation by local authority, development and implementation of regulations by state, and development and implementation of regulations by local authority. This specific template focuses on the scenario where the state develops the regulations, and the local authority implements them.

The template is broken down into 12 sections recommended to be included for an ordinance. For a local jurisdiction to develop an ordinance several parameters would need to be defined for the program as referenced in Section 2.6, such parameters include:

1. Defining the alternate water sources that may be used to supply an ONWS (excluding groundwater wells).
2. Selecting the allowable non-potable end uses to be supplied by an ONWS.
3. Specifying the type and scale of developments that would be required to or recommended to implement an ONWS.
4. Determining the applicable rules and regulations for ONWS, including:
    a. Treatment and water quality standards, based off existing regulations or proposed risk-based standards as summarized in Section 2.4.2.
    b. Operation, monitoring, and reporting standards
    c. Application process to obtain a permit to install an ONWS
    d. Review process to approve a permit for an ONWS (plan check and construction)
    e. Inspection and certification requirements to approve an ONWS for operation, including site supervisor certification requirements
    f. Permit issuance, renewals, revocation, enforcement or transfers due to Change of Ownership
5. Establishing fees, penalties, and incentives
6. Developing guidelines, manuals, and references.

Section 3: One Water Program Development through One Water Vision

The One Water concept involves a collaborative and comprehensive long-term approach to community-based water management that recognizes all urban water supplies as resources (e.g., surface water, groundwater, stormwater, wastewater, graywater, etc.). One Water policies are implemented through integrated planning to meet community and ecosystem needs. One Water planning and implementation requires a coordinated effort to identify integrated water management practices and priorities to support building water security and resiliency. The implementation of a dual plumbing ordinance and ONWS projects in the City can be supported through this type of long-term water resource planning. A One Water Vision for the City's Onsite Water Reuse Strategy can guide the development and implementation of an ONWS Program in the context of the City's potable and non-potable water resources.

3.1 Case Studies for One Water and Dual Plumbing

Three relevant case studies were evaluated to understand how dual plumbing implementation is being achieved in other communities and how ONWS fit into the broader One Water framework. These programs were selected based on their similarity to the City of Sacramento criteria for applicable building types, water sources, and uses, as well as the mechanism by which a dual plumbing ordinance is (to be) implemented. While none of these case studies can be directly duplicated to meet the City of Sacramento's goals for implementing dual plumbing or ONWS, the lessons learned can be used to inform the development of the Sacramento dual plumbing ordinance and/or ONWS program.

Case Study 1. San Francisco Onsite Water Reuse Program: This case study provides an example of a city that is a leader in the State of California as an adopter of ONWS and development of a program for planning, monitoring, and installation. The case study demonstrates the use of pilot studies to develop organizational knowledge and technical capacity. It demonstrates the resources and coordination needed to administer this program and enforce the requirements. The case study also introduces the concept of district scale projects and the opportunities and drawbacks of these types of projects.

Case Study 2. City of Santa Monica Recycled Water Ordinance: This case study provides an example of a smaller scale project, when compared to the San Francisco case study. The ordinance took 1 year to draft and applies to buildings 7,500 square feet or larger. It demonstrates the integration of the ordinance with existing water infrastructure, current County regulations and processes, and future water conservation initiatives.

Case Study 3. One Water Ordinance (Honolulu, Hawaii): This case study provides an example of a process to develop the principles and procedures for how city departments and agencies work together, including establishing regular interagency meetings and collaboration. This ordinance describes mechanisms to support developers. This case

study also demonstrates the value of pilot studies in analyzing the potential benefits of different ONWS systems, including stormwater capture and potable water conservation.

Appendix A provides case study summary sheets with key information about each of the programs. Appendix B provides the ordinances for each city. The City's One Water Vision and Onsite Water Reuse Strategy builds off the lessons learned from these case studies.

3.1.1 San Francisco Case Study

The City of San Francisco was the first city in the United States to mandate newly constructed buildings to install ONWS. As of 2022, the Non-potable Water Ordinance requires that new development projects of 100,000 square-feet or greater must use ONWS. For commercial buildings, the project must meet its toilet and urinal flushing and drain trap priming demands through the collection, treatment, and use of available blackwater and condensate. For residential and mixed-use buildings, the building must meet its toilet and urinal flushing, irrigation, clothes washing, and drain trap priming demands through the collection, treatment, and use of available graywater and condensate. In addition to the requirements for buildings 100,000 square-feet (sq ft) or greater, buildings 40,000 square-feet or larger must submit water budget calculations and assess the supply available from alternative water sources and the demand from required non-potable uses.

ONWS Timeline

The San Francisco Onsite Water Reuse Program was first established in 2012 as a voluntary program. In 2012 the SFPUC created a voluntary program for water reclamation. SFPUC led the onsite initiative by installing an ONWS with a 5,000 gallons per day capacity in the lobby of its administrative building, treating the building's wastewater, and reducing the building's demand by more than 70 percent.

In 2013 the program was amended to include district-scale systems. A district-scale project is when two or more buildings within a development share a system. In 2015, the program became mandated, requiring onsite systems. Between 2012 and the mandate of ONWS, many of the systems were driven by achieving credits towards Leadership in Energy and Environmental Design (LEED) certifications, complying with the City's stormwater management ordinance, and individual project sustainability goals. The stormwater management ordinance was in place before the ONWS ordinance and required the retention of stormwater onsite through development of bioswales, green roofs, or rainwater harvesting systems. In buildings that opted for rainwater harvesting systems, the ONWS permit process was required. In 2016, buildings 250,000 square feet or larger required ONWS. In 2021, regulations for ONWS were further tightened to require new developments as of January 1, 2022 with 100,000 square feet or greater to require ONWS.

Ordinance Exemptions

Exemptions to the Non-potable Water Ordinance include:

- Rehabilitation of buildings constructed prior to August 1, 2015

- Any 100% affordable housing project, 100% permanent supportive housing project, or any housing project that is funded or constructed pursuant to the HOPE SF Program
- Hospital buildings, health service buildings, and institutional healthcare use buildings
- Industrial buildings
- Production, distribution, and repair use buildings
- A building that will receive water service from the San Francisco Public Utilities Commission through no larger than a 5/8" domestic water meter or a 5/8" recycled water domestic meter

Implemented ONWS Systems

SFPUC led by example and in 2012 installed an ONWS in the lobby of its administration building with a capacity of 5,000 gallons per day. The building contains two onsite water systems, a Living Machine® and a rainwater harvesting system. In 2021, SFPUC published a report that details the developments in San Francisco that are currently operating or are in the process of installing a non-potable water system. This report included 17 sites, which were using rainwater, blackwater, bay water, graywater, foundation drainage, steam condensate, stormwater for onsite non potable reuse. 14 of the 17 projects used rainwater or rainwater and another water source, and 14 of the 17 projects used non potable reuse water for toilet and urinal flushing. On average the building size was 650,600 square feet (375,800 sq ft for 50th percentile) and the volume treated at each building on average was 5.91 million gallons per year (0.91 MG/yr for 50th percentile).

Project Funding

SFPUC incentivized project developers to go 'above and beyond' the required treatment volumes through a grant program. The Onsite Water Reuse Grant Program provides grants for voluntary or 'above-and-beyond' projects, with the level of funding based on estimated water offset (gal/yr for 10-years). The maximum funding available to offset the upfront construction costs for each project is $1 million for offsetting 3 million gallons per year or more of water. Based on the available case study information, this grant has provided funding to five of the case study projects, ranging in 14%-20% of the ONWS installation cost[4].

Agency Coordination and Staffing Requirements

SFPUC manages the program administration where they review the onsite non-potable water budgets, track the projects and annual potable offset achieved, and provide technical support and outreach to developers. SFPUC also manages the cross-connection control program.

SFPUC is also supported directly by the SF Department of Public Health, SF Department of Building Inspections, and SF Public Works. The SF Department of Public Health, Environmental Health issues the water quality and monitoring requirements. They also review the engineering

[4] ONWS installation costs were available for four of the five projects that have received funding through the SFPUC Onsite Water Reuse Grant Program.

reports that are submitted by the developers. They are responsible for issuing the permit to operate the system and once the systems are in operation, they are responsible for reviewing the water quality reporting from the systems.

The SF Department of Building Inspections conducts plumbing plan checks and issue plumbing permits. They are also responsible for inspecting and approving system installations. SF Public Works Department is responsible for right of way mapping, issuing encroachment permits as needed. These roles and responsibilities are summarized in Table 3-1.

Table 3-1: San Francisco Onsite Water Reuse Program Core Agencies (Adapted from SFPUC, 2021)

San Francisco Public Utilities Commission	SF Department of Public Health-Environmental Health	SF Department of Building Inspections	SF Public Works
Program Administration & Cross-Connection Control	***Environmental Health***	***Construction***	***Right of Way & Mapping***
Review onsite non-potable water supplies & demands	Issue water quality & monitoring requirements	Conduct Plumbing Plan check and issue Plumbing Permit	Issue encroachment permits as needed for infrastructure in the Right-of-Way (if needed)
Administer citywide project tracking & annual	Review & approve non-potable engineering report	Inspect and approve system installations	Includes condition on a subdivision map or a parcel map requiring compliance with the Non-Potable Ordinance prior to approval and issuance of said map (if applicable)
Provide technical support & outreach to developers	Issue permit to operate onsite systems		
Managers Cross-Connection Control Program[1]	Review water quality reporting to evaluate compliance with standards while system is operating		

Table Adapted from SFPUC

1. Cross-connection control program requires inspection and testing prior to operation of the system. For blackwater systems the system must be tested every four years. For graywater, rainwater, groundwater, etc. subsequent cross-connection testing is not required.

SFPUC currently has one full-time employee who operates the program administration. During project startup, there was one full-time employee and one part time employee dedicated to the program. These employees are funded through the operating budget of SFPUC. Other departments have not seen increased staffing and activities are funded through permitting fees. The City is not involved in the operation and maintenance of any of the installed ONWS.

System Implementation Steps

SFPUC has a ten-step process for developers implementing ONWS. These steps are as follows:

1. A **water budget** must be submitted that demonstrates the available water supplies and non-potable demands. SFPUC has a Non-Potable Water Use Calculator available to support developers at this step.

2. Submit **non-potable implementation plan** (District Scale Projects only) that provides details on the design, operation, and phasing schedule. SFPUC has a checklist to aid developers at this step. This includes schematic layouts of onsite water reuse system components, details on the district scale system, estimated potable and non-potable demands, analysis of anticipated sewer system impacts, proposed ownership model, as well as a phasing plan for implementation of the project.

3. Submit an **application for permit to operate** to San Francisco Department of Public Health – Environmental Health (SFDPH-EH). This provides the department of health information on the proposed system. An **engineering report** is prepared and submitted to SFDPH-EH that provides details on the treatment system design and technical information for the onsite non-potable water systems. SFPUC has developed a database of ONWS vendors and technologies to assist developers at this stage.

4. Obtain an **encroachment permit** if the project includes installing infrastructure in the public right-of-way. This is reviewed by San Francisco Public Works (SFPW) to identify any potential utility conflicts.

5. Obtain **plan check approval and complete system construction**. This includes a plumbing plan check to verify that the ONWS meets State of California and San Francisco Plumbing Code requirements. Once the system is constructed, a Construction Certification Letter must be submitted to verify that the system was installed in accordance with the engineering report. System modifications from the engineering report must be submitted.

6. Once the system is constructed, before it can be used a **cross-connection test and complete post-construction inspection** must be completed. The City has a list of certified cross-connection control specialists who are qualified to conduct the tests. Cross-connection testing is required for all systems before startup and after any major plumbing alterations. Blackwater systems require cross-connection testing every four years.

7. Submit documentation for a **permit to operate** after passing the cross-connection test. This permit step includes submitting an operation and maintenance manual, proof of a contract with a laboratory for water quality testing, information demonstrating that all parties legally agree with their responsibilities, as well as a treatment system manager affidavit. Graywater systems require a Grade 2 water treatment plant or distribution system operator or Grade 2 Wastewater Treatment Plant operator. Blackwater systems require a Grade 2 wastewater treatment plant operator. At this stage the project is also added to the City's tax collector website.

8. Obtain a **permit to operate** from SFDPH-EH. This permit allows the start of the system in a conditional mode.

9. Once the permit is issued, the system can be operated in **conditional startup mode.** A 90-day period of conditional startup is followed. During this phase the system is verified that it meets log reduction targets, BOD, total suspended solids (TSS), and turbidity requirements. During this time the treated water is diverted to the sewer and the end uses are supplied with potable water. Rainwater, stormwater, foundation drainage, and blackwater have varying conditional startup water quality sampling requirements.

10. Once the conditional startup mode proves the system is operating and meeting water quality requirements the system can **operate in final mode with approval**. Treatment system managers must continue to report monitoring results to SFDPH-EH, with blackwater systems reporting quarterly and other systems reporting annually. Systems must also be regularly inspected and tested to verify it is operating correctly. This is demonstrated through water quality monitoring. Once the systems are operating in final use mode, blackwater systems must submit reports on a quarterly basis and other water source systems must submit reports on an annual basis to SFDPH-EH. Backflow prevention assemblies and cross-connection tests must be conducted in accordance with local and state regulations.

Implementation of District-Scale Projects

A district-scale project is defined as a system serving two or more buildings, whether under the jurisdiction of one entity or several entities. District-scale projects were added to the program in 2013. These projects can provide for greater efficiencies for onsite water reuse, however, are subject to additional requirements given the complexity of design, phasing, and implementation. District-scale projects were incorporated due to the found benefits of balance of supply/demand, reduced operation and maintenance (O&M) complexity/cost, building footprint, payback period, and stormwater compliance. Challenges to district-scale projects have included higher initial program cost, ownership and maintenance agreements, schedule and phasing challenges, permitting requirements, as well as encroachment permits and private infrastructure challenges. Examples of district scale projects include the following:

- ***Chase Center arena*** which includes two towers adjacent to the arena and a 3.2 acres public plaza. It is owned by a single entity and ongoing service and maintenance is contracted.

- ***Moscone Center Expansion Project*** includes a 1.5 million square feet project using rainwater, foundation drainage and steam condensate to treat approximately 15 million gallons per year. The project was conducted with the City and County of San Francisco's Convention Facilities Department, San Francisco Public Works, and the San Francisco Tourism Improvement District Management Corporation. A motivation of the project was for LEED Certification and compliance with the San Francisco Mayoral Executive Directive 14-01.

- ***Mission Rock*** will be a new mixed-use 28-acre neighborhood that includes parks, open space, residential, commercial, and retail. As of 2021, the project is still in design, but

will treat blackwater to produce 43,000 gallons per day. The project will establish its own utility organization (Mission Rock Utilities, Inc.) to oversee the system and the daily activities of the utility will be managed by Ever Green Energy through a management services agreement.

Summary of San Francisco Case Study

SFPUC pioneered the implementation of ONWS in the United States. SFPUC led by example through the implementation of the first system in their buildings. The program started as an optional, sustainability driven and LEED certification program with a strong nexus between the stormwater requirements. Funding opportunities for developers aided the growth of the program and encouraged programs to achieve water reuse above recommendations or requirements. Over time, as technologies developed, and implementation and monitoring systems were established by various City departments the program became mandated. Ongoing activity required to support the project from SFPUC as well as support from the public health, public works, and building inspection departments. District-scale projects emerged because of the findings of the initial projects and provide potential cost-savings to developers.

While the San Francisco Onsite Water Reuse Program has shown that an ONWS program is feasible in California, it has taken a decade to become the robust and stable program that it is. The City of Sacramento will need to go through much of the same discovery path to establish an ONWS of its own that matches the City's local climate, economy, and building potentials. The development of the City of Sacramento's ONWS can benefit, however, from the lessons learned by the San Francisco Onsite Water Reuse Program to establish its own ONWS in a shorter amount of time. Unlike San Francisco, which is both the City and County, the City of Sacramento will need to obtain buy-in from other agencies with jurisdictions within the City boundaries.

3.1.2 Santa Monica Case Study

The City of Santa Monica aims to reduce its dependence on imported water using municipal recycled water and become water self-sufficient by 2023. A recycled water ordinance to increase the use of municipal recycled water is one way in which Santa Monica aims to reduce its dependence on imported water. In 2014, the City established the recycled water service area through their Sustainable Water Master Plan in 2014. Since 2014, the City of Santa Monica has increased their recycled water production through the Sustainable Water Infrastructure Project, which has included upgrading their Urban Runoff Recycling Facility. The City is currently evaluating additional potential opportunities to expand their recycled water service (purple pipe) network.

The City Council passed the dual plumbing ordinance on March 22, 2022, which sets guidelines for dual-plumbed buildings and landscape irrigation within the City's service area. The City of Santa Monica began drafting a Recycled Water Ordinance and Recycled Water User Guidelines in 2021. The ordinance requires the use of recycled water by: (1) all new developments of 7,500 square-feet or greater, and (2) existing potable water surface irrigation applications within the existing local recycled water service area. For indoor use, dual plumbing systems are to be utilized in new buildings that are commercial, industrial, or multi-facility residential developments, with applications including: flushing toilets/urinals, industrial process or boiler

feeds, commercial laundries or carwashes, industrial or commercial cooling towers or evaporative condensers. Outdoor uses will include surface irrigation for highway and median landscaping, city parks, cemeteries, commercial building landscaping, and public-school grounds.

Ordinance Exemptions

Exemptions to the Recycled Water Ordinance will include:

- Any exemptions recognized by the Los Angeles County Department of Public Health.
- Fire protection systems in any development
- Uses where recycled water quality has been deemed non-suitable for a particular fixture or equipment as reasonably determined by the Manager
- Uses when installing a recycled water system for surface irrigation and/or dual-plumbing system uses is commercially infeasible as reasonably determined by the Manager. In this case a Recycled Water In-Lieu Fee shall be required.

Influent Water Sources

Currently the City of Santa Monica's recycled water production comes from the Santa Monica Urban Runoff Recycling Facility (SMURRF) and is used for beneficial non-potable reuse. Influent sources include dry weather runoff (water from excessive irrigation spills, construction sites, pool draining, car washing, washing down of pavement) and occasional wet weather runoff.

The City of Santa Monica is currently in the process of expanding recycled water sources through the City's Sustainable Water Infrastructure Project (SWIP). The SWIP will deliver advanced treated recycled water to the City for both groundwater replenishment and non-potable use for applications including irrigation and toilet flushing. As part of the SWIP, the City of Santa Monica is constructing an advanced water treatment plant to treat 1 MGD of municipal wastewater for non-potable and indirect potable reuse. The current recycled water demand is lower than the planned increase in production of recycled water, so the implementation of the ordinance will expand recycled water use opportunities in the City. The installation of dual plumbing will not only increase demand, it will also facilitate expansion of the existing recycled water infrastructure to ultimately reduce dependency on imported water and increase water self-sufficiency.

Agency Coordination and Staffing Requirements

Several agencies were involved in the drafting process of the Recycled Water Ordinance, and they continue to be involved based on the requirements of the ordinance. These agencies include the City Building and Safety Department, City Water Resources Division, Los Angeles County Department of Public Health, Los Angeles County Sanitation District, the Los Angeles Regional Water Quality Control Board, and the State Water Resources Control Board.

The City of Santa Monica Water Resources Division led the development of the Recycled Water Ordinance. They are the entity that will review the recycled water use applications and oversee the implementation and inspection of the systems. They are supported by the City Building and Safety Department who review the building permit applications, issue building permits, and collect the associated fees. The costs to the City of Santa Monica for administering and implementing the requirements of the Recycled Water Ordinance will be covered by administrative fees. Building permit applicants that are candidates for recycled water use under the City of Santa Monica's ordinance will be required to pay the administrative fee at the time of issuance of the building permit.

Los Angeles County Department of Public Health administers the Cross-Connection and Water Pollution Control Program and provides cross-connection control and signage regulations. Los Angeles County Department of Public Health is delegated by the State to approve recycled water use and coordinates between applicants and the State Water Resources Control Board Division of Drinking Water. For new applications for recycled water use within the City of Santa Monica, reviews, inspections and conditional use approvals are incorporated into the County's existing processes. Additionally, water quality and system requirements are regulated by the Los Angeles Regional Water Quality Control Board and the State Water Resources Control Board. The Los Angeles County Sanitation Districts is a local organization that provides recycled water user site supervisor training. These agencies and their roles are summarized in Table 3-2.

Table 3-2: Core Agencies for City of Santa Monica Recycled Water Ordinance

City Building & Safety	City Water Resources Division	Los Angeles County Department of Public Health	Los Angeles County Sanitation District	Los Angeles Regional Water Quality Control Board	State Water Resources Control Board, Division of Drinking Water
Construction	***Program Administration***	***Cross-Connection Control***	***Training***	***Permitting***	***Program Administration and Review***
Review building permit applications	Led development of Recycled Water Ordinance	Sets regulations for cross-connection safety and testing	Oversees recycled water users site supervisor training program	Sets SWIP waste discharge requirements	Reviews project plans and specifications for dual-plumbing systems
Issue Building permits and collect associated fees	Review recycled water use applications Oversees implementation and inspection of systems	Approves recycled water signage		Set Water Reclamation Requirements requiring the City to implement ordinances governing the use of RW	

Project Funding

As part of the City's Sustainable Water Master Plan (SWMP) three major projects were identified to achieve water self-sufficiency for the City: expanding the City's WTP capacity and efficiency; increase groundwater production; and construct a new advanced water treatment facility and pipeline. To help offset the capital expenditures, the City plans to pursue funding programs. These opportunities include: Metropolitan Water District's Local Water Resources Program, California Department of Water Resources Water Quality, Supply. And Infrastructure Improvement Act of 2014 (Proposition 1) Grants, United States Bureau of Reclamation programs; and County of Los Angeles Measure W funding. For the funding to draft the Recycled Water Ordinance and Recycled Water User Guidelines, the City has budget allocated and did not choose to pursue any funding opportunities.

Summary of Santa Monica Case Study

The recycled water ordinance sets forth a path for the City's future use of recycled water that aligns with their objective of water self-sufficiency and integrates into their planned construction of the SWIP. The development of the ordinance took almost one year to draft and applies to buildings 7,500 square feet or larger.

The City of Santa Monica is similar to the City of Sacramento in that it requires to support of another agency to enforce water quality requirements. However; in this case this authority was assigned to Los Angeles County Department of Public Health well before the City's efforts to expand its recycled water program. Even still, the City of Santa Monica's recycled water ordinance can be used as a model for a program that is in its initial stages, which has not yet fully defined the requirements to comply with the program or the fees or resources needs to administer it.

3.1.3 Honolulu Case Study

Background

In 2016 the Hawaii Community Foundation convened the Freshwater Initiative Council. It consisted of a group of water department leads, regulators, large landowners, and other stakeholders to arrive at quantitative goals for the state to collectively achieve to meet water security goals by the year 2030. The primary factors that contributed to establishing water security measures included: decreasing overall rainfall, increasing drought conditions, land use changes and increasing evapotranspiration. These were drivers to establish the Freshwater Initiative Council and water security goals, outlined in the publication "The Blueprint for Action: Water Security for an Uncertain Future." The following are the goals outlined in the report for Hawaii to meet the water security target by 2030:

- Conservation: Increase Water Efficiency (40 million gallons per day, by increasing efficiency by 8%)
- Reuse: Double the volume of reuse (50 million gallons per day)
- Recharge: Direct stormwater back into the ground (30 million gallons per day)

The Freshwater Initiative (FWI) goals were the driver for local water departments and regulators to work together to achieve these goals.

City and County of Honolulu One Water Ordinance

In 2020, Bill 65 was introduced to the City and County of Honolulu (CCH) Council to codify how water security and climate adaptation goals would be met, as well as encouraged partnerships and interagency coordination for water-related infrastructure. The bill was brought forward by the City and County of Honolulu Office of Climate Change, Sustainability and Resiliency and supported by the Honolulu Board of Water Supply (potable water supplier), City and County of Environmental Services (wastewater), City and County of Honolulu Facilities and Maintenance (stormwater) and the City and County of Honolulu Department of Transportation (roads).

The One Water Ordinance outlines both principles and procedures that will guide the coordinating departments and agencies. The procedures methodize how the agencies will work together on sea level rise, water and climate related issues and includes establishing regular interagency meetings and collaboration as well as pilot projects. In addition, the ordinance recognizes the need for partnerships with developers interested in supporting one water goals. Mechanisms to support these projects are also described; for example, creating easier permitting pathways for projects that are investing in climate resilience infrastructure. Table 3-3

summarizes the roles and responsibilities of the agencies implementing the One Water Ordinance.

Table 3-3: Summary of Core Working Agencies for Honolulu

State of Hawaii Department of Health - Wastewater Branch	CCH Environmental Services	Honolulu Board of Water Supply	CCH Department of Facility Maintenance	CCH Planning and Permitting
Environmental Health	***Sanitary Sewer & Municipal WWTPs***	***Potable and Municipal Recycled Water Distribution***	***MS4 Stormwater Systems***	***Building Permits/Plumbing Code***
Oversees Hawaii Administrative Rules 11-62 relating to wastewater and recycled water	Reviews development's sewer plans and provide municipal sewer hookups	Reviews development's potable water demands. Provides water meter.	Administrates rules relating to stormwater quality and quantity. Review Stormwater Quality Reports and inspects LIDs.	Reviews and inspects development projects for building code and plumbing code.
Provides water quality rules (except for rainwater and stormwater), reviews engineering reports, inspection, water quality monitoring	Currently would require a variance with approval from CCH ENV (and DOH) for onsite wastewater treatment	Distributes recycled water from municipal wastewater treatment plant	Oversees LID/GSI projects in the right-of-way.	*Ultimate building permit requires the sign off approval of the project from the other CCH department noted in this table.

Note: City and County of Honolulu are one agency

Onsite Reuse for New and Redevelopment

In 2019 the Honolulu Board of Water Supply led an initiative to identify where onsite reuse along the new transit-oriented development corridor may have the most benefits for multiple agencies and developers. The One Water planning effort combined city and state data available that showed:

- Areas of low sustainable (ground) water yield
- Areas of flooding, sea level rise and lower sewer capacity
- Soil capacity for groundwater recharge
- Optimum zones for rainwater harvesting

The study also identified four larger transit-oriented redevelopment projects to investigate the potential water and cost savings for onsite reuse at the district and building scale.

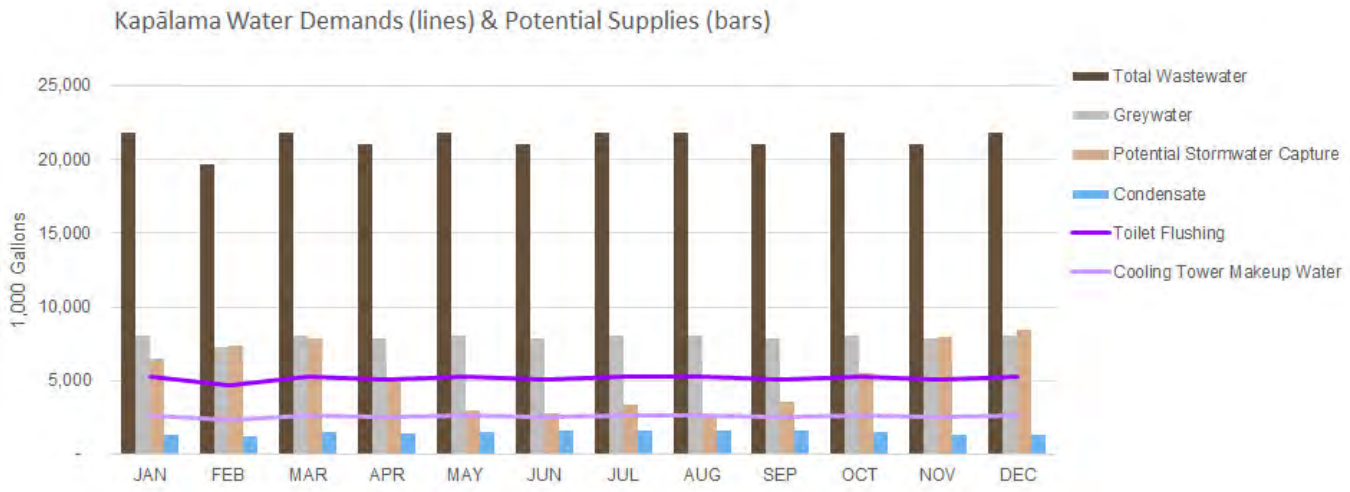
Kapālama Redevelopment Onsite Reuse Analysis

Of the four major redevelopment projects identified in the One Water planning effort, the Kapālama Redevelopment project was selected for a deeper analysis for the potential benefits for onsite reuse. It was selected because of the project location in an area where there is potential to achieve multiple benefits across multiple agencies. The site characteristics showed that the redevelopment project was in an area of lower sewer capacity area and nuisance flooding and was projected to be impacted by future sea level rise. Without any intervention to include onsite reuse, the development had the following baseline conditions:

- Total area: **88 acres**
- Number of projected residential units: **4,400**
- Assumed daily water demand: **880K gallons per day (gal/day)** (200 gpd per unit)
- Average number of residents in PUC = **2.4 people/residential unit**
- Projected annual water & sewer bill: >**$2.8M**
- Estimate annual stormwater runoff: **~64 million gallons (MG)**
- Projected annual stormwater utility fee: **~$188K** ($4.82/1000 sq ft IA)

The onsite reuse analysis investigated onsite reuse both at the district scale and single building level. Annual onsite water supplies were compared to various annual non-potable water end use demands to determine optimum strategies.

Figure 3-1: Kapālama Water Demands and Potential Supplies (District Scale)



As shown in Figure 3-1, wastewater and graywater supplies exceeded the non-potable reuse demands and that stormwater (as rainwater collected from rooftops or land area runoff) could meet cooling tower makeup water throughout the year, while only supplying toilets for about 6-7 months during an average year of rainfall. The trend was also the same at a disaggregated scale for the individual parcels that comprise the overall project.

Individual Parcel

An average size parcel was identified within the redevelopment to undergo an onsite reuse assessment to evaluate the cost-benefit for a typical building in this development. The parcel included the following baseline conditions should no action be taken:

- Average parcel size: **1.6 acres**
- Number of projected residential units: **81** (4400 total/54 parcels)
- Assumed water demand: **200 gallons per unit**
- Average number of residents = **2.4 people/residential unit**
- Total estimated annual water demand: **4.67 MG**
- Projected annual water & sewer bill: **$53,400**
- Estimated annual stormwater runoff: **1.1 MG**
- Projected stormwater utility fee: **$3,400/yr**

A water balance was conducted for the parcel based on the expected number of building occupants, estimated building footprint and rainfall. The analysis yielded estimates for non-potable water demands and potential onsite supplies (blackwater, graywater, condensate, and rainwater from the building roof). As shown in Figure 3-2, it is estimated that 4.4 MG of wastewater would be generated, 7% of which is condensate recovery, 50% graywater, and 25% stormwater capture from the roof (rainwater). Although the remaining 18% of wastewater would not be recoverable, the amount of wastewater that can be reused is still more than enough to meet the non-potable demands of toilet flushing, cooling and heating, and irrigation totaling 2.87 MG.

Figure 3-2 also shows that the reuse of wastewater would also result in a savings in energy due to the avoided pumping, treatment, and distribution of potable water by the local water utility. Reuse would also result in annual savings to residents from avoided potable water and sewer fees both on the supply side (potable water) and the demand side (sewer or storm drain discharge). Although costs for specific ONWS were not evaluated, this analysis shows how much cost savings from the reuse of wastewater can be used to offset installation and operations costs of onsite treatment.

Alternative Source Water Selection

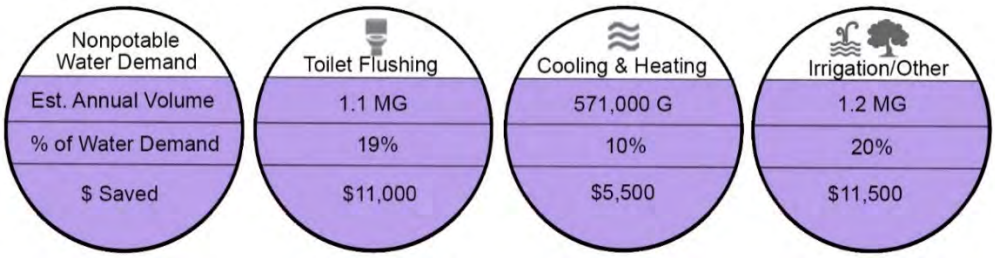
The results of the District Scale and Individual Parcel analyses both indicate there was more than adequate blackwater and graywater supplies to meet the non-potable end uses for toilet flushing, cooling tower makeup water and irrigation. However, after discussions with the various city water agencies and due to the site conditions, rainwater harvesting/stormwater capture from roofs was determined to have the most benefit across multiple agencies and would meet capital and operational costs considerations for the developer. Identified benefits for the agencies included:

- Supporting the reduction of current flooding and future sea level rise
- Storing stormwater (minimizes impacts of sanitary sewer overflows (SSOs) during rain events)
- Conserving potable water

Figure 3-2: Annual Water Portfolio and Annual Non-Potable Water Demands

Annual Water Portfolio (with Occupant Cost-Savings)

Annual Non-Potable Water Demands



1. Energy Assumption based on average energy intensity of 3.2 kWh/1000 gal for Oahu (DLNR, 2016 Hawaii Water Energy Nexus Report)
2. Occupant savings are based on assumption of replacing potable water with non-potable water (estimated from avoided potable water and sewer costs)
3. Total wastewater includes graywater and blackwater
4. 12 gal/1000sq ft per day (Novak 2014)
5. Assumes stormwater capture from building roofs only

Regulating Onsite Reuse

The City and County of Honolulu is currently using the 2018 Uniform Plumbing Code which includes code for non-potable reuse for indoor fixtures. Currently, the State of Hawaii Department of Heath Wastewater Branch is collaborating with developers to conduct initial pilots for onsite reuse to identify overlaps in responsibilities. It will likely be adopting a similar regulatory framework for onsite reuse as outlined by the Blue-Ribbon Commission.

Summary of Honolulu Case Study

Although the City and County of Honolulu is a single entity, they adopted the One Water Ordinance to serve as a roadmap for the different agencies to work together to meet the Freshwater Initiative water security goals. In addition to outlining the principles and procedures for how city departments and agencies work together, the One Water Ordinance establishes a commitment to lead, plan, and implement the development of comprehensive planning, regulations, design, and construction of city infrastructure that incorporates climate change adaptation solutions. Demonstration projects will inform the development of climate change adaptation solutions such as ONWS as well as provide an opportunity for CCH to partner with developers and find ways to streamline permitting pathways for projects that are investing in climate resilience infrastructure.

