Review of the San Francisco Public Utilities Commission's Water Efficiency and Alternative Water Supply Programs and Policies Within Their Retail Service Area

December 2023

Final Memorandum

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I. Executive Summary

The San Francisco Public Utilities Commission (SFPUC) provides water, power, and wastewater services to people and businesses across their retail service area in and around the City and County of San Francisco, and serves as a water wholesaler to 27 municipalities, water suppliers, and private entities in Alameda, Santa Clara, and San Mateo counties. The Pacific Institute reviewed and offered recommendations for enhancing SFPUC's water efficiency and local supply programs and policies to secure additional water savings, especially in dry years.

For this review, which was focused on the SFPUC's retail service area, the Pacific Institute performed a literature review of relevant documents from the SFPUC and peer organizations and interviewed SFPUC staff from the water efficiency and alternative water supply teams. Pacific Institute held a workshop in June 2023, along with several follow-up conversations to discuss opportunities and challenges for achieving additional water savings and augmenting water supplies within the SFPUC retail service area.

The SFPUC offers a robust portfolio of policies and programs to support water efficiency and alternative water supplies, and these efforts have achieved significant reductions in potable water demand. Retail water demand—both on a total and per person basis—has declined for several decades, even as the population continued to rise. Today, residential water use is among the lowest in California due, in part, to the SFPUC's water efficiency policies and programs.

There are opportunities to build on these successes to seek additional water savings. For example, while average residential water use is among the lowest in California, some households use far more than the San Francisco average. Additionally, commercial, industrial, and institutional customers represent a large and growing percentage of water use within the SFPUC retail service area. Further, there are a growing number of new tools available to help customers better understand and manage their water use.

The Pacific Institute identified 26 recommendations for adjustments to the SFPUC's programs and policies for water efficiency and local water supply portfolio to further enhance these offerings, including a recommendation to improve demand forecasting. Some of these recommendations represent relatively minor changes to existing programs while others would require a new program or policy and/or engagement with other departments or divisions within the SFPUC.

Additional evaluation, including the potential for water savings, is needed to determine which of these to pursue and how to prioritize among them. For some recommendations, the water savings may be difficult to quantify because of limited data and uncertainty in levels of participation and available resources. Some may offer lower water savings but provide additional co-benefits that could make them worthwhile to pursue. Finally, additional resources, including staff, will be required to effectively implement these recommendations. In 2024, SFPUC will launch its 2025 Retail Conservation Plan, providing an opportunity to evaluate and integrate these recommendations and considerations into planning and budgeting processes.

II. Introduction

The San Francisco Public Utilities Commission (SFPUC) provides water, power, and wastewater services to people and businesses across their retail service area, which corresponds with the boundaries for the City and County of San Francisco, but also includes some retail water customers outside of San Francisco. The SFPUC also serves as a water wholesaler to 27 municipalities, water suppliers, and private entities in Alameda, Santa Clara, and San Mateo counties.

The SFPUC has made significant investments to advance water efficiency among its retail customers and develop local water sources. Climate change and regulatory uncertainties are prompting the SFPUC to examine new technologies, practices, and programs that can help further extend and augment dry year supplies.

The Pacific Institute conducted a review of the SFPUC's existing water efficiency and local supply programs and related policies to provide recommendations for updating and/or expanding these programs and policies to secure additional water savings, especially in dry years when supply shortages are most likely. This work focused on SFPUC's retail service area only, as SFPUC does not direct wholesale agency programming.

For this review, the Pacific Institute performed a literature review of relevant SFPUC documentation related to water use, water efficiency policies and programs, and local water supply options, as well as documents from peer organizations. The Pacific Institute also conducted three remote interviews with SFPUC staff from the water efficiency and alternative water supply teams to discuss opportunities and challenges for achieving additional water savings and augmenting water supplies within the SFPUC retail service area. Pacific Institute held a workshop on June 22, 2023, and conducted several follow-up conversations to discuss these opportunities in more detail.

This memo presents the findings and recommendations from Pacific Institute's review of the SFPUC's water efficiency and alternative water supply policies and programs within the retail service area. Section 3 provides background on the SFPUC water system and uses of water within the SFPUC retail service area. Section 4 provides findings and recommendations to enhance the SFPUC's policies and programs for water efficiency and alternative water supplies. Finally, Section 5 offers a summary and conclusions.

III. Background on the SFPUC Water System and Water Use

The SFPUC owns and operates the Regional Water System, a complex network of pipelines and facilities that conveys water to 2.7 million residents and businesses in San Francisco and three other Bay Area counties. Approximately 85% of the water within the Regional Water System is sourced from the Tuolumne River watershed and the remaining 15% from surface waters in the Alameda and Peninsula watersheds.

Approximately two-thirds of the water from the Regional Water Systems is provided through wholesale deliveries to 27 municipalities, water suppliers, and private entities in Alameda, Santa Clara, and San Mateo counties. The remaining one-third is delivered to the SFPUC's retail customers, i.e., residents and businesses in San Francisco and a small number of residential customers and non-residential facilities

outside of San Francisco.[1] While surface water conveyed through the Regional Water System is a major water source for SFPUC's retail customers, other water sources for its retail customers include local groundwater, recycled water, and stormwater.

Retail water demand—both on a total and per person basis—has experienced a general decline, even as the population continued to increase. Figure 1 shows total and per capita water demand for SFPUC retail customers between 2005 and 2020. In 2005, retail water demand was 84 million gallons per day (MGD), and total per capita demand was 110 gallons per capita per day (gpcd). By 2020, the most recent year for which these data are available, retail water demand was just 65 MGD, and total per capita demand was 76 gpcd (SFPUC 2021b). While this figure shows trends since 2005, other data suggest that the general trend of declining demand goes back as far as the mid-1960s. These reductions are due to a combination of factors, including the SFPUC's efficiency policies as well as programs and federal and state standards and codes.

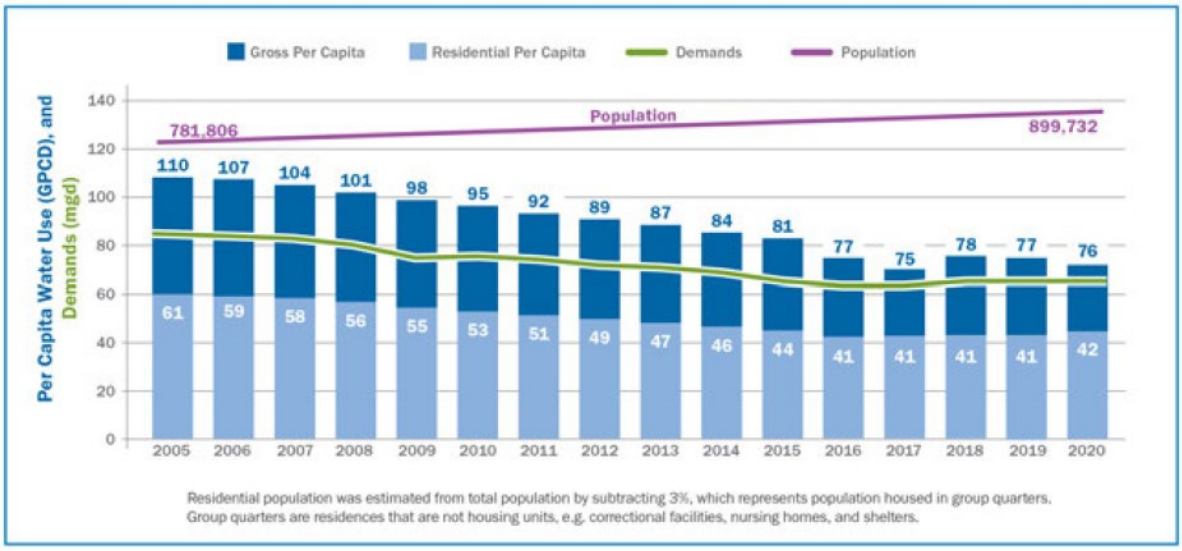

Figure 1. Total and Per Capita Water Use for the SFPUC Retail Customers, 2005 to 2020
Source: SFPUC 2021b

Note: This figure shows water use trends between 2005 and 2020. Other data suggest that water use has been declining since the mid-1960s; however, those data are not included here because of differences in calculation methods.