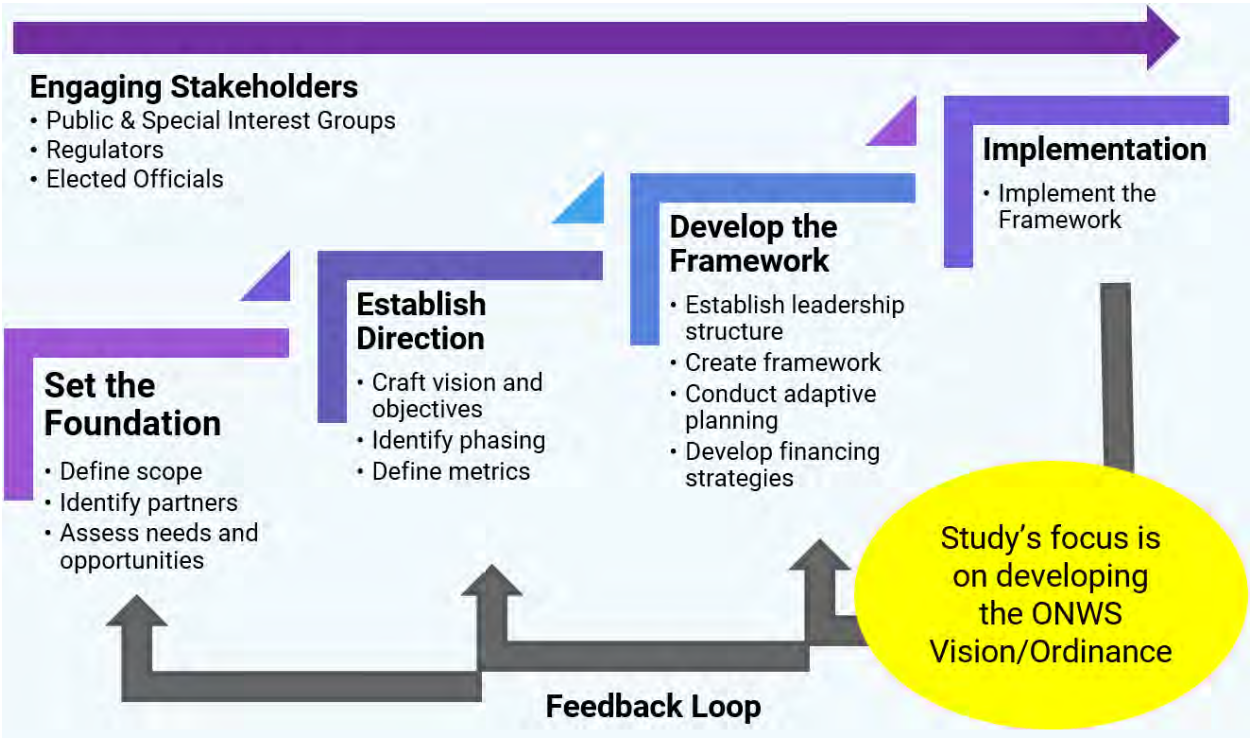
Although rainwater was identified as the optimal alternative water source for Honolulu, this resource may not be preferred in the City of Sacramento, which experiences less precipitation annually. The method to analyze the Kapālama Redevelopment can be used to estimate the potential water and cost savings, as well as ONWS that would work best for Sacramento.

Similar to the City and County of San Francisco, the City and County of Honolulu is a single entity. Even still, CCH adopted the One Water Ordinance to define how the departments would work together to develop the plans and programs, regulations, and design updates to meet the Freshwater Initiative water security goals. This approach could be used by the City of Sacramento to develop its ONWS program, as well as further define how it fits into a One Water Vision and the City's Climate Implementation Framework.

3.2 ONWS One Water Vision

Long-term implementation of a dual plumbing ordinance can be supported by the creation of the City's One Water Vision, which would consist of the scope, vision, and objectives for the City's ONWS program. The Water Research Foundation drafted the "Blueprint for One Water" with a suggested process for developing a One Water Framework. The City of Sacramento is currently in the process of Setting the Foundation, Establishing the Direction, and Engaging Stakeholders.

Figure 3-3: Blueprint for a One Water Approach



Adapted from "Blueprint for One Water" (The Water Research Foundation)

A series of workshops were held to identify the top priorities and direction for the City's Onsite Water Reuse Strategy and One Water Vision. One Water is the idea that water, similar to mass, is neither created nor destroyed, it is merely transformed. The quality of this water is largely dependent on human behavior. Therefore, it is important to be proactive about protecting it. The San Francisco, Santa Monica, and Honolulu case studies were used as examples of how One Water and Onsite Water Reuse Strategies were developed and implemented to demonstrate the specific actions and decisions needed to create and implement a dual plumbing and ONWS ordinance and program. At this stage of development, the City's One Water Vision will apply to the City's One Water Reuse Strategy only, as its application to other City programs and activities have not yet been evaluated.

The goals of the One Water Vision Workshops were to:

1. Identify key components of a Sacramento One Water Vision for the Onsite Water Reuse Program;

2. Define high level goals for a Sacramento Onsite Water Reuse System Program in the context of the Sacramento One Water Vision; and,

3. Establish objectives of Sacramento Dual Plumbing Ordinance to meet the goals for onsite reuse and the Sacramento One Water Vision.

During the One Water Vision Workshops, City staff representing DOU, CDD, the Department of Public Works and City Manager's Office of Climate Action and Sustainability were asked a series of questions related to 1) the City's One Water Vision, 2) the role of onsite water reuse in the One Water Vision, and 3) implementation of a dual plumbing ordinance. The following sections summarize the outcomes of the workshops. A draft framework for the City's Onsite Water Reuse Strategy and One Water Vision for use in development of the dual plumbing ordinance is provided as Appendix C.

3.2.1 Sacramento One Water Vision

Based on workshop discussion, the Sacramento One Water Vision as applied to the City's Onsite Water Reuse Strategy should lead to:

- Reliable and resilient water systems for the future
- Optimized use of local water resources
- Use of right resources to the right use

In order to implement the Sacramento One Water Vision, the effort will need to be driven by:

- Bold leaders from senior positions at both political and executive levels
- Legislators and local and regional representatives from regulatory agencies
- Engaged stakeholders, including community representatives

The Sacramento One Water Vision should also consider:

- Water in the Sacramento region is of good quality, and affordable, especially when compared to the cost and availability of recycled water from Regional San or from ONWS.
- On-going engagement with the regulatory agencies (State Water Resources Control Board and Sacramento County) will be needed to help drive the development and implement the One Water Vision.

3.2.2 Role of Onsite Water Reuse in the Sacramento One Water Vision

Workshop participants identified the top drivers and goals for the City's Onsite Water Reuse Strategy:

- Balancing the needs of the community, including developers, trades and labor unions, and other stakeholders
- Reliable and resilient water systems for the future
- Optimized use of local water resources

Aligning energy use and reducing carbon emissions, matching the right resource to the right use, and avoiding costs for the collection of drainage were also identified as important goals and drivers. In addition, as this Study was initiated in response to the New Building Electrification Ordinance and the City's Climate Implementation Workplan, the Onsite Water Reuse Strategy is an opportunity to think about long-term sustainability of water and its relationship to climate change.

The greatest challenges to achieving the One Water Sacramento Vision through the Onsite Water Reuse Program are:

- Establishing water quality standards and monitoring and reporting requirements for alternate water sources and/or end uses
- Establishing a permit process for initial and ongoing operations for ONWS
- Publicizing the program to developers, promoting best practices, and expanding and encouraging ONWS

Other challenges identified include integrating the Onsite Water Reuse Program into local construction requirements and building permit processes and selecting the allowable types of alternate water sources. In addition, there are currently no state regulations in place that define water quality requirements for ONWS except for water quality parameters for rainwater systems defined in the CPC; therefore, the program that the City implements may need to be updated as these regulations are developed.

3.2.3 Implementation of a Dual Plumbing Ordinance

Workshop participants agreed that the objectives of Dual Plumbing Ordinance are to:

- Increase resiliency and adaptability of our water and wastewater infrastructure
- Establish and sustain communication with community stakeholders
- Integrate onsite reuse strategies with land use and other planning efforts (sewer, wastewater treatment, reuse, and drainage, etc.)
- Provide a favorable economic environment for private investment

Achievement of these objectives will be a process; therefore, Workshop participants identified the following elements that should be included in the initial Dual Plumbing Ordinance:

- Roles and responsibilities, including assigning agencies for overseeing water quality criteria, monitoring, and permitting requirements
- Updates to existing City policies, rules, regulations, and design guidelines, as well as procedures/guidelines for City departments
- Defining the parameters and boundaries to require dual plumbing, including options for developers to opt out of installing dual plumbing. The Dual Plumbing Ordinance should also allow the City flexibility in how they enforce the requirement.

Additional activities that can be considered for the initial Dual Plumbing Ordinance include establishing fees and incentives for installing dual plumbing and protections for the City against taking over abandoned ONWS (for example as the result of building ownership changes).

Once the City's Dual Plumbing Ordinance is adopted, the City should turn its focus to the following activities to continue working towards achieving the objectives of the Dual Plumbing Ordinance:

- Evaluating, refining, and updating roles and responsibilities as needed
- Continue to update procedures/guidelines for City departments
- Expand incentives for installing dual plumbing and update fees as needed
- Participate in partnerships and support pilot projects to showcase the Dual Plumbing Ordinance

In addition to adopting the anticipated State treatment standards and requirements, additional actions the City take include continuing the development and modification of rules and regulations, including options for developers to opt out; updating existing City policies, rules, regulations, and design guidelines; and establishing a collaboration framework for addressing and implementing the City's One Water Vision.

Section 4: Economic Considerations

This Section presents an economic assessment of dual-plumbing and onsite treatment installation and operations costs and potential fees and funding opportunities to offset those costs. Understanding the potential costs to dual-plumb and treat onsite water supplies will aid the City in defining the size of commercial buildings that could be required to construct dual plumbing.

4.1 Dual Plumbing Construction Cost Comparison

A model of costs to install dual plumbing, compared to conventional single plumbing systems, was developed to aid the City in communicating with developers the financial consideration of a dual plumbing ordinance. A dual plumbing cost model was developed to compare the added construction cost to dual-plumb a commercial building in comparison to using the potable water system in the same building.

The cost model reviewed 17 new commercial buildings ranging in constructed area of 8,000 square feet to 271,000 sq ft constructed in California within the last five years. Construction costs for these buildings were adjusted for Sacramento using location indices and escalated to 2022 dollars. Table 4-1, Figure 4-1, and Figure 4-2 summarizes the findings of the dual plumbing costs model for the City of Sacramento. Based on the cost model, it was observed that the cost of adding dual plumbing varied according to building size and type as well as the number of plumbing fixtures per sq ft.

Table 4-1: Dual Plumbing Cost Model Results for the City of Sacramento

	Capital Cost to Add Dual Plumbing
Average Unit Cost	$2.88/sq ft
For a 100,000 sq ft Building	$288,000
For a 250,000 sq ft Building	$720,000
% of Total Plumbing Cost	9.0
% of Total Construction Cost	0.34

Based on 2022 dollars

Figure 4-1: Cost Per Area ($/SF) to Add Dual Plumbing to Commercial Buildings

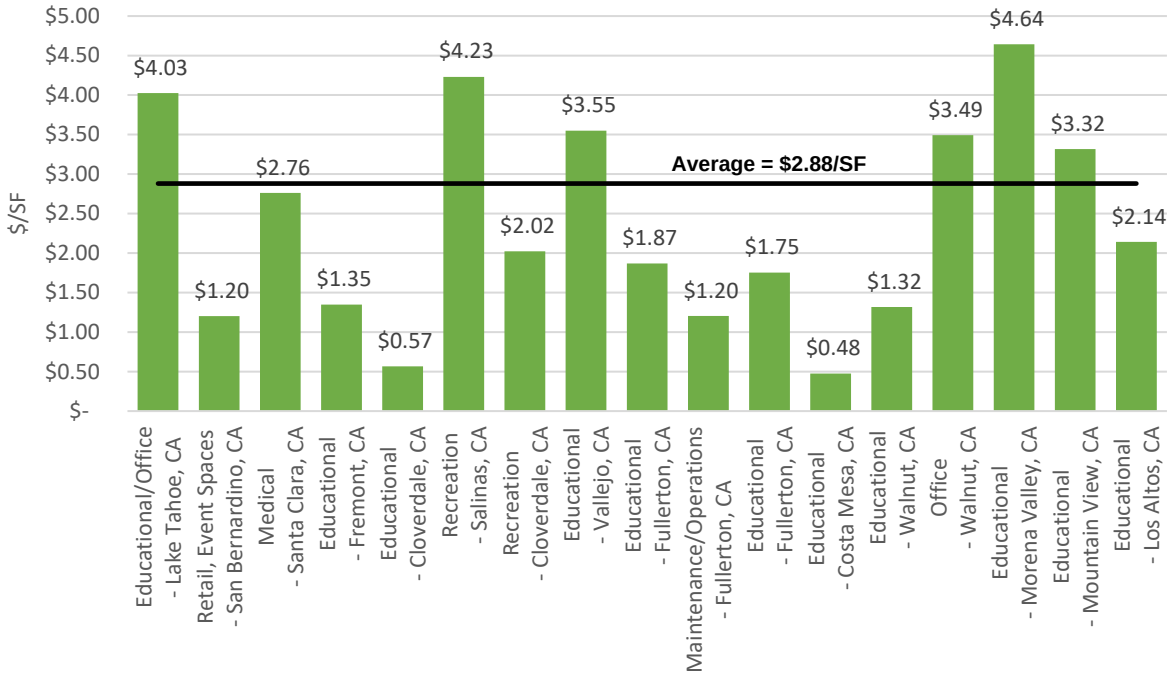
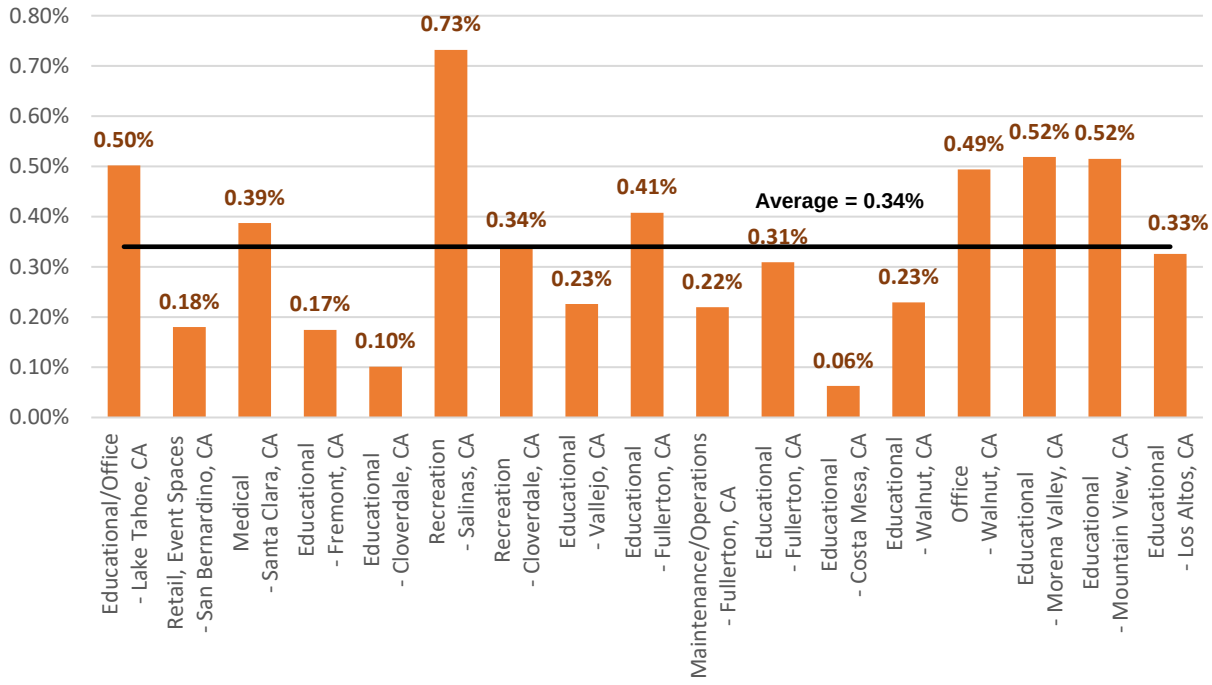


Figure 4-2: Percent Increase to Total Project Cost to Add Dual Plumbing to Commercial Buildings



The cost model is a high-level assessment of the potential construction cost implications on new commercial developments using available data and information. Limitations on this model include:

- Building uses and types were limited to public and institutional buildings such as schools, medical facilities, and military housing. These uses and types of buildings are assumed to have similar water uses, fixtures, and density of fixtures as offices, gyms and other recreational buildings, and hotels.

- Data for industrial use buildings was not available for this model; however, estimating dual-plumbing costs based on previously constructed industrial-use buildings is difficult as the fixtures and water demands are highly variable. For example, a brewery would have significantly different fixtures and demand than a cold-storage facility or a bulk distribution warehouse.

- Plumbing and construction costs are variable and depend on many factors including but not limited to the size of the development, the use of the building, and the density of fixtures.

- Construction and cost data was available for public buildings only; data from private developers was not provided. Historically the construction costs of public buildings were expected to be lower than private developments, as the public bid process required for public projects is intended to create competition for the work. However, current supply chain issues, inflation, labor shortages and labor union agreements, and other market forces have contributed to recent increases in building and construction costs in the double-digits[5], regardless of if a project was required to use competitive bidding or not. Therefore, the costs presented should be viewed as a snapshot in time and may not reflect future building and construction costs.

- No evaluation has been made on the impacts of the cost to install dual plumbing on future building ownership costs or leasing potential.

- This model compares construction costs only and does not estimate maintenance or operation costs, nor does it include costs related to the replacement of dual plumbing systems.

Additional details on the dual plumbing cost model, including a description of the types of building, cost assumptions, and construction assumptions, can be found in Appendix D.

4.2 ONWS Treatment and Operations Costs

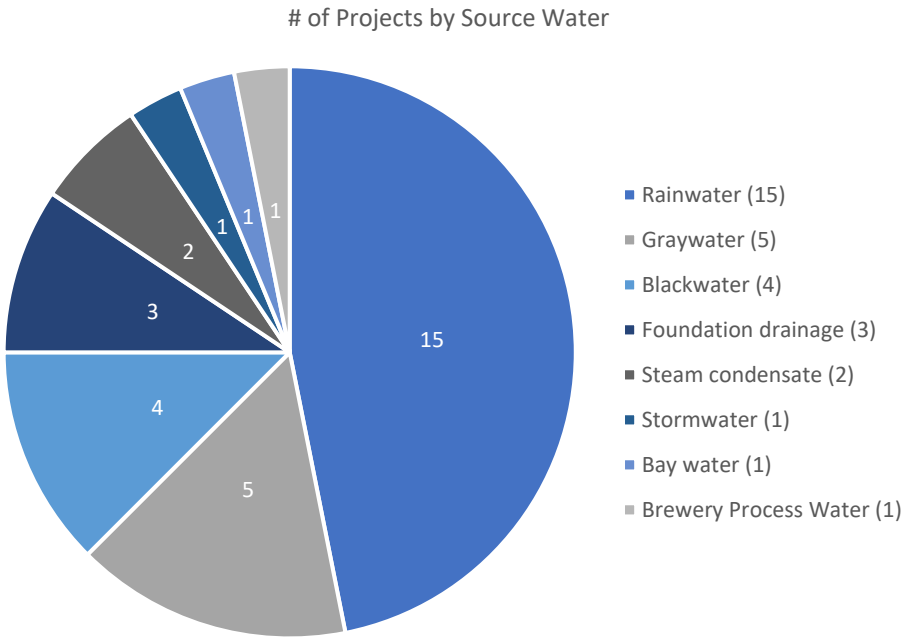
The cost of treatment and operations using ONWS is highly variable depending on the source and end use (which impacts treatment level), amount of demand (which impacts storage volume), and technology (which also impacts operations and maintenance costs). These costs can include on-going energy use for treatment and distribution, chemical additions, replacement

[5] "ENR Cost Indexes in San Francisco (1978-2022)." Engineering News-Record. Accessed 16 May 2022. <https://www.enr.com/economics/historical_indices/SanFrancisco>

parts or repairs, and operator time. Specific cost information for treatment and operation of ONWS was not available, but the projects implemented under the San Francisco Onsite Water Reuse Program were reviewed to understand the overall potential cost impacts to developers and building owners. Appendix E summarizes the available information reviewed for each of the projects implemented under the San Francisco Onsite Water Reuse Program.

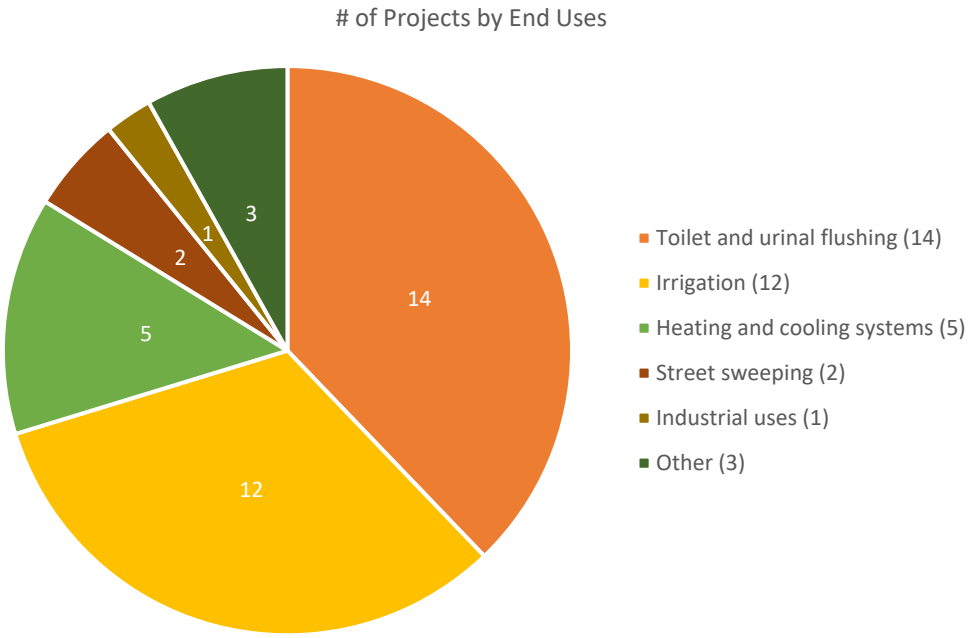
Evaluation of ONWS treatment and operations costs included a review of 20 new commercial and industrial use buildings ranging in constructed area of 69,000 sq ft to 2,700,000 sq ft constructed under the San Francisco Onsite Water Reuse Program. Based on the data available, as shown in Figure 4-3, most projects used multiple sources, with rainwater capture systems being the most common ONWS, followed by graywater systems, and then foundation drainage. Blackwater, steam condensate, and stormwater ONWS were least common. Treatment volumes for all projects ranged from 30,000 gallons per year to 39 million gallons per year. As shown in Figure 4-4, the most common uses of non-potable reuse water were toilet and urinal flushing, followed by irrigation, and then heating and cooling systems.

Figure 4-3: Summary of Projects Implemented Under the San Francisco Onsite Water Reuse Program by Source Water



*Based on a total of 20 projects. Some projects use multiple alternative water sources.

Figure 4-4: Summary of Projects Implemented Under the San Francisco Onsite Water Reuse Program by End Uses



*Based on a total of 20 projects. Some projects supply multiple end uses.

Table 4-2 summarizes the average ONWS treatment costs (construction and operations and maintenance [O&M]) based on available data through the San Francisco Onsite Water Reuse Program. The information summarized in Table 4-2 and Appendix E is based on data voluntarily provided to the San Francisco Onsite Water Reuse Program by building developers and owners and has the following limitations:

- The year of building construction or ONWS installation or startup was not always provided, therefore these costs were not normalized to 2022. Similarly, not enough information was provided to normalize O&M costs to 2022.
- Treatment and storage capacities were not provided. When not specified, it was assumed that the treatment volumes provided are average values (e.g., gallons per day or gallons per year).
- Reported treatment volumes did not split out volumes per ONWS source for those systems that treated multiple alternative sources. Similarly demand volumes were provided for the development as a whole and did not provide demands for each non-potable use.
- Annual O&M costs were mostly provided as an aggregated value; costs for specific O&M items, such as energy, chemicals, and operator time, were not available for all projects.

- Total development construction cost was not always provided; therefore, analysis of ONWS installation impacts on the total construction cost was not conducted.

- Separate costs for the construction of dual plumbing was not provided.

Based on the above data limitations, a summary of the installation and O&M costs should be used only to understand the relative scale and ranges of costs and should not be used to estimate potential costs for developments in Sacramento. Furthermore, installation and O&M costs may be impacted by related City standards, future state or other regulations, or offsets from other programs.

Based on the data available through the San Francisco Onsite Water Reuse Program, installation of ONWS made up less than 1 percent of the overall project cost. As can be seen in Table 4-2, on a per gallon per year (gal/yr) and per sq ft basis, rainwater systems are the costliest to install, followed by blackwater systems. Blackwater treatment is typically more costly to purchase and install, but the cost for rainwater is brought up due to the costs of storage, which is sized to meet demand annual. The effects of storage on the cost to install rainwater ONWS is further illustrated in a review of the three (3) projects installed with rainwater as the only reuse supply, where construction costs ranged from about $3/gal/yr to about $11/gal/yr or about $4/sq ft to about $11/sq ft. However, rainwater systems are the lowest cost to operate with a consistent range of annual costs based on the San Francisco Onsite Water Reuse Program. The addition of graywater, concentrate and stormwater can result in an order of magnitude increase in annual O&M costs.

Table 4-2: ONWS Treatment Costs (based on San Francisco Onsite Water Reuse Program Projects)

Water Source	Average Development Size (sq ft)	Average Treatment Volume (gal/yr)	Average Construction Cost ($/sq ft)	Annual O&M Cost ($)	Annual O&M Cost ($/gal)
Blackwater only[1]	2,700,000	39,000,000	3.11	NA[2]	NA[2]
Blackwater + additional water sources[1]	280,000	913,000	3.60	NA[2]	NA[2]
Graywater + additional water sources	803,000	10,600,000	0.82	50,000 to 18,300,000	0.03 to 0.94
Condensate + additional water sources	1,500,000	19,000,000	1.07	18,300,000	0.94
Foundation Drainage only	NA[2]	17,600,000	NA[2]	NA[2]	NA[2]
Foundation Drainage + additional water sources[1]	1,500,000	15,000,000	1.67	NA[2]	NA[2]
Rainwater only	89,000	204,000	6.09	2,500 to 38,000	0.07 to 0.10
Rainwater + additional water sources	840,000	10,600,000	1.55	50,000 to 18,300,000	0.03 to 0.94
Stormwater + additional water sources[2]	1,500,000	19,000,000	0.47	18,300,000	0.94
Brewery Process Water[1]	NA[2]	3,700,000	NA[2]	NA[2]	NA[2]

Notes:
1. Data available through the San Francisco Onsite Water Reuse Program for one (1) project only.
2. No data available through the San Francisco Onsite Water Reuse Program

4.3 Onsite Non-Potable Water System Market Assessment Comparison

Understanding the market for ONWS is typically the first step towards creating a successful reuse program. An initial market assessment investigation was conducted to identify developments that are anticipated to be developed in the upcoming years and identify their location and scale that could implement ONWS. The approach includes evaluating opportunity areas in Sacramento to refine the scale where ONWS may provide the most benefit and meet economic needs. Potential to use recycled water produced by Regional San was also considered.

The following information was reviewed for commercial buildings, as the City is not anticipated to apply the ordinance to residential buildings:

- *Approved commercial non-residential building developments larger than 100,000 sq ft since 2010* (via the City's Accela Building Permit database, Building Data)
- *Approved entitlements that do not yet have a building permit* (via the City's Accela Building Permit database, Planning Data)
- Opportunity area mapping information that was developed for the City's Water Master Plan
- Regional San future recycled water pipeline phasing for the City of Sacramento

4.3.1 Market Assessment Mapping

The market assessment mapping approach considered future non-potable demands for new developments that could be served by (1) onsite treatment systems and (2) municipal recycled water from Regional San. In order to understand the number of developments that may be impacted by Sacramento's dual plumbing ordinance, based on the San Francisco Onsite Water Reuse Program case study information, this market assessment also considered developments with habitable areas over 250,000 sq ft and between 100,000 sq ft and 250,000 sq ft. Developments with habitable areas between 50,000 sq ft and 100,000 sq ft were also considered.

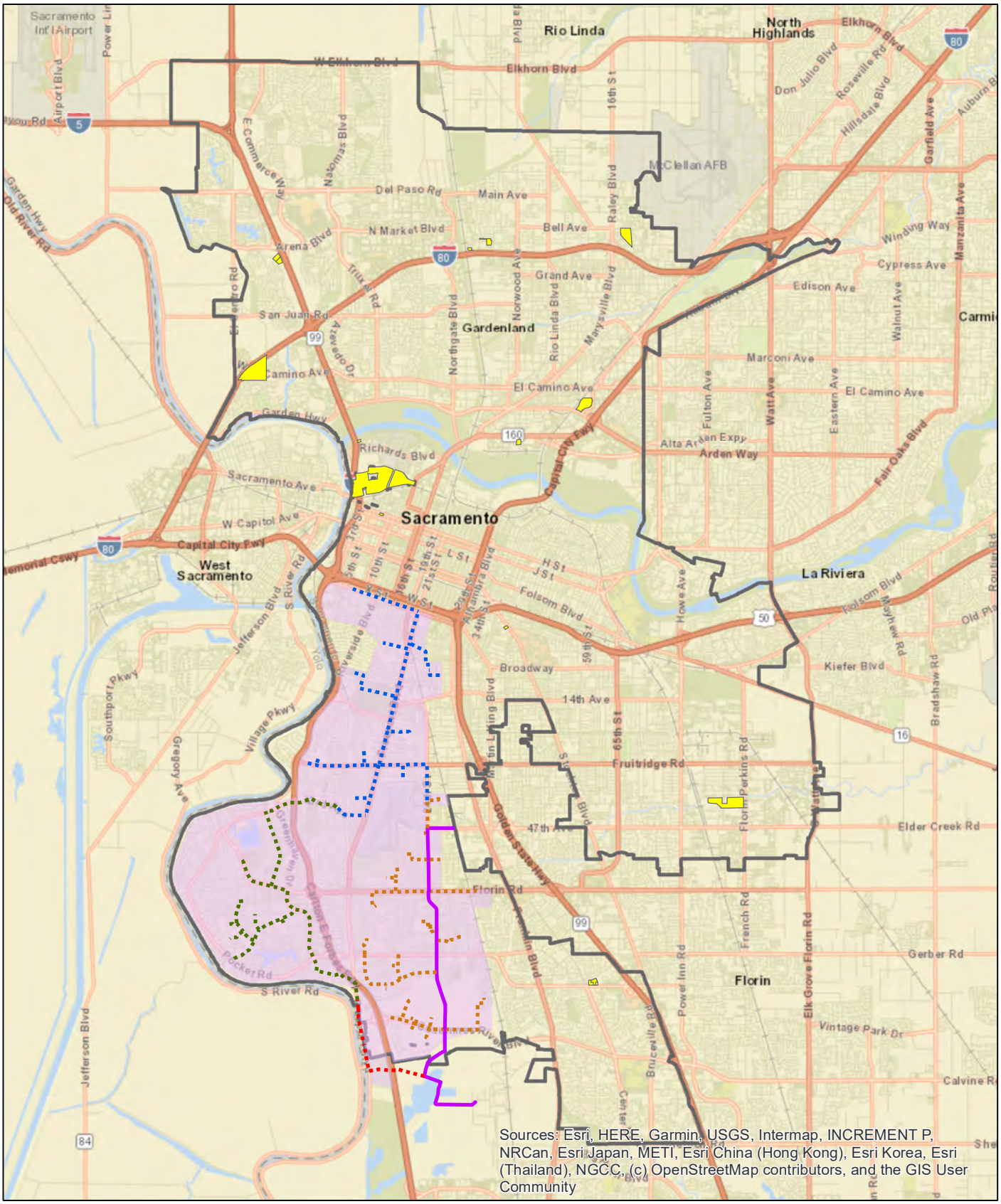
To understand the scale of future commercial developments that may need to comply with the dual plumbing ordinance, a review of approved and completed commercial developments in the City of Sacramento since 2010 (Building Data) was conducted and found that in the past 12 years there were:

- 8 total new commercial developments with habitable areas between 100,000 sq ft and 250,000 sq ft. Building uses include amusement (1), industrial (5), and retail store (2).
- 5 total new commercial developments with habitable areas greater than 250,000 sq ft. Building uses include amusement (1), industrial (2), and office (2).

However, past developments alone cannot predict future growth, so a review of the planned commercial developments from the City's Planning Data was conducted and found that there are 14 building permit applications for non-residential developments over 100,000 sq ft. Building uses include commercial/retail (6), hotel/motel (2), industrial (3), office (1), and warehouse (2). The locations of these future developments are shown on Figure 4-5.

While the City's dual plumbing ordinance is considering the applicability of onsite treatment, a dual-plumbed building could similarly be designed to receive municipal recycled water if there is an available source of supply. Discussions with Regional San representatives during April 2022 found that the supply of municipal recycled water is not anticipated to be significantly impacted by the reduction in flows through the use of ONWS or dual plumbing, as the resulting flow reduction is expected to be only a small amount when compared to Regional San's average daily treatment volume of 124 million gallons per day. Despite this, current and planned contracts use up the currently available supply of municipal recycled water. If the use of municipal recycled water were to be expanded within the City of Sacramento, future additional recycled water supply would rely on the wastewater generation from future new developments within the Regional San and Sacramento Area Sewer District service areas. Therefore, while municipal recycled water supply is not readily accessible to users within the City of Sacramento today, it may be an option available in the future.

Regional San already has recycled water pipelines that extend into the City of Sacramento and the potential synergy between these two programs were evaluated as part of the market assessment mapping exercise. Figure 4-5 shows the existing portion of the Regional San recycled water pipeline within the City of Sacramento, as well as potential future expansions. Based on Figure 4-5, a majority of the future developments are not within the proposed Regional San recycled water pipeline expansion area (shown in purple) and are therefore candidates for an ONWS.