[1] Customers outside San Francisco include clusters of residential houses in Sunol, Redwood City, Daly City, Fremont, Millbrae, Castlewood, and Groveland, and several large, non-residential facilities, such as the San Francisco County Jail in San Bruno, the Sunol Valley Golf Course, the San Francisco International Airport in Millbrae, the Lawrence Livermore National Laboratory in Livermore, and the NASA Ames Research Center in Mountain View.

Of the total retail water demand, multi-family and single-family residential customers represent 33% and 21%, respectively (Figure 2). Non-residential customers—which represent commercial, industrial, institutional, and municipal uses, as well as irrigation through dedicated meters—represent 35% of retail water demand. Current estimates of supply-side water loss consist of both real and apparent losses and represent about 10% of total retail demand.[2]

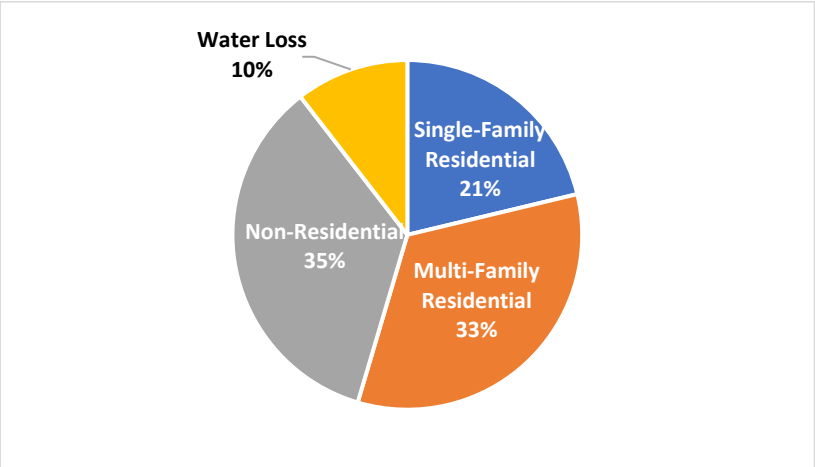

Figure 2. Retail Water Use by Sector in 2020
Data Source: Table 4-1 of the 2020 Urban Water Management Plan (SFPUC 2021b)
Note: These data are for in-city and suburban retail water demand. Groveland CSD is not captured here.

IV. Findings and Recommendations for Water Efficiency and Alternative Water Supply Policies and Programs

The SFPUC has actively promoted water conservation and efficiency for over three decades. Their efficiency policies and programs have shifted over time, and it currently offers a robust mix of strategies to promote long-term water efficiency improvements for their residential and non-residential customers. These strategies include mandates, financial incentives, technical assistance, water management tools, and education and outreach. The SFPUC currently implements over 25 different efficiency-related measures and has evaluated and implemented many more over the past 30 years. Its Conservation Section has 13 staff and an operating budget of approximately $3.8 million, excluding salaries. In its 2020 Conservation Plan, the SFPUC estimated its conservation program and plumbing codes had a savings of approximately 86,385 acre-feet (AF) (equivalent to 5.5 MGD) between 2005 (the year the SFPUC developed its first conservation forecast model) and 2019, and estimated a future savings of 117,221 AF (or 4.2 MGD) between 2020 and 2045. Due, in part, to its longstanding commitment to water conservation and efficiency, the SFPUC has among the lowest per capita water use in California.

The SFPUC also manages a large portfolio of local and regional water supply projects and programs. Local alternative water supply projects and programs administered by the SFPUC include on-site water reuse, recycled water, purified water, groundwater, and stormwater capture. These programs support diversification of the SFPUC's water supply (the SFPUC currently receives 85% of water supply from the

[2] Real losses consist of physical losses of water through leaks and storage overflows, whereas apparent losses consist of meter inaccuracies, data handling errors, and unauthorized consumption.

Hetch Hetchy System) and enhance water supply resilience, especially during droughts. The SFPUC also employs several projects in collaboration with regional partners to further diversify and secure water supplies for all SFPUC customers.

The Pacific Institute's evaluation focused on policies and programs for residential and non-residential customers within the SFPUC's retail service area. The SFPUC also has a program to reduce supply-side water losses within its system, but an evaluation of that program was outside the scope of this review. Additionally, this evaluation did not examine policies and programs for the SFPUC's wholesale customers, as the SFPUC does not direct wholesale agency programming.

In this section, we offer findings and recommendations for enhancing the SFPUC's water efficiency and alternative water supply policies and programs based on an evaluation by the Pacific Institute and input from SFPUC staff. Because projections of future water demand are integral to water efficiency and supply planning, we also offer recommendations for improving demand forecasts.

For each recommendation, we provide a suggested period to begin implementation, i.e., in the near term (in up to two years); mid term (in two to four years); and long term (in more than four years). We also offer an estimated level of effort required for implementation, i.e., low (minor change to existing programs), medium (major change to existing programs), and high (new program or policy and/or requires engagement with other departments or divisions). Both qualitative measures were assigned with input from the SFPUC staff.

Additional evaluation, including a quantitative estimate of the potential water savings, is needed to determine which of the recommendations to pursue and how to prioritize among them. This is best done by the SFPUC as part of the measure evaluation and conservation model updates that will be initiated in 2024 in support of development of its 2025 Retail Conservation Plan. As of the time this memo was issued, the SFPUC assumes that the feasibly attainable water savings from the recommended measures is likely in the low range, but this assessment could change after it estimates potential water savings as part of the Conservation Plan process and adjusts assumptions about levels of participation and resources available.

Residential Efficiency Measures

As of 2020, there were approximately 900,000 people in SFPUC's retail service area (in and outside of San Francisco per its 2020 Urban Water Management Plan, or UWMP), a 15% increase from 2005. During this same period, daily residential per capital water use (R-GPCD) decreased by 30% (SFPUC 2021a). Residential water use in San Francisco is among the lowest, on a per capita basis, in the State of California. Average R-GPCD, which includes both indoor and outdoor usage, was 42.9 gpcd in 2020 (SFPUC 2021a). More recent data show that R-GPCD was even lower (40.8 gpcd) in fiscal year 2022–2023 (as estimated by the Pacific Institute),[3] though rationing and a drought surcharge during this period

[3] Analysis of residential water use was performed by Pacific Institute staff with anonymous account-level data for July 2022–June 2023 that included: volume of water consumed, number of days during which the water was consumed, account type (single-family residential, multi-family residential, and a combination account type that includes fire service for indoor sprinklers), number of dwelling units, occupancy (estimated by SFPUC), category (single-family or multi-family), number of people per household, and calculated R-GPCD. Account data were excluded from the analysis if occupancy was blank or zero, people per household was less than 0.9, number of days was less than 180 or more than 365 (to avoid billing irregularities), it had no account type information, or if R-GPCD was less than 1 or more than 1,000 GPCD. Final sample size was 103,211 accounts, or approximately 66% of the total number of residential accounts billed in July 2022-June 2023.

may have been a factor. According to the SFPUC's 2020 UWMP, R-GPCD is projected to decrease to 38 gpcd by 2025 (SFPUC 2021b). The SFPUC's conservation and efficiency programs and efforts have contributed to this reduction by incentivizing residential customers to upgrade fixtures and appliances to more efficient models, educating homeowners about their water usage and leaks (when they occur), and supporting codes and regulations.

While *average* residential per capita use is far below levels seen across the state, some households use far more than the SFPUC's residential average per capita use for its retail service area. Figure 3, from an analysis of residential water accounts between July 2022 and June 2023, shows the distribution of per capita use for residential households in San Francisco; the long tail on the right side of the curve represents accounts with higher-than-average per capita water use (see Footnote 3, above, for details on the data cleaning process). The 80th quantile is 54.9 gpcd and represents the threshold demarcating the top 20% of users (i.e., the portion with the highest water usage rates). The 90th quantile is 72.4 gpcd and represents the threshold demarcating the top 10% of users. These households likely offer the greatest opportunities for additional water savings. For comparison, data from the California State Water Resources Control Board's Water Conservation Portal shows that average 2022 R-GPCD (the most recent year for which a complete dataset is available) was 65 gpcd in the San Francisco Bay region and 92 gpcd statewide (CA SWRCB 2023).

In this section, we summarize the findings of our review of SFPUC's conservation and efficiency programs and related efforts for single- and multi-family residential households and provide opportunities for enhancements.

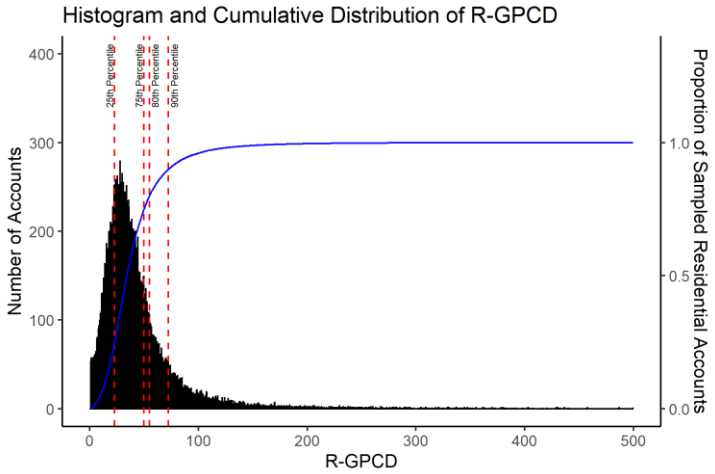

Figure 3. Distribution of Average R-GPCD from Single- and Multi-Family Residential Accounts, July 2022–June 2023

Notes: The left Y-axis shows number of accounts, with the red dashed lines (from left to right) demarcating the 25th, 75th, 80th, and 90th quantiles. The blue curve shows the proportion of sampled residential accounts captured by the distribution (Right Y-axis). Sample size = 103,211.

High-Use Alerts

While average residential household usage in the SFPUC's retail service area is low, approximately 37% of customers exceed this average (Figure 3). Of these, the top 20% of households use at least 54.9 gpcd, and the top 10% use at least 72.4 gpcd. The SFPUC currently sends high-use alerts once a year (more frequently in a drought year) to the top 2% of single- and small multi-family households via email, letter, follow-up calls, and door hangers. The SFPUC also issues leak alerts and does outreach via Customer Service staff when water use exceeds 400% of average daily use for the previous six months. Leak alerts and related recommendations are discussed in more detail in Water Management Tools (p. 22). Households with water usage that exceeds the average within the SFPUC retail service area may be good candidates for additional assistance for replacement of inefficient fixtures, leak identification and repair, landscape and outdoor water use improvements, and addressing other forms of water waste.

Recommendation: Expand high-use alerts and direct messages to a larger group of residential households (near term, low level of effort)

We recommend the SFPUC expand its outreach to high-use customers by targeting single- and small multi-family households with higher-than-average water use.[4] This outreach can be phased in over time, focusing first on sending alerts to the top 10% of water-using households and later expanding this to the top 15–20%. High-use alerts and direct messages can help increase awareness of the SFPUC's water conservation program offerings and support increased participation for those households with the highest likelihood for inefficient water use.

Water use of the top 20% and even the top 10% of households in the SFPUC's service area is relatively low compared to the state average. Some of these households may be using water efficiently but have high occupancy, larger areas of irrigated landscape, or other special water needs. Communication and outreach for this program should take this into account to ensure messaging is clear. Specifically, households falling within the 10th and 20th percentile may benefit from targeted direct mailers and other forms of outreach that focus on conservation core services without using the "high-use" or "top user" designation.

Additionally, the SFPUC could allow customers to set custom automatic high-use alerts when it migrates its My Account online portal to a new system (anticipated within about 3 years) when their usage exceeds some user-defined threshold, e.g., two times average seasonal water use. For example, East Bay Municipal Utility District (EBMUD) has an automated high-use alert system whereby customers can choose to be alerted whenever their water use goes one, two, or three times above their seasonal water use (East Bay MUD 2023).

Ultra-High Efficiency Toilet Incentives

In the United States, toilets are responsible for an estimated 30% of annual household indoor water use (US EPA 2016). Based on a model that incorporates both "natural" fixture replacement and active conservation programs, the SFPUC's fixture saturation model estimates that, in 2025, 14% of single-family households and 13% of multi-family households may still have inefficient toilets that exceed the federal standard of 1.6 gallons per flush (gpf) (SFPUC 2021a). Further, a 2020 survey by SFPUC of

[4] Here, average use is based on the SFPUC retail service area.

residential leak program participants showed most residential leaks were caused by a leaky toilet (SFPUC 2021a).

The SFPUC began offering incentives for replacement of inefficient toilets in the 1990s, starting first with $10 toilet sales, then moving to rebates for over 15 years, and adding direct installation, including vouchers, in 2010. In 2016, the SFPUC ended its toilet and urinal rebate programs but continued a direct-install program for single- and multi-family customers that provides free replacement (including the fixture and installation) of toilets that use 3.5 gpf or more with a WaterSense-certified 1.1 gpf model (also known as "ultra-high efficiency toilets") or, in some instances, a 0.8 gpf model.[5] Toilet incentives, including the direct-install program, are expected to be phased out by 2025 (SFPUC 2021a). The SFPUC's direct-install program was initially open to commercial customers, but the SFPUC could no longer incentivize toilet replacements after 2017 due to the requirements set forth in the San Francisco Commercial Conservation Ordinance, which established a 2017 deadline for commercial properties to replace old fixtures.

Recommendation: Expand programs that support replacement of inefficient toilets in residential households (near term, low level of effort for current direct install program modification and mid term, high level of effort for new program)

i. **Replace 1.6 gpf toilets within current residential direct installation program.** During discussions with SFPUC staff as part of this evaluation, we recommended lowering the threshold for the direct-install toilet program from 3.5 to 1.6 gpf. Shortly thereafter, in August 2023, the SFPUC implemented this recommendation within its current residential direct installation program, and an updated description about the program was quickly posted to the SFPUC website.

ii. **Consider establishing a new direct-install toilet program for residential customers after the current program expires in 2025 and evaluate feasibility of adding toilet replacements into leak repair assistance.** We recommend the SFPUC consider continuing a direct-install toilet program beyond 2025. This would allow for the program to more broadly serve residential households that had, up until August 2023, not been eligible for the program due to the 3.5 gpf replacement requirement. Direct-install programs reduce the financial barriers for upgrading a toilet, which may be especially important for low-income households. The SFPUC should also consider bundling the continuation of the direct-install program with a leak repair assistance program.

iii. **Provide an incentive for ultra-high efficiency toilets (UHETs)**. We recommend the SFPUC provide an incentive, such as a voucher or rebate, for replacing toilets using 1.6 gpf or more with a UHET using 1.0 gpf or less. This would incentivize customers who may not want to participate in a direct installation program to pursue an upgrade beyond current code requirements.

    As one example, the Metropolitan Water District of Southern California (through SoCal Water$mart) currently offers rebates starting at $40 per toilet for "premium" high efficiency toilets using 1.1 gpf or less (MWDSC nd). Their eligibility criteria states that the existing toilet

[5] The US EPA WaterSense program, a voluntary labeling program for water-efficient products, certifies toilets with a rated flush volume of 1.28 gpf or less (20% less than the Federal standard of 1.6 gpf) that meet performance standards. Many WaterSense-labeled toilets have flush volumes of 1.1 gpf or less.

must use 1.6 gpf or more. Denver Water offers residential rebates of up to $100 for exchanging one or two inefficient toilets for a 1.1 gpf or less toilet (Denver Water 2023).

Residential Landscape Incentives

In the SFPUC's retail service area, single-family irrigation area is approximately one-third that of the state average (DeOreo et al. 2011). SFPUC notes in their 2020 Retail Water Conservation Plan that many residential customers have some outdoor water use, and not all accounts have efficient outdoor use (SFPUC 2021a). To help residential customers with irrigation systems improve their landscape efficiency, the SFPUC offers water-wise evaluations and reports that include a review of the irrigation system components to identify leaks. It also provides single-family and multi-family properties of 10 or fewer units with garden spray nozzles and soil moisture meters to help improve outdoor watering practices. The SFPUC evaluated offering rebates for weather-based irrigation controllers (WBICs) for small to medium-sized landscapes (250 to 5,000 square feet) but has not yet incorporated this measure into their program offerings.