C:\Users\EvelynChoudhary\OneDrive - Kennedy Jenks Consultants\Desktop\Projects\Sac-Onsite\SacOnsite_Acella_filtered.mxd Date: 6/9/2022 Printed by: EvelynChoudhary

Legend

Proposed Recycled Water Pipelines

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5

Proposed Recycled Water Area

City Limits

Planned Commercial Properties for Development

N

Kennedy/Jenks Consultants

City of Sacramento
OnSite Non-Potable Water Reuse Strategy

ONWS Opportunity Areas

K/J Project Number
2270001*00

Figure 4-5

4.3.2 Market Assessment for a Typical Commercial Property

To estimate the potential construction cost for an ONWS with various source waters, a recent commercial development was selected from the City's Accela Building Permit database to represent a 'typical' commercial property. 8340 Delta Shores Circle was selected as a recent 'typical' commercial development. This building was developed between 2016 and 2018, as shown in Figure 4-6, with the pre-development (2016) on the left and the post-development (2018) on the right. Google Earth, US EPA data, and other available information was used to estimate the parameters of the building based on various water sources. Building stats include the following:

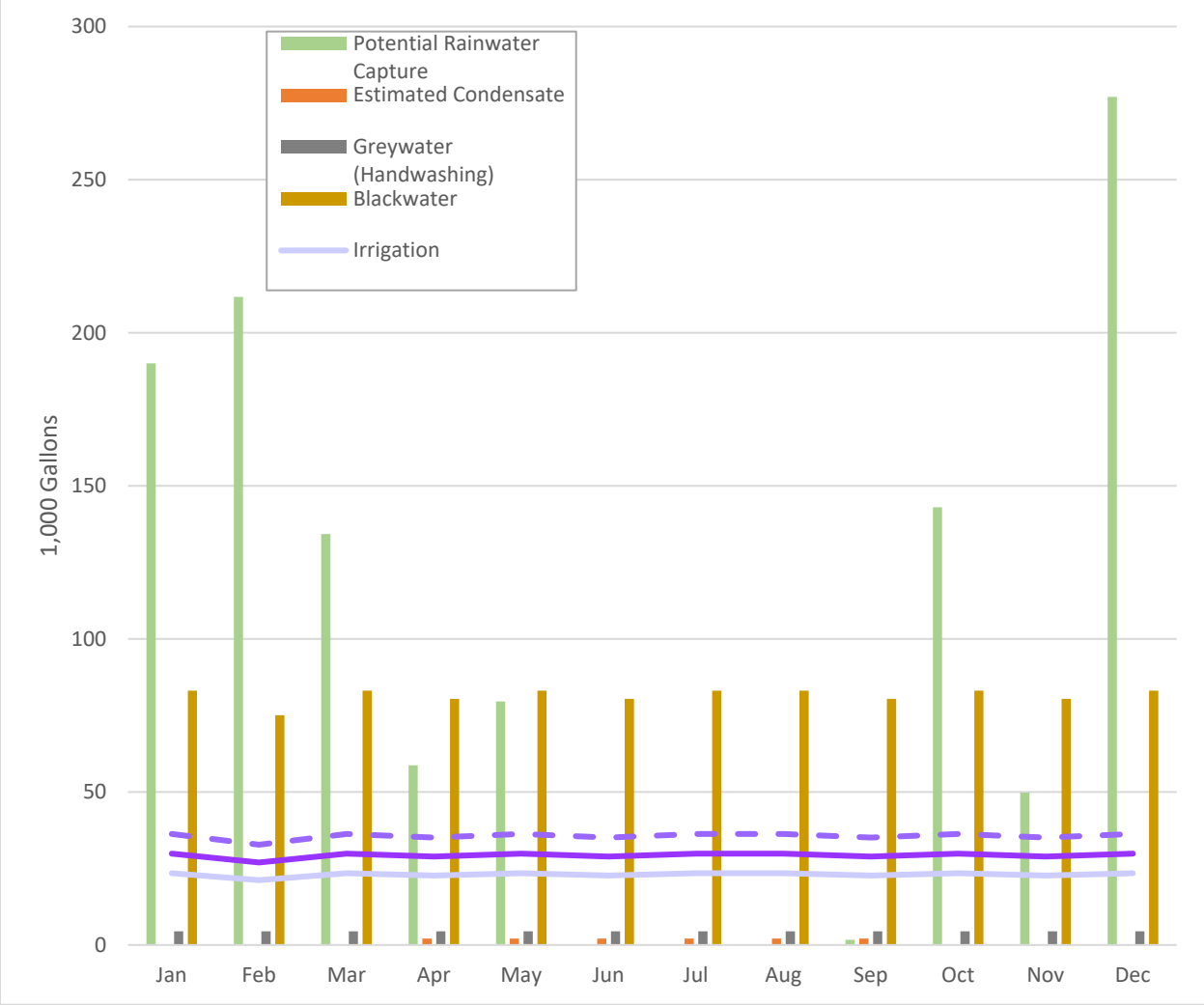
- building interior area = ~173,300 square feet.
- building footprint (based on Google Earth) = ~102,400 square feet.
- 2021 total metered water usage = 1.25 MG.
- Average daily water demand = 3,440 gallons.
- Average daily blackwater volume[6] = About 2,680 gallons, or 78% of the water demand based on US EPA water demands for commercial (office) buildings.

Figure 4-6: Pre and Post Development of 8340 Delta Shores Circle

Based on the proposed site parameters the total infrastructure required for each of the types of water were identified and the cost savings were estimated. These accounted for the seasonal variation in supplies and demand throughout the year. For example, rainwater capture is varied based on available precipitation. Historical trends indicate the capture will be highest in December, January, and February, while the capture will be lowest in June, July, and August. Figure 4-7 identifies the anticipated supplies (potential rainwater capture, estimated condensate, graywater from handwashing, and total average monthly blackwater [including graywater]) and demands (irrigation, toilet flushing, and cooling and heating). The largest potential supplies are potential rainwater capture, followed by total blackwater.

[6] Water use percentages: EPA and American Water Works Association (AWWA); plumbing estimate does not include showers; 20 secondhand wash, 0.5 gallons per minute, 1.28 gallons per flush.

Figure 4-7: Estimated Non-Potable Water Supplies and Demands for 8340 Delta Shores Circle

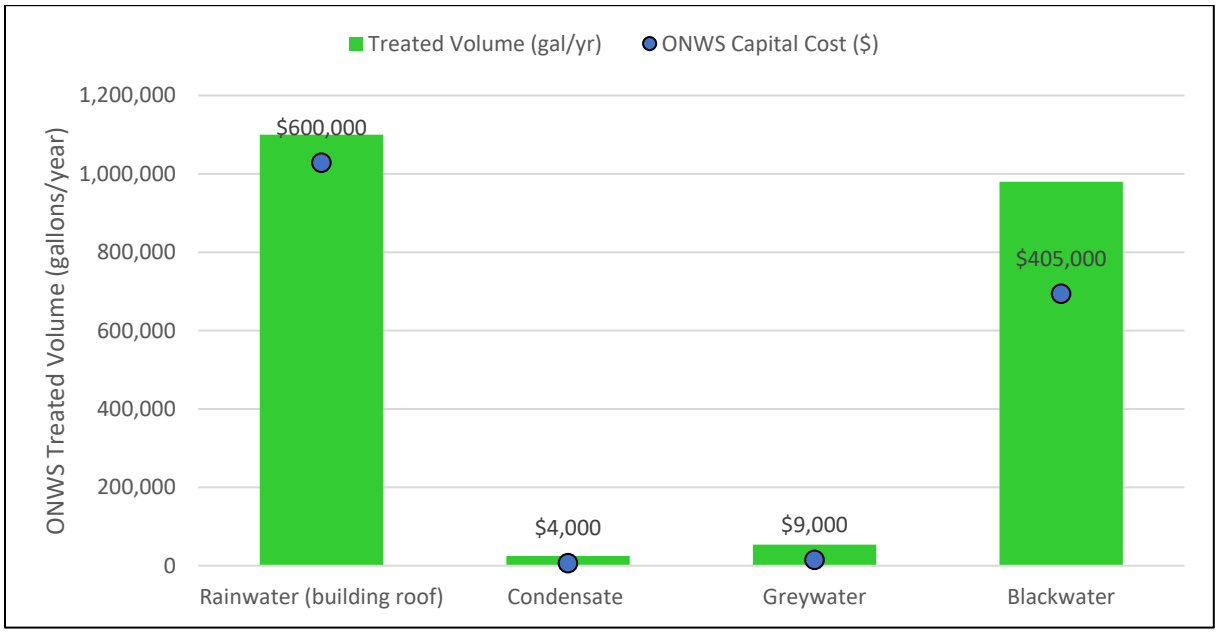


Notes:

1. Rainfall Data Source: California State Univ at Sacramento (CSU), California Data Exchange Center.
2. Condensate: 12 gal/1000 sq ft per day (Novak, Allen, et al. Designing Rainwater Harvesting Systems: Integrating Rainwater into Building Systems); air-conditioned space is equal to building area; AC running April through September.

A comparison of treatment size and rough order of magnitude (ROM) capital costs is shown in Figure 4-8. This demonstrates that condensate is the lowest cost option in terms of capital cost, however, it also produces the smallest amount of water. The higher capital cost options such as rainwater and blackwater provide significant water volumes in comparison.

Figure 4-8: Estimated Capture and ONWS Capital Cost for 8340 Delta Shores Circle by ONWS Type



Construction costs, potable water savings, O&M costs, and ONWS Program fees are all critical to identifying return on investment, which will be completed in the next phase of developing the City's ONWS Program.

4.4 ONWS Program Administration Resources

In addition to the cost impacts to developers and commercial building owners, the implementation of an onsite water reuse program will also require City resources to administer the program. As presented as Step 7 of *Blueprint for Onsite Water Systems A Step-by-Step Guide for Developing a Local Program to Manage Onsite Water Systems* in Section 2.6 of this Study, one or more agencies will need to be responsible for administering permits; reviewing data, and engineering and design reports; and shutting down non-compliant systems. Step 8 involves publicizing the program, developing resources, and providing clear direction to project sponsors and developers on how to comply with program requirements. These additional responsibilities will fall to the City and potentially to other local agencies to fulfill.

A review of the agency coordination and staffing requirements for San Francisco Onsite Water Reuse Program case study presented in Section 3.1 provides an estimate of the potential resources to implement an onsite water reuse program:

- The San Francisco Onsite Water Reuse Program is administered by one full-time equivalent, but startup of the program involved one additional part-time equivalent. These employees are funded through the operating budget of the SFPUC.

- Support from the SF Department of Public Health, SF Department of Building Inspections, and SF Public Works to provide reviews of dual plumbing documents and

conduct inspections of cross-connection controls was folded into existing processes and the additional responsibility load is offset by a fee-for-service structure.

Although the City of Sacramento is not anticipated to see as large or as many commercial developments as the City of San Francisco, the City of Sacramento will need to commit resources to the administration of an ONWS program and enforcement of the dual plumbing ordinance. If the City of Sacramento chooses to adopt a dual plumbing ordinance without an ONWS program, enforcement responsibilities can likely be folded into existing roles and responsibilities and use the existing fee-for-service structure to recover the cost of review and inspection times. Furthermore, to support administration of a dual plumbing and/or ONWS program, the City of Sacramento can adopt the use of an administration fee to be submitted by developers at the time of application, similar to the City of Santa Monica's recycled water program.

4.5 Cost Summary and Funding Options

Sections 4.1, 4.2, and 4.3, present the estimated impacts to developers and project sponsors the implementation of a dual plumbing ordinance with ONWS requirements:

- Based on the dual plumbing cost model, adding dual plumbing to a building adds less than 1% to the total construction cost of the building.

- ONWS system costs vary based on treatment capacity, filtration and disinfection technology, and property use. Review of projects implemented under the San Francisco Onsite Water Reuse Program reveal that rainwater treatment systems and blackwater treatment systems are the most expensive ONWS to install, averaging about $6/sq ft and about $3 sq ft, respectively.

- Review of four projects implemented under the San Francisco Onsite Water Reuse Program with O&M cost information found that rainwater systems can be the lowest cost to operate, ranging from $2,500/yr to $38,000/yr or $0.07/gal/yr to $0.10/gal/yr. Combining rainwater systems with other ONWS can increase O&M costs at least one order of magnitude. This could be different for Sacramento, however, since it does not see the same amount of rainfall as San Francisco.

The City may consider options to defray the added costs of potential compliance with a dual plumbing ordinance:

- Capacity charge adjustments – while every building will still be required to install potable water connections capable of meeting all building demands, the City could choose to reduce this charge based on the expected savings due to the installation of ONWS or use of municipal recycled water. This charge reduction will need to be supported by demonstration of actual reduction in City water use. This option will require Proposition 218 authorization for implementation.

- Wastewater adjustments – the city could consider adjusting wastewater charges to the extent there is a reduction in service needs. This option will require Proposition 218 authorization for implementation.

- Water savings rebate program – The City of Sacramento offers water conservation rebates to water customers based on the installation of water saving devices or low water use landscapes. A similar program could be implemented for commercial/industrial properties that implement OWNS.

- Permit fee waivers – the City can choose to waive building permit fees for projects that install dual plumbing and ONWS, however this strategy should be evaluated against the cost to the City to support reviews, inspections, and administration.

- Federal and State grants – for publicly owned buildings, the City may support the application of a grant application for the cost of construction in compliance with the dual plumbing ordinance and ONWS program.

In addition to added costs to developers and project sponsors, the City and other agencies responsible for the implementation and enforcement of the dual plumbing ordinance and ONWS program will need to devote additional resources. For the City of San Francisco's Onsite Water Reuse Program, one full-time employee, whose funding comes from the SFPUC operating budget, administers the program with support from other existing departments, who are funded through permit/plan review and inspection fees.

The National Blue Ribbon Commission's "Local Ordinance Framework" presented in Section 2.7 provides recommended approaches to cost recovery and program funding based on existing programs that have been implemented in the United States. Based on the "Local Ordinance Framework" and a review of the case studies presented in Section 3, the following funding options are available:

- Initial Permit Application Fee for costs related to investigating and processing an ONWS application and issuing a permit. This amount of this fee would be based on source (e.g., rainfall capture, stormwater, graywater, blackwater).

- Annual License Fee, the amount of which would be based on source.

- A Plan Review/Onsite Inspection Hourly Rate would also be assessed for permit/ownership transfers, review of district-scale projects, and additional reviews, or onsite inspection.

For the San Francisco Onsite Water Reuse Program, depending on source, the initial application fee for an ONWS ranges from $2,014 to $11,783 and the annual license fee ranges from $560 to $2,186. The hourly review/inspection rate for ONWS is $249. For a Sacramento commercial building valued at $100 million, the initial application fee would be about 1% of the Building and Plan review fees.

In addition to the above fee-for-service mechanisms, San Francisco charges for excess use for potable makeup water, to be assessed at two-times the metered rate for potable water plus two-time the calculated wastewater discharge rate. This charge would be assessed when the amount of potable water used by the project is greater than the amount indicated on the water budget that was submitted with the initial building permit.

Other funding mechanisms available for the implementation of an onsite water reuse program include:

- Developer cost-sharing: during the initial year(s) of the Onsite Water Reuse Program, the City may solicit partners to implement pilot projects that will inform the growth of the Program. The City may offer incentives through capacity rate reductions for water services.

- Grants for construction costs of pilot projects: the US Bureau of Reclamation's CALFED Water Use Efficiency Grant Program funds water use efficiency activities such as small recycled water and reuse projects. Current grant policies require that the pilot project be publicly owned. Historically solicitations for new project applications have opened annually.

- City General Funds: while the City's Onsite Non-Potable Water Reuse Program is in development, the Program could draw on General Funds to develop program materials and conduct stakeholder outreach.

Because it is intended that a dual plumbing ordinance, if adopted, become effective concurrent with the New Building Electrification Ordinance, the City is interested in potential cost trade-offs between dual plumbing (and/or ONWS) and building electrification. A study on the net cost of fully electrifying new non-residential buildings that also install dual plumbing and ONWS was not conducted as part of this Study; however, cost effectiveness studies prepared by California Energy Codes and Standards indicate cost savings for all-electric commercial nonresidential buildings.

Section 5: Dual Plumbing Ordinance and ONWS Program Feasibility and Next Steps

This section summarizes the Study findings, citing relevant case studies and considerations that would influence the viability of dual-plumbing and ONWS for the City of Sacramento. Recommendations to consider when implementing a dual plumbing ordinance and developing an ONWS program are provided, including some key next steps.

5.1 Case Studies to Demonstrate the Viability of Implementing Dual Plumbing and ONWS when Supported by the Right Ordinance

The three case studies introduced in Section 3.1 are summarized herein to demonstrate that dual-plumbing and ONWS can be a viable component of a water supply portfolio in urban areas when supported by an appropriate ordinance. These case study programs include elements that are similar to those that the City of Sacramento is interested in implementing, such as the criteria for applicable building types, water sources, and uses, as well as the adoption of an ordinance.

In 2012 the City and County of San Francisco adopted their Onsite Water Reuse ordinance for commercial, multi-family, and mixed-use developments. The ordinance was implemented in a phased approach, starting with optional incentives for developers to implement ONWS and after proving the program, feasibility of onsite reuse, and new technologies for onsite treatment the requirements became mandatory for new developments of a certain size. The ordinance started requiring developments 250,000 sq ft and larger to install and operate ONWS, and based on the findings from implementation, it now requires developments 100,000 sq ft and larger to install and operate an ONWS. The ordinance also considers the implementation of district scale projects which are often technically and administratively more complex but provide larger benefits in terms of water production and cost savings due to the economy of scale. For commercial buildings, the ONWS are required to supply the toilet and urinal flushing and drain trap priming demands through the collection, treatment, and use of available blackwater and condensate. In San Francisco there are 17 sites that either have an operating ONWS or are in the process of installing one, as recorded by the City's program documentation.

The City of Santa Monica approved a dual plumbing ordinance in 2022 requiring all new developments of 7,500 square-feet or greater within the recycled water service area to use recycled water. Dual plumbing systems are only required for new commercial, industrial or muti-family residential for flushing toilets, industrial process or boiler feeds, commercial laundries or carwashes, industrial or commercial cooling towers or evaporative condensers. The benefit and outcomes of the ordinance is not known at this time.

The City and County of Honolulu introduced a One Water Ordinance in 2020 to guide the city departments and agencies to work together and in partnership with developers interested in supporting one water goals. In 2019 the Honolulu Board of Water Supply led an initiative to identify where onsite reuse could be feasible and selected a redevelopment project for detailed

analysis of the potential benefits for onsite reuse. The analysis found onsite rainwater harvesting as the most beneficial alternative that would meet one water ordinance goals and capital and operational costs considerations for the developer due to the high precipitation rates in the region and lower implementation costs for reuse of rainwater for non-potable needs.

Overall, these 3 case studies provide examples of where a dual plumbing ordinance and ONWS programs have been introduced and are at varying stages of implementation. A key part of each of these programs required defining the roles and responsibilities within their existing organizations to support the development, implementation, and management of the program. The pathway for such an ordinance or program, timeline, and considerations, are unique to the needs of each City and region and should be considered in detail when defining the criteria for an ordinance or ONWS program.

5.2 Dual Plumbing Ordinance Considerations

5.2.1 Regulatory Considerations

The existing regulations in California, the CPC Chapter 15, 16 and CCR Title 17, provide the requirements for installing dual plumbing systems that allow for use of alternate water sources (rainwater, graywater and recycled water) for non-potable applications and provide considerations for protection of the public water system and public health. Following the standards of these codes, the regulations allow for the Authority Having Jurisdiction to approve permits for dual plumbed systems that have been designed and constructed following these standards. For the City of Sacramento, the agencies involved in ordinance development would need to establish agency jurisdiction to regulate these systems and responsibilities for enforcing state requirements for non-potable water use. The City of Sacramento (and other Authorities Having Jurisdiction) will also need to review and update the standards and codes that are impacted by allowing the use of municipal recycled water or alternative water supply, such as Regional San's Water Reclamation Permit to allow indoor uses, the City's drinking water standard details, and potentially sewer/storm drainage standard details.

5.2.2 Technical Considerations

It is technically feasible for new commercial developments to include dual-plumbed systems to convey alternative water supplies for non-potable needs. Multiple developments in California already include dual plumbed systems to supply outdoor irrigation and indoor non-potable needs with alternate water sources collected and treated onsite or municipal recycled water.

5.2.3 Administrative Considerations

Administrative considerations related to the development of Dual-Plumbing Ordinance, include:

- Defining the roles and responsibilities for the agencies that will oversee the implementation of the ordinance;
- Updating existing City standards and regulations as needed to allow for dual-plumbing systems;

- Defining the parameters and boundaries for requiring dual-plumbing systems, including options for developers to opt-out of installing dual plumbing systems if proven it is not feasible for that development (i.e., non-compatible building use or insufficient water savings). The Dual Plumbing Ordinance should also allow the City flexibility in how they enforce the requirements.

Without an available supply of municipal recycled water, the City would need to develop an ONWS program to complement a dual plumbing ordinance, which would have additional administrative requirements as discussed in Section 5.3

5.2.4 Economic Considerations

Understanding the potential costs of dual-plumbed systems will help inform the economic feasibility and financial implications of implementing a dual plumbing ordinance. The Dual-Plumbing Cost Model discussed in Section 4.1 estimated that the cost of installing dual plumbing to a building to serve toilet/urinal flushing and washing machines would add about 0.34% to the total building construction cost, or approximately $2.88/sq ft, to the total building construction cost for an average 100,000 sq ft building in Sacramento, constructed in 2022. The cost model reviewed 18 new commercial buildings ranging in constructed areas of 8,000 sq ft to 271,000 sq ft constructed in California within the last five years.

For the City of Sacramento, the possibility of supplying new developments with municipal recycled water for non-potable uses was evaluated in Section 4.3. The initial market assessment investigation looked at the potential to use municipal recycled water produced by Regional San to supply the concentrated areas where new developments are currently planned for the City. However, from Figure 4-5, planned areas for new commercial developments do not overlap significantly with areas where Regional San is planning to expand the municipal recycled water service. Based on discussions with Regional San personnel, the planned municipal recycled water production for Regional San has already been allocated, further reducing the viability of using municipal recycled water to supply dual plumbed systems in new developments in the City.

The City of Sacramento could consider incentives for developers and/or building owners to install dual plumbing systems. For example, the City and County of San Francisco offers capacity charge adjustments for new buildings installing ONWS and provides funding opportunities to incentivize developers, offering up to $1 million for offsetting 3 million gallons per year or more of water demand. This option will require Proposition 218 authorization for implementation. The City of Santa Monica waives building permit fees for projects and properties that include reuse systems, although this strategy should be evaluated in combination with the opportunities of using building permit fees to support the program inspection and/or administrative costs. A rebate program similar to the City's existing water conservation rebate program could also be created for buildings that install dual plumbing and/or ONWS.

Additionally, the green building market continues to grow. LEED, Living Building Challenge, or other green certified buildings with lower operating costs and better indoor environmental quality are more attractive to corporate, public and individual buyers and have higher demand for leasing. Owners of green buildings reported that their return of investment (ROI) improved by

19% on average for existing green building projects, and real estate in locations like San Diego has shown lower vacancy for green buildings than non-green developments. Green developments may be eligible for additional funding opportunities such as the green project reserve under the Clean Water State Revolving Fund (J Worthen Foundation, 2018).

A dual plumbing ordinance should include provisions for developers to provide a water balance budget with potential offsets for potable water demands, and a cost estimate for the required dual plumbing and/or ONWS. Exceptions or incentives could be included in the ordinance for developments that do not seem to be cost effective due to a high cost of implementation or minor potential for offsetting potable demands.

5.3 ONWS Considerations

5.3.1 Regulatory Considerations

Although there are no regulations currently for ONWS, regulations for risk-based water quality standards for ONWS are expected to be finalized and adopted by December 1, 2022. Due to the timing of the regulations, it should be feasible to develop an ONWS program following the recommended risk-based water quality standards once approved by the State Water Board.

The City and County of San Francisco developed their requirements for ONWS based on the *Guidebook for Developing and Implementing Regulations for Onsite Non-potable Water Systems* by the Blue Ribbon Commission. The guidebook refers to the recommendations from the WRF study that establishes a risk-based approach for pathogen removal and/or inactivation targets (Sharvelle et al., 2017). The City and County of Honolulu will likely be adopting a similar regulatory framework for onsite reuse as outlined by the Blue-Ribbon Commission. The regulations for risk-based water quality standards for ONWS are expected to follow the similar recommendations from the Blue Ribbon Commission and WRF Study.

Following the guidelines from the Blue Ribbon Commission and studies for risk-based approach for ONWS, SFPUC proved there is a regulatory pathway for developing an ONWS program. The *Blueprint for On-site Water Systems* developed by SFPUC, provides a potentially useful guide for other agencies to develop their own ONWS programs (see Section 2.6).

5.3.2 Technical Considerations

As summarized in Section 2.4, it is technically feasible to provide treatment systems for alternate water sources that meet the pathogen removal and/or inactivation targets defined as the water quality standards for the protection of public health, similar to the treatment systems used for both drinking water and potable reuse.

Treatment systems such as MF, UF, MBR, UV disinfection, ozone or chlorine disinfection have been used for ONWS in California and have proven the capacity of the technology to treat alternate water sources and provide clean and safe non-potable supplies for dual plumbed systems. There are accepted pathogen crediting frameworks for validation, field verification, and monitoring of treatment performance. Certified operators will be required for operation and maintenance of these systems.

5.3.3 Administrative Considerations

One of the first steps for the City of Sacramento to develop an ONWS program would be to define the roles and responsibilities for the agencies that will oversee the implementation and administration of the program, including defining the ONWS water quality criteria, monitoring, and permitting requirements and identify updates to existing permits, ordinances, and City standards that would need to be implemented in order to support an ONWS program. Typically, agencies that would need to be involved with such program include: the local building department, utilities division, public health department, sanitation district, and regulatory regional and state water boards.

The greatest challenges identified in Section 3.2 for an ONWS Program included:

1. Selecting the allowable types of alternate water sources and establishing water quality standards and monitoring and reporting requirements for alternate water sources and/or end uses,

2. Establishing a permit process for initial and ongoing operations for ONWS,

3. Publicizing the program to developers, promoting best practices, and expanding and encouraging ONWS, and

4. Integrating the ONWS Program into local construction requirements and building permit processes.

Potential solutions to these challenges that the City could consider include:

1. Wait for the state to establish water quality standards.

2. Establishing water quality standards based on the recommended risk-based standards by the National Blue Ribbon Commission, and updating the ONWS program to incorporate any changes required once the risk-based water quality standards are adopted by the State Water Board,

3. Establish rules and regulations for operations of ONWS based on regulations implemented by other agencies such as the SF DPH *Rules and Regulations Regarding the Operation of Alternate Water Source Systems,*

4. Engaging with Stakeholders early on the process of developing the program to get buy in and continue the engagement beyond the development phase to promote and expand the program. Evaluate opportunities to partner with developers in pilot projects to test the program considerations and adjust as needed for successful implementation,

5. Involving the building department in the development of the program to establish the best pathway to update local requirements, and

6. Include in the ordinance considerations to update permit processing fees to cover the costs of developing and implementing an ONWS program.

Overall, it is feasible to develop an ONWS program, but it will require collaboration, clear roles and responsibilities for the different city agencies to set the foundation for the successful implementation of the program.

Table 5-1 presents an initial list of roles and responsibilities based on the case study examples as well as the City's existing roles and responsibilities.

Table 5-1: Initial ONWS Program Coordination Matrix

City of Sacramento – Department of Utilities	Sacramento County Environmental Management Department/Other Regulator*	City of Sacramento – Community Development Department	City of Sacramento – Public Works	Developer
Program Administration	***Environmental Health***	***Construction***	***Right-of-Way and Mapping***	***Comply with Ordinance***
Review onsite non-potable water supplies & demands (coordinate with CDD) Administer city-wide project tracking & annual potable offset achieved Provide technical support as needed Manages Cross-Connection Control Program: Once building permit closed, ensure system remains as approved (Cross-Connection Inspections, Annual CC Survey) Coordination w/County EMD/other Regulator	Issue water quality & monitoring requirements Review and approve non-potable engineering report Issue permit to operate onsite system Review water quality reporting Provide technical support as needed	Conduct Plumbing Plan check and issue Plumbing Permit (Building) Inspect and approve system installations. Issue certification of occupancy (Building) Outreach to developers (Planning) Provide technical support as needed. Provide first point of contact, direct questions to appropriate departments (Current Planning) *Include advisory note on planning applications for applicable projects	Issue Encroachment Permits as needed for infrastructure in the Right-of-Way (if needed). Provide technical support as needed	

* Sacramento County EMD provides municipal recycled water compliance assistance and has established and enforces the rules and regulations for municipal recycled water use and distribution in the County. No entity has committed to this role for the City of Sacramento Onsite Non-Potable Water Reuse Program as of May 2022.

5.3.4 Economic Feasibility

The cost of ONWS treatment can range from $0.50/sq ft to over $6/sq ft (see Table 4-2). ONWS treatment and operation costs are highly variable depending on the source and end use (which impacts treatment level), amount of demand (which impacts storage volume), and the selected technology to be used (which also impacts operations and maintenance costs). The evaluation of ONWS treatment and operations costs of 20 new commercial buildings in San Francisco, ranging in constructed area of 69,000 sq ft to 2,700,000 sq ft, reflected the variability of these treatment and operation costs as summarized in Section 4.2.

Similarly, the economic feasibility of ONWS should be evaluated for specific cases, as each commercial or industrial development will have varying non-potable water needs and opportunities for onsite supply. ONWS requirements should include provisions for developers to evaluate the cost effectiveness of ONWS. An ONWS program should include considerations for district-scale ONWS that could make a project economically feasible due to economy of scale.

Startup of the Sacramento ONWS Program could find support through private-public partnerships to implement pilot projects that will inform the growth and development of the Program. Grants through the federal and state government, such as US Bureau of Reclamation's CALFED Water Use Efficiency Grants, may also be available to fund the construction of publicly owned ONWS. The City may also offer incentives through capacity rate reductions for water services and LEED or other green building certifications.

5.4 ONWS Program Implementation Considerations

5.4.1 Pilot Test

In order to further explore and define the ONWS Program, the City can establish a pilot program, to trace out the City's process for reviewing permits, applications, and plans, as well as to understand better the needs of developers and building owners. There are multiple avenues to implement a pilot ONWS Program:

- City-Owned ONWS: Following the example of the San Francisco Onsite Water Reuse Program, the City can install a ONWS in a city-owned facility as a retrofit or as new construction. The City can partner with an ONWS vendor interested in showcasing their product, and the vendor would be responsible for designing the ONWS and operate the system for the duration of the pilot test. If the installation is permanent, the City would take over operation of the ONWS following the end of the pilot test. Design and construction costs for the ONWS can be paid for through state or federal grants.

- Other Publicly Owned ONWS: The City can also partner with another local public entity to install and operate an ONWS in a public building. Similar to the City-Owned ONWS pilot above, this project would also partner with a vendor to design and operate the ONWS for the pilot test period. At the end of the test, the local public entity would be responsible for the operations and maintenance of the ONWS. Potential public partners include Sacramento County, Sacramento Municipal Utility District (SMUD), and California State University Sacramento. Design and construction costs for the ONWS can be paid for through state or federal grants.

- Developer Partnership: The City can solicit opportunities to partner with developers to implement ONWS in their developments, offering breaks on permitting fees and/or capacity charges. The additional benefits to a developer include direct input on the development of the ONWS program as well as an opportunity to showcase the development. At this time, no state or federal funding opportunities for privately-owned ONWS have been identified to offset the costs of planning, design, construction, or operation of this ONWS.

The duration of the pilot portion of the ONWS Program can be as little as three years, during which the City can evaluate the permitting, review, and inspection process; monitor the performance of installed ONWS; conduct additional stakeholder outreach; coordinate with state and local regulators; and develop and update City policies, rules, regulations, and design guidelines. Information and experience garnered from these pilot projects can inform funding/cost-recovery options, expansion or modification of the City's dual plumbing ordinance, or additional resources needed to achieve program goals and objectives. A pilot program would also allow the City to wait until the release of anticipated state regulations related to ONWS before finalizing the City's requirements.

5.4.2 Program Size Considerations

Dual plumbing ordinances and ONWS programs are typically defined based on a specific development footprint, however for commercial and industrial buildings the non-potable water demands can vary considerably regardless of the footprint of the development, based on the uses intended for the building. It is recommended that the City of Sacramento considers a water balance budget as a parameter in defining the program size in addition to the development footprint.

Based on review of permitted and completed commercial developments in the City of Sacramento since 2010, the quantities of new developments based on footprint for the past 12 years include:

- 18 developments over 50,000 sq ft, the majority being hotels, offices and retail stores,
- 8 developments over 100,000 sq ft, mostly for industrial purposes,
- 5 developments over 250,000 sq ft, mostly industrial and office space.

Assuming that future commercial developments in the City follow a similar parameter of growth as seen for the past decade, the City could consider initiating a program for developments larger than 100,000 sq ft as long as the water budget and economic study do not deem the project not economically feasible. The City could revise the program in the future to adjust the footprint criteria based on changes in the development market or other local and state regulations.

5.4.3 ONWS Alternate Sources Considerations

The City's ONWS could consider requiring specific alternate water sources to supply ONWS or allow for the developer to provide the combination of sources that best help meet the project non-potable demands. As an example, commercial buildings in San Francisco are required to supply the toilet and urinal flushing and drain trap priming demands using available blackwater

and condensate, which are typically the largest and most reliable alternate water sources in commercial buildings.

For industrial developments, non-potable industrial process water could provide an opportunity for onsite reuse and be a cost-effective project. Industrial developments can have large non-potable demands for cleaning of equipment or process areas, and for heating and cooling systems, and can have a significant process wastewater generation that results in considerable water bills and sewer discharge fees. This combination of factors allows for the potential of reuse of industrial effluent for ONWS. Industrial onsite reuse systems are unique to the type of process and should be evaluated on a case-by-case basis. There are examples in California of breweries, wineries, and other industrial manufacturing that use ONWS for treatment of industrial effluent for supply of non-potable demands. Brewing companies like Anchor in San Francisco, Lagunitas in Petaluma, Seismic in Santa Rosa are examples of industrial ONWS that have been driven by strong environmental values and economic cost effectiveness of these systems.

Unlike the Honolulu case study (see Section 3.1.3) that found that onsite rainwater harvesting was the most beneficial alternative water source for reuse, the City of Sacramento does not have a consistent precipitation pattern that would allow for reliable harvesting and use of rainwater to supply ONWS. With climate change, precipitation patterns are becoming more variable and unreliable. Therefore, it is recommended that the City of Sacramento ONWS program considers alternate water sources in addition to rainwater. The program should include considerations to prohibit or limit ONWS that are supplied only with rainwater as this would increase capital and operational costs driven by large storage needs and require constant backup potable supply during periods of low precipitation.

5.4.4 ONWS Program Implementation and Cost

The City's ONWS Program can zipper into the City's existing building permitting, review and inspections process, which also coordinates with Sacramento County. Additional time and materials can be expected for ONWS-specific reviews and inspections, and based on the San Francisco Onsite Water Reuse Program, this can require as much as one additional full-time position to coordinate between departments and Sacramento, provide ONWS-related technical support, and develop and facilitate a stakeholder outreach program. Furthermore, start-up of the San Francisco Onsite Water Reuse Program relied on an additional one and a half full-time positions, which were later tapered back as the program stabilized.