Recommendation: Target outreach for WBIC rebates to customers with inefficient outdoor water use (near to mid term, medium level of effort)

The SFPUC is considering establishing a WBIC rebate program for residential and commercial customers. We recommend the SFPUC target incentives for WBICs to customers that have inefficient outdoor water use, as identified in an irrigation evaluation or by other means. This recommendation is based on research that indicates WBICs achieve water savings for households that overirrigate but can increase usage for those customers that underirrigate or for those with irrigation systems that are not functioning properly. For example, Davis and Dukes (2015) found that homeowners in Florida with well-maintained irrigation systems who overirrigated by at least two times the monthly gross irrigation requirement were the most likely to save water.[6] The authors recommended targeting this group for WBICs and providing information on how to use the WBIC. Research by Pittenger (2004) supports educating homeowners on proper use of the controller. In a study in Utah, Evans et al. (2022) found that WBICs saved water compared to the average homeowner, but only some of them saved water relative to evapotranspiration requirements. It should be noted that these studies were not performed in San Francisco, and therefore the results may not be reflective of the impact of WBICs on outdoor water use in the SFPUC's retail service area.

Stacking Incentives: Water Conservation and Green Infrastructure

In 2023, the SFPUC's Wastewater Enterprise began piloting a new Green Infrastructure Grant program for residential customers. The goal of the program is to reduce the amount of stormwater runoff entering the sewer system and help lower customer sewer service charges. Potential green infrastructure projects eligible under the program include, for example, rain gardens, permeable pavement, and cisterns. While focused on reducing stormwater runoff, the program may provide other benefits, such as reduced outdoor water use and improved drought tolerance of the property's landscape. Grant funds can cover all project costs related to construction of the green infrastructure elements of the project, including labor. As of 2023, the pilot was only being offered in specific areas for

[6] Davis and Dukes (2015) specifically state: "Smart controllers are recommended for homeowners who average two times the monthly [gross irrigation requirement] for at least three months per year over at least three years when implemented in conjunction with relatively well-maintained irrigation systems. Water savings were guaranteed when ratios averaged more than six using the same frequency standards."

single-family homes or small apartment buildings with six or fewer units and a total lot size of 6,000 sq. ft. or less. Interested homeowners must complete an online eligibility assessment, and SFPUC staff work with eligible homeowners to review their plan and obtain bids from contractors. If the project is approved for grant funds the homeowner will be required to sign a contract with SFPUC to receive the funds, after which they can hire the contractor and secure any necessary permits. After installation, SFPUC staff inspect the installation and help train the homeowner in the ongoing maintenance requirements. The pilot program has potential for expansion to the entire SFPUC service area in future years.

Recommendation: Explicitly integrate water conservation as a goal of the Green Infrastructure Grant Program (mid term, medium level of effort)

We recommend the SFPUC's water conservation team more actively engage with their Wastewater Enterprise colleagues to identify opportunities for stacking (i.e., co-funding) incentive programs, such as for water saving devices, like cisterns, that both enterprises currently incentivize through separate programs. The benefits of stacking incentives can include both increased funding for specific measures, reduced duplicative offerings for customers, and potentially a sharing of the workload between the two groups (Diringer and Shimabuku 2021). The SFPUC's Conservation Tracking Model estimates that rain barrels and cisterns can save 302 to 887 gallons per year, respectively, for homes that replace potable water with rainwater for landscape irrigation (SFPUC 2021b).

In addition, if the Green Infrastructure Grant Program continues beyond the pilot, we recommend the program add a goal of saving water. Setting this goal would serve to motivate both program implementers and participants to explicitly incorporate water conservation infrastructure into the design and implementation of the projects and thereby increase the potential for reducing potable water use from program participants.

Residential Water Conservation Ordinance

Since 2009, the Residential Water Conservation Ordinance has required all residential property owners to repair plumbing leaks and replace inefficient plumbing fixtures at the time of sale or transfer of title, or upon major improvement. Specifically, the Ordinance requires all existing fixtures with flow rates that exceed the rates shown below be replaced with new water-efficient models that meet current California plumbing standards:

- Showerheads with a maximum flow rate over 2.5 gallons per minute (gpm) (no showers may have more than one showerhead per valve);
- Faucets and faucet aerators with a maximum flow rate over 2.2 gpm; and
- Water closets (toilets) with a maximum rated water consumption over 1.6 gpf.

The flow rates in the Ordinance, however, are higher than the current California Plumbing Code.[7]

[7] California Plumbing Code can be found at https://epubs.iapmo.org/2022/CPC/.

Recommendation: Update the Residential Water Conservation Ordinance to replace all fixtures that exceed the current California Plumbing Code (long term, high level of effort)

We recommend the SFPUC update the Residential Water Conservation Ordinance to require replacement of any fixtures that *exceed* current California Plumbing Code. This would, for example, trigger updates of toilets using 1.6 gpf to at least 1.28 gpf, a 20% savings. This recommendation is consistent with recommended updates to the Commercial Water Conservation Ordinance and could be done simultaneously. Updating these local ordinances would require extensive stakeholder engagement processes, as well as approval from the City and County board of supervisors and approval from the SFPUC Commission. The SFPUC should pursue this recommendation once they have studied the estimated remaining population of 1.6 gpf toilets and estimated savings from replacement. Before changing the ordinance, the SFPUC could lead a communication and outreach effort about the anticipated changes to the mandate.

Non-Residential Efficiency Measures

The SFPUC has a significant non-residential customer base, including office buildings, retail stores, restaurants, hotels, and manufacturing facilities. Non-residential customers comprise 25% of the retail customer base and 35% of water use (SFPUC 2021a). Further, while recent demand forecasts suggest that single-family demand will remain relatively unchanged, non-residential demand, after taking conservation into account, is projected to increase by 3.1 MGD, or 21%, by 2045.

Water use for non-residential customers is highly diverse. Water is used for many different purposes within this sector, such as for washing and sanitation, landscape irrigation, process water, and building cooling and heating. It also varies dramatically between business sectors. Figure 4, recreated from SFPUC's 2020 Retail Water Conservation Plan, shows the top non-residential water-using sectors. Hotels are the largest non-residential water user, with an average annual water use of nearly 4,500 acre-feet, nearly two times larger than Office Buildings, the next highest water user. Restaurants, Services, and Retail round out the top five highest water-use sectors.

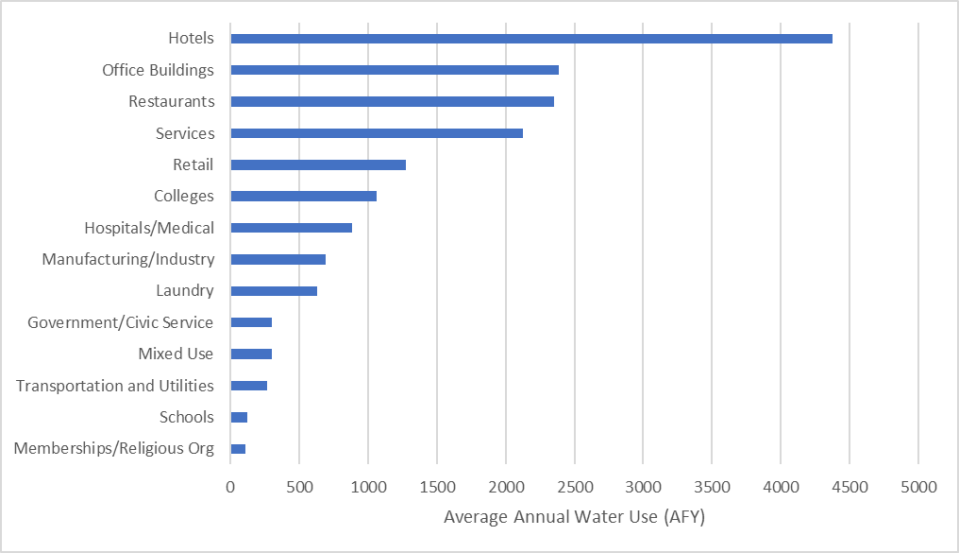

Figure 4. Non-Residential Sectors Ordered by Average Annual Water Use
Source: SFPUC 2021a

There are many ways that non-residential customers can reduce water use, reflecting the diversity of ways in which water is used inside and outside the building. Some of these are like residential water efficiency measures, such as installing efficient toilets and urinals, while others are customized for specific end uses. Studies show that non-residential sectors have significant opportunities for saving water through conservation and efficiency improvements. One study looking at overall efficiency opportunities in the non-residential sector projected water savings of 30–50% based on industry and strategy (Gleick et al. 2003). Another study documented potential water savings of 40% on adoption of water efficient strategies in offices, hotels, and restaurants, among others (Smith and Yuhas 2004).

Non-residential customers represent a large and growing share of water use within the SFPUC retail service area per the long-range demand estimates used in the SFPUC's 2020 UWMP, and studies have shown they may have significant water savings opportunities. Indeed, several of the measures identified in the 2020 Retail Water Conservation Plan as offering the most feasibly attainable potential for water savings are focused on non-residential customers. In this section, we summarize the findings of our review of the efficiency policies and programs for the non-residential sector and provide opportunities for enhancements.

Commercial Equipment Rebate Program

The commercial equipment rebate program provides rebates for non-residential customers to reduce water use through upgrades or replacement of existing indoor water-using equipment. Per the SFPUC's 2020 Conservation Plan, this program has a low cost per acre-foot of water conserved, making it, as currently structured, one of the most cost-effective assistance programs offered by the SFPUC (SFPUC 2021a). Given the cost effectiveness, it appears there is room to increase the dollar amount of rebates issued to customers. The program offers fixed rebates for six types of standardized equipment with predictable water savings, including cooling tower pH controllers, commercial laundry retrofits, and connectionless food steamers. For unique or site-specific equipment retrofits, the SFPUC offers custom rebates in the amount of $1 per hundred cubic feet (CCF) of water saved over a 10-year period, with funding capped at 50% of the project's equipment costs. Custom retrofit projects are approved on a case-by-case basis and require in-line metering for 60 days before and after the equipment is installed to verify water savings. To support program outreach, the SFPUC has established relationships with key business associations in the region, including the SF Hotel Council, Golden Gate Restaurant Association, and the Building Owners and Management Association, although ongoing engagement opportunities with some of these groups is still rebounding since the COVID-19 pandemic.

Through this program, the SFPUC approves, on average, one project a year and, as of March 2023, has completed 10 projects over the program's lifetime. Approved projects have included a diverse mix of water saving measures that provide significant water savings. For example, a commercial laundry business received a rebate of $48,905 to improve the water efficiency of their washing machines, based on a projected water savings of 35 million gallons over 10 years. Likewise, a San Francisco hotel received a rebate of $3,510 to replace a dishwashing machine with a water-efficient model, based on projected water savings over a 10-year period. The project resulted in an annual water savings of 262,000 gallons. The SFPUC provides short summaries of completed projects on their website, providing businesses with helpful, real-world examples (SFPUC 2023).

Recommendation: Provide greater flexibility, increase the incentive, and expand outreach in the Commercial Equipment Rebate program to increase participation (mid term, medium level of effort)

The Commercial Equipment Rebate program provides significant water savings opportunities for the participating customers and is highly cost effective. Yet, participation is low. Below, we provide several recommendations that may help to increase participation in the program.

i. **Increase the incentive for the custom rebate program.**
The current rebate is set at $1 per CCF of water saved over a 10-year period, with funding capped at 50% of the project's equipment costs. To increase interest in the program, we recommend the SFPUC increase the amount of the incentive. As one example, the Los Angeles Department of Water and Power currently offers an incentive of $7.00 per 1,000 gallons of water saved, not to exceed the installed cost of the project.

ii. **Consider using a vendor to help administer and market the rebate program.**
We recommend the SFPUC consider using a consultant with specific experience with commercial, industrial, and institution (CII) properties to help market and conduct outreach to potential program participants as well as to technology and service providers. In parts of Southern California, for example, technology and service providers use the rebate program as part of their marketing strategy, helping to increase program participation and ultimately save water. As the program grows, a consultant could potentially also help administer contracts if the SFPUC determined that would reduce staff burden. This relationship could be structured to leverage the skills and expertise of the consultant while still allowing the SFPUC to maintain administrative control of the program.

iii. **Provide greater flexibility for determining custom project water savings.**
The SFPUC currently requires in-line metering for 60 days before and after a measure is installed to verify custom project water savings. The in-line metering requirement is more stringent than in programs run by peer organizations; however, the 60-day monitoring period is shorter than in other programs. We recommend the SFPUC allow participants to continue to use in-line metering but also allow other ways for the customer to demonstrate water savings, such as by using meter readings. The additional flexibility could allow measures whose savings cannot be detected with in-line metering, such as toilet leak sensors, to participate in the program. However, some measurement approaches may require a longer monitoring period to ensure the accuracy of the water savings and could delay processing of the reimbursement.

The SFPUC could also consider varying both the rebate amount and payout period based on the quality of data. Participants that have higher quality data, e.g., that use in-line meters, would be eligible for a higher rebate that is paid out earlier, whereas those using less accurate methods would be eligible for a lower rebate paid out later. As one example, the Metropolitan District of Southern California varies the reimbursement for its Water Savings Incentive Program (WSIP) based on proof of water savings. The WSIP program has had success in allowing for flexibility in their program and increasing program participation (Bill McDonnell and Gary Tilkian, Metropolitan Water District of Southern California, personal communication, July 13, 2023).

iv. **Clarify that multi-family buildings are eligible to participate in the custom rebate program.** Multi-family residents comprise one-third of SFPUC's customer base (SFPUC 2021b). The SFPUC's commercial equipment rebate program is open to multi-family buildings, although this is not clearly stated on the program website. To help increase participation in the program, we recommend the SFPUC update the program website to clarify that multi-family buildings are eligible.

v. **Update the program terms and conditions to clarify that leased equipment is allowed and explain the terms of allowing leased equipment in the program.** Many businesses lease rather than purchase equipment. We recommend the SFPUC allow leased equipment to be eligible for the rebate program. This can be done on a case-by-case basis, so that the SFPUC maintains discretion on whether to approve the project based on the project lifetime, water savings, and cost. The Los Angeles Department of Water and Power, for example, expanded their commercial program to accept leased equipment on a case-by-case basis, resulting in a significant increase in program participation.

vi. **Continue generating case studies of projects funded through this program.** The SFPUC publishes short case studies of completed projects on the program website. We recommend the SFPUC continues providing these case studies. Real-world examples of projects spanning various industries that received funding are effective ways to encourage businesses to apply for and engage in the rebate program.

Targeted Outreach to High-Use Customers

There are more than 14,000 non-residential accounts within the SFPUC retail service area, and both water use and water savings opportunities can vary dramatically across these sectors. The best practice among water conservation practitioners is to use a targeted approach to obtain the greatest water savings with available resources. The 2020 Retail Water Conservation Plan recommended targeting four industries—hotels, restaurants, office buildings, and schools (SFPUC 2021, p. ES-3)—three of which represent the highest water-using sectors within the SFPUC retail service area.

Recommendation: Expand targeted outreach to water-intensive accounts (mid term, low level of effort)

While continued effort on the highest use sectors, as measured by total water use, is essential, we recommend the SFPUC expand its outreach to other water-intensive sectors. Figure 5 shows water use intensity, as measured by average annual water use per account, for 14 non-residential sectors. Hotels remain at the top of the list, using an average of 6.7 acre-feet per year (AFY) per account. Hotels are followed by Government/Civic Services (4.8 AFY per account), Colleges (4.5 AFY per account), Hospitals (2.2 AFY per account), and Laundry (1.9 AFY per account). Greater outreach efforts to these customers could result in projects with large water savings.

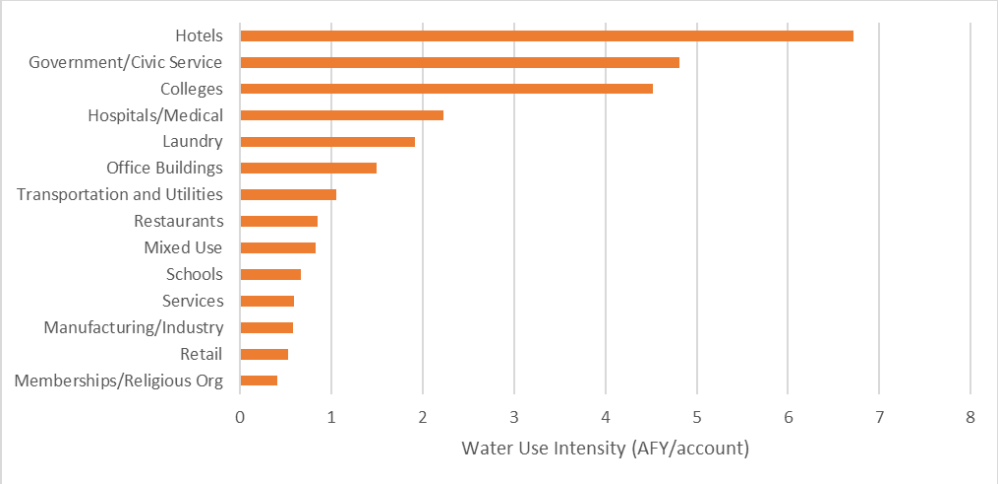

Figure 5. Non-Residential Sectors Ordered by Water Use Intensity
Data Source: SFPUC

Recommendation: Send annual notifications to high-use non-residential customers and more frequent notifications during water shortages (mid term, low to medium level of effort)

About once a year during non-drought years, and up to about quarterly during drought years, the SFPUC sends high-use notifications to the top 2% of single-family and small multi-family water users. Notifications are periodically provided to large multi-family customers. During the 2013–2017 drought, the SFPUC also conducted outreach, mainly through in-person meetings, to the top non-residential water users they weren't already working with.