Similar to the existing building permit and review program, on-going administration of the City of Sacramento's ONWS program can be funded through fee-for-service mechanisms to review ONWS-related engineering documents, plans, and permits. These fees include an initial application fee, annual license fee, and an hourly review/inspection rate similar to what is already charged by the City for building permitting and inspections. Development of Program stakeholder outreach materials and documents may be funded through the City's General Funds.

5.5 Recommended Next Steps

As stated in Section 1.1, the goal of this Study is to evaluate the potential for the adoption of a dual plumbing ordinance with consideration for the future installation of water reuse systems onsite. At this stage of the City's efforts, there are multiple options available to the City in how the dual plumbing ordinance is adopted, enforced, and modified, including:

1. **Do not adopt** a dual plumbing ordinance at this time. Continue to develop the City's One Water Vision and Onsite Water Reuse Strategy with the intent of adopting a dual plumbing ordinance in the future.

2. **Adopt** a local dual plumbing ordinance which allows new buildings to **voluntarily** install dual plumbing with or without a non-potable water source.
3. **Adopt** a dual plumbing ordinance **requiring** new **buildings within the vicinity of existing and planned Sacramento Regional County Sanitation District pipelines** and meeting the eligibility criteria (e.g., commercial, non-residential of 100,000 sq ft or greater) to install dual plumbing and connect to municipal recycled water when it becomes available. At this time, Regional San has no plans on expanding recycled water service within the City of Sacramento, but this may change in the future.
4. **Adopt** a dual plumbing ordinance **requiring all new buildings** meeting the eligibility criteria (e.g., commercial, non-residential of 100,000 sq ft or greater) to install dual plumbing. After the state adopts water quality standards the City can then incorporate these standards for buildings to collect, treat, and reuse water onsite.
5. **Adopt** a dual plumbing ordinance **requiring all new buildings** meeting the eligibility criteria (e.g., commercial, non-residential of 100,000 sq ft or greater) to also install ONWS. After the state adopts water quality standards for ONWS, the City can update the ordinance as needed.

A dual plumbing ordinance may be implemented in combination or separate from an ONWS program. If a dual plumbing ordinance is implemented without an ONWS program in consideration, it could lead to dual plumbing systems that are stranded. or never supplied with alternative water supplies, unless they can connect to a municipal recycled water source produced off-site. However, a dual plumbing ordinance could be the first step implemented to allow for the development of an ONWS program while new developments are designed to have dual plumbing systems to be supplied in the near future from ONWS.

To aid the City in determining the next actions needed to develop a dual plumbing ordinance (with or without an ONWS program), the recommended next steps include:

1. Identify public and private partners and work with them to develop and implement pilot ONWS projects.

2. Define the One Water Vision for the City's Onsite Water Reuse Strategy to guide the development and implementation of an ONWS Program and identify roles and responsibilities, program needs, and next steps.

3. Engage stakeholders in a review and comment process for the draft dual plumbing ordinance to get buy in early on and include considerations based on stakeholder recommendations.

As part of Phase 2 of the City's Onsite Non-Potable Water Reuse Strategy, the City should:

1. Establish a small group to champion and facilitate the development of the dual plumbing ordinance. The core group should consider including representatives from the public health department, planning and building officials, and water/wastewater utilities.

2. Using existing guidelines and examples from other locations, draft the dual plumbing ordinance that defines the alternate water sources to be used, the allowable non-potable end uses, the type and scale of developments required to install dual plumbing systems, the applicable rules and regulations, fees, and incentives.

3. Track the implementation and adoption of the water quality standards for ONWS expected to be released by the State Water Board in 2022 and review the draft risk-based regulations once released.

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Dual Plumbing and Onsite Non-Potable Water Systems Study

16 June 2022

Prepared for

City of SACRAMENTO

City of Sacramento
Department of Utilities
1395 35th Avenue
Sacramento, California 95822

KJ Project No. 2270001.00

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Appendix A

Case Study Summary Sheets

San Francisco Onsite Nonpotable Reuse Systems (ONWS)

Summary of Ordinance Implementation

Applicable Ordinances:	Non-potable Water Ordinance (NPO) Stormwater Management Ordinance (SMO) –Established prior to NPO
Ordinance Applicable to:	New development projects of 100,000 sq ft or more (ordinance began with 250,000 sq ft, updated June 2021). New developments 40,000 sq ft or greater required to submit water budget.
Influent Water Sources:	Rainwater, Blackwater, Bay Water, Graywater, Foundation Drainage, Steam Condensate, Stormwater
Non-Potable End Uses:	**Indoor:** Toilet and urinal flushing, Priming drain traps, Clothes washing (cold water) **Outdoor:** Subsurface irrigation, Drip or other surface non-spray irrigation, Spray irrigation, Decorative fountains and impoundments, Cooling applications, Dust control/street cleaning
Cross Connection Testing:	Cross connection testing required before conditional startup, after major plumbing modification, and for blackwater systems every 4-years per regulations.

Funding Opportunities:

San Francisco Public Utilities Commission (SFPUC) provides grants for voluntary or 'above-and-beyond' projects, with funding based on estimated water offset (gal/yr for 10-years), with a maximum funding of $1 million.

Funding for grant program is through operating budget.

DPH funds operations through fee for service

Agencies Involved:

San Francisco Public Utilities Commission (SFPUC) leads the ONWS mission but collaborates closely with a number of other agencies to protect health, monitor systems, and review plans for new systems.

SFPUC had 1.5 full time employees during project startup and now has 1 full time employee to run the program.

Implementation Timeline :

Summary of Active Projects Using ONWS

17 active projects were assessed as part of this analysis, data provided by San Francisco Water Power Sewer (2012-present). There are an additional 17 projects that as of September 2021 that are in the application process.

	Building Size (sq ft)	Volume Treated (MG/yr)	Volume Per Area (MG/yr)/sq ft
Maximum	2,700,000	39.06	14.5
Average	650,600	5.91	3.6
50th Percentile	375,800	0.91	1.84
Minimum	69,000	0.03	0.04

Primary Influent Water Source:	14 of 17 of projects used rainwater or rainwater and another source
Primary Non-Potable End Use:	14 of 17 of projects used non potable reuse water for toilet/urinal flushing
Technology Vendors Used:	Aquacell, Epicleantech, Living Machine

Ordinance Implementation Steps for Developers

1. Submit Water Budget Application
2. Submit Non-Potable Implementation Plan (District Scale Projects Only)
3. Submit Application for Permit to Operate
4. Obtain Encroachment Permit (if applicable)
5. Obtain Plan Check Approval and Complete System Construction
6. Conduct Cross-Connection Test & Complete Post-Construction Inspection
7. Submit Documentation for a Permit to Operate
8. Obtain a Permit to Operate
9. Operate in Conditional Startup Mode
10. Operate in Final Mode with Approval

Ordinance Exemptions

- ❑ 100% Affordable Housing Projects
- ❑ Hospitals, Health Services, & Institutional Healthcare Buildings
- ❑ Industrial, production, distribution & repair use buildings
- ❑ Rehabilitation of buildings constructed prior to 2015

Additional Facts

Implementation was done in conjunction with the stormwater Management Ordinance allowing for synergies between programs.

If a treatment process is being used to achieve log reduction targets, continuous online monitoring of process performance is required.

SFPUC led by example and installed an onsite water reclamation system in the lobby of its administration building with a capacity of 5,000 gallons per day

District scale projects were incorporated due to the found benefits of balance of supply/demand, reduced O&M complexity/cost, building footprint, payback period, and stormwater compliance. District scale is defined as 2 or more buildings that use a single system.

Santa Monica Recycled Water Ordinance with Dual Plumbing

Summary of Ordinance Implementation

The City of Santa Monica adopted a recycled ordinance in March of 2022. The ordinance establishes the requirements for recycled water use and provisions of recycled water service within the boundaries of the City, including the criteria for dual plumbing systems and outdoor irrigation.

Applicable Ordinances:	Recycled Water Ordinance, Water Shortage Response Plan, Water Neutrality Ordinance, Green Building Ordinance
Ordinance Applicable to:	New developments within the recycled water service area with area of 7,500 sq ft or greater; existing potable water surface irrigation applications within the service area identified as eligible for RW use by the City
Influent Water Sources:	Dry weather runoff (water from excessive irrigation spills, construction sites, pool draining, car washing, washing down of pavement) and wet weather runoff is treated at the Santa Monica Urban Runoff Recycling Facility (SMURRF) for beneficial non-potable reuse. As part of the Sustainable Water Infrastructure Project, the City also plans to construct an Advanced Water Treatment Plant, expected to be online the summer of 2023, to treat 1 MGD of municipal wastewater for immediate non-potable reuse, and when properly permitted indirect potable reuse via aquifer recharge.
Non-Potable End Uses:	**Indoor:** Dual plumbing systems (flushing toilets/urinals, industrial process or boiler feeds, commercial laundries or carwashes, industrial or commercial cooling towers or evaporative condensers. Dual plumping will only be utilized for new buildings that are commercial, industrial, or multi-facility residential developments. **Outdoor:** Surface irrigation for highway and median landscaping, city parks, cemetery, commercial building landscaping, and public school grounds
Cross Connection Testing:	Los Angles County Department of Public Health certifies backflow prevention assembly testers, regulates onsite cross-connection control
Funding Opportunities:	Future pipelines and wells will be paid for by water supply rates. The City has budget allocated for the Recycled Water Ordinance and did not choose to peruse any funding opportunities. An In-Lieu Fee can be paid by developer as an alternative to installing a system when deemed infeasible
Agencies Involved	

Implementation Timeline :

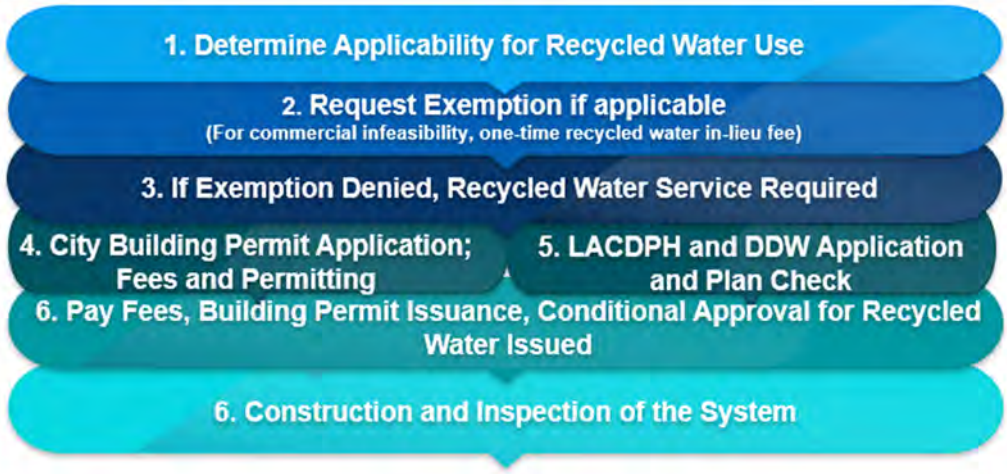
The City of Santa Monica has a goal of Water-Self Sufficiency by 2023

Path to Sustainable Water Use and Water Self-Sufficiency by 2023

Year	Activity
2011	Council asks staff to develop water self-sufficiency plan
2014	Council adopts Sustainable Water Master Plan
2015	Council adopts Water Shortage Response Plan (20% reduction in water consumption)
2016	Updated Green Building Ordinance and water efficient landscape and irrigation standards
2017	Water Neutrality Ordinance put into effect
2018	Update to Sustainable Water Master Plan, Water Rate Study, New Olympic Sub-Basin treatment strategy
2019	Implementation of Santa Monica Urban Runoff Recycling Facility (SMURRF)
2021	Drafting of Recycled Water Ordinance and User Guidelines Begins
2022	Adoption of Recycled Water Ordinance
2023	Expected Completion of Advanced Water Treatment Plant upgrades at Arcadia WTP
2023	Water self-sufficiency achieved

Development path of Recycled Water Ordinance

Anticipated Ordinance Implementation Steps for Developers and Ordinance Exemptions



Ordinance Exemptions

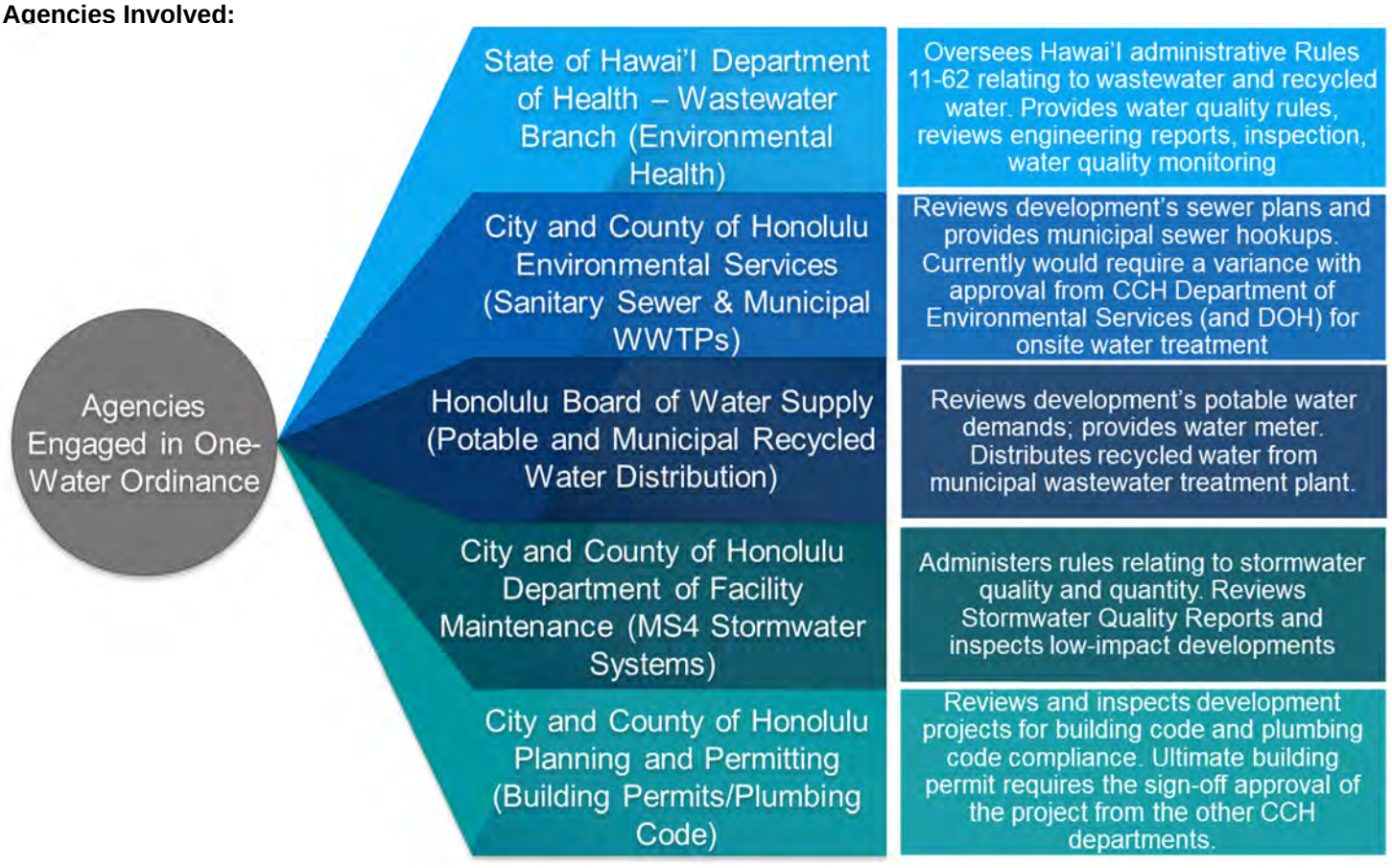
- Fire protection systems in any development
- Where recycled water quality deemed non-suitable for a particular fixture or equipment
- If recycled water system is commercially infeasible (User must pay Recycled Water in-Lieu fee)
- Any exemptions recognized by LACDPH

Hawai'i One-Water Ordinance

Summary of Ordinance Implementation

The City and County of Honolulu (CCH) passed a One-Water ordinance in 2020 as a result of the Hawaii Freshwater Initiative. The ordinance codifies how the city agencies will collaborate on water infrastructure initiatives to build climate resiliency and water security.

Applicable Ordinances:	City and County of Honolulu One-Water Ordinance (2020). Hawaii Freshwater Initiative Blueprint for Action (2018).
Ordinance Applicable to:	City Agencies. Codifies how city agencies will work together towards climate resiliency and water infrastructure.
Influent Water Sources:	Rainwater, Blackwater, Graywater
Non-Potable End Uses:	**Indoor:** Toilet and urinal flushing (Rainwater only) **Outdoor:** Water features, Irrigation (spray, drip, subsurface), Cooling applications (makeup water)
Cross Connection Testing:	Cross connection testing is required per plumbing code and State of Hawaii Department of Health (DOH) HAR 11-62.
Funding Opportunities:	As part of the ordinance and Hawaii Freshwater Initiative, pilot projects are being offered for onsite reuse.
Agencies Involved:	



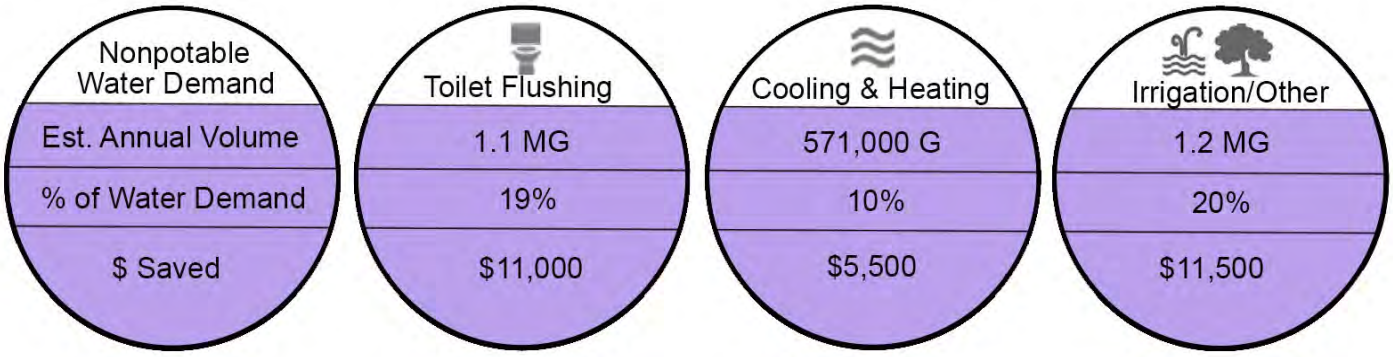
Implementation Timeline:
Path to Sustainable Water Use and Water Security by 2030

Year	Activity
2016	Hawaii Freshwater Initiative (HFI) Council established
2017	HFI water budget study
2018	HFI published "A Blueprint for Action: Water Security for an Uncertain Future"
2019	HFI initiates grant program for pilot projects demonstrating meeting one or more of the goals of the HFI Blueprint for Action.
2020	City and County of Honolulu updates the plumbing code to the UPC 2018 that provides allowances for nonpotable (rainwater and reclaimed water) for both outdoor and indoor reuse.
2021	Hawaii Community Foundation convened a "Nonpotable Water Advisory Committee" to support the State of Hawaii Department of Health (DOH) to adopt water quality rules and monitoring requirements for onsite wastewater treatment for indoor recycled water reuse.
2022	Hawaii Community Foundation and Hawaii DOH explore pilot projects for onsite wastewater treatment and reuse.
2023	Pass bill to provide funding to DOH to hire staff to oversee nonpotable water reuse program (for voluntary onsite wastewater treatment and indoor reuse).

Onsite Reuse Analysis for Kapālama Mixed Use Development

Annual Water Portfolio (with occupant cost savings):

Annual Nonpotable Water Demands:



1. Energy Assumption based on average energy intensity of 3.2 kWh/kgal for Oahu (DLNR, 2016 Hawaii Water Energy Nexus Report)
2. Occupant savings are based on assumption of replacing potable water with nonpotable water (estimated from avoided potable water and sewer costs) and SWU fee of $4.82/1000 sf IA and credit is no more than 50% fee credit w/GI
3. Total wastewater includes greywater and blackwater
4. 12 gal/1000sq ft per day (Novak 2014)
5. Assumes water capture from building roofs only

Appendix B

Case Study Ordinances

Appendix B-1

San Francisco Non-Potable Water Ordinance

AMENDED IN COMMITTEE
9/9/2021

FILE NO. 210536 ORDINANCE NO. 155-21

[Health, Business and Tax Regulations Codes - Alternate Water Sources for Non-Potable Applications]

Ordinance amending the Health Code to 1) lower the threshold, from 250,000 to 100,000 square feet of gross floor area, for requiring that new buildings be constructed, operated, and maintained using specified alternate water sources for required non-potable uses; 2) exempt certain affordable housing projects and property uses from that requirement; 3) require that certain categories of new buildings use specific sources of nonpotable water for specific purposes; 4) ~~require that new developments with multiple buildings install an alternate water source system serving the entire development; 5)~~ **modify certain administrative review fees;** ~~and 6~~**5) require the payment of excess use charges and penalties for failure to properly use and maintain alternate water source systems; amending the Business and Tax Regulations Code to update certain annual license fee amounts for operating alternate water source systems;** and 6) the completion of reports on purified water, recycled water, and Non-potable District Systems; **and affirming the Planning Department's determination under the California Environmental Quality Act.**

NOTE: **Unchanged Code text and uncodified text** are in plain Arial font.
Additions to Codes are in *single-underline italics Times New Roman font*.
Deletions to Codes are in ~~*strikethrough italics Times New Roman font*~~.
Board amendment additions are in double-underlined Arial font.
Board amendment deletions are in ~~strikethrough Arial font~~.
Asterisks (* * * *) indicate the omission of unchanged Code subsections or parts of tables.

Be it ordained by the People of the City and County of San Francisco:

Section 1. Environmental Findings.

The Planning Department has determined that the actions contemplated in this ordinance comply with the California Environmental Quality Act (California Public Resources Code Sections 21000 et seq.). Said determination is on file with the Clerk of the Board of Supervisors in File No. 210536 and is incorporated herein by reference. The Board affirms this determination.

Section 2. The Health Code is hereby amended by revising Article 12C, Sections 12C.1 through 12C.9 and 12C.11 through 12C.13, to read as follows:

SEC. 12C.1. PURPOSE AND FINDINGS.

The Board of Supervisors finds that:

(a) All California water users are responsible for making effective use of the available water resources.

(b) The development of alternate water source systems will assist in meeting future water requirements of the City and lessen the impacts of new developments on the City's sewer system.

(c) Establishing a regulatory structure that provides administrative efficiency and a streamlined project approval process will assist developers who opt to design, install, operate, and maintain alternate water source systems.

(d) Adoption of Article 12C by the Board of Supervisors and adoption of rules and regulations by the Department of Public Health will help achieve the City's goals for water supply use and preservation by:

(1) Promoting the values and benefits of non-potable water use while recognizing the need to invest water and other resources as efficiently as possible;

(2) Encouraging the use of non-potable water for non-potable applications; and

(3) Replacing potable water use for toilet and urinal flushing and irrigation to the maximum extent possible with alternative water sources.

(e) It shall be City policy that within five years of the effective date of Ordinance No. 109-15, adding this subsection (e) to Article 12C, the City shall use only non-potable water for the purpose of irrigating and cleaning parks, streets, and other public spaces. Within two years of the effective date of that ordinance, the City Administrator, in consultation as appropriate with other City departments, boards, and commissions, including, among others, the Recreation and Park Department, Department of Public Works, Port of San Francisco, San Francisco International Airport, ~~*Department*~~ *Division* of Real Estate, and Capital Planning Committee, shall study what will be required to accomplish this policy, including associated costs, and report the results of the study to the Mayor and Board of Supervisors. Upon receiving this study, the Board of Supervisors intends to evaluate any changes to the law and Capital Plan needed to implement this policy.

(f) The General Manager of the San Francisco Public Utilities Commission shall submit a report to the Board of Supervisors by December 31, 2021, evaluating the challenges of, and opportunities for requiring the construction, operation and maintenance of Non-potable District Systems at District Development Projects. The report shall also identify the opportunities for the expansion of water heating systems including, but not limited to thermal solar hot water preheating systems, graywater preheating systems, wastewater heat recovery systems, and geo-thermal hot water preheating systems.

(g) *In order to further determine opportunities to maximize and expand the use of nonpotable sources of water, the General Manager* of the San Francisco Public Utilities Commission *shall submit to the Board of Supervisors by June 1, 2022, a report evaluating opportunities to develop a recycled water and purified water supply for San Francisco.*

(h) The General Manager of the San Francisco Public Utilities Commission shall submit a report to the Board of Supervisors by December 31, 2022, identifying the opportunities for

biogas utilization and energy recovery from the San Francisco Public Utilities Commission's Biosolids Digester Facilities Project.

SEC. 12C.2. DEFINITIONS.

The terms used in this Article 12C have the meaning set forth below:

100% Affordable Housing Project: *a building where 100% of the residential units (not including a manager's unit) have (1) a maximum affordable purchase price or affordable rent set at 120% of the unadjusted area median family income as determined by the Mayor's Office of Housing and Community Development on an annual basis and derived from the HUD Metro Fair Market Rent Area that contains San Francisco; (2) a rent that does not exceed 30% of the applicable household income limit for a rental unit, or a purchase price with an annual housing cost that does not exceed 33% of the applicable income limit for an owner-occupied unit, as may be adjusted for household size and bedroom count; and (3) a recorded regulatory agreement, consistent with any applicable federal, state, or City government regulatory requirements, to assure that the residential units are sold or rented in accordance with the above criteria for the life of the project or a minimum of 55 years, whichever is shorter.*

100% Permanent Supportive Housing Project: *a new building where 100% of the residential units (not including a manager's unit) are (1) owned by a nonprofit charitable organization or qualified related legal entity, (2) used for permanent supportive housing to formerly homeless households subject to a recorded declaration of restriction, and (3) funded through a subsidy agreement with the Department of Homelessness and Supportive Housing.*

Alternate Water Source: a source of ~~*non*~~*Non*-potable water that includes Graywater, on-site treated ~~*non*~~*Non*-potable water, Rainwater, *Stormwater, Foundation Drainage,* Blackwater, and any other source approved by the Director.

Alternate Water Source System: The system of facilities necessary for providing Non-potable Water for use in a Development Project, including but not limited to all collection,

treatment, storage, and distribution facilities. Non-potable Water System shall have the same meaning.

Blackwater: wastewater containing bodily or other biological wastes, as from toilets, dishwashers, kitchen sinks, and utility sinks.

City: the City and County of San Francisco.

***Commercial Building**: a building with a commercial use as defined in Planning Code Section 102, amended from time to time.*

Condensate: water vapor collected from air conditioning systems.

Development Project: Construction of *a* new *building or* buildings. Development Projects are Large Development Projects and Small Development Projects. Development Project does not include rehabilitation of buildings constructed prior to *August 1, 2015* ~~*the effective date of this Article 12C*~~. Development Project does not include (1) *any 100% Affordable Housing Project, 100% Permanent Supportive Housing Project, or* ~~*any*~~ housing project funded or constructed pursuant to the HOPE SF Program sponsored and developed by the San Francisco Housing Authority and either the Mayor's Office of Housing and Community Development or the Office of Community Investment and Infrastructure; *(2) Hospital Buildings, Health Service Buildings, and Institutional Healthcare Use Buildings; (3) Industrial Use Buildings; (4) Production, Distribution, and Repair Use Buildings;* (*5*~~*2*~~) construction of a new building that will receive water service from the San Francisco Public Utilities Commission through no larger than a 5/8" domestic water meter or a 5/8" recycled water domestic meter, as determined in accordance with the San Francisco Public Utilities Commission's rules for water service; *(6*~~*3*~~) for District projects located within the boundaries of the Reclaimed Water Use Map, construction of new buildings subject to a disposition and development agreement or similar contractual agreement approved before November 1, 2015, that includes in its applicable infrastructure plan the construction and operations of water treatment facilities within the

project boundaries that would provide recycled water to the project; *(7~~4~~)* for District projects located within the boundaries of the Reclaimed Water Use Map, construction of new buildings subject to a development agreement or similar contractual agreement, within a development phase or subphase, a street improvement plan, or a tentative map or vesting tentative map approved before November 1, 2015; or *(8~~5~~)* for District projects located outside the boundaries of the Reclaimed Water Use Map, construction of new buildings subject to a development agreement or similar contractual agreement, within a development phase or subphase, a street improvement plan, or a tentative map or vesting tentative map approved before November 1, 2017.

Director: the Director of Health or any individual designated by the Director to act on ~~*his or her*~~*the Director's* behalf.

District *Development Project*: *a Large Development Project consisting of two or more buildings* ~~*a group of two or more parcels that share Alternate Water Sources*~~.

District System: An Alternate Water Source System serving a District Development *P*~~*p*~~roject.

First Certificate of Occupancy: either a temporary certificate of occupancy or a Certificate of Final Completion and Occupancy as defined in San Francisco Building Code Section 109A, whichever is issued first.

Foundation Drainage: nuisance groundwater that is extracted to maintain a building's or facility's structural integrity and would otherwise be discharged to the City's sewer system. Foundation Drainage does not include non-potable groundwater extracted for a beneficial use that is subject to City groundwater well regulations.

General Manager: the General Manager of the San Francisco Public Utilities Commission, or any individual designated by the General Manager to act on his or her behalf.

Graywater: untreated wastewater that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes. "Graywater" includes, but is not limited to, wastewater from bathtubs, showers, bathroom sinks, lavatories, clothes washing machines, and laundry tubs, but does not include wastewater from *toilets,* kitchen sinks*, utility sinks,* or dishwashers.

Gross Floor Area: The floor area of a Development Project as defined in Planning Code Section 102*, as amended from time to time*.

Health Service Building*: A building with a health service use as defined in Planning Code Section 102, as amended from time to time.*

Hospital Building*: A building with a hospital use as defined in Planning Code Section 102, as amended from time to time.*

Industrial Use Building*: A building with an industrial use as defined in Planning Code Section 102, as amended from time to time.*

Institutional Healthcare Use Building*: A building with an institutional healthcare Use as defined in Planning Code Section 102, as amended from time to time.*

Large Development Project:

(a) Prior to January 1, 2022, a Large Development Project is the construction ~~Construction~~ of a single building, or construction of multiple buildings on one or more parcels in accordance with a phased plan or approval, with a total ~~*gross floor area*~~ *Gross Floor Area* for the single building or the multiple buildings of 250,000 square feet or more:

~~*(a)*~~ *(1)* located within the boundaries of the Reclaimed Water Use Map designated in accordance with Sections 1203 and 1209 of the Public Works Code and subject to a site permit or building permit that is final and effective after November 1, 2015; or

~~(b)~~ *(2)* located outside the boundaries of the Reclaimed Water Use Map designated in accordance with Sections 1203 and 1209 of the Public Works Code and subject to a site permit or building permit that is final and effective after November 1, 2016.

(b) On or after January 1, 2022, a Large Development Project is the construction of a single building, or construction of multiple buildings on one or more parcels in accordance with a phased plan or approval, with a total Gross Floor Area for the single building or the multiple buildings of 100,000 square feet or more.

(c) Large Development Projects ~~*are not limited to buildings constructed by individuals or non-governmental entities but, to the extent allowed by law, also*~~ include*, to the extent allowed by law,* buildings constructed and operated by any local, state, or federal government entity, including the City~~*and County of San Francisco*~~.

Large Development Project Applicant: The person or entity applying for authorization to construct and operate a Large Development Project.

Mixed-Use Residential Building: *A building with both a residential use and a commercial use as defined in Planning Code Section 102.*

Multi-Family Residential Building: A building that contains three or more dwelling units.

Non-potable Water: ~~*Non-potable*~~ water collected from ~~*alternate water sources,*~~ *Alternate Water Sources* ~~*treated, and intended to be used on the Project Applicant's site or District parcels and is suitable for direct beneficial use*~~.

Non-potable Water Engineering Report: Report submitted by *the* Project Applicant to the Director describing the Alternate Water Source ~~*system*~~ *System* in accordance with the rules and regulations adopted by the Department of Health.

Nonpotable Water System: The same meaning as Alternate Water Source System.

Non-~~*residential*~~ *Residential Building*: A building *with a non-residential use as defined in Planning Code Section 102.* ~~*that contains occupancies other than dwelling units*~~.

~~***NSF 350 System:*** *Any treatment system certified by NSF International to meet NSF/ANSI Standard 350 for Onsite Residential and Commercial Reuse Treatment Systems, as amended from time to time.*~~

Permittee: *The Project Applicant, or any subsequent owner, assignee, successor in interest or any other transferee subject to this Article 12C, including, but not limited to, operations and maintenance of an Alternative Water Source System. Permittee includes, but is not limited to, the owner of the common areas within a District Development Project and any homeowners association or similar entity that maintains the common areas within a District Development Project. Permittee does not include the Project Applicant, subsequent owners, assignees, successors in interests, transferees, owners of a common area, homeowners associations, or any other person or entity associated with a Development Project serviced by an Alternative District System dedicated to the City in accordance with Section 12C.4(h) of this Article 12C.*

~~*The operator of an Alternate Water Source System under this Article 12C, including, but not limited to, a third - party contractor obtained for the purpose of operating and maintaining all or any portion of the Alternate Water Source System*~~.

Production, Distribution, Repair Use Building: *A building with production, distribution, repair Use as defined in Planning Code Section 102.*

Project Applicant: the person or entity applying for authorization to install and use an Alternate Water Source *System*~~*project*~~.

Rainwater: precipitation collected from roof surfaces or other manmade, aboveground collection surfaces.

~~*Responsible Party: The Project Applicant, or any subsequent owners, assignees, successors in interest or any other transferees responsible for compliance with this Article 12C. Responsible Party*~~

~~*includes, but is not limited to, the owner of the common areas within a District Development Project and any homeowners association or similar entity that maintains the common areas within a District Development Project. Responsible Party does not include the Project Applicant, subsequent owners, assignees, successors in interests, transferees, owners of common area, homeowners associations, or any other person or entity associated with a Development Project serviced by an Alternative District System as described in Section 12C.4(d).*~~

Small Development Project:

(a) Prior to January 1, 2022, a Small Development Project is the construction ~~*Construction*~~ of a single building, or construction of multiple buildings on one or more parcels in accordance with a phased plan or approval, with a total ~~*gross floor area*~~ *Gross Floor Area* for the single building or the multiple buildings of 40,000 square feet or more, but less than 250,000 square feet.

(b) On or after January 1, 2022, a Small Development Project is the construction of a single building, or construction of multiple buildings on one or more parcels in accordance with a phased plan or approval, with a total Gross Floor Area for the single building or the multiple buildings of 40,000 square feet or more, but less than 100,000 square feet.