We recommend the SFPUC send annual notifications to high-use non-residential customers and more frequent notifications during water shortages. This should be done for the SFPUC's largest water users, as well as the top users within each non-residential sector. High-use notifications should be combined with resources about available technical assistance and incentive programs to promote greater participation in these programs. We note that the SFPUC is currently evaluating expansion of their outreach to CII customers to meet state-mandated performance measures, which are anticipated to become effective in 2025. We recommend that changes to existing efforts be aligned with and even go beyond state requirements.

Non-Residential Landscape Incentives

The SFPUC has several policies and programs focused on advancing landscape efficiency for non-residential customers. The Large Landscape Grant Program provides funding to customers with landscapes over 10,000 square feet who implement irrigation improvements, installation of low water-use plants, and/or switch to recycled water.[8] The program offers $4 per square foot of project area (up to $1.5 million) and requires a 50% funding match. Applicants must complete multiple steps, including providing a project work plan, schedule, budget, and a site map of the proposed project area. Because this is a grant program, businesses must negotiate a grant agreement with SFPUC. Grantees must complete the project within two years of receiving the first disbursement of grant funds and provide

[8] This program is open to all customers; however, the minimum landscape size of 10,000 square feet is such that most participants are non-residential customers.

detailed monthly reports until construction is complete. Participation in this program has been low, with just 12 projects receiving funding since the program started in April 2010.

The SFPUC also offers free outdoor evaluations for non-residential customers to help identify irrigation improvements and provide plant recommendations for improving landscape efficiency. Participants may be provided free garden spray nozzles. The SFPUC evaluated offering rebates for WBICs for small to medium-sized landscapes (250 to 5,000 square feet) but has not yet incorporated this measure into its program offerings.

Additionally, SFPUC administers the Water Efficient Irrigation Ordinance, which is modeled on the state's Model Water Efficient Landscape Ordinance (MWELO). San Francisco's landscape ordinance, which was passed in 2009, requires new landscapes of at least 500 square feet to submit water budget worksheets, planting and irrigation plans, and additional project plans for final approval. The water budget worksheets effectively preclude the use of large expanses of turf in favor of low water-use plants.

Finally, new legislation requires the SFPUC to permanently ban the irrigation of non-functional turf for non-residential properties. Assembly Bill (AB) 1572 was approved by the California Legislature and signed by Governor Newsom in October 2023. The law will phase out the use of potable water for irrigation of non-functional turf on commercial, industrial, and institutional properties, and on properties of homeowners' associations, common interest developments, and community service organizations beginning in 2027.[9] Non-functional turf is defined broadly as any turf not located in a recreational use area or community space and includes street medians and parking lots. The SFPUC is currently assessing the extent of non-functional turf in its retail service area and does not yet know the potential water savings of this ban. According to the SFPUC, to date, the assessment suggests that most turf areas served by dedicated irrigation meters are functional, i.e., for playing fields, parks, cemeteries, or other areas considered special landscapes.

Recommendation: Provide additional assistance to navigate the large landscape program application process (near term, low level of effort)

The SFPUC has a dedicated staff member to guide businesses through the application process of the large landscape grant program. However, additional assistance would help to increase program participation and engagement, including, for example, simple communications materials on how to meet the eligibility requirements and clear marketing of these outreach materials on the program website and through other channels. Businesses typically don't have the in-house expertise or capacity to navigate a multi-step, administratively complicated application process, which hinders participation in the program. Providing clear assistance through the application process will help improve participation. SFPUC can also generate case studies of completed projects to encourage other customers to participate. These case studies can also be used by businesses to share their landscape improvements and sustainability commitment to their customers and networks.

[9] We note that the August 2023 draft of the proposed regulation to Make Conservation a California Way of Life includes a ban on the use of potable water for irrigating non-functional turf beginning in 2025. It is unclear how this discrepancy will be resolved and could take effect as early as 2025.

Recommendation: Expand outdoor device offerings to include WBICs and soil moisture sensors for non-residential customers (near term, medium level of effort)

We recommend the SFPUC expand outdoor device offerings to include incentives for WBICs and soil moisture sensors for non-residential customers. Research has shown that WBICs are effective in reducing water use for those that overirrigate. However, they can increase water use for those that under-irrigate their landscapes or those with irrigation systems that are not functioning properly.[10] To avoid inadvertently increasing water use, the SFPUC should require that properties undergo a Water-Wise Evaluation and target the incentives to those that overirrigate their landscapes. The SFPUC has determined that a rebate program would be the best approach to distribute these devices and is considering establishing a WBIC program in 2024–2025. We recommend this program move forward and be expanded to include soil moisture sensors.

Recommendation: Support removal of non-functional turf through design incentives and active enforcement (mid term, high level of effort)

While AB 1572 has banned the use of potable water for irrigating non-functional turf, it does not stipulate what non-functional turf should be replaced with. Without guidance and support, there is a real risk that non-functional turf will be replaced with high water-use plants or hardscape and still be watered with poorly designed irrigation systems. This underscores the need for a proactive effort to promote attractive and sustainable landscapes. To minimize this risk, we recommend that SFPUC provide incentives for sustainable landscape design for businesses required to replace non-functional turf.

As one example, Contra Costa Water District has a Landscape Design Assistance Program, available to both residential and commercial customers, that reimburses customers for a 2-hour consultation with a professional landscape designer (Contra Costa Water District n.d.). During the consultation, the designer provides general design ideas for the site and makes plant pallet recommendations. A list of approved sustainable landscape designers is provided to customers, who must complete a turf conversion project to be eligible for reimbursement for the design.

Additionally, the SFPUC will need to play an active role in seeking compliance with a ban on irrigation of non-functional turf with potable water. Unlike with San Francisco's Water Efficient Irrigation Ordinance, which is triggered by the installation of a new landscape or major renovation, there is no obvious trigger for this ban. This will require the SFPUC to be proactive in reaching out to affected customers to educate them about the ban and provide assistance to support compliance. Continued refinement of the SFPUC's in-progress mapping of non-functional turf throughout the SFPUC retail service area could also provide a mechanism for conducting outreach to affected customers and evaluating progress on implementing this ban.

[10] It should be noted that these studies were not performed in San Francisco and were not performed for the CII sector and therefore, the results may not be reflective of the impact of WBICs on outdoor water use in the SFPUC's retail service area and with CII customers.

Business Recognition Programs

In addition to physical and regulatory risk around water management, businesses are highly motivated by reputational drivers. Being able to demonstrate a commitment to sustainability can help motivate businesses to invest in sustainability strategies, including water efficiency. The San Francisco Green Business Program is a recognition program for businesses, non-profit organizations, and institutions. It connects businesses to sustainability resources offered by San Francisco public agencies, including rebates and other incentives. The program has three levels of recognition for green businesses: an Entry-Level Efficiency level for those implementing basic environmental management practices; a Certified level for those meeting high business standards; and an Innovator level for those that are leaders in their field. The program was established by city ordinance as a partnership between the SFPUC, the San Francisco Department of Public Health, and the San Francisco Environment Department, and is part of the larger California Green Business Network. San Francisco Environment Department handles the program administration, and SFPUC Water and Wastewater Enterprises provide funding and staff support.

Recommendation: Feature water savings more prominently in the San Francisco Green Business Program (near term, low level of effort)

We recommend the SFPUC continue working with San Francisco Environment Department to more prominently feature water savings in the San Francisco Green Business Program. Specific improvements include featuring water as a key focus area on the program website and highlighting water-centric case studies. There could also be a prominent link to the SFPUC conservation and efficiency programs for businesses, and the Green Business Program could be featured on the SFPUC website. Together, these changes would encourage businesses to participate in SFPUC technical assistance and incentive programs and inspire other businesses to do the same.

Commercial Water Conservation Ordinance

Since 2017, the Commercial Water Conservation Ordinance has required all commercial building owners to repair plumbing leaks and replace inefficient plumbing fixtures. Specifically, as of 2017, the Ordinance requires all existing fixtures with flow rates that exceed the rates shown below be replaced with new water-efficient models that meet current California plumbing standards:

- Showerheads with a maximum flow rate over 2.5 gpm (no showers may have more than one showerhead per valve);
- Faucets and faucet aerators with a maximum flow rate over 2.2 gpm; and
- Water closets (toilets) with a maximum rated water consumption over 1.6 gpf.

To help customers comply with this ordinance, the SFPUC conducted extensive outreach with the Department of Building Inspection and, until 2017, offered free toilet and urinal replacements and rebates. Since 2017, the SFPUC has continued to offer free phone consultations, evaluations, and devices, including faucets and showerheads, as well as rebates for commercial washers and equipment. These efforts have supported the replacement of inefficient devices; however, there remain opportunities to expand replacement of inefficient fixtures.

Recommendation: Update the Commercial Water Conservation Ordinance to require replacement of fixtures that exceed current CA standards (long term, high level of effort)

We recommend the SFPUC update the Commercial Water Conservation Ordinance to require replacement of any fixtures that *exceed* current California plumbing code. This would, for example, trigger updates of toilets using 1.6 gpf to at least 1.28 gpf, a 20% savings. Before updating the Commercial Ordinance, we recommend the SFPUC evaluate the remaining population of CII toilets using 1.6 gpf, and the potential water and cost savings of replacing these with 1.28 gpf toilets. This recommendation is consistent with recommended updates to the Residential Water Conservation Ordinance and could be done simultaneously.

Water Management Tools

For many water suppliers, until recently, customers obtained information about their water use on their bills—which were sent out monthly or even less frequently and often used units most didn't understand, e.g., hundred cubic feet. Today, there are a growing number of tools available to provide near real-time information for customers to better understand and manage their water use. The SFPUC has been a leader on this front and, since 2014, has provided an online water use portal to help customers to manage their water use, as well as monthly water bills, and a leak notification program. In this section, we offer recommendations for strategies to further enhance the effectiveness of these tools.

Customer Leak Program

Customer leaks can represent a significant use of water, and new technologies can help water utilities and customers to identify them more quickly. Nearly 99% of SFPUC retail customers residing in San Francisco are in the Advanced Metering Infrastructure (AMI) system, and the SFPUC began implementing a leak notification system using AMI in 2015. Leak notifications were initially sent weekly via postcards; however, an automated leak alert system was implemented in 2017 (Alliance for Water Efficiency 2023). Currently, notification thresholds are defined as follows:

- Single-family residential and small multi-family residential (2-5 units): 1 cubic foot, or about 7.48 gallons, per hour for a minimum of 48 hours;
- Irrigation customers: 1 cubic foot, or about 7.48 gallons, per hour for a minimum of 48 hours;
- Large multi-family residential: 1 cubic foot, or about 7.48 gallons, per hour for a minimum of 72 hours plus changes in nighttime consumption; and
- Commercial customers: 1 cubic foot, or about 7.48 gallons, per hour for a minimum of 72 hours plus changes in nighttime consumption.

When an alert is triggered, the account holder, property owner, and occupant (if not the same as the owner) receive an email, text message, and recorded phone message (if contact information is available), as well as a mailed letter. Notifications are sent in English, Spanish, Chinese, and Tagalog. In fiscal year 2021–2022, the SFPUC issued 14,000 leak alerts to single family, multi-family, commercial, and irrigation customers (SFPUC 2022). The SFPUC offers free simple repairs for leaks detected during conservation evaluations and a high bill adjustment for repairing leaks, though the information provided to customers about the adjustment is difficult to understand. While SFPUC has a robust customer leak program, we offer several recommendations for further enhancements.

Recommendation: Expand leak repair assistance program (near term, low level of effort for messaging improvements; mid term, high level of effort for direct assistance program)

The SFPUC offers simple repairs at no cost for leaks detected during a conservation evaluation and adjusts bills for customers that repair continuous leaks. We recommend the SFPUC better communicate the leak repair assistance available using clear and compelling messages, including for high bill adjustments. We also recommend the SFPUC consider offering additional direct incentives to help accelerate repairs inside and outside the building. Additional leak repair assistance could be bundled with the toilet direct installation program, should that program continue beyond 2025, to help reduce the administrative burden of increasing program offerings. Such a program would be especially helpful for those unable to afford repairs. While open to all customers with a demonstrated leak, the program can be targeted to customers that do not repair the leak after receiving a leak notification.

A growing number of utilities offer leak repair assistance, and these programs can serve as a model for the SFPUC. For example, the City of Sacramento offers a leak repair rebate to reimburse homeowners or tenants of single-family and small multi-family homes for fixing a verified continuous leak. Rebates of up to $500 are available for any leak detection services needed and repair costs, including materials and labor for a licensed plumber (City of Sacramento n.d.). Additionally, under the City of Sacramento's Leak-Free Sacramento program, a city-approved contractor evaluates and repairs indoor and outdoor leaks at no cost for low-income and single-family residential homeowners in disadvantaged areas (City of Sacramento n.d.). The City of Portland uses a different model to assist its customers, working with community partners and local plumbers to offer free leak repair for continuous and intermittent leaks, including for underground pipes, for income-qualified homeowners. Portland prioritizes the limited program funds to customers with the largest leaks and those without water due to a leak (City of Portland n.d.).

Recommendation: Pilot leak detection innovations (mid term, medium level of effort)

Water use patterns for large multi-family residential and commercial customers are complex, and the SFPUC has recently developed an innovative leak detection approach for these customers. To further enhance the leak program, we recommend the SFPUC pilot innovations like artificial intelligence (AI) to identify leaks for large multi-family and commercial customers. The pilot could be done after reviewing one to two years of data from the existing program.

Recommendation: Evaluate installation of more sensitive water meters (long term, high level of effort)

The SFPUC's threshold for triggering alerts is 7.5 gallons per hour, equivalent to 180 gallons per day. This threshold is higher than for some utilities, e.g., the City of Sacramento's threshold is 5 gallons per hour. However, the SFPUC's current volumetric threshold is based on the sensitivity of meters installed throughout its service area. More sensitive meters would allow for a lower alert threshold and greater opportunity for leak identification. However, replacing existing meters before the end of their useful life for this purpose would not be cost effective, and we recommend the SFPUC evaluate installing more sensitive meters when the current stock of meters is replaced.

Customer Online Water Use Portal

The SFPUC offers an online web portal, My Account, where residential and non-residential customers can view their bills, perform account services, and view and download hourly, daily, weekly, and monthly water use. Residential customers can also compare household water use to the previous year and with the SFPUC's goal to keep residential use under 50 gpcd. Since its launch in 2014, registration has reached nearly 97,500 users (SFPUC 2022).

Recommendation: Enhance functionality of the My Account online portal (near term, low level of effort to lower the water use goal; mid term, high level of effort to change platforms)

We recommend the SFPUC enhance the functionality of the My Account online portal. For residential customers, this includes lowering the per capita water use goal from 50 to 45 gpcd and allowing customers to easily compare their water usage with the average and most efficient households. Figure 6 provides a screenshot of an online water report showing the customer's household water usage over a two-year period, along with that of an average and most efficient household in the agency's service area.[11] The portal could also be expanded to allow all customers to set custom automatic high-use alerts when their usage exceeds some threshold, e.g., two times average seasonal water use.