(c) Small Development Projects ~~*are not limited to buildings constructed by individuals or non-governmental entities but, to the extent allowed by law, also*~~ include*, to the extent allowed by law,* buildings constructed and operated by any local, state, or federal government entity, including the City ~~*and County of San Francisco*~~.

Small Development Project Applicant: The person or entity applying for authorization to construct and operate a Small Development Project.

Small Residential Building: A building that contains no more than two dwelling units.

Stormwater: Precipitation collected from at-grade or below-grade surfaces.

Water Budget: The calculation of the potential volume of onsite ~~*alternate water*~~ *Alternate Water Source* supplies and demands of a Development Project and any other building subject to this Article 12C.

Water Budget Calculator: The water use calculation ~~*application*~~ *tool* approved by the General Manager that provides for the assessment of a proposed onsite water system, ~~*alternate water source*~~ *Alternate Water Source*, and the end uses of the Alternate Water Source.

Water Budget Documentation: An in-depth assessment of the Project Applicant's non-potable water use, including survey information, water meter readings, water service billing information, Alternate Water Source schematic drawings, or any other information deemed necessary by the General Manager. For proposed District Systems, Water Budget Documentation shall include implementation information that, at a minimum, shall address potential infrastructure and public right of way conflicts, demonstrate compliance with all applicable requirements, and establish the capabilities of the Development Project Applicant to effectively operate the District System.

SEC. 12C.3. APPLICABILITY.

(a) This Article 12C shall apply to the installation and operation of the Alternate Water Source ~~*systems*~~ *Systems* at Large Development Projects, and to the voluntary installation and operation of the Alternate Water Source ~~*systems*~~ *Systems* at sites containing ~~*multi-family*~~ *Multi-Family Residential Building* and ~~*non-residential*~~ *Non-Residential* buildings. This Article does not apply to:

~~(1)~~ ~~(a)~~ Systems at ~~*small residential*~~ *Small Residential Buildings* ~~*occupancies*~~.

~~(2)~~ ~~(b)~~ Graywater systems where Graywater is collected solely for subsurface irrigation and does not require disinfection, as determined by the Director.

(3) ~~(c)~~ Rainwater systems where Rainwater is collected solely for subsurface irrigation, drip irrigation, or non-sprinkled surface applications and does not require disinfection, as determined by the Director.

(b) Nothing in the ordinance in Board File No. 201536 amending this Article 12C is intended to impair or limit any contract right that exists as of the effective date of said ordinance. In connection with the application of Article 12C as it relates to development agreements or similar development contracts, or approved development plans administered by the Office of Community Investment and Infrastructure, the General Manager shall consult with the City Attorney to determine whether the application of this Article 12C to a specific Development Project will violate the terms of contracts that the City entered into before the aforementioned effective date.

SEC. 12C.4. DEVELOPMENT PROJECT REQUIREMENTS.

(a) Large Development Projects shall be constructed, operated, and maintained in compliance with the following:

(1) *For Large Development Projects and District Development Projects that submit an application for a site permit on or prior to January 1, 2022, an Alternate Water Source System shall be constructed, operated, and maintained.* All toilet and urinal flushing and irrigation demands shall be met through the collection and reuse of available onsite Rainwater, Graywater, and Foundation Drainage, to the extent required by application of the Water Budget Documentation developed for each Development Project.

(2) For Large Development Projects and District Development Projects *consisting* solely *of* ~~a single~~ *Commercial Buildings that submit an application for a site permit after January 1, 2022, an Alternate Water Source System shall be constructed, operated, and maintained. Toilet and urinal flushing demands* and drain trap priming *are required non-potable uses. The collection and reuse of Blackwater* and Condensate *(required Alternate Water Sources) shall be*

used for required non-potable uses to the extent required by application of the Water Budget Documentation.

(3) For Large Development Projects and District Development Projects *consisting* solely *of* ~~a single~~ *Multi-Family Residential Building*s *or Mixed-Use Residential Building*s *that submit an application for a site permit after January 1, 2022, an Alternate Water Source System shall be constructed, operated, and maintained. Toilet and urinal flushing, clothes washing,* drain trap priming, *and irrigation demands are required non-potable uses. The collection and reuse of Graywater* and Condensate *(required Alternate Water Source*s*) shall be used for required non-potable uses to the extent required by application of the Water Budget Documentation.*

(4) For District Development Projects that consist of any combination of Commercial, Residential and Mixed-Use Residential Buildings, and that install a District System, toilet and urinal flushing, clothes washing, drain trap priming, and irrigation demands are required non-potable uses. The collection and reuse of Graywater and Condensate (required Alternate Water Sources) shall be used for required non-potable uses to the extent required by application of the Water Budget Documentation.

(5) For District Development Projects that consist of any combination of Commercial, Residential and Mixed-Use Residential Buildings, and that install building-by-building Alternate Water Source Systems, the required non-potable uses and required Alternate Water Sources shall be the uses and sources for each category of building type describe in subsections (a)(2) and (a)(3) of this section.

~~(4) For District Development Projects consisting of solely Commercial Buildings that submit an application for a site permit after January 1, 2022, a District System shall be constructed, operated and maintained. Toilet and urinal flushing and irrigation demands are required non-potable uses. The collection and reuse of Blackwater (required~~

~~Alternate Water Source) shall be used for required non-potable uses to the extent required by application of the Water Budget Documentation.~~

~~(5) For District Development Projects consisting of any Multi-Family Residential Buildings or Mixed-Use Residential Buildings that submit an application for a site permit after January 1, 2022, a District System shall be constructed, operated, and maintained. Toilet and urinal flushing, clothes washing, and irrigation demands are required non-potable uses. The collection and reuse of Graywater (required Alternate Water Source) shall be used for required non-potable uses to the extent required by application of the Water Budget Documentation.~~

(b) A Large Development Project Applicant shall use the Water Budget Calculator as follows:

(1)~~*(2)*~~ *For Large Development Projects that submit an application for a site permit on or prior to January 1, 2022, a*~~*A*~~ Large Development Project Applicant shall use the Water Budget Calculator, as provided by the General Manager's rules, to prepare a Water Budget assessing the amount of Rainwater, Graywater, and Foundation Drainage produced on site, and the planned toilet and urinal flushing and irrigation demands.

(2) For Large Development Projects that submit an application for a site permit after January 1, 2022, a Large Development Project Applicant shall use the Water Budget Calculator, as provided by the General Manager's rules, to prepare a Water Budget assessing the amount of Alternate Water produced on site by the required Alternate Water Sources, and the amount of Alternate Water needed to supply the required non-potable uses.

(c) Use of Alternate Water for Large Development Projects shall be as follows:

(1) For Large Development Projects that submit an application for a site permit on or prior to January 1, 2022, if ~~*If*~~, based on the Water Budget Documentation, the available supply from onsite sources exceeds the demands for toilet and urinal flushing and irrigation,

100% of those demands shall be met by using the available onsite sources. If, based on the Water Budget Documentation, the available supply from onsite sources is less than the demands for toilet and urinal flushing and irrigation, 100% of the available onsite supply shall be used to meet the demands for toilet and urinal flushing and irrigation. Available Blackwater or Stormwater supplies may be used instead of, or in addition to Rainwater, Graywater, and Foundation Drainage to meet the available onsite supply requirements calculated in accordance with the Water Budget Documentation requirements of this Section 12C.4~~*(a)*~~*(c)(1)*.

(2)~~*(3)*~~ *For Large Development Projects that submit an application for a site permit after January 1, 2022, if, based on the Water Budget Documentation, the available supply from required Alternate Water Sources exceeds the demand from required non-potable uses, 100% of that demand shall be met by using the required Alternate Water Sources. If, based on the Water Budget Documentation, the available supply from required Alternate Water Sources is less than the demand from required non-potable uses, 100% of the available supply from required Alternate Water Sources shall be used to meet the demand from required non-potable uses.*

(*d*) Small Development Project Applicants shall *be as follows:*

(1) For Small Development Projects that submit an application for a site permit on or prior to January 1, 2022, Small Development Project Applicants shall use the Water Budget Calculator, as provided by the General Manager's rules, to prepare a Water Budget assessing the amount of Rainwater, Graywater and Foundation Drainage produced on site, and the planned toilet and urinal flushing and irrigation demands.

(2) For Small Development Projects that submit an application for a site permit after January 1, 2022, Small Development Project Applicants shall use the Water Budget Calculator, as provided by the General Manager's rules, to prepare a Water Budget assessing the supply from Alternate Water Sources available on site, and the demand from non-potable uses on site.

(e) Large Development Projects and District Development Projects shall be subject to excess use charges for exceeding potable water allocations determined in accordance with rules adopted by the General Manager. If a Large Development Project or District Development Project exceeds its allocation of potable water, the Permittee for the Large Development Project or District Development Project shall be subject to excess use charges on each unit of potable water exceeding the allocation at 300% (or 3x) the applicable water and wastewater rates.

(f) Large Development Projects and District Development Projects shall not provide Non-potable Water to water users or for purposes located outside the boundaries of the Large Development Project or District Development Project, except (1) as permitted in the sole discretion of the General Manager, or (2) when the water users or other purposes are located on property contiguous to, or across a public right of way from the boundaries of the Large Development Project or District Development Project, and the total amount of Non-potable Water produced by the Alternate Water Source System will not exceed 125% of the Large Development Project's or District Development Project's required non-potable demands as determined by the approved Water Budget Documentation.

(*g*~~e~~) Additional Requirements for District Systems. All District Systems shall conform to the following requirements~~, subject to the General Manager's determination, in his or her sole discretion, that an exception to any of such requirements will fulfill the purposes and objectives of this Article 12C~~:

(1) In addition to preparation of the Water Budget, ~~Development~~ Project Applicants for District Systems shall submit implementation plans to the General Manager for review and approval, in accordance with guidelines and rules established by the General Manager.

(2) ~~District Systems shall be operated by a single Permittee having sole control of operations of all of its facilities, including but not limited to treatment and distribution facilities.~~

District Systems shall be constructed in accordance with all applicable City utility standards and specifications.

(3) ~~*District Systems and Development Projects shall not provide Non-potable Water to water users or for purposes located outside the boundaries of the District or approved Development Project, except when the water users or other purposes are located on property contiguous to, or across a public right of way from the boundaries of the District or approved Development Project, and the total amount of Nonpotable Water produced by the Alternate Water Source System will not exceed 125% of the District System's or approved Development Project's Non-potable Water demands for toilet and urinal flushing and irrigation, as determined by the approved Water Budget Documentation.*~~

~~*(4) For District Systems, the ongoing operation and maintenance responsibilities of the Responsible Party shall be held by the owner of the common areas within the District Development Project, and may be transferred to a homeowners association or similar entity that maintains the common areas within the District Development Project.*~~

~~*Where a District System complies with the requirements in subsections 1 through 4 of this subsection 12C.4(c), including any exceptions approved by the General Manager, individual*~~ *Individual buildings within a* ~~*Development Projects with the*~~ District Development Project shall not be required to demonstrate compliance as long as the individual buildings ~~Buildings~~ ~~*Development Projects*~~ are provided service by ~~the~~ an approved District System.

(*h*~~*d*~~) The General Manager may approve ~~*alternative*~~ *Alternate* District Systems that will achieve compliance with the purposes and objectives of this Article 12C, in accordance with guidelines and rules established by the General Manager. Alternative District Systems may include, but are not limited to, *the dedication to the City, without cost to the City, of a District System's treatment and/or conveyance system that is constructed in accordance with all applicable utility standards and specifications*~~*water purchase agreements*~~.

(*ie*) City departments shall not issue an encroachment permit, a site permit, or a plumbing permit for a Large Development Project or a Small Development Project, or approve a Non-potable Water Engineering Report, prior to the General Manager's determination that the Water Budget Documentation has been prepared in accordance with the General Manager's rules for Water Budget calculations.

(*jf*) Subdivision Approvals.

(1) **Parcel Map or Tentative Subdivision Map Conditions**. The Director of Public Works shall not approve a tentative subdivision map or a parcel map for any property unless a condition is imposed requiring compliance with this Article 12C to serve the potential uses of the property covered by the parcel map or tentative subdivision map, as specified in the provisions of this Article.

(2) **Subdivision Regulations**. The Director of Public Works shall adopt regulations consistent with, and in furtherance of this Article 12C.

(3) **Final Maps**. The Director of Public Works shall not endorse and file a final map for property within the boundaries of the City without first determining that:

(A) The subdivider has complied with the conditions imposed on the tentative subdivision map or parcel map, pursuant to this Article 12C; and

(B) For any such conditions not fully satisfied prior to the recordation of the final map, the subdivider has signed a certificate of agreement and/or improvement agreement, to ensure compliance with such conditions.

(4) This ~~S~~subsection (*fi*) shall not apply to tentative subdivision maps or parcel maps submitted solely for the purposes of condominium conversion, as defined in Subdivision Code Section 1308(d).

(*k*) In the event that a privately owned Alternate Water Supply System approved by the General Manager is subsequently determined by the California Public Utilities

Commission to be subject to that agency's jurisdiction and regulation, the San Francisco Public Utilities Commission may, with the consent of the affected owner, acquire and operate the facilities.

SEC. 12C.5. REGULATION OF ALTERNATE WATER SOURCES.

(a) Any person or entity who installs and operates an Alternate Water Source system shall comply with this Article 12C, the rules and regulations adopted by the Department of Public Health, and all applicable ~~*local*~~ *City*, state, and federal laws.

(b) *The* ~~*Within 90 days after passage of this ordinance, the*~~ Director shall issue rules and regulations regarding the operation of Alternate Water Source systems necessary to effectuate the purposes of ~~*the*~~ *this* Article *12C* and to protect public health and safety. These regulations shall address, at a minimum:

(1) Water quality criteria;

(2) Monitoring and reporting content and frequencies; and

(3) Operation and maintenance requirements.

(c) The Director shall review applications for Alternative Water Sources systems and may issue or deny such applications, in accordance with applicable laws and regulations.

(d) The Department of Building Inspection shall review plans and issue or deny plumbing permits for the construction, installation, or modification of Alternate Water Source systems, in accordance with applicable laws and regulations.

SEC. 12C.6. PROJECT APPLICANT AND/OR PERMITTEE DESIGN AND CONSTRUCTION REQUIREMENTS.

(a) Prior to initiating installation of any Alternate Water Source project, Project Applicants shall submit to the Director an application for permits to operate Alternate Water Source systems. Such applications shall comply with the requirements of this Article 12C and any regulations the Director has issued. Project Applicants shall pay a non-refundable permit

application fee to cover the costs of investigation and processing the application and issuing the permit. Each project application submitted to the Director shall include a Non-potable Water Engineering Report that provides project information the Director determines to be necessary for complete review of the proposed project. City departments may not approve or issue permits for any site installing an Alternate Water Source system unless and until the Director has approved the Non-potable Water Engineering Report.

The Non-potable Water Engineering Report for District systems must include information on the permanent legal agreements between property owners, and provide documentation that each party is a willing and responsible participant in the District Non-potable Water use.

(b) System Design. All buildings using Non-potable Water from Alternate Water Source systems shall include:

(1) A flow meter on the non-potable distribution system to account for Non-potable Water use;

(2) A flow meter on the potable make-up water pipeline to the Alternate Water Source System;

(3~~2~~) A reduced pressure backflow assembly (RP) within 25 feet of the downstream side of the point of connection or meter to protect the City's public water and/or recycled water system;

(4~~3~~) Signage that state law and the Department of Public Health's rules and regulations require;

(5~~4~~) Cross connection control in accordance with California Code of Regulations Titles 17 and 22 and the San Francisco Public Utilities Commission's Cross Connection Control Program; *and*

(*6~~5~~*) Any other requirements the Director determines are necessary to protect public health.

(c) Plumbing Permit. A Project Applicant shall obtain from the Department of Building Inspection an appropriate plumbing permit and any other building or installation permit required to construct, install, alter, an Alternate Water Source system. Each parcel within a District shall obtain appropriate plumbing and any other building or installation permits required.

(d) Encroachment Permit. A Project Applicant shall obtain from the Department of Public Works appropriate authorization for placement of any pipelines or other portions of an Alternate Water Source system within the public right-of-way.

(e) Construction Certification Letter. Project Applicants shall certify to the Director that Alternate Water Source system construction is complete and consistent with the approved Non-potable Water Engineering Report in accordance with the provisions of this Article 12C and any implementing rules and regulations. City departments may not approve or issue a First Certificate of Occupancy or approval for any Alternate Water Source system until the Director has reviewed and verified the Construction Certification Letter.

SEC. 12C.7. FEES.

(a) The non-refundable application fees for alternative source water system permits are:

(1)	Rainwater*, Stormwater, Foundation Drainage*	*$2,616.28~~$1,544.00~~*
~~(2) NSF 350 systems~~		*~~$2,688.00~~*
~~(3) Foundation Drainage~~		*~~$5,032.00~~*
(*2~~4~~*)	Graywater	*$8,142.66~~$5,032.00~~*
(*3~~5~~*)	Blackwater	*$13,958.84~~$9,034.00~~*
(*4~~6~~*)	Transfer of any permit	$*226* *~~229.00~~*

(*5*~~7~~)	District Scale, the applicable amount above, plus	$*226*~~*191.00*~~ per hour for plan review and/or on-site inspection.

(b) The fees set forth in this Section 12C.7 may be adjusted each year, without further action by the Board of Supervisors.

Not later than April 1, the Director shall report to the Controller the revenues generated by the fees for the prior fiscal year and the prior fiscal year's costs of operation, as well as any other information that the Controller determines appropriate to the performance of the duties set forth in this Section *12C.7*.

Not later than May 15, the Controller shall determine whether the current fees produce, or are projected to produce, revenues sufficient to support the costs of providing the services for which the fees are assessed and that the fees will not produce revenue that significantly exceed more than the costs of providing the services for which the fees are assessed.

The Controller shall if necessary, adjust the fees upward or downward for the upcoming fiscal year as appropriate to ensure that the program recovers the costs of operation without producing revenue which is significantly more than such costs. The adjusted rates shall become operative on July 1.

(c) Every permit holder shall also pay an annual license fee as provided in the Business and Tax Regulations Code Section 249.24.

SEC. 12C.8. OPERATING REQUIREMENTS.

When the Director determines the *Project Applicant* ~~*applicant*~~ has satisfied all the requirements of this Article 12C, the Director may issue an operations permit for an Alternative Water Source system. Permittees shall timely submit all water quality monitoring

information required by the provisions of this Article and the Department of Public Health's rules and regulations. Permittees shall conduct ongoing backflow prevention and cross connection testing in accordance with this Article, the rules and regulations of the Department of Public Health, and all applicable ~~*local*~~ *City*, state, and federal laws.

SEC. 12C.9. NON-POTABLE WATER USE AUDITS.

When required by the General Manager, the Permittee ~~*or property owner,*~~ shall conduct a Non-potable Water use audit describing the extent of Non-potable Water use in accordance with requirements provided by the General Manager.

SEC. 12C.11. INSPECTION ~~*AND NOTICES OF VIOLATION*~~.

The Director may inspect any Alternate Water Source system subject to the requirements of this Article 12C to determine compliance with the provisions of this Article and applicable regulations.

SEC. 12C.12. VIOLATION AND PENALTIES.

~~*The Director may impose administrative penalties on any Permittee, or person otherwise subject to the requirements of this Article 12C, who violates any provision of this Article or any applicable rule or regulation shall be subject to enforcement in accordance with Chapter 100 of the San Francisco Administrative Code with respect to administrative penalties, and may pursue any other available legal remedies for such violations.*~~

Administrative penalties shall be assessed and collected by the Department of Public Health as set forth in this Section 12C.12.

(a) Any Permittee, or other person otherwise subject to the requirements of this Article 12C, who violates any provision of this Article or any applicable rule or regulation shall be subject to an administrative penalty imposed by order of the Director, not to exceed $1,000. Each day or portion

thereof that a violation exists constitutes a separate and distinct violation for which an administrative penalty may be imposed. In assessing the amount of the administrative penalty, the Director may consider any one or more of the following: the nature and seriousness of the misconduct, the number of violations, the persistence of the misconduct, the length of time over which the misconduct occurred, and the willfulness of the violator's misconduct.

(b) If the Director determines that any Permittee, or other person otherwise subject to the requirements of this Article 12C, is in violation of any provision of this Article or any applicable rule or regulation, the Director shall issue a Notice of Violation to the person. The Notice of Violation shall contain the following information: a description of circumstances or condition constituting the violation; the date by which the person must correct the violation; the amount of the administrative penalty that the Director will impose daily until such time as the person has demonstrated to the satisfaction of the Director that the violation has been corrected; and the right to seek administrative review of the Notice of Violation by filing an appeal within 30 days of the date that the Notice of Violation is served to challenge the Director's determination and/or the proposed administrative penalty.

(c) If no request for administrative review is timely made, the right to request a hearing shall be waived, and the Director's determination shall become final. The failure to timely request a hearing shall constitute a failure to exhaust administrative remedies and shall preclude judicial review of the validity of the enforcement action. The Director shall issue an order imposing the administrative penalties, which shall be due and payable within 15 days of the date of the order.

(d) Administrative penalties assessed by the Director shall be paid to the Treasurer of the City and County of San Francisco and credited to the Public Health Environmental Health Code Compliance Fund, authorized by Administrative Code Section 10.100-193.

SEC. 12C.13. REVOCATION AND SUSPENSION OF PERMIT.

The Director may order a Permittee to cease operation of an Alternate Water Source system, or may revoke or suspend the permit to operate if the Director determines that:

(a) The *Permittee or its* managers, operators or any employees has violated any provision of this Article 12C or any regulation issued pursuant to this Article;

(b) The Alternate Water Source system is being operated or maintained in a manner threatening the public health or health of patrons and/or residents; or

(c) The *Permittee* ~~*owner or operator*~~ has refused to allow any duly authorized City official to inspect the premises or the operations of the Alternate Water Source system.

Section 3. Article 2 of the Business and Tax Regulations Code is hereby amended by revising Section 249.24, to read as follows:

SEC. 249.24. NON-POTABLE WATER SYSTEMS.

Every person, firm, or corporation engaged in operating an alternate water source system that requires a permit from the ~~*San Francisco*~~ Department of Public Health shall pay an annual license fee to the Tax Collector in the amount listed below. For the purpose of this Section *249.24*, the term "alternate water source *system*~~*systems*~~" shall have the same meaning as that in Article 12C of the ~~*San Francisco*~~ Health Code.

(a) Rainwater*, Stormwater, and Foundation Drainage*	*$1,613.45*~~*$ 472.00*~~
~~*(b) NSF 350 systems*~~	~~*$ 929.00*~~
~~*(c) Foundation Drainage*~~	~~*$1,387.00*~~
(~~*d*~~*b*) Graywater	*$2,195.07*~~*$1,387.00*~~
(~~*e*~~*c*) Black water	*$2,195.07*~~*$1,844.00*~~

The license fee set forth above shall be paid annually on or before March 31, in accordance with the provisions of Section 76.1 of the Business and Tax Regulations Code.

Section 4. Scope of Ordinance. In enacting this ordinance, the Board of Supervisors intends to amend only those words, phrases, paragraphs, subsections, sections, articles, numbers, punctuation marks, charts, diagrams, or any other constituent parts of the Municipal Code that are explicitly shown in this ordinance as additions, deletions, Board amendment additions, and Board amendment deletions in accordance with the "Note" that appears under the official title of the ordinance.

Section 5. Effective Date. This ordinance shall become effective 30 days after enactment, except as otherwise stated in this ordinance. Enactment occurs when the Mayor signs the ordinance, the Mayor returns the ordinance unsigned or does not sign the ordinance within ten days of receiving it, or the Board of Supervisors overrides the Mayor's veto of the ordinance.

APPROVED AS TO FORM:
DENNIS J. HERRERA, City Attorney

By: /s/ John Roddy /s/
JOHN RODDY
Deputy City Attorney

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City and County of San Francisco
Tails
Ordinance

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 210536 **Date Passed:** September 28, 2021

Ordinance amending the Health Code to 1) lower the threshold, from 250,000 to 100,000 square feet of gross floor area, for requiring that new buildings be constructed, operated, and maintained using specified alternate water sources for required non-potable uses; 2) exempt certain affordable housing projects and property uses from that requirement; 3) require that certain categories of new buildings use specific sources of nonpotable water for specific purposes; 4) modify certain administrative review fees; 5) require the payment of excess use charges and penalties for failure to properly use and maintain alternate water source systems; and 6) the completion of reports on purified water, recycled water, and Non-potable District Systems; amending the Business and Tax Regulations Code to update certain annual license fee amounts for operating alternate water source systems; and affirming the Planning Department's determination under the California Environmental Quality Act.

July 08, 2021 Public Safety and Neighborhood Services Committee - CONTINUED TO CALL OF THE CHAIR

September 09, 2021 Public Safety and Neighborhood Services Committee - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

September 09, 2021 Public Safety and Neighborhood Services Committee - RECOMMENDED AS AMENDED

September 21, 2021 Board of Supervisors - PASSED ON FIRST READING

Ayes: 11 - Chan, Haney, Mandelman, Mar, Melgar, Peskin, Preston, Ronen, Safai, Stefani and Walton

September 28, 2021 Board of Supervisors - FINALLY PASSED

Ayes: 11 - Chan, Haney, Mandelman, Mar, Melgar, Peskin, Preston, Ronen, Safai, Stefani and Walton

File No. 210536

I hereby certify that the foregoing Ordinance was FINALLY PASSED on 9/28/2021 by the Board of Supervisors of the City and County of San Francisco.

Angela Calvillo
Clerk of the Board

London N. Breed
Mayor

10/8/21

Date Approved

Appendix B-2

City of Santa Monica Recycled Water Ordinance

City Council Meeting March 22, 2022 Santa Monica, California

ORDINANCE NUMBER 2697 (CCS)

(City Council Series)

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SANTA MONICA MODIFYING SECTION 7.12.170 OF THE SANTA MONICA MUNICIPAL CODE TO ADD WATER RECYCLING REQUIREMENTS

WHEREAS, the extreme dryness that has ravaged California now ranks as the driest 22-year period in at least 1,200 years; and

WHEREAS, California Water Code Section 461 requires the maximum reuse of recycled water in the satisfaction of requirements for beneficial uses of water; California Water Code Section 13550 states that it is a waste or unreasonable use of water if recycled water is available, is of adequate quality, of a reasonable cost to the user, will not be detrimental to public health, and will not adversely affect downstream water rights, or water quality, or be injurious to plant life, fish, or wildlife; and California Water Code Section 13551 provides that no one shall use water suitable for potable domestic use for non-potable uses, if suitable recycled water use is available; and

WHEREAS, recycled water is a source of water for approved non-potable uses as specified in the California Code of Regulations Title 22 Recycled Water Criteria; and

WHEREAS, the City's Water Division has constructed the Sustainable Water Infrastructure Project (SWIP), which is able to deliver treated wastewater at a tertiary level for non-potable uses and as allowed by Title 22 Recycled Water Criteria; and

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region (RWQCB) has required, as a condition to permitting the SWIP (Permit Order Number R4-2021-0044), that the City adopt an ordinance providing for the use of recycled water; and

WHEREAS, the sale of recycled water to water customers that can use the water for approved purposes will benefit water ratepayers overall by reducing the need to purchase imported potable water; and

WHEREAS, recycled water is also a component of the City's 2020 Urban Water Management Plan, the long-range plan to develop a sustainable water supply portfolio; and

WHEREAS, the City has developed a recycled water system to meet the increasing urban demand and offset potable uses; and

WHEREAS, in order to expand its recycled water service, the City desires to require certain new developments to install facilities necessary for the delivery of recycled water, as a development standard.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF SANTA MONICA DOES HEREBY ORDAIN AS FOLLOWS:

SECTION 1. Santa Monica Municipal Code Section 7.12.170 is hereby amended to read as follows:

7.12.170 Recycled Water Requirements

(a) **Recycled Water Use.** Recycled water shall be used within the City's recycled water service area in-lieu of potable water for all approved uses consistent with all applicable federal, state, and local laws effective January 1, 2023.

(b) **Definitions.** The following definitions apply for purposes of administering this Section:

(1) **Recycled water.** Refers to domestic wastewater that has been cleaned so that it can be used more than once or reused.

(A) **Non-potable reuse.** Refers to the use of recycled water for non-potable uses. The City treats wastewater, stormwater, and urban runoff to a quality suitable for non-potable uses such as landscape irrigation, water features, or toilet flushing as regulated by Title 22 of California's Code of Regulations. Non-potable recycled water is not intended for human consumption.

(B) **Indirect potable reuse.** Refers to the use of advanced treated recycled water for a Groundwater Replenishment Reuse Project where the advanced treated recycled water is used to replenish a groundwater basin. The City treats wastewater, stormwater, and urban runoff to a quality suitable for groundwater replenishment regulated by Title 22 of California's Code of Regulations.

(2) **Recycled water service area.** The areas identified in the recycled water service area map. The recycled water service area map will be posted on the City's Water Resources Division website and included in the Guidelines.

(3) **Regulating agencies for recycled water.** Rules and Regulations for the end use of recycled water are enforced by the following agencies.

(A) **LARWQCB**. The California Regional Water Quality Control Board, Los Angeles Region, is the State of California agency that regulates discharges of recycled water to surface waters on behalf of the United States Environmental Protection Agency through the issuance of National Pollutant Discharge Elimination System or Waste Discharge Requirement/Water Reclamation Requirement permits, which incorporate applicable recycled water requirements for the production, distribution and use of recycled water.

(B) **DDW.** The State Water Resources Control Board, Division of Drinking Water is the State of California agency that regulates drinking water and coordinates with the Regional Boards to ensure a proposed recycled water project complies with all federal and state regulations for the protection of public health.

(C) **LACDPH.** The Los Angeles County Department of Public Health is the agency that certifies backflow prevention assembly testers, also having jurisdiction to regulate onsite cross-connection control in Los Angeles County.

(4) **Non-potable recycled water applications.** The City's recycled water is suitable for the following non-potable applications:

(A) **Surface irrigation application.** Allowable uses of recycled water for surface irrigation applications including any of the following: food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop; parks and playgrounds; school yards; residential and freeway landscaping; golf courses; cemeteries; decorative fountains; ornamental nursery stock where the public is not restricted; and other allowable applications specified by Title 22 of California's Code of Regulations provided approval is obtained from DDW and LACDPH.

(B) **Dual-plumbing application.** A system utilizing separate piping systems for recycled water and potable water within a facility and where the recycled water serves plumbing fixtures (excluding fire suppression systems) used for flushing toilets and urinals, industrial process or boiler feeds, commercial laundries or carwashes, industrial or commercial cooling towers, evaporative condensers within a building; and/or other allowable applications specified by Title 22 of California's Code of Regulations provided approval is obtained from DDW and LACDPH.

(5) **Guidelines**. Santa Monica Recycled Water Use Guidelines, Policy, and Procedures.

(6) **Applicant**. Means an Owner or authorized representative of a potential reuse site, who applies for recycled water service from the City, meeting user requirements set forth by LACDPH and DDW.

(7) **Director.** The Director of the City's Public Works Department or his or her designee.

(8) **New development**. Any new structure with any plumbing fixture(s), cooling tower(s), and/or new, enlarged, or relocated irrigation system, pond, or water feature.

(9) **Projected potable water demand.** The total amount of projected potable water demand for a proposed new development.

(10) **Projected non-potable water demand**. The total amount of projected non-potable water demand for a proposed new development.

(c) **Applicability for mandatory recycled water use.** All new development within the recycled water service area and with a total floor area of 7,500 square feet or more shall be required to utilize 100 percent recycled water for surface irrigation and/or dual-plumbing applications.

(d) **Exemptions for recycled water use**.

(1) Any exemptions recognized by the LACDPH.

(2) Fire protection systems in any development may not utilize recycled water and must be supplied by a separate potable water system unless allowed by LACDPH.

(3) Where recycled water quality has been deemed non-suitable for a particular fixture, equipment or application as reasonably determined by the Director; in such case, the particular fixture, equipment or application may be exempt from the use of recycled water and must be supplied by a separate potable water system.

(4) New development with a planning entitlement application determined complete before January 1, 2023.

(e) **Recycled water implementation procedures.** Applicable candidates for recycled water use must utilize the following standards for the implementation of recycled water services.

(1) **Departmental standards, forms, and other regulations.** The City's Department of Public Works, Water Resources Division shall develop the Guidelines, including administrative standards, policies, procedures, and technical details, to carry out the purposes of this Section. The Guidelines shall be compiled in a separate document referred to as the Santa Monica Recycled Water Use Guidelines, Policy, and Procedures on file in the office of the Water Resources Division and posted on the City's Water Resources Division website. The City shall regularly maintain and update the Guidelines.

(2) **Recycled water service design standards.** Recycled water systems for surface irrigation and dual-plumbing applications shall be designed and installed in accordance with the Guidelines and Chapter 8.32 (Plumbing Code), as amended from time to time.

(3) **Operation, maintenance, and inspection standards.** Recycled water systems for surface irrigation and dual-plumbing applications shall be operated, maintained, and inspected in accordance with Chapter 7.12 (Utility Division); any approvals of the recycled water systems issued by the City, LACDPH, and DDW; and the Guidelines.

(f) **Permit and regulatory approval requirements for applicable candidates for recycled water use.**

(1) **Building Permit.** As required by Section 8.08.050, an approved building permit from the City shall be required for the use of recycled water. An administrative fee shall be imposed to cover cost of administering and implementing the recycled water use requirements of this Section and shall be set by City Council resolution. The administrative fee shall be assessed and paid to the City by the permit applicant at the time of issuance of the building permit.

(2) **Conditional approval for use of recycled water**. Applicant shall receive conditional approval for use of recycled water from LACDPH. LACDPH may also require the applicant receive conditional approval for use of recycled water from DDW according to the Guidelines. Applicant shall be responsible for filing required application(s) for recycled water service pursuant to this Section with LACDPH and DDW. Application requirements shall be pursuant to the Guidelines and as required by all applicable regulatory bodies. The City will not file applications to LACDPH and DDW on behalf of the applicant. The City will not issue a building permit until the necessary approvals or conditional approvals are obtained from LACDPH.

(3) **Other permits and regulatory approvals.** In addition to any permit required under this Section, the applicant must obtain and comply with all other required authorizations and permits and all other regulatory approvals from all City departments, and state and federal agencies.

(g) **Termination of service.** The City may discontinue recycled water service to a facility for the following reasons:

(1) **Non-payment of bills.** A service may be discontinued for nonpayment of any water charges of a customer, whether or not the payment delinquency is associated with recycled water service at the service connection or at any other City recycled or domestic water service connection of the same customer.

(2) **Benefit of public safety.** Service may be discontinued if, at any point in the City's distribution system, the recycled water does not meet the requirements of regulatory agencies. Service would, in such case, be restored at such time as recycled water again meets the requirements of regulatory agencies, or at such time as the City supplements the recycled water system with water from other sources.

(h) **Violations.** In addition to any criminal, civil or other legal remedy established by law that may be pursued to address violations of the municipal code, violations of the provisions of this Section are subject to the penalty provisions in Chapter 1.08.

(i) **Undue hardship appeal procedure.**

(1) The Director may exempt an owner or applicant from the requirements of this Section, upon showing by the owner that the requirements of this Section would cause undue hardship.

(2) For purposes herein, an “undue hardship” shall be found where imposition of the recycled water requirements would deprive the owner of a development site of all economically beneficial use of that site or otherwise be prohibited by applicable State or Federal law.

(3) An undue hardship application shall include all information necessary for the Director to make a finding of undue hardship, including, but not limited to, documentation showing the factual support for the claimed undue hardship.

(4) The Director may approve the undue hardship exemption application, in whole or in part, with or without conditions.

(5) Any exemption granted by the Director is effective immediately.

SECTION 2. Any provision of the Santa Monica Municipal Code or appendices thereto inconsistent with the provisions of this Ordinance, to the extent of such inconsistencies and no further, is hereby repealed or modified to that extent necessary to effect the provisions of this Ordinance.

SECTION 3. If any section, subsection, sentence, clause, or phrase of this Ordinance is for any reason held to be invalid or unconstitutional by a decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this Ordinance. The City Council hereby declares that it would have passed this Ordinance and each and every section, subsection, sentence, clause,

or phrase not declared invalid or unconstitutional without regard to whether any portion of the ordinance would be subsequently declared invalid or unconstitutional.

SECTION 4. The Mayor shall sign and the City Clerk shall attest to the passage of this Ordinance. The City Clerk shall cause the same to be published once in the official newspaper within 15 days after its adoption. This Ordinance shall become effective 30 days from its adoption.

APPROVED AS TO FORM:

DocuSigned by:
Susan Cola
61C02D0CAE84432...

SUSAN COLA
Interim City Attorney

Approved and adopted this 22nd day of March, 2022.

DocuSigned by:
823148D999FF4F3...
Sue Himmelrich, Mayor

State of California)
County of Los Angeles) ss.
City of Santa Monica)

I, Nikima Newsome, Assistant City Clerk of the City of Santa Monica, do hereby certify that the foregoing Ordinance No. 2697 (CCS) had its introduction on March 8, 2022 and was adopted at the Santa Monica City Council meeting held on March 22, 2022, by the following vote:

AYES: Councilmembers Brock, Davis, de la Torre, Negrete, Parra, Mayor Himmelrich, Mayor Pro Tem McCowan

NOES: None

ABSENT: None

ATTEST:

DocuSigned by:
7032651E371E430...
Nikima Newsome, Assistant City Clerk

4/14/2022
Date

A summary of Ordinance No. 2697 (CCS) was duly published pursuant to California Government Code Section 40806.

Appendix B-3

Honolulu One Water Ordinance

A BILL FOR AN ORDINANCE

A BILL FOR AN ORDINANCE TO AMEND CHAPTER 2 OF THE REVISED ORDINANCES OF HONOLULU 1990, AS AMENDED, RELATING TO THE OFFICE OF CLIMATE CHANGE, SUSTAINABILITY AND RESILIENCY.

BE IT ORDAINED by the People of the City and County of Honolulu:

SECTION 1. Purpose and Findings. The purpose of this ordinance is to describe the duties and responsibilities of the Office of Climate Change, Sustainability and Resiliency.

The City and County of Honolulu ("City") Office of Climate Change, Sustainability and Resiliency ("Resilience Office") was established by a Charter amendment approved by the voters in the 2016 general election (now codified as Section 6-107 of the Revised Charter of Honolulu 1973 (2017 Edition)) and is charged with, among other things: (1) tracking climate change science and potential impacts of climate change on City facilities; (2) coordinating actions and policies of departments within the City to protect economic activity from climate impacts and develop resilient infrastructure in response to the effects from climate changes; (3) developing or coordinating City policies and programs to improve the environmental performance of City operations and advance environmental priorities; and (4) promoting the resiliency of Oahu's communities and coastal areas.

Since its establishment in 2016, the Resilience Office has actively engaged the Oahu community and developed an overarching policy document entitled *Ola: Oahu Resilience Strategy*. To develop and implement policies that advance climate change and sustainability goals, as well as the 44 specific resilience-building actions defined by the Resilience Strategy, which was adopted by the Honolulu City Council in Resolution 19-233 as a guiding policy document for the City, the Resilience Office works to ensure equitable engagement with community members, stakeholders from the business and non-governmental sector, and other relevant agencies to create practical policies that take multiple considerations, impacts, and costs into account.

In addition to the implementation of the Resilience Strategy, the Resilience Office continues to track, make progress on, and meet the City's established climate change and sustainability goals and commitments, such as establishing a carbon neutral economy and implementing the 2018 Global Climate Action Summit policies, which were outlined in Resolution 18-221, CD1, FD1.

A BILL FOR AN ORDINANCE

This ordinance codifies the duties and responsibilities of the Resilience Office. This ordinance therefore ensures that the City meets its climate change and sustainability goals and objectives, consistent with Section 6-107 of the Revised Charter of Honolulu, the City's General Plan and Development Plans, State law, and the Paris climate agreement, and equitably builds resilience within Oahu's communities.

SECTION 2. Section 2-1.2, Revised Ordinances of Honolulu 1990, is repealed:

["~~**Sec. 2-1.2 Annual energy evaluation.**~~

~~Within 60 days following the end of each fiscal year, beginning with the fiscal year ending June 30, 2009, and each year thereafter, the mayor shall submit to the council a written report detailing the City's:~~

~~(1) Electricity, gasoline, diesel, and biodiesel consumption and costs during the previous fiscal year; and~~

~~(2) Progress in implementing energy conservation policies, programs, and projects.~~"]

SECTION 3. Chapter 2, Article ___, Revised Ordinances of Honolulu 1990 ("Office of Climate Change, Sustainability and Resiliency"), as enacted by Ordinance 20-3, is repealed.

SECTION 4. Chapter 2, Revised Ordinances of Honolulu 1990 ("The Mayor and Executive Agencies – Additional Powers, Duties and Functions"), is amended by adding a new article to be appropriately designated by the Revisor of Ordinances and to read as follows:

"**Article __. Office of Climate Change, Sustainability and Resiliency**

Sec. 2-__.1 Definitions.

As used in this article, unless the context otherwise requires:

"Climate change adaptation" means the process of anticipating and adjusting to actual or expected climate change impacts and effects by taking appropriate actions to prevent or minimize the damage they cause and advantageously improve environmental and community conditions.

"Covered city facility" means a facility that exceeds 10,000 gross square feet in total floor area and is owned, leased, or managed by the city and the city regularly pays all or part of the energy and/or water utility bill, except for single family, duplex, triplex and fourplex residential homes and related accessory structures, or any other residential building with less than 5 units; and other building types not meeting the purpose of this article, as determined by the executive.

"Directors" means the head officials of all city departments or agencies, including all semi-autonomous city departments or agencies, including but not limited to, the directors of the departments of planning and permitting, design and construction, transportation services, environmental services, and parks and recreation, the director and chief engineer of facility maintenance, the manager and chief engineer of the board of water supply, and the executive of climate change, sustainability and resiliency.

"Executive" means the executive for climate change, sustainability and resiliency.

"Memorandum of understanding" means an inter-agency/departmental agreement to work collaboratively on an issue, such as climate change and sea level rise adaptation-related policies, strategies, projects, and programs, that provides details on the collaborative framework, including but not limited to the duties, responsibilities, procedures, and commitments of each participating city department/agency.

"Net-negative carbon emissions" means at least as much carbon is captured from the atmosphere annually as activities within the city release by reducing emissions as much as possible and then balancing remaining emissions with carbon removal or carbon offset programs.

"Office" means the office of climate change, sustainability and resiliency.

"One water" means an integrated resource planning and implementation approach to managing finite freshwater, wastewater, and stormwater resources for long-term resilience and reliability, meeting both community and ecosystem needs.

"One water climate resilience checklist" means a list of strategic and tactical actions, including but not limited to: research and monitoring; policy and regulation; financing, planning, and engineering; public outreach; design and construction; and performance metrics that are essential components of climate change adaptation.

"One water panel" means a formal group of representatives from city departments and agencies including, but not limited to, representatives from the

department of planning and permitting, department of design and construction, department of transportation services, department of facility maintenance, department of environmental services, department of parks and recreation, the board of water supply, and the office of climate change, sustainability and resiliency.

Sec. 2-__.2 Energy program.

(a) The office shall establish and manage an energy program to coordinate actions and policies of city departments and agencies related to:

(1) Greenhouse gas emissions reduction;

(2) On-site renewable energy generation and storage;

(3) Energy efficiency and conservation; and

(4) Renewable-fueled transportation,

in accordance with implementation of the objectives in the city's climate action plan specified in Section 2-__.12.

(b) As set forth in subsection (a), the office shall develop or coordinate actions with city departments and agencies to implement the following:

(1) The maintenance and monitoring of all information related to city energy use and energy-related billing;

(2) City energy efficiency, conservation, and savings projects, to ensure consistency and alignment with city policies, including the monitoring of energy savings performance contracts and energy benchmarking programs;

(3) The conversion of the city fleet, which must transition to 100 per cent electric or renewable technology by 2035, excepting first responder vehicles, until available electric or renewable technology is able to support the needs deemed necessary for supporting emergency response, including securing additional federal funds for these purposes;

(4) Electric or renewable fuel vehicle infrastructure, including revenue collection associated with electric vehicle charging at city facilities;

(5) The development and annual update of a greenhouse gas emissions inventory, that captures greenhouse gas emissions related to activities within the city;

(6) The development and implementation of the objectives in the city's climate action plan specified in Section 2-__.12, which will facilitate the integration of the climate action plan's components into all city operations, projects, plans, procedures, and other decision-making processes, and the monitoring of the city's progress in achieving emissions reductions targets set forth in the climate action plan;

(7) The provision of technical assistance to city departments and agencies and other partners in the development of programs, projects, external partnerships, and federal, state, and private funding proposals to attract resources to the city related to energy; and

(8) The use of collected city energy use data to educate city departmental and agency staff on opportunities and pathways for reducing energy consumption in city facilities.

Sec. 2-__.3 Energy use reporting.

Beginning with the quarter ending June 30, 2021, and each quarter thereafter, the office shall collect from all city departments and agencies data that details each department's or agency's energy use, including but not limited to electricity, gasoline, diesel, and biofuel consumption, and costs during the previous quarter, and shall annually report the city's energy usage data in the annual sustainability report specified in Section 2-__.15.

Sec. 2-__.4 Building energy benchmarking.

(a) There is hereby established a municipal building energy benchmarking policy for the city to measure facilities' energy and water use over time for transparency in energy usage. Under this policy, the city hereby expresses its commitment to increasing the energy efficiency of its building stock to reduce the city's energy usage and its associated costs and carbon pollution.

(b) The office shall develop or coordinate actions with city departments and agencies with responsibilities for the maintenance of public buildings and facilities, as appropriate, to facilitate the energy benchmarking of every existing covered city facility for the purposes of measuring energy use and performance over time.

The office shall:

(1) Report the city's energy use data collected in Section 2-__.3, water use data collected in Section 2.__.6, and any other basic property and usage characteristics necessary to benchmark covered city facilities against other similar properties in an industry-recognized benchmarking tool such as ENERGY STAR Portfolio Manager or comparable tool as determined by the executive; and

(2) Provide training on ENERGY STAR Portfolio Manager or comparable tool as needed by the city departments and agencies.

(c) The office shall annually report a summary of city facilities' benchmarked data in the annual sustainability report specified in Section 2-__.15.

(d) The office shall assist all necessary and relevant city departments and agencies, as appropriate, in using the benchmark to monitor efforts to improve the efficiency of the city's building stock and in securing federal funds to advance additional energy efficiency gains.

Sec. 2-__.5 Coastal and water program.

(a) The office shall establish and manage a coastal and water program to coordinate actions and policies of city departments and agencies related to:

(1) Adapting to climate change impacts;

(2) Protecting coastal areas and beaches;

(3) Promoting the resiliency of communities and coastal areas;

(4) Developing resilient physical and natural infrastructure in preparation for and response to the effects of climate changes; and

(5) Coordinating and supporting integrated water and urban forest resources management, in accordance with the city's general plan, development plans, zoning ordinances, and subdivision ordinance, and to increase sustainability and resiliency.

(b) As set forth in subsection (a), the office shall develop or coordinate actions with city departments and agencies to implement the following:

(1) The development and management of a coastal monitoring data program to assess shoreline change and assist in the incorporation of the information into city shoreline regulations, policies, plans, and programs;

(2) The development, management, and maximization of the city's participation in the Federal Emergency Management Agency (FEMA) National Flood Insurance Program Community Rating System, including securing federal funding and partnerships to advance the program; and

(3) The provision of technical assistance to city departments and agencies, and other partners in the development of programs, projects, external partnerships, and federal, state, and private funding proposals to attract resources to the city related to coastal and water issues.

Sec. 2-__.6 Water use reporting.

Beginning with the quarter ending June 30, 2021, and each quarter thereafter, the office shall collect from all city departments and agencies data that details each department's or agency's water usage during the previous quarter, and shall annually report the city's water usage data in the annual sustainability report specified in Section 2-__.15.

Sec. 2-__.7 Climate resilience and equity program.

(a) The office shall establish and manage a climate resilience and equity program to coordinate actions and policies of city departments and agencies to advance procedural, distributional, structural, intergenerational, and cultural equity related to:

(1) Disparate outcomes of climate change impacts;

(2) Programmatic and policy responses to climate change impacts; and

(3) Underlying projects, policies, and programs that have created and contributed to unequal resilience and vulnerability to climate change impacts.

(b) As set forth in subsection (a), the office shall develop or coordinate actions with city departments and agencies to implement the following:

(1) Inclusive, community-centered engagement practices and decision-making processes related to increasing community access, participation, and representation in resilience programs and policies;

(2) The prioritization of frontline communities and environmental justice by being an accessible resource for two-way communication for climate change information and decision-making;

(3) The standardization and utilization of tools to advance equity in research, policy formulation and implementation, trainings, and operational processes;

(4) The provision of technical assistance to city departments and agencies, and other partners in the development of programs, projects, external partnerships, and federal, state, and private funding proposals to attract resources to the city related to achieving climate resilience and equity; and

(5) Advancement of short- and long-term reduction and ultimate elimination of disparity, harm, and disparate impact in programs, projects, and policy and planning processes while increasing social and government process inclusion.

Sec. 2-__.8 Food security and sustainability program.

(a) The office shall establish and manage a food security and sustainability program to coordinate actions and policies of departments and agencies within the city related to food security, sustainability, and climate resilience.

(b) As set forth in subsection (a), the office shall develop or coordinate actions with city departments and agencies to implement the following:

(1) The development, implementation, and reporting of objectives in a city-wide food system development plan that advances food security, self-sufficiency and sustainability for the food system within the city;

(2) The development of federal, state, and nonprofit partnerships and funding sources to encourage community alignment to increase food security, including local food supply, production, transportation and distribution, especially to frontline communities that have historically lacked access to healthy and affordable local food supplies;

(3) The provision of technical assistance to city departments and agencies and other partners in the development of programs, projects, external partnerships, and federal, state, and private funding proposals to attract resources to the city related to achieving food security and sustainability; and

(4) Coordinating with public, private, and nonprofit groups working to address issues of the food and agricultural systems within the city, including the sustainability and vulnerability of these systems in the face of natural disasters, climate change impacts, and other disruptions.

Sec. 2-__.9 Zero waste program.

The office shall establish and manage a zero waste program to develop or coordinate actions and policies of departments and agencies within the city related to moving toward a circular economy by promoting waste reduction initiatives and encouraging the continual use of resources to eliminate waste.

Sec. 2-__.10 Pre-disaster multi-hazard mitigation program.

(a) The office shall assist the department of emergency management in establishing and managing a pre-disaster hazard mitigation program to coordinate actions and policies of city departments and agencies related to reducing loss of life and property by lessening the impact of natural disasters that are projected to increase in intensity and frequency due to climate change.

(b) As set forth in subsection (a), the office shall develop or coordinate actions with city departments and agencies to implement the following:

(1) The preparation and implementation of the city's official pre-disaster multi-hazard mitigation plan updated in accordance with requirements set forth by the Federal Emergency Management Agency (FEMA);

(2) The inclusion of climate adaptation strategies and ensuring climate resilience and equity in hazard mitigation plans and planning processes;

(3) The continued eligibility for federal funding and maximum utilization of federal funding and other resources to support hazard mitigation;

(4) The provision of technical assistance to all city departments and agencies and other partners in the development of programs, projects, and applications for federal, state, and private funding for hazard mitigation actions;

(5) The provision of support to all city departments and agencies to ensure the pre-disaster hazard mitigation plan is used as a resource for considering hazard mitigation and disaster resilience in all city plans and planning processes; and

(6) The tracking and evaluation of city-wide investment in disaster resilience as reported by all city agencies, which may be made publicly available in the annual sustainability report specified in Section 2-__.15.

Sec. 2-__.11 Long-term disaster recovery.

The office, in in coordination with the mayor and the department of emergency management, and other necessary and interested city departments and agencies, as appropriate, shall prepare and coordinate implementation of a long-term disaster recovery plan for the city. Within sixty days following the end of the fiscal year ending June 30, 2022, the office shall submit to the mayor and the council a long-term disaster recovery plan for the city. The long-term disaster recovery plan must:

(1) Be defined as the plan for sustained disaster recovery operations over an extended period of time of months or years, as necessary, transitioning from the short-term recovery operations under the emergency operations plan;

(2) Provide a long-term disaster recovery framework including organization, policies, and processes that are consistent with the vision, goals, and function of the city;

(3) Be inclusive in both planning and implementation to meaningfully consider input from all levels of government, individual members of the public, representatives of the private sector, and any interested non-governmental or non-profit groups or organizations which may include at least one open public meeting in each council district; and

(4) Be reviewed by the office annually, in coordination with all necessary and interested city departments and agencies, as appropriate, and updated every five years with support to the maximum extent from federal funding and in conjunction with the pre-disaster multi-hazard mitigation plan specified in Section 2-__.10.

Sec. 2-__.12 Climate action.

(a) There is hereby established a climate action policy for the city to transition to 100 percent renewable energy within the city and achieve net-negative carbon emissions for emissions related to activities within the city no later than 2045, consistent with state law.

(b) The office, in coordination with all necessary and interested city departments and agencies, as appropriate, shall prepare and assist in the implementation of a climate action plan to reduce greenhouse gas emissions related to activities within the city and achieve the goal of net-negative carbon emissions related to activities within the city no later than 2045. The climate action plan shall be based on the best available science and internationally accepted best practices and must:

(1) Include a greenhouse gas emissions inventory for emissions related to activities within the city and use the inventory to set emissions baselines and forecasts and identify targets for emissions reduction goals;

(2) Identify specific and measurable benchmarks, policies, and action strategies to achieve reductions in greenhouse gas emissions related to activities within the city; provided that this subdivision shall not apply to activities not primarily regulated by the city, including activities of the utilities' business segments, subsidiaries, and affiliates that are subject to regulation by the Public Utilities Commission;

(3) Incorporate or align with the goals and objectives of any and all other emissions reduction plans adopted by other city departments and agencies;

(4) Identify, to the extent possible, affordable solutions to advance implementation of the objectives in the climate action plan;

(5) Identify, to the extent possible, potential federal funds that can be secured to help advance implementation of the objectives in the climate action plan; and

(6) Be inclusive in both planning and implementation to meaningfully consider input from all levels of government, individual members of the public, representatives of the private sector, and any interested non-governmental or non-profit groups or organizations which may include at least one open public meeting in each council district.

(c) The office, in coordination with all necessary and interested city departments and agencies, as appropriate, shall:

(1) Annually track the city's progress in meeting emissions reductions targets and implementing the strategies identified in the plan and summarize such progress in a brief report or in the annual sustainability report specified in Section 2-__.15, and share the annual report with council;

(2) Update the climate action plan every five years, starting no later than 2025; and

(3) Submit, within one hundred twenty days following the end of each year it is updated, the climate action plan for approval through a resolution, by one reading, by the council. The council shall approve or disapprove the action plan within ninety days. Should the council fail to approve or disapprove the climate action plan, the climate action plan submitted by the office will be deemed approved.

Sec. 2-__.13 Climate change adaptation.

(a) The office shall develop policies and coordinate climate change adaptation actions of departments and agencies within the city to take a proactive approach in adapting to impacts resulting from climate change and sea level rise, and to

align programs to help protect and prepare the city and its residents for the physical and economic impacts of climate change to the maximum extent practicable. Under such policies, the city hereby expresses its commitment to lead, plan, and implement the development of comprehensive and balanced planning, regulations, design, and construction of climate change and sea level rise adaptation of city infrastructure systems.

(b) As set forth in this section, there is hereby established a one water policy, principles, and procedures for city departments and agencies. This policy will provide a climate change adaptation solution and one water collaboration framework to be incorporated in the planning of all city infrastructure systems.

(1) One water principles will consist of the following:

(A) Value all water in the natural and built environment, utilize and manage freshwater, wastewater and stormwater resources for their best use, and preserve water's quality and quantity;

(B) Increase climate resilience and adaptation for freshwater, stormwater, wastewater, water reuse, water desalination, and transportation systems;

(C) Find opportunities to partner on projects taking advantage of co-benefits, overlapping goals, and limited funding. Identify projects to leverage the multiple benefits of one water practices;

(D) Consistent messaging with the public and developers around stormwater, wastewater, freshwater, water reuse, and sea water;

(E) Encourage consistent use of national industry best practice guidelines and emerging technology to ensure the efficient and best use of water resources;

(F) Recognize one water as a long-term investment that can save money over time; and

(G) Build partnerships with stakeholders and organizations, including identifying to the extent possible, potential federal funds that can be secured to help advance the one water goals of the city.

(2) One water procedures will guide city departments and agencies to:

(A) Establish a one water panel of affected city departments and agencies to consult on city projects and programs, private development infrastructure master plans, and updating building codes and design standards;

(B) Develop an interagency memorandum of understanding detailing collaboration procedures for research and monitoring, policies and procedures, plans and programs, regulations and design standards, capital improvements, and shared and supplemental funding opportunities;

(C) Incorporate one water climate resilience in the city's development and sustainable communities plans, watershed management plans, infrastructure plans, and developer coordination for climate change adaptation;

(D) Develop a checklist of strategic and tactical actions for one water climate resilience and collaboration including but not limited to research and monitoring, policies and regulations, coordinating resources, planning and engineering, public outreach, and design and construction for climate change and sea level rise adaptation, with both a 2050 and 2100 time outlook;

(E) Prioritize and sequence one water climate resilience initiatives to address critical infrastructure serving economic and transportation centers, and other critical facilities;

(F) Identify one water projects to promote innovative and scalable concepts; and

(G) Develop an alternative coordinating mechanism for private developments interested in participating in such a mechanism to more simply navigate the permitting systems among the various city agencies and align investments with city plans, regulations, and infrastructure capacity for climate resilience.

(3) The city's policy is to employ a one water collaboration framework for climate change and sea level rise adaptation in the planning, design,

construction, maintenance, and operation of the city's infrastructure under the jurisdiction of the directors. The one water panel shall be coordinated and organized on a regular basis by the office.

(4) The city's policy is to jointly adopt a one water climate resilience checklist and associated procedures to be used by the directors and their staff as guidance when initiating, policies, regulations, rules, planning, designs, and construction of any infrastructure project. The checklist must be jointly updated from time to time by the directors, as necessary and appropriate, to facilitate the implementation of this article.

(5) The city's policy is to evaluate and initiate updates of existing policies, rules, regulations, and design guidelines to ensure consistency with the one water climate resilience policy, principles, procedures, and national industry best practices. The updates may occur from time to time, as necessary, by the directors to reflect current best practices.

(6) One water climate resilience features are not required if the head official of an affected city department, agency, or semi-autonomous city agency determines, in writing with appropriate documentation, prior to or during the project planning and design process, that:

(A) The resilience feature is prohibited by law;

(B) The cost of the resilience feature would be excessively disproportionate to the need, savings, or probable future use over the long term;

(C) There is an absence of current or future need for the resilience feature; or

(D) The safety of the public may be placed at unacceptable risk by implementation of the resilience feature.

(7) The office shall submit to the council, within one hundred twenty days following the end of each calendar year, beginning with the year ending December 31, 2021, and each year thereafter, a report detailing compliance with the one water climate resilience policy, and the principles and procedures included therein, during the prior calendar year. The report must detail the climate resilience actions initiated during that year

and must include a list of exceptions made, with the accompanying appropriate documentation, pursuant to subdivision (6) for that year.

(8) The annual report required in this section may be part of the annual sustainability report required by Section 2-__.15 for purposes of compliance with this section.

Sec. 2-__.14 Report on visitor industry sustainability progress.

(a) The office shall issue an annual report on the Oahu visitor industry's sustainability efforts and progress toward reducing solid waste, energy consumption, fossil fuel usage, and water waste, and encouraging multi-modal transportation options. The executive may consult with other government and private entities in order to produce the report.

(b) The content and metrics of the report in subsection (a) will be determined by the executive in consultation with a visitor industry stakeholder advisory group based on internationally accepted best practices and be updated periodically as best practices evolve. The stakeholder advisory group shall include but not be limited to one member from each of the following organizations: The Hawaii Tourism Authority, the Hawaii Lodging and Tourism Association, the Sustainable Tourism Association of Hawaii, and the Oahu Visitor's Bureau. The report may include, but not be limited to, the following:

(1) Identifying industry stakeholders and forms of engagement;

(2) Setting parameters for information gathered;

(3) Identifying key topics to report;

(4) Documenting organization management approaches to relevant topics, including organization policies and practices, commitments, goals, and (short, medium, and long-term targets);

(5) Identifying risks and opportunities for various organizations;

(6) Defining performance-based reporting for material topics, which may include subjects such as energy and water consumption;

(7) Developing content management procedures and structure to support the accuracy and ease of overall sustainability reporting; and

(8) Setting goals and targets, and transparently reporting on progress toward meeting them.

(c) Tourism-related entities shall respond to annual requests from the executive for information on solid waste generation, energy consumption, fossil fuel use, and water use. For the purposes of this annual report, the executive shall determine relevant tourism-related entities from the lodging, transportation, activity, and other tourism-related sectors.

Sec. 2-__.15 Annual sustainability report.

The office shall submit an annual sustainability report to the mayor and the council and make the report publicly available within one hundred twenty days following the end of each calendar year, beginning with the year ending December 31, 2020, and each year thereafter. The content and metrics of the report will be determined by the executive and must measure the city's overall performance in meeting its established sustainability, energy, and resilience targets and objectives.

Sec. 2- __.16 Climate change commission.

Consistent with Charter Section 6-107(h), there shall be a climate change commission consisting of five members with expertise in climate change in Hawaii. The climate change commission will be governed by Charter Section 13-103, and shall:

(1) Gather the latest science and information on climate change effects in the city and provide advice as is deemed appropriate to the executive, the mayor, the council, and city departments and agencies; and

(2) At a minimum, meet quarterly, unless meeting is deemed unnecessary by a majority of the commission members."

SECTION 5. Severability. If any provision of this ordinance, or the application thereof to any person or circumstance is held invalid, the invalidity does not affect other provisions or applications of the ordinance that can be given effect without the invalid provision or application, and to this end, the provisions of this ordinance are severable.

CITY COUNCIL
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII

ORDINANCE 20-47

BILL 65 (2020), CD2

A BILL FOR AN ORDINANCE

SECTION 6. In SECTION 2 of this ordinance, ordinance material to be repealed is bracketed and stricken. When revising, compiling, or printing this ordinance for inclusion in the Revised Ordinances of Honolulu, the Revisor of Ordinances need not include the brackets or the material that has been bracketed and stricken.

SECTION 7. This ordinance takes effect upon its approval.

INTRODUCED BY:

Ikaika Anderson (br)

DATE OF INTRODUCTION:

September 1, 2020
Honolulu, Hawaii

Councilmembers

APPROVED AS TO FORM AND LEGALITY:

Deputy Corporation Counsel
DUANE W.H. PANG

APPROVED this 23rd day of December, 2020.

Mayor, City and County of Honolulu

CITY COUNCIL
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII
CERTIFICATE

ORDINANCE 20-47

BILL 65 (2020), CD2

Introduced: 09/01/20 By: IKAIKA ANDERSON – BY REQUEST Committee: BUDGET

Title: A BILL FOR AN ORDINANCE TO AMEND CHAPTER 2 OF THE REVISED ORDINANCES OF HONOLULU 1990, AS AMENDED, RELATING TO THE OFFICE OF CLIMATE CHANGE, SUSTAINABILITY AND RESILIENCY.

Voting Legend: * = Aye w/Reservations

09/09/20	COUNCIL	BILL PASSED FIRST READING AND REFERRED TO COMMITTEE ON BUDGET. 8 AYES: ANDERSON, ELEFANTE, FUKUNAGA, KOBAYASHI, MANAHAN, MENOR, PINE, WATERS. 1 ABSENT: TSUNEYOSHI.
09/16/20	BUDGET	BILL POSTPONED IN COMMITTEE. 5 AYES: ELEFANTE, MANAHAN, MENOR, PINE, WATERS.
		NOTE: EFFECTIVE SEPTEMBER 23, 2020, COUNCILMEMBER IKAIKA ANDERSON, REPRESENTING COUNCIL DISTRICT III, RESIGNED FROM OFFICE. [Refer to Communication CC-256(20)] NOTE: THE APPOINTMENT OF ALAN KEKOA TEXEIRA TO FILL A VACANCY IN THE OFFICE OF COUNCILMEMBER FOR COUNCIL DISTRICT III WAS APPROVED ON WEDNESDAY, SEPTEMBER 23, 2020. (refer to RES20-236, FD1) CC-269(20) KOBAYASHI - COUNCIL STANDING COMMITTEE ASSIGNMENTS.
10/21/20	BUDGET	CR-249 – BILL REPORTED OUT OF COMMITTEE FOR PASSAGE ON SECOND READING AND SCHEDULING OF A PUBLIC HEARING AS AMENDED IN CD1 FORM. 5 AYES: ELEFANTE, MANAHAN, MENOR, PINE, WATERS.
10/23/20	PUBLISH	PUBLIC HEARING NOTICE PUBLISHED IN THE HONOLULU STAR-ADVERTISER.
11/05/20	COUNCIL/PUBLIC HEARING	CR-249 ADOPTED. BILL PASSED SECOND READING AS AMENDED, PUBLIC HEARING CLOSED AND REFERRED TO COMMITTEE ON BUDGET. 8 AYES: ELEFANTE, KOBAYASHI, MANAHAN, MENOR, PINE, TEXEIRA, TSUNEYOSHI, WATERS. 1 ABSENT: FUKUNAGA.
11/13/20	PUBLISH	SECOND READING NOTICE PUBLISHED IN THE HONOLULU STAR-ADVERTISER.
11/18/20	BUDGET	CR-295 - BILL REPORTED OUT OF COMMITTEE FOR PASSAGE ON THIRD READING AS AMENDED IN CD2 FORM. 5 AYES: ELEFANTE, MANAHAN, MENOR, PINE, WATERS.
12/09/20	COUNCIL	CR-295 ADOPTED AND BILL 65 (2020), CD2 PASSED THIRD READING AS AMENDED. 9 AYES: ELEFANTE, FUKUNAGA, KOBAYASHI, MANAHAN, MENOR, PINE, TEXEIRA, TSUNEYOSHI, WATERS.

I hereby certify that the above is a true record of action by the Council of the City and County of Honolulu on this BILL.

GLEN I. TAKAHASHI, CITY CLERK

ANN KOBAYASHI, CHAIR AND PRESIDING OFFICER

Appendix C

Onsite Water Reuse Strategy and One Water Vision Draft Framework

City of Sacramento
Onsite Non-Potable Water Reuse One Water Vision Framework

Vision Statement

The City of Sacramento's Onsite Non-Potable Water Reuse Program seeks to optimize the use of local water resources and provide reliable and resilient water systems for the future.

Program Goals:	• Optimize the use of local water resources • Provide reliable/resilient water systems for the future • Balance community needs (e.g., water conservation, economic feasibility of new development, job creation)
Program Objectives:	• Establish and sustain communication with community stakeholders • Integrate on-site reuse strategies with land use and other planning efforts (sewer, wastewater treatment, reuse, drainage, etc.) • Provide a favorable economic environment for private investment Increase resiliency and adaptability of water and wastewater infrastructure.
Affected City Policies, Rules, and Regulations:	**The City of Sacramento's dual plumbing ordinance is the first step in the implementation of the Onsite Non-Potable Water Reuse Program.** Adoption of ordinance will require coordination between Business Services, Building Division, Planning Division, Office of Climate Action and Sustainability, and Utilities and Water Division. **The nexus with existing policies, rules, and regulations will need to be explored.**
Potential Ordinance Applicable to:	New commercial building construction with habitable area 100,000 square feet and above.
Potential Ordinance Exemptions:	• Hospitals, Health Services, Institutional Healthcare Buildings • Mixed-Use Buildings with Residential Uses • Building Additions that add less than 100,000 sq ft of new area • Where recycled/reuse water quality is deemed non-suitable for a particular fixture or equipment • Any exemptions recognized by Sacramento County, State of California Water Resources Control Board, or Central Valley Regional Water Quality Control Board
ONWS Influent Water Sources:	Municipal recycled water, blackwater, graywater, condensate, evaporative cooling.
Potential Non-Potable End Uses:	**Indoor:** Toilet and urinal flushing, priming drain taps, clothes washing (not currently allowed by Central Valley Regional Water Quality Control Board) **Outdoor:** Irrigation, street cleaning, heating and cooling systems, dust control, decorative fountains and impoundments

Water Quality Standards and Monitoring	To be developed in conjunction with the Sacramento County, Sacramento County Sanitation District, State Water Resources Control Board, or Central Valley Regional Water Quality Control Board
Cross Connection Testing:	Cross connection testing required before conditional startup, after major plumbing modification, and for blackwater systems every 4-years per regulations. Testing must occur annually in accordance with Chapters 15 and 16 of the California Plumbing Code.
Potential Cost Recovery Methods	• Initial permit application fee, Annual license fee, Hourly review rate • Developer cost-sharing • City general fund • State and Federal grants and loans (current opportunities open to publicly-owned projects only)
Potential Incentives:	• Capacity Charge Adjustments – reduce water and sewer rates based reduction in potable and sewer service (would require Proposition 218 authorization if considered) • Pilot Project grant funding via CALFED Water Use Efficiency Grants • Provide stormwater fee credits for rainwater harvesting (if a future impact fee is assessed) • Rebate Program (similar to water conservation rebate program)
Potential Penalties:	• Excess Use Charge assessed for exceeding potable make-up water use reported in Water Budget • System shutdown until it returns to compliance
Permitting Process:	To be incorporated into existing new construction permitting process. To be developed during Onsite Non-Potable Water Reuse Program startup
Program Performance Metrics:	• # of Water Budgets reviewed/applications received for ONWS candidate developments • # of ONWS systems permitted • Gallons per year of water reused via ONWS

Agencies, Roles, and Responsibilities:

City of Sacramento – Department of Utilities (DOU)	Sacramento County Environmental Management Department (EMD) /Other Regulator*	City of Sacramento – Community Development Department (CDD)	City of Sacramento – Public Works	Developer
Program Administration	**Environmental Health**	**Construction**	**Right-of-Way and Mapping**	**Comply with Ordinance**
Review onsite non-potable water supplies & demands (coordinate with CDD) Administer city-wide project tracking & annual potable offset achieved Provide technical support as needed Manages Cross-Connection Control Program: Once building permit closed, ensure system remains as approved (Cross-Connection Inspections, Annual Cross-Connections Survey) Coordination w/County EMD/other Regulator	Issue water quality & monitoring requirements Review and approve non-potable engineering report Issue permit to operate onsite system Review water quality reporting Provide technical support as needed	Conduct Plumbing Plan check and issue Plumbing Permit (Building) Inspect and approve system installations. Issue certification of occupancy (Building) Outreach to developers (Planning) Provide technical support as needed. Provide first point of contact, direct questions to appropriate departments (Current Planning) *Include advisory note on planning applications for applicable projects	Issue Encroachment Permits as needed for infrastructure in the Right-of-Way (if needed). Provide technical support as needed	Submit water quality and cross connection reports and documentation to regulators

* Sacramento County Environmental Management Department provides recycled water compliance assistance and has established and enforces the rules and regulations for recycled water use and distribution in the County. No entity has committed to this role for the City of Sacramento Onsite Non-Potable Water Reuse Program as of June 2022.

Appendix D

Dual Plumbing Cost Model, O’Connor Construction Management, Inc.

www.ocmi.com

City of Sacramento
Dual Plumbing System for Building and Site

Sacramento, CA

Kennedy Jenks
Task 3.1 Dual Plumbing Cost Model R4
Job No. 220091.000
12 May 2022

INSIGHT

DUAL PLUMBING COST MODEL FOR COMMERCIAL BUILDINGS R4

COST MODEL/COST STUDY

ROW/COL	1	2		3	4	5	6	7	8	9	10	11	12	13
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		GSF		Total Project Cost	Mid-point of construction	Escalation Adjustment (6% per annum)	Location	City index adjustment percentage (Project Location -> Sacramento) for plumbing trade	Total Project Cost Adjusted Per City Index and Escalation per annum	Total Plumbing Cost	Total Plumbing Cost (Escalated to todays dollars and location using city index)	Total Plumbing Fixtures
		PROJECT TITLE	PROJECT SCOPE	BUILDING	SITE									
2	COMMERCIAL	University Center in South Lake Tahoe, CA.	- New university student center included related site work. - Single Story - USE: Classrooms, offices and restrooms	7,734	35,049	$5,384,715	1-Jul-17	28%	Lake Tahoe, CA	-10%	$6,203,191.68	$144,624	$166,607	15
3	COMMERCIAL	Student union in San Bernardino, CA for CSU San Bernardino	- Student union center and related site work. - Three story -USE: Retail spaces, activities spaces and event spaces	123,965	215,492	$67,091,637	1-Jun-20	11%	San Bernardino, CA	12%	$82,814,166.08	$1,692,406	$2,089,012	96
4	COMMERCIAL	Outpatient surgery center in Santa Clara CA.	Surgery center including pre/post anesthesia recovery, pharmacy, lab, clinic. - Two story - USE: Medical	38,741	60,845	$23,611,340	1-Oct-17	27%	Santa Clara, CA	-8%	$27,622,604.87	$2,288,537	$2,677,330	62
5	COMMERCIAL	Thornton Middle School - Administration	- Administration building and necessary surrounding site work. - Two-story. - USE: Education.	8,748	21,962	$7,618,540	22-Jan-22	1%	Fremont, CA	-12%	$6,760,365.89	$250,985	$222,714	15

ROW/COL	1	2		3	4	5	6	7	8	9	10	11	12	13
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		GSF		Total Project Cost	Mid-point of construction	Escalation Adjustment (6% per annum)	Location	City index adjustment percentage (Project Location -> Sacramento) for plumbing trade	Total Project Cost Adjusted Per City Index and Escalation per annum	Total Plumbing Cost	Total Plumbing Cost (Escalated to todays dollars and location using city index)	Total Plumbing Fixtures
		PROJECT TITLE	PROJECT SCOPE	BUILDING	SITE									
6	COMMERCIAL	Cloverdale Unified School District: Jefferson Elementary School	- Classroom building with related site work and new play structure, hardscape, landscape, irrigation, fencing, parking and underground utilities. - Two-story. - USE: Education.	14,425	16,480	$7,356,743	1-Nov-20	8%	Cloverdale, CA	2%	$8,103,899.69	$382,452	$421,295	20
7	COMMERCIAL	Community Center Building	- Recreation center. - One story. Type 5A Construction. - USE: public, recreation	10,202	16,213	$7,315,045	1-Dec-20	8%	Salinas, CA	-25%	$5,896,443.54	$286,730	$231,125	20
8	COMMERCIAL	Washington Middle School Gymnasium	- Addition of a new gymnasium with related site work including hardscape, landscape and underground utilities.	13,539	17,066	$7,341,445	1-Jan-21	7%	Cloverdale, CA	2%	$8,012,167.94	$223,079	$243,460	22
9	COMMERCIAL	Mare Island Technology Academy	- Construction of new campus including multi-purpose room, administration, science, play fields, parking lot and associated utilities	31,488	309,000	$50,729,101	23-Aug-22	-3%	Vallejo, CA	0%	$49,460,873.48	$1,295,974	$1,263,575	83
10	COMMERCIAL	Fullerton College Instructional Building	- Instructional building. - 2-story. - USE: Education	24,060	18,439	$13,350,876	1-Apr-24	-13%	Fullerton, CA	-6%	$11,034,106.34	$553,039	$457,070	36
11	COMMERCIAL	Fullerton College Maintenance and Operations Building	- Maintenance and operations building with storage and maintenance shops. - 2-story. - USE: Maintenance for educational facilities.	15,658	20,018	$10,382,444	1-Apr-24	-13%	Fullerton, CA	-6%	$8,580,784.60	$400,006	$330,593	12
12	COMMERCIAL	Fullerton College Instructional Building	- Construction of a new three story instructional, building housing and humanities division and associated site work. - 3-story. - USE: Education	77,466	53,328	$42,849,132	1-Oct-20	9%	Fullerton, CA	-6%	$43,912,798.69	$1,237,648	$1,268,371	100

ROW/COL	1	2		3	4	5	6	7	8	9	10	11	12	13
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		GSF		Total Project Cost	Mid-point of construction	Escalation Adjustment (6% per annum)	Location	City index adjustment percentage (Project Location -> Sacramento) for plumbing trade	Total Project Cost Adjusted Per City Index and Escalation per annum	Total Plumbing Cost	Total Plumbing Cost (Escalated to todays dollars and location using city index)	Total Plumbing Fixtures
		PROJECT TITLE	PROJECT SCOPE	BUILDING	SITE									
13	COMMERCIAL	Orange Coast College Chemistry Building	- Construction of a new two-story chemistry building consist of large lecture halls, offices, chemistry labs and prep spaces including associated site work. - 2-story. - USE: Education	39,950	41,273	$32,571,247	23-Jul-22	-2%	Costa Mesa, CA	-6%	$30,149,478.99	$3,440,817	$3,184,982	190
14	COMMERCIAL	Mount Sac Technology and Health Facility	- Construction of new technology resource center including classrooms, Architecture/industrial manufacturing, computer and networking technology. - 4-story - USE: Education	271,413	149,812	$169,489,673	24-Aug-22	-3%	Walnut, CA	-6%	$156,087,170.29	$5,465,166	$5,033,005	199
15	COMMERCIAL	Mount Sac Instruction Offices Building	- Construction of instruction offices including associated site work. - 2-story. - USE: Education	44,472	136,633	$34,323,627	1-Sep-22	-3%	Walnut, CA	-6%	$31,447,364.74	$1,100,941	$1,008,684	40
16	COMMERCIAL	Moreno Valley H.S., Performing Arts Center	- Construction of a one story with mezzanine. - Theatre type with 625 fixed seats. - Single story. - USE: Education	26,240	230,615	$19,288,612	1-Jan-20	13%	Morena Valley, CA	8%	$23,488,832.09	$609,685	$742,448	34
17	COMMERCIAL	Mountain View High School, New Classrooms	- New high school with several single story buildings, walkway and associated site work. - Single story, (total 4 buildings) - USE: Education	35,072	53,713	$21,794,598	1-Mar-20	12%	Mountain View, CA	-8%	$22,574,615.19	$1,585,856	$1,642,613	63
18	COMMERCIAL	Los Altos High School, New Buildings	- New high school with several buildings including 2-story classroom, engineering labs, multipurpose and gym and associated site work. - One 2-story building and (2) single story. - USE: Education	48,649	40,886	$30,881,720	1-Mar-20	12%	Los Altos, CA	-8%	$31,986,960.51	$1,293,094	$1,339,373	60

INSIGHT

DUAL PLUMBING COST MODEL FOR COMMERCIAL BUILDINGS R4

NEW CONSTRUCTION

ROW/COL	1	2		14	15	16	17	18	19	20	21	22	23	24
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		Fixture Density (GSF/Fixture)	Total Toilets/ Urinals/ Washing machines	Total Cost of Potable Water plumbing	Total Cost of Potable Water plumbing (Escalated to todays dollars and location using city index)	Cost of Potable Water Plumbing /Fixture	Approximate cost to add dual plumbing to building + miscellaneous items (buffer tank, pumps, additional equipment, 30%)	Approximate cost to add dual plumbing system to building / GSF	Approximate cost/fixture to add dual plumbing system to building	% Addition of dual plumbing cost to total plumbing cost	% Addition of dual plumbing cost to Project cost	Total cost of domestic water service (backflow preventer, valve, piping and fittings to main service line) in site
		PROJECT TITLE	PROJECT SCOPE	BUILDING										
2	COMMERCIAL	University Center in South Lake Tahoe, CA.	- New university student center included related site work. - Single Story - USE: Classrooms, offices and restrooms	516	6	$51,981	$59,882	$3,992	**$31,139**	**$4.03**	**$5,189.80**	**19%**	**0.50%**	$6,059
3	COMMERCIAL	Student union in San Bernardino, CA for CSU San Bernardino	- Student union center and related site work. - Three story -USE: Retail spaces, activities spaces and event spaces	1,291	39	$228,764	$282,374	$2,941	**$149,129**	**$1.20**	**$3,823.81**	**7%**	**0.18%**	$15,646
4	COMMERCIAL	Outpatient surgery center in Santa Clara CA.	Surgery center including pre/post anesthesia recovery, pharmacy, lab, clinic. - Two story - USE: Medical	625	15	$290,748	$340,143	$5,486	**$106,980**	**$2.76**	**$7,132.03**	**4%**	**0.39%**	$13,675
5	COMMERCIAL	Thornton Middle School - Administration	- Administration building and necessary surrounding site work. - Two-story. - USE: Education.	583	4	$38,347	$34,028	$2,269	**$11,796**	**$1.35**	**$2,949.08**	**5%**	**0.17%**	$3,153

ROW/COL	1	2		14	15	16	17	18	19	20	21	22	23	24
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		Fixture Density (GSF/Fixture)	Total Toilets/ Urinals/ Washing machines	Total Cost of Potable Water plumbing	Total Cost of Potable Water plumbing (Escalated to todays dollars and location using city index)	Cost of Potable Water Plumbing /Fixture	Approximate cost to add dual plumbing to building + miscellaneous items (buffer tank, pumps, additional equipment, 30%)	Approximate cost to add dual plumbing system to building / GSF	Approximate cost/fixture to add dual plumbing system to building	% Addition of dual plumbing cost to total plumbing cost	% Addition of dual plumbing cost to Project cost	Total cost of domestic water service (backflow preventer, valve, piping and fittings to main service line) in site
		PROJECT TITLE	PROJECT SCOPE	BUILDING										
6	COMMERCIAL	Cloverdale Unified School District: Jefferson Elementary School	- Classroom building with related site work and new play structure, hardscape, landscape, irrigation, fencing, parking and underground utilities. - Two-story. - USE: Education.	721	2	$57,138	$62,941	$3,147	**$8,182**	**$0.57**	**$4,091.14**	**2%**	**0.10%**	$28,570
7	COMMERCIAL	Community Center Building	- Recreation center. - One story. Type 5A Construction. - USE: public, recreation	510	9	$91,531	$73,781	$3,689	**$43,162**	**$4.23**	**$4,795.75**	**19%**	**0.73%**	$27,013
8	COMMERCIAL	Washington Middle School Gymnasium	- Addition of a new gymnasium with related site work including hardscape, landscape and underground utilities.	615	12	$35,396	$38,630	$1,756	**$27,392**	**$2.02**	**$2,282.69**	**11%**	**0.34%**	$32,090
9	COMMERCIAL	Mare Island Technology Academy	- Construction of new campus including multi-purpose room, administration, science, play fields, parking lot and associated utilities	379	30	$243,949	$237,850	$2,866	**$111,761**	**$3.55**	**$3,725.36**	**9%**	**0.23%**	$66,843
10	COMMERCIAL	Fullerton College Instructional Building	- Instructional building. - 2-story. - USE: Education	668	13	$115,873	$95,765	$2,660	**$44,957**	**$1.87**	**$3,458.20**	**10%**	**0.41%**	$8,468
11	COMMERCIAL	Fullerton College Maintenance and Operations Building	- Maintenance and operations building with storage and maintenance shops. - 2-story. - USE: Maintenance for educational facilities.	1,305	4	$52,621	$43,490	$3,624	**$18,845**	**$1.20**	**$4,711.36**	**6%**	**0.22%**	$6,279
12	COMMERCIAL	Fullerton College Instructional Building	- Construction of a new three story instructional, building housing and humanities division and associated site work. - 3-story. - USE: Education	775	57	$178,839	$183,278	$1,833	**$135,809**	**$1.75**	**$2,382.62**	**11%**	**0.31%**	$34,705

ROW/COL	1	2		14	15	16	17	18	19	20	21	22	23	24
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		Fixture Density (GSF/Fixture)	Total Toilets/ Urinals/ Washing machines	Total Cost of Potable Water plumbing	Total Cost of Potable Water plumbing (Escalated to todays dollars and location using city index)	Cost of Potable Water Plumbing /Fixture	Approximate cost to add dual plumbing to building + miscellaneous items (buffer tank, pumps, additional equipment, 30%)	Approximate cost to add dual plumbing system to building / GSF	Approximate cost/fixture to add dual plumbing system to building	% Addition of dual plumbing cost to total plumbing cost	% Addition of dual plumbing cost to Project cost	Total cost of domestic water service (backflow preventer, valve, piping and fittings to main service line) in site
		PROJECT TITLE	PROJECT SCOPE	BUILDING										
13	COMMERCIAL	Orange Coast College Chemistry Building	- Construction of a new two-story chemistry building consist of large lecture halls, offices, chemistry labs and prep spaces including associated site work. - 2-story. - USE: Education	210	24	$124,855	$115,572	$608	**$18,978**	**$0.48**	**$790.75**	**1%**	**0.06%**	$37,161
14	COMMERCIAL	Mount Sac Technology and Health Facility	- Construction of new technology resource center including classrooms, Architecture/industrial manufacturing, computer and networking technology. - 4-story - USE: Education	1,364	63	$943,447	$868,843	$4,366	**$357,579**	**$1.32**	**$5,675.86**	**7%**	**0.23%**	$67,320
15	COMMERCIAL	Mount Sac Instruction Offices Building	- Construction of instruction offices including associated site work. - 2-story. - USE: Education	1,112	23	$226,819	$207,812	$5,195	**$155,340**	**$3.49**	**$6,753.89**	**15%**	**0.49%**	$5,462
16	COMMERCIAL	Moreno Valley H.S., Performing Arts Center	- Construction of a one story with mezzanine. - Theatre type with 625 fixed seats. - Single story. - USE: Education	772	17	$153,933	$187,452	$5,513	**$121,844**	**$4.64**	**$7,167.30**	**16%**	**0.52%**	$43,485
17	COMMERCIAL	Mountain View High School, New Classrooms	- New high school with several single story buildings, walkway and associated site work. - Single story, (total 4 buildings) - USE: Education	557	30	$181,344	$187,834	$2,981	**$116,278**	**$3.32**	**$3,875.95**	**7%**	**0.52%**	$41,571
18	COMMERCIAL	Los Altos High School, New Buildings	- New high school with several buildings including 2-story classroom, engineering labs, multipurpose and gym and associated site work. - One 2-story building and (2) single story. - USE: Education	811	18	$257,876	$267,105	$4,452	**$104,171**	**$2.14**	**$5,787.28**	**8%**	**0.33%**	$14,403

DUAL PLUMBING COST MODEL FOR COMMERCIAL BUILDINGS R4

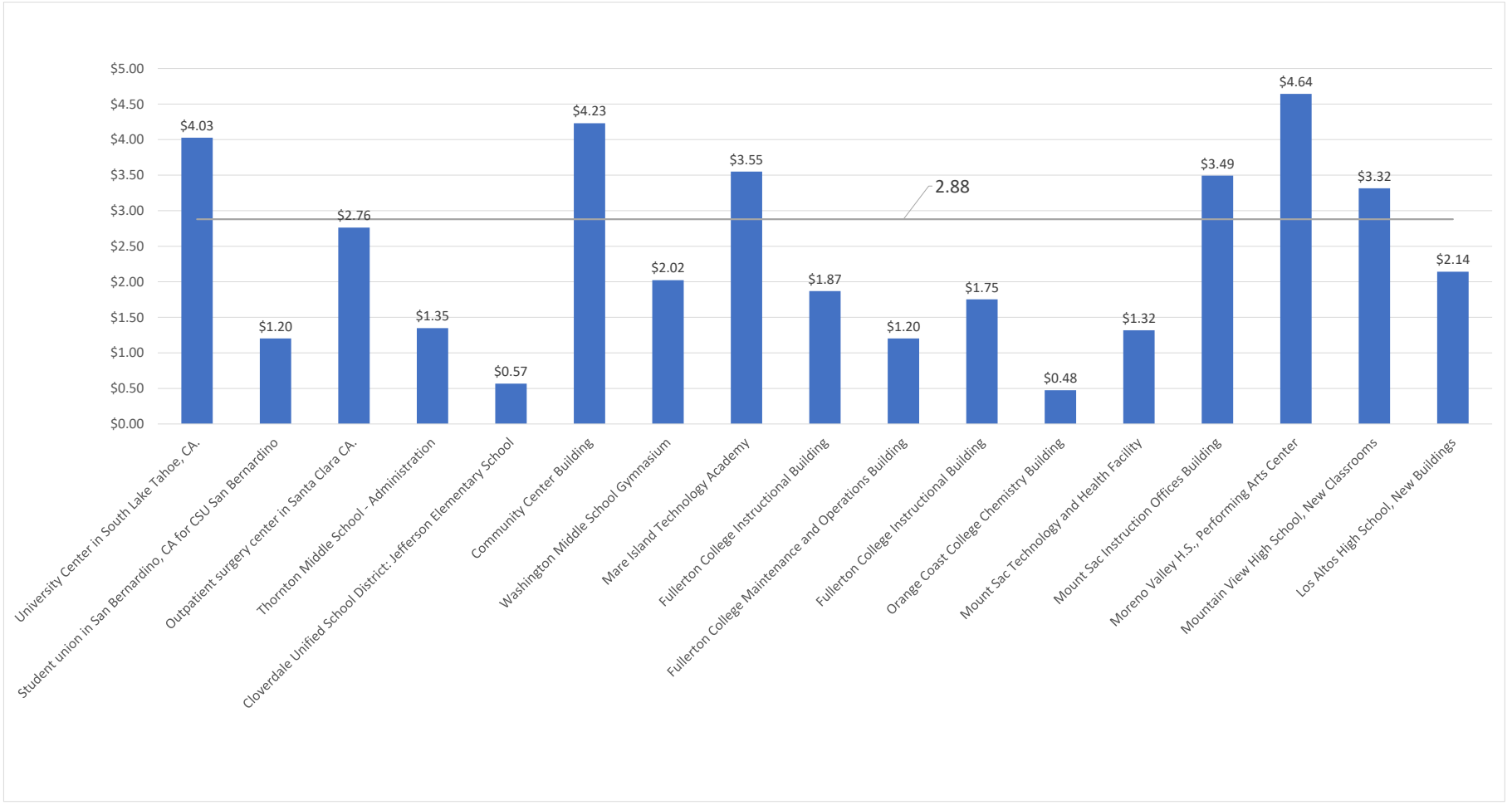
ROW/COL	1	2		25	26	27
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		Adjusted total cost for domestic water service in site	Total cost to add dual plumbing service in site. (Assume 30% more than domestic water service) The assumption is based on the additional piping connection to City service in the building site	Approximate cost to add dual plumbing system in site/SF
		PROJECT TITLE	PROJECT SCOPE	SITE		
2	COMMERCIAL	University Center in South Lake Tahoe, CA.	- New university student center included related site work. - Single Story - USE: Classrooms, offices and restrooms	$6,980	$9,074	$0.26
3	COMMERCIAL	Student union in San Bernardino, CA for CSU San Bernardino	- Student union center and related site work. - Three story -USE: Retail spaces, activities spaces and event spaces	$19,313	$25,106	$0.12
4	COMMERCIAL	Outpatient surgery center in Santa Clara CA.	Surgery center including pre/post anesthesia recovery, pharmacy, lab, clinic. - Two story - USE: Medical	$15,998	$20,798	$0.34
5	COMMERCIAL	Thornton Middle School - Administration	- Administration building and necessary surrounding site work. - Two-story. - USE: Education.	$2,798	$3,637	$0.17

ROW/COL	1	2		25	26	27
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		Adjusted total cost for domestic water service in site	Total cost to add dual plumbing service in site. (Assume 30% more than domestic water service) The assumption is based on the additional piping connection to City service in the building site	Approximate cost to add dual plumbing system in site/SF
		PROJECT TITLE	PROJECT SCOPE	SITE		
6	COMMERCIAL	Cloverdale Unified School District: Jefferson Elementary School	- Classroom building with related site work and new play structure, hardscape, landscape, irrigation, fencing, parking and underground utilities. - Two-story. - USE: Education.	$31,472	$40,913	$2.48
7	COMMERCIAL	Community Center Building	- Recreation center. - One story. Type 5A Construction. - USE: public, recreation	$21,774	$28,306	$1.75
8	COMMERCIAL	Washington Middle School Gymnasium	- Addition of a new gymnasium with related site work including hardscape, landscape and underground utilities.	$35,022	$45,528	$2.67
9	COMMERCIAL	Mare Island Technology Academy	- Construction of new campus including multi-purpose room, administration, science, play fields, parking lot and associated utilities	$65,172	$84,724	$0.27
10	COMMERCIAL	Fullerton College Instructional Building	- Instructional building. - 2-story. - USE: Education	$6,998	$9,098	$0.49
11	COMMERCIAL	Fullerton College Maintenance and Operations Building	- Maintenance and operations building with storage and maintenance shops. - 2-story. - USE: Maintenance for educational facilities.	$5,189	$6,746	$0.34
12	COMMERCIAL	Fullerton College Instructional Building	- Construction of a new three story instructional, building housing and humanities division and associated site work. - 3-story. - USE: Education	$35,566	$46,236	$0.87

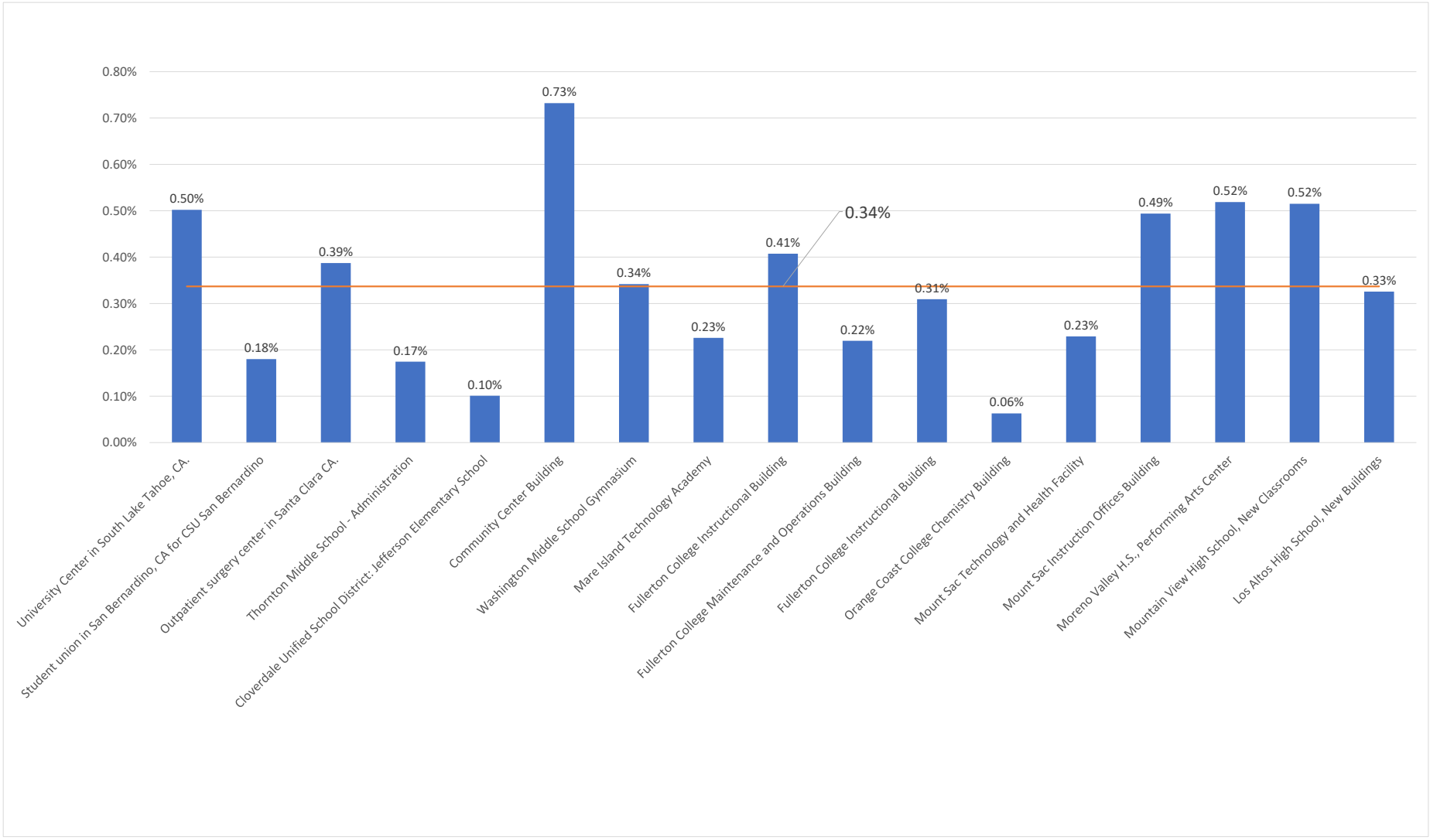
ROW/COL	1	2		25	26	27
1	TYPE OF BUILDING (COMMERCIAL / INDUSTRIAL)	BUILDING DESCRIPTION		Adjusted total cost for domestic water service in site	Total cost to add dual plumbing service in site. (Assume 30% more than domestic water service) The assumption is based on the additional piping connection to City service in the building site	Approximate cost to add dual plumbing system in site/SF
		PROJECT TITLE	PROJECT SCOPE	SITE		
13	COMMERCIAL	Orange Coast College Chemistry Building	- Construction of a new two-story chemistry building consist of large lecture halls, offices, chemistry labs and prep spaces including associated site work. - 2-story. - USE: Education	$34,398	$44,717	$1.08
14	COMMERCIAL	Mount Sac Technology and Health Facility	- Construction of new technology resource center including classrooms, Architecture/industrial manufacturing, computer and networking technology. - 4-story - USE: Education	$61,996	$80,595	$0.54
15	COMMERCIAL	Mount Sac Instruction Offices Building	- Construction of instruction offices including associated site work. - 2-story. - USE: Education	$5,004	$6,506	$0.05
16	COMMERCIAL	Moreno Valley H.S., Performing Arts Center	- Construction of a one story with mezzanine. - Theatre type with 625 fixed seats. - Single story. - USE: Education	$52,954	$68,840	$0.30
17	COMMERCIAL	Mountain View High School, New Classrooms	- New high school with several single story buildings, walkway and associated site work. - Single story, (total 4 buildings) - USE: Education	$43,059	$55,977	$1.04
18	COMMERCIAL	Los Altos High School, New Buildings	- New high school with several buildings including 2-story classroom, engineering labs, multipurpose and gym and associated site work. - One 2-story building and (2) single story. - USE: Education	$14,919	$19,394	$0.47

GRAPHS

COST/SF ADDING DUAL PLUMBING SYSTEM FOR COMMERCIAL BUILDINGS



% INCREASE FOR ADDING DUAL PLUMBING SYSTEM TO TOTAL PROJECT COST FOR COMMERCIAL BUILDINGS



DUAL PLUMBING COST MODEL FOR COMMERCIAL BUILDINGS R4

OCMI JOB #: 220091.000 | 12 May 2022

ASSUMPTIONS, FINDINGS AND CONCLUSION

OBJECTIVE

- To develop cost data for adding dual-plumbing system in new construction for commercial buildings in Sacramento, CA.
- To develop opinion of probably cost to add dual plumbing system to new construction with regards to new buildings codes.
- To determine the cost savings with complete electrification of the building and eliminating the natural gas service.
- To determine the financial impact of city requirements on the community/developers.
- To determine the % to total project cost and the $/SF impact for the total development cost when adding dual plumbing system.

COLUMN DESCRIPTION INCLUDING ASSUMPTIONS

- Column 1: Type of building. All are commercial buildings for now as there was not enough data in database for industrial buildings.
- Column 2: Brief description and scope for the development.
- Column 3: Gross floor area for building.
- Column 4: Gross area for building site.
- Column 5: Total project cost when it was estimated. (unadjusted)
- Column 6: Mid point of construction, this will be used to escalate or de-escalate the project.
- Column 7: Escalation adjustment factor, assume 6% per annum.
- Column 8: Project location. This will be used to adjust cost to Sacramento as the destination city per city index.
- Column 9: City index adjustment factor.
- Column 10: Adjusted total project cost.
- Column 11: Total plumbing cost (unadjusted).
- Column 12: Adjusted total plumbing cost.
- Column 13: Total plumbing fixtures in the project.
- Column 14: Fixture density = Gross floor area (COL 3)/ TOTAL PLUMBING FIXTURES (COL 13)
- Column 15: Total toilets, urinals and washing machine. Assuming these fixtures will use recycled water for flushing/clothes washing.
- Column 16: Total cost for domestic potable water. (unadjusted)
- Column 17: Adjusted total potable water cost.
- Column 18: Cost of potable water/fixture. (COL 17/ COL 13)
- Column 19: Approximate cost to add dual plumbing system to building + miscellaneous items (buffer tank, pumps, additional equipment, 30%) (COL 18 x COL 15 x 1.30)
- Column 20: Dual plumbing system cost/ SF (COL 19/COL 3)
- Column 21: Dual plumbing system cost/fixture (COL 19/COL 15)
- Column 22: % Addition to total plumbing cost (COL 19/COL 12)
- Column 23: % Addition to total project cost (COL 19/COL 10)
- Column 24: Total cost of domestic water service in site including connection to main service line up to 100 LF (unadjusted). Any extension beyond 100 LF are not included in this cost study.
- Column 25: Adjusted total cost of domestic water service in site.
- Column 26: Total cost to add dual plumbing system (Assume 30% addition to domestic water service).(COL 28 x 1.30)
- Column 27: Cost to add dual plumbing system to site per site GSF including piping to main service line of a maximum of 100 LF. (COL 29 / COL 3) Assuming dual plumbing is supplied with recycled water.

ASSUMPTIONS/FINDINGS

Assumption for Plumbing

- The assessed developments are mostly of commercial use with GSF ranging from 8,000 SF to 271,000 SF
- The assessed developments were selected from OCMI's in-house database in which OCMI was the cost consultant for these projects.
- The assessed developments have been escalated up to today's date using an escalation rate of 6% per annum.
- The assessed developments have been escalated per city index using Sacramento, CA as the destination city.

- Initial construction cost which includes building entrance (valve, earthquake valve, meters…etc)
- Building piping to the fixture/equipment including any fittings

Assumption for Dual Plumbing

- Added a contingency for additional equipment of 30% to the total cost for adding dual plumbing system which includes any additional cost for equipment, i.e. buffer tank, pumps…etc. (See description of COL 19 above)
- Assume recycled water will be used only for toilet flushing, urinal flushing and washing machine for commercial building.
- Added an additional analysis for residential/housing buildings, these buildings typically have a high fixture density (< 300 SF/fixture) vs. commercial buildings
- Only initial construction cost are included inclusive of contractor/subcontractor markups. Running and maintenance costs are not included in this cost study.
- Assuming site has no landscape fixtures.

Cost to add dual plumbing to building and site includes the following:

- Separate shut-off valve for dual plumbing system.
- Separate backflow preventer and pressure regulator for the dual plumbing system
- Piping to required fixtures including rough-ins.
- Piping to main service line, 100 LF maximum. Any extension beyond 100 LF are not included in this cost study.
- Miscellaneous items including buffer tank, pumps and other equipment. (30%, see column 19)

Findings:

- Cost to add dual plumbing system to a buildings depends on various factors including:
  - Building size
  - Plumbing fixture density which the is the total square divided by the total plumbing fixtures
  - Domestic water piping cost to fixtures, which is the total cost of material and labor to route domestic water piping to fixture including rough-ins
  - If the buildings contains common areas, for example, laundry and housekeeping areas, private and public restrooms…etc.

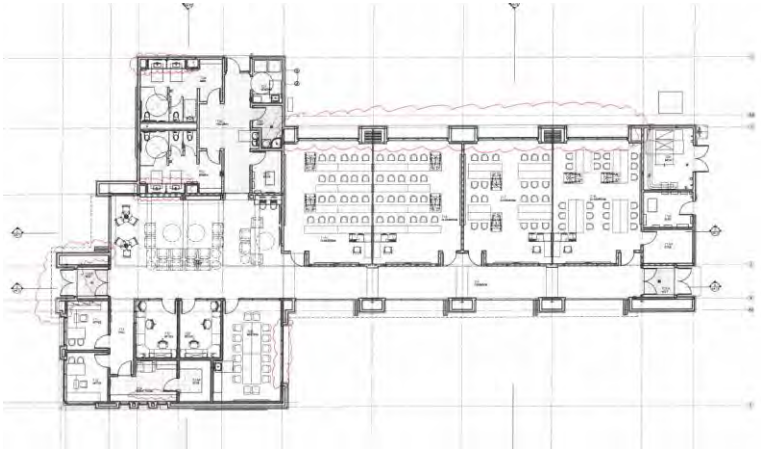
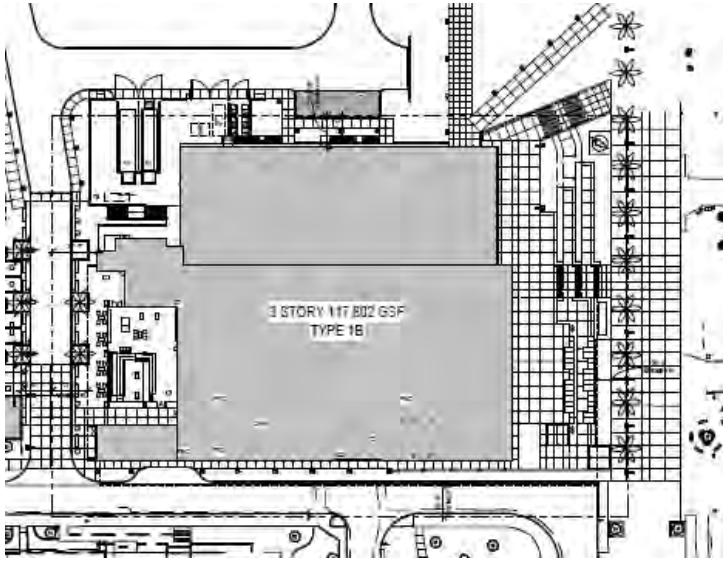
CONCLUSION

For an assumed **100,000 GSF** commercial building:

- Adding dual plumbing system would cost approximately **$288,000** or **$2.88/SF** or **%0.34** added to total project construction cost
- Excluding natural gas system will result in a cost savings of approximately **$39,000** or **$0.39/SF**
- Adding dual plumbing system in site would cost approximately **$35,000** or **$0.78/SF** of site GSF, this includes the following:
  - Connection to main on site/street.
  - Shut-off valve and backflow preventer for dual plumbing to bring recycled water.
  - Piping to building, 100 LF maximum. Any extension beyond 100 LF are not included in this cost study.
- Total net cost for adding dual plumbing system and total building electrification would be **$2.64/SF** or **$264,000**

For an assumed **100,000 GSF** residential/housing building:

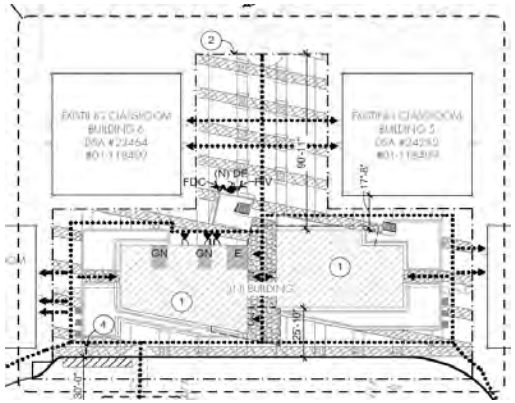
- Adding dual plumbing system would cost approximately **$514,000** or **$5.14/SF** or **%1.31** added to total project construction cost
- Adding dual plumbing system in site would cost approximately **$107,000** or **$4.34/SF** of site GSF, this includes the following:
- Total net cost for adding dual plumbing system and total building electrification would be **$5.60/SF** or **$560,000**

PICTURES	
ROW #	
2	 
3	 

4


EXIT
ENTRY
NEW 2 STORY BUILDING WITH
FULLY SPRINKLERED TYPE II A
CONSTRUCTION
EXIT
ENTRY

5



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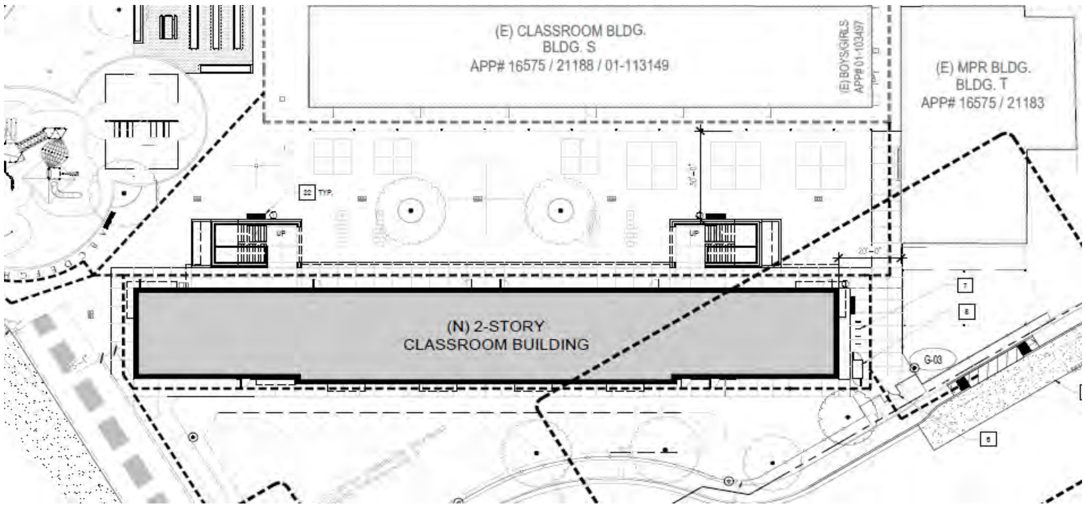
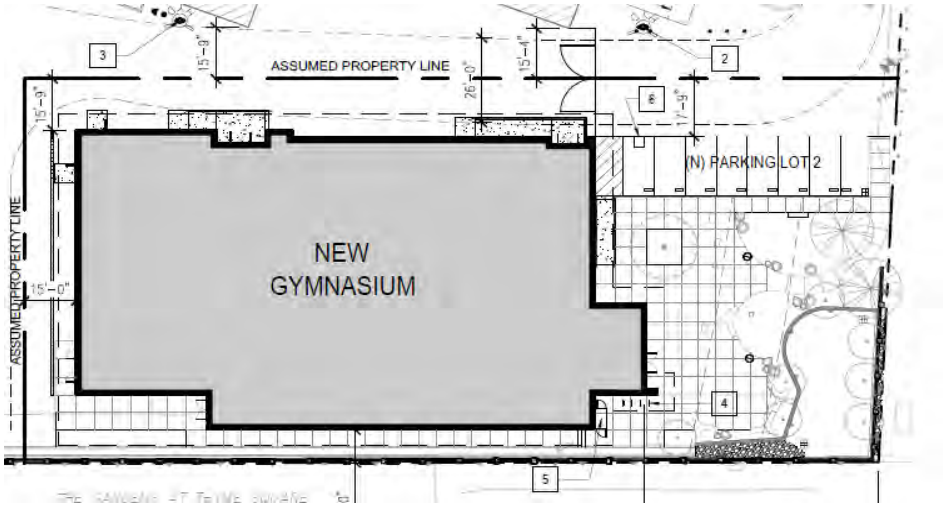

(E) CLASSROOM BLDG.
BLDG. S
APP# 16575 / 21188 / 01-113149
(E) MPR BLDG.
BLDG. T
APP# 16575 / 21183
(N) 2-STORY
CLASSROOM BUILDING
G-03

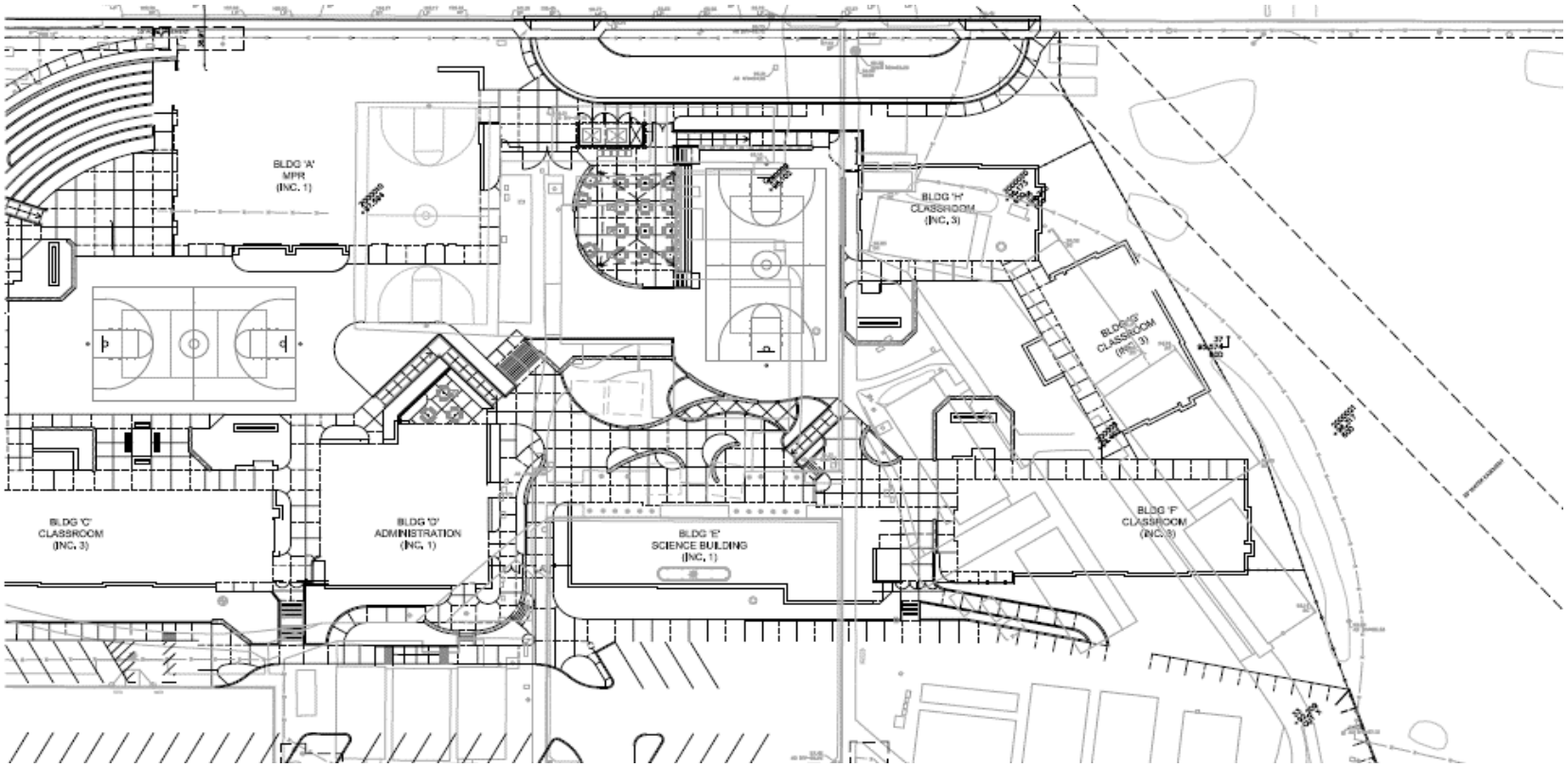
7


POTENTIAL
OUTDOOR
PLAZA
ENTRANCE
MULTIPURPOSE 2
1600 SF
MULTIPURPOSE 1
4640 SF
KITCHEN
TEEN
LOUNGE
500 SF
STAGE
HEBBRON HEIGHTS
RECREATION CENTER
FLOOR PLAN

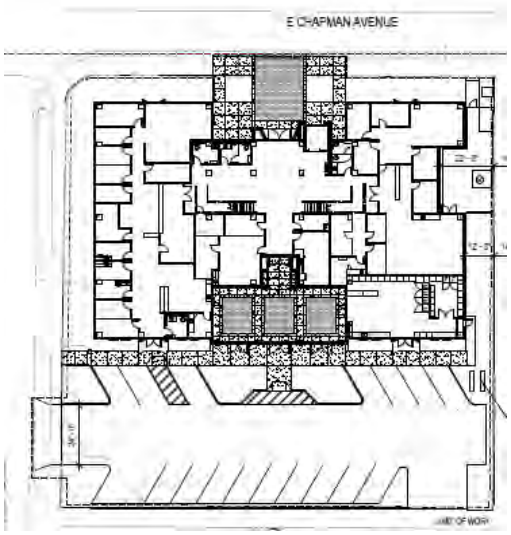
8


ASSUMED PROPERTY LINE
(N) PARKING LOT 2
NEW
GYMNASIUM
ASSUMED PROPERTY LINE

9


BLDG 'A'
MPR
(INC. 1)
BLDG 'H'
CLASSROOM
(INC. 3)
BLDG 'G'
CLASSROOM
(INC. 3)
BLDG 'C'
CLASSROOM
(INC. 3)
BLDG 'D'
ADMINISTRATION
(INC. 1)
BLDG 'E'
SCIENCE BUILDING
(INC. 1)
BLDG 'F'
CLASSROOM
(INC. 3)

10



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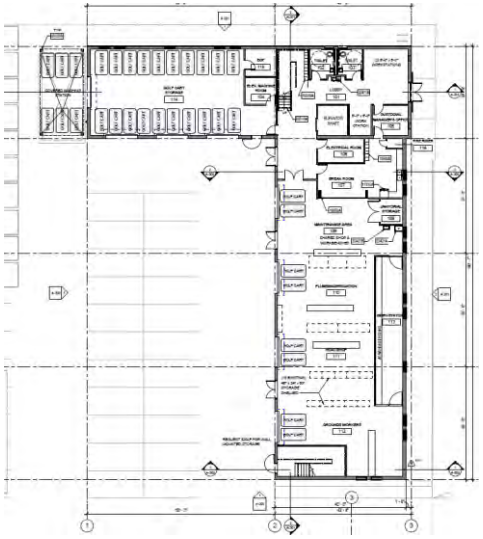

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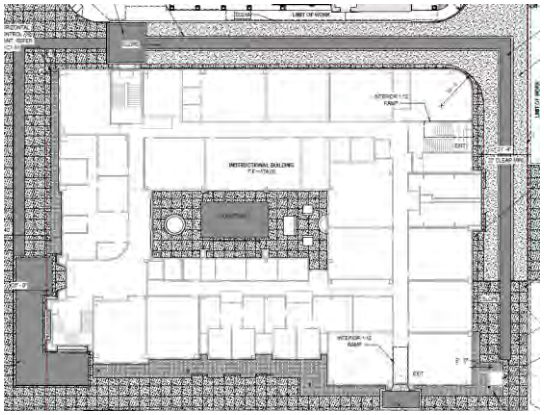

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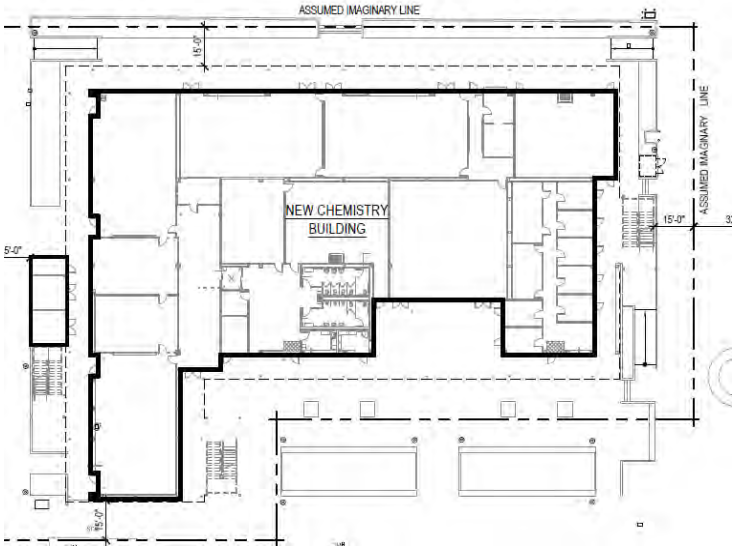
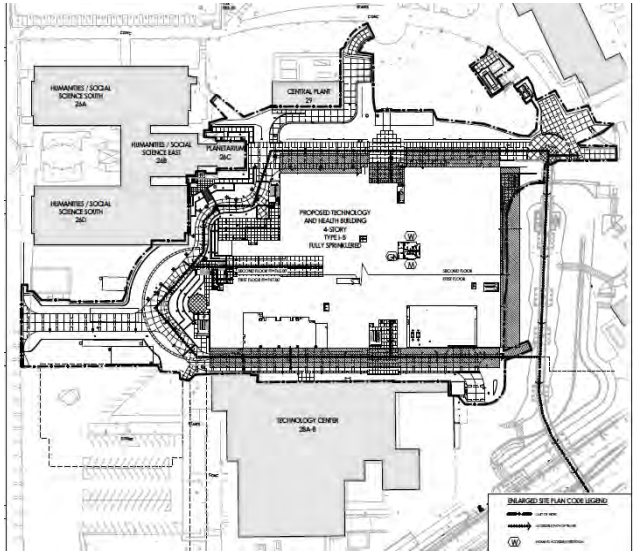
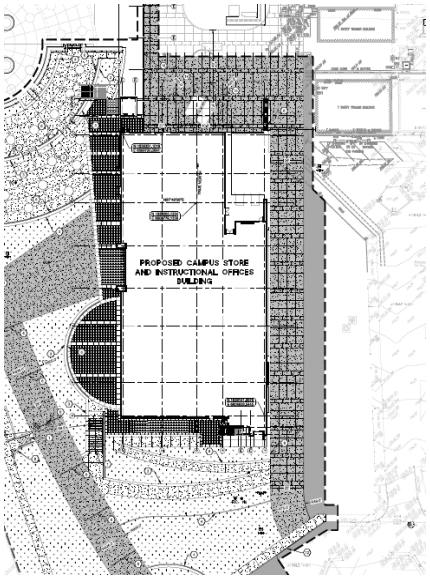

ASSUMED IMAGINARY LINE
15'-0"
NEW CHEMISTRY
BUILDING
5'-0"
15'-0"
ASSUMED IMAGINARY LINE
15'-0"

14

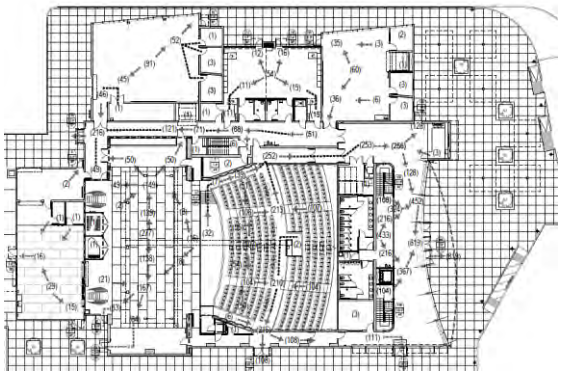

HUMANITIES / SOCIAL SCIENCE SOUTH 28A
CENTRAL PLANT 27
HUMANITIES / SOCIAL SCIENCE EAST 28B
PLANETARIUM 28C
HUMANITIES / SOCIAL SCIENCE SOUTH 28D
PROPOSED TECHNOLOGY AND HEALTH BUILDING 4-STORY TYPE I-B FULLY SPRINKLERED
SECOND FLOOR
FIRST FLOOR
TECHNOLOGY CENTER 28A-B
ENLARGED SITE PLAN CODE LEGEND


TECHNOLOGY + HEALTH

15


PROPOSED CAMPUS STORE AND INSTRUCTIONAL OFFICES BUILDING

16



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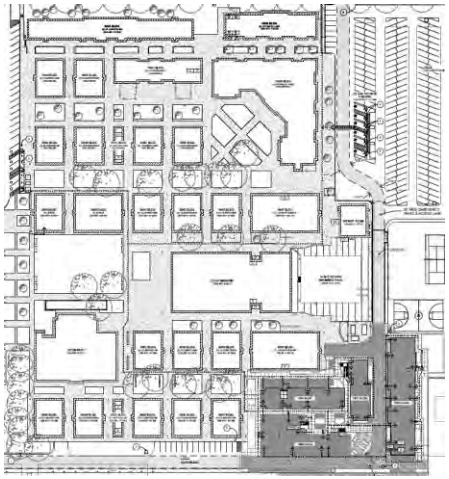

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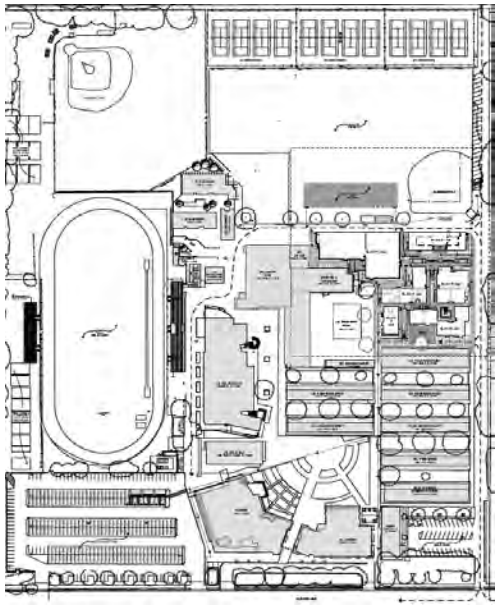

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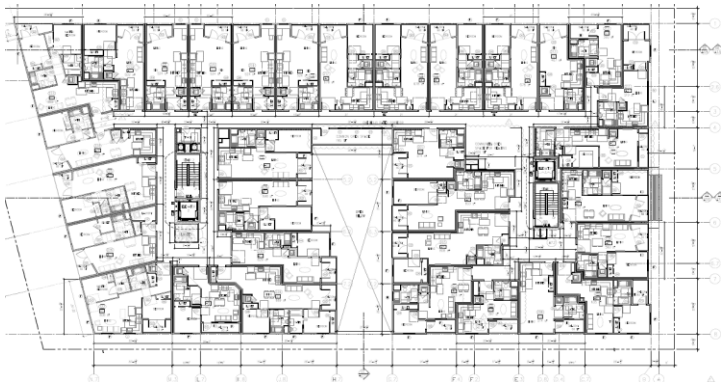

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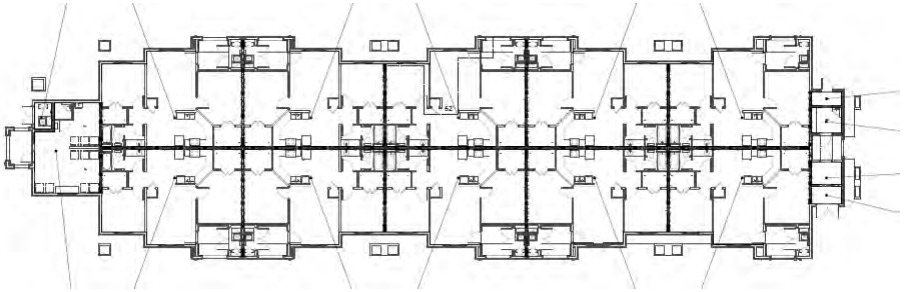
21



Appendix E

San Francisco Onsite Reuse Program Projects Summary

San Francisco ONWS Case Studies (As of June 2022)

Primary Data Sources:
1. San Francisco's Onsite Water Reuse System Projects, San Francisco Public Utilities Commission, September 2021. https://sfpuc.org/sites/default/files/construction-and-contracts/design-guidelines/1.%20SF_Non-potable_Case%20Studies_2021.pdf
2. Innovative Water Reuse and Resource Recovery Projects, San Francisco Public Utilities Commission, March 2022. https://www.sfpuc.org/sites/default/files/documents/CaseStudiesInnovativeWaterReuse2022.pdf

ID	Project	Status	Size (sq ft)	# Alter-native Water Sources	Black Water	Rain-water	Bay Water	Gray-water	Found-ation Drain-age	Steam Conden-sate	Storm-water	Process Water	Application	Average Treatment Volume (Gal/Yr)	Drivers for Non-Potable Water Reuse	ONWS Installation Cost	Annual O&M	Technologies	Contact Reference
1	San Francisco Public Utilities Commission Headquarters — 525 Golden Gate Avenue	Online 2012	277,500	2	x	x							Toilet Flushing, Subsurface Irrigation	912,500	LEED Points, Pilot Project, Public Education	$1,000,000	Not available	Living Machine, Rainwater Harvesting	John Scarpulla, San Francisco Public Utilities Commission (jscarpulla@sfwater.org)
2	The Exploratorium — Pier 15	Online 2013	333,000	2		x	x						Toilet Flushing, Heating & Cooling	2,364,000	Project Sustainability Goals, Public Education, Leed Platinum Certification, and Mandate (San Francisco Stormwater Management Ordinance)	Not available	Not available	Rainwater harvesting, bay water used for heating/cooling	Jennifer Fragomeni, The Exploratorium (jfragomeni@exploratorium.edu)
3	Whole Foods Mixed-use Development — 38 Dolores Street	Online 2013	195,000	1		x							Subsurface Irrigation, Drip Irrigation	26,000	LEED Points, Sustainable Sites Pilot Project Certification, and Mandate (San Francisco Stormwater Management Ordinance)	Not available	Not available	Rainwater harvesting	Jon Yolles, The Prado Group (jyolles@pradogroup.com); Eric Girod, BKF Engineers (egirod@bkf.com)
4	James R. Herman Cruise Terminal — Pier 27	Online 2014	88,000	1		x							Toilet Flushing, Irrigation	370,000	LEED Certification and Mandate (San Francisco Stormwater Management Ordinance)	$930,000	$38,000	Rainwater harvesting with prefiltreation system	Lucas Yee, San Francisco Public Works (Lucas.Yee@sfdpw.org)
5	Vera Haile Senior Housing & St. Anthony's Foundation Dining Room & Social Work Center — 121/129 Golden Gate Avenue	Online	110,000	1		x							Toilet Flushing	37,000	Mandate (San Francisco Stormwater Management Ordinance)	$400,000	$2,500	Rainwater harvesting	Sharon Christen, Mercy Housing California (schristen@mercyhousing.org)
6	San Francisco Museum of Modern Art — 151 Third Street	Online	235,000	1		x							Toilet/Urinal Flushing, Irrigation, Cooling Tower Make-up	365,000	Sustainability Goals, Reduce Potable Water Use, and Compliance with San Francisco Stormwater Management Ordinance	Not available	Not available	Rainwater harvesting, 50 micron filtration filter, 20 micron bag filter	Bob Reuter, Reuter Project Management (reuter@ix.netcom.com)
7	Market Street Place — 945 Market Street	Online	375,810	1		x							Toilet Flushing, Cooling Tower Make-Up	446,000	LEED Points and Mandate (San Francisco Stormwater Management Ordinance)	Not available	Not available	Water Control Corporation RW-Series Skid Mounted Water Reclamation Packaged System consisting of 25 and 5 micron filtration followed by ultraviolet (UV) disinfection	Phillip Alexander, Randall Lamb (PAlexander@RandallLamb.com); and Kathy Kwong, Gensler (Kathy_Kwong@Gensler.com)
8	Bill Sorro Community - Affordable Housing Project — 200 6th Street	Online	69,000	1		x							Toilet Flushing	45,000	Project Sustainability Goals and Mandate (San Francisco Stormwater Management Ordinance)	$280,000	Not available	Rainwater harvesting, particulate filters to remove the suspended solids and ultraviolet (UV) disinfection	Sharon Christen, Mercy Housing California (schristen@mercyhousing.org)
9	181 Fremont Mixed-use Tower — 181 Fremont Street	Online	706,617	2		x		x					Toilet Flushing, Irrigation	1,300,000	Sustainability Goals, LEED Points, and Mandate (San Francisco Stormwater Management Ordinance)	Not available	Not available	Aquacell system for greywater, PHOENIX Rainwater Treatment System	Ben Arnold, PHOENIX/Aquacell (bena@aquacell.us)

San Francisco ONWS Case Studies (As of June 2022)

Primary Data Sources:
1. San Francisco's Onsite Water Reuse System Projects, San Francisco Public Utilities Commission, September 2021. https://sfpuc.org/sites/default/files/construction-and-contracts/design-guidelines/1.%20SF_Non-potable_Case%20Studies_2021.pdf
2. Innovative Water Reuse and Resource Recovery Projects, San Francisco Public Utilities Commission, March 2022. https://www.sfpuc.org/sites/default/files/documents/CaseStudiesInnovativeWaterReuse2022.pdf

ID	Project	Status	Size (sq ft)	# Alter-native Water Sources	Black Water	Rain-water	Bay Water	Gray-water	Found-ation Drain-age	Steam Conden-sate	Storm-water	Process Water	Application	Average Treatment Volume (Gal/Yr)	Drivers for Non-Potable Water Reuse	ONWS Installation Cost	Annual O&M	Technologies	Contact Reference
10	San Francisco Permit Center at 49 South Van Ness Avenue – San Francisco, CA	Online	523,800	2		x		x					Toilet/Urinal Flushing, Subsurface Irrigation	1825000	Non-potable Water Ordinance Compliance	$400,000	$50,000	Aquacell --rainwater harvesting, graywater passes through a 130-micron filter and then undergoes a biological treatment process before it enters a break tank, while rainwater is pumped directly from its collection tank into the break tank. From the break tank, the mixture of rainwater and filtered graywater is pumped through the treatment skid for further filtration, UV disinfection, and chlorine dosing to maintain a residual in the treated water storage tank.	David Guan, Cal Pacific Systems (David.guan@calpacificsystems.com), 415-252-8600
11	Fifteen-Fifty at 1550 Mission Street – San Francisco, CA	Construction Completed 2020	760,000	2		x		x					Toilet/Urinal Flushing, irrigation	2,737,500	Non-potable Ordinance Compliance, Cost-Savings, Developer Focus on Sustainability	Not available	Not available	Epic Cleantec	Eric Hough, Chief Commercial Officer - Epic Cleantec (eric@epiccleantec.com)
12	UN Plaza Foundation Drainage Project — Market Street	Construction Completed 2020	Not available	1					x				Irrigation, Street Sweeping, Mak-up water in Plaza Fountain	5,292,500	Reduce Potable Water Use and Comply with Executive Directive 14-01	$3,000,000	Not available	multiple step media filtration coupled with disinfection. The treated water will be stored in a 15,000 gallon tank	Raymond Lui, San Francisco Public Works (Raymond.Lui@sfdpw.org)
13	Moscone Center Expansion Project — 747 Howard Street	Online	1,500,000	3		x			x	x			Toilet/urinal Flushing, irrigation, street cleaning	15,000,000	LEED Certification, Compliance with San Francisco Mayoral Executive Directive 14-01, and Compliance with San Francisco's Stormwater Management Ordinance	$2,500,000	Not available	multi-step filtration and UV disinfection.	Steve Basic, The Moscone Center (sbasic@moscone.com)
14	Energy Center San Francisco-BART Foundation Drainage Project — Powell Street BART Station	Online	Not available	1					x				Steam Heating in DS SF Steam Loop	30,000,000	Reduce Potable Water Use and Sustainability Goals	$3,500,000	$200,000	Raw water collection tank with a coarse strainer, microfiltration (MF), and closed circuit reverse osmosis (CCRO). The water also undergoes softening to remove minerals that interfere with the process of steam production	Gordon Judd, Clearway Energy (gordon.judd@clearwayenergy.com)
15	Chase Center – San Francisco, CA	Online 2021	1,480,000	4		x		x		x	x		Toilet/Urinal Flushing, spray irrigation	53,000	Stormwater Management Ordinance and Non-potable Water Ordinance Compliance	$700,000	$50,000	Aquacell	Neil Joson, SJ Engineers (njoson@sjengineer.com), 510-832-1505
16	Mission Rock at Third and Mission Rock Street – San Francisco, CA	Design	2,700,000	1	x								Cooling Tower Make-up, Toilet/Urinal Flushing, Irrigation	39,055,000	The Eco-District Program, Model Sustainable Development, Non-potable Water Ordinance Compliance	$8,400,000	Not available		Steven Minden, Tishman Speyer & Mission Rock Partners (sminden@tishmanspeyer.com), 213-458-1272

San Francisco ONWS Case Studies (As of June 2022)

Primary Data Sources:
1. San Francisco's Onsite Water Reuse System Projects, San Francisco Public Utilities Commission, September 2021. https://sfpuc.org/sites/default/files/construction-and-contracts/design-guidelines/1.%20SF_Non-potable_Case%20Studies_2021.pdf
2. Innovative Water Reuse and Resource Recovery Projects, San Francisco Public Utilities Commission, March 2022. https://www.sfpuc.org/sites/default/files/documents/CaseStudiesInnovativeWaterReuse2022.pdf

ID	Project	Status	Size (sq ft)	# Alter-native Water Sources	Black Water	Rain-water	Bay Water	Gray-water	Found-ation Drain-age	Steam Conden-sate	Storm-water	Process Water	Application	Average Treatment Volume (Gal/Yr)	Drivers for Non-Potable Water Reuse	ONWS Installation Cost	Annual O&M	Technologies	Contact Reference
17	Uber Mission Bay at 1455 and 1515 Third Street – San Francisco, CA	Construction Complete	406,210	2		x		x					Toilet Flushing, Irrigation	693,500	Non-Potable Water Ordinance (Article 12C Compliance)	$500,000	$23,000 Est. – Operation/ Maintenance $35,000 Est. – Article 12C Testing $23,000 Est. – Treatment System Manager	800-micro prefilter, 30-micron sediment filter, and an 186mJ/cm2 UV disinfection tower with a combined collection volume of 24,000 gallons for both buildings. Graywater is treated using an 800-micron prefilter, NSF-350 certified membrane bioreactor, and an 186mJ/cm2 UV disinfection tower with a combined average treatment capacity of 1,200 gallonsSystem designer Heat Transfer Equipment Company (HTEC) is contracted for operations and maintenance, and third-party affiliates will provide lab analysis and the treatment system manager role.	Bill McCabe, Heat Transfer Equipment Company (bill@htecompany.com)
18	PureWater SF	Construction Complete	277,500	2	x	x							Testing and Analysis for Potential Potable Reuse Applications	1,460,000	Test Treatment Process Reliability, Staff and Public Engagement, Operator Training, Support State and National Research	$1,200,000	Not available	ultrafiltration, reverse osmosis, and an ultraviolet advanced oxidation process (UF/RO/UV AOP)	Manisha Kothari, SFPUC (mkothari@sfwater.org)
19	NEMA	Construction Complete	Not available	1	x								Nutrient Recovery to Produce High-Quality Sterile Soil Amendment	1,095,000	Cost-savings, Developer's Sustainability Goals, Developer's Desire to Prepare for Future Article 12C Projects	Not available	Not available	Epic Cleantec	Eric Hough, Chief Commercial Officer - Epic Cleantec (eric@epiccleantec.com)
20	Anchor Brewing Company	Construction Complete	Not available	1								x	Industrial	3,650,000	Sustainability Goals	$5,290,000	Not available	Cambrian's wastewater reuse technology	Michelle Keefer, Cambrian (mkeefer@cambrianinnovation.com)