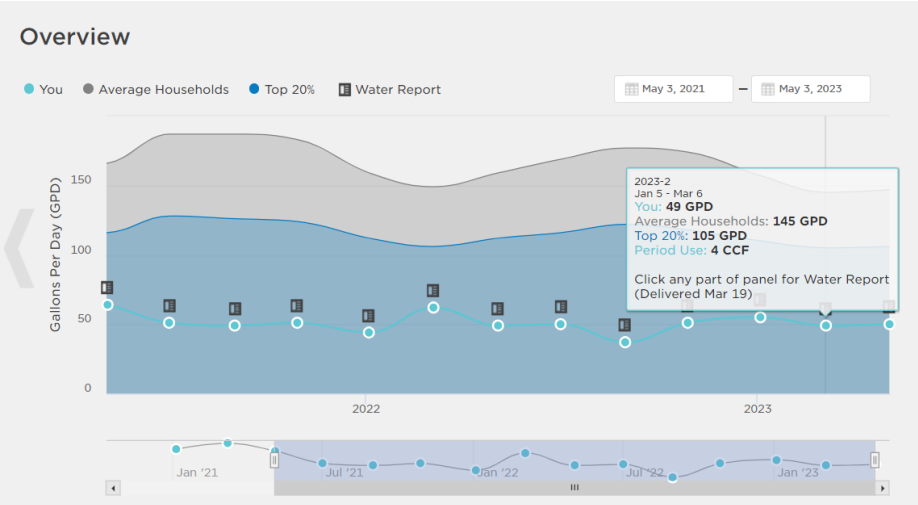

Figure 6. Online Portal Comparing Customer Usage with the Average and Most Efficient Households

Marketing and Outreach

The SFPUC offers its customers a wide array of efficiency programs. These programs are typically marketed via the SFPUC website, social media channels, electronic and print newsletters, bill inserts, and communications with customers directly or through a third-party, e.g., a business association. However, program offerings can be hard to find on the website and are sometimes spread across multiple webpages. Additionally, program descriptions on the website and in direct communications are comprehensive but may contain too much detail for most customers.

[11] In the figure, top 20% refers to the 20% of households with the most efficient water use, i.e., those households with the lowest per capita water usage.

Recommendation: Engage marketing and outreach experts to develop a robust, strategic communications and outreach strategy and marketing materials (near term, medium level of effort)

We recommend the SFPUC engage marketing and outreach experts to enhance its ongoing communications and outreach strategy, along with marketing materials that use clear and compelling messages targeted to key audiences. This will help to reduce confusion and/or complexity surrounding program offerings and enrollment processes, promoting increased awareness of and action to improve water stewardship in San Francisco, and greater participation in the SFPUC's existing programs.

Alternative Water Supplies

Alternative water supplies comprise approximately 3.5% of the SFPUC's retail water supply portfolio. With current and anticipated projects, this proportion is expected to increase to approximately 11.3% by 2045 (SFPUC 2021b; 2021a). This increase is attributed primarily to four sources: (1) expansion of the existing recycled water system to serve additional non-potable demands on the west side of the retail service area, (2) active on-site water reuse projects that are expected to come online by the year 2045, and (3) initiation and expansion of the SFPUC's PureWaterSF program to deliver and blend purified water into the retail potable water distribution system, and (4) groundwater. Beyond these programs, the SFPUC also continually explores opportunities for stormwater capture and use to further make use of recycled/purified water supplies, and we recommend continuing these efforts. While most opportunities for enhancement have already been addressed or are in progress, a few opportunities remain to improve alternative water supply use for retail customers.

Recommendation: Lower threshold for water Budget Calculator submittal to developments greater than 10,000 square feet (mid term, medium level of effort)

We recommend the SFPUC reduce the threshold for requiring water budget calculations to 10,000 gross square feet. The current Non-potable Water Ordinance, most recently amended in 2021, requires developments over 100,000 gross square feet to install an onsite water reuse system. New developments of 40,000 gross square feet or more are required to submit water budget calculations that assess on-site water reuse potential. The water budget calculations provide an opportunity for developments that are not subject to the mandatory water reuse requirements to evaluate their site's potential for on-site water reuse, with the potential for voluntary adoption. While these developments would not be required to adopt on-site water reuse, they may still present cost-effective opportunities for water demand reductions.

Based on the most recent Development Pipeline Report developed by San Francisco Planning Department staff, reducing the water budget calculations threshold to 10,000 square feet would nearly double the number of developments being reviewed for on-site water reuse adoption potential (from 73 to 131, based on Q1 2023 data). These submittals would place additional burdens on both staff and developers. However, they would inform future updates to the Non-potable Water Ordinance and provide a targeted outreach mechanism to project developments that might not otherwise consider onsite reuse.

Innovative Water Management Strategies

The SFPUC promotes the exploration of new ways to conserve water, recover resources, and diversify its water supply. As one example of its leadership, it was the first utility in the nation to provide incentives for—and ultimately require—onsite water reuse systems in new, large developments. The SFPUC

regularly vets and evaluates advanced technologies for the potential to reduce residential and commercial water use and is currently examining the public health risks of recirculating showers and clothes washers and graywater systems in single-family homes. Additionally, through its Innovations Program, the SFPUC has examined several innovative efforts, including atmospheric water generation using renewable energy and onsite reuse of process water at breweries.

Recommendation: Continue investigating devices potentially eligible for incentives (near term, high level of effort)

We recommend the SFPUC continue its practice of evaluating new technologies and assess the feasibility of integrating those technologies proven to be safe and effective into its incentive programs. We commend the SFPUC for its ongoing evaluation of advanced technologies for the potential to reduce residential and commercial water use. In addition to technologies already being studied, there are a variety of available technologies—such as flow meters, leak sensors, and integrated toilet-sink devices that use graywater from an attached bathroom faucet for toilet flushing—that offer additional water savings opportunities. Moreover, intensifying water scarcity around the world is likely to prompt new technologies and approaches.

Recommendation: Expand the Innovations Program (near term, low to medium level of effort)

We recommend the SFPUC expand its existing Innovations Program by taking a proactive approach to solicit innovative ideas and strategies for conserving water and diversifying its water supply. As one example, Metropolitan Water District of Southern California's Innovation Conservation Program (ICP) provides grant funding for research on the water savings and reliability of innovative water savings devices, technologies, and strategies. Through the ICP, which was launched in 2001, Metropolitan issues an RFP every two years to solicit proposals for pilot and demonstration projects from government agencies, academic institutions, businesses, non-profit organizations, and entrepreneurs. To be eligible, projects must be completed within one year and be relevant to the funding partners' service area. In 2022, a total of $275,000 was awarded for six projects.[12] The ICP is currently funded by Metropolitan and Southern California Gas Company, but past funding partners have included the US Bureau of Reclamation, the US Environmental Protection Agency, Southern Nevada Water Authority, and Western Resource Advocates.

There are several options for expanding the Innovation Program. The SFPUC could, for example, develop and operate a stand-alone program. Another option would be to partner on a regional program with other entities in the San Francisco Bay Area, such as other water supply utilities, the Bay Area Water Supply and Conservation Agency, and Pacific Gas and Electric, to leverage additional resources for a larger program. A third option would be to partner directly with Metropolitan to expand their program, leveraging resources across the state.

Demand Forecasts

As part of the development of the 2020 UWMP, the SFPUC commissioned Brattle Group to develop a water demand forecasting model to project retail area water demands over the 2045 planning horizon. The forecasting model uses an econometric approach to project account-level water use for existing

[12] Final reports for past ICP projects can be found at https://www.bewaterwise.com/icp-projects.html. Grant recipients for 2022 can be found at https://www.bewaterwise.com/documents/2022-ICP-Recipients.pdf.

residential and commercial customers, accounting for historical responses in demand to weather and marginal water rates. The model also controls for the influence of previously implemented water conservation policy and effects from the COVID-19 pandemic. Additional water demands from growth are assumed to match average demand patterns of existing customers and added to projected demands for existing customers.

The SFPUC staff has also separately projected water savings from future active (e.g., conservation programs) and passive (e.g., natural replacement of less efficient plumbing fixtures with more efficient models) conservation efforts. These active conservation savings are then subtracted from demand forecast outputs to obtain final projected water demands (passive conservation savings are implicitly accounted for within the econometric model specification, though they are not explicitly estimated within the model). An in-depth explanation of demand forecast model development, calibration, and results can be found in Appendix E of the 2020 UWMP. Based on our review of the model documentation and results, and through discussion with SFPUC staff, we offer several recommendations for improving the demand forecasts, all of which could be implemented in the near term, as the SFPUC is updating its water demand forecasts for its 2025 UWMP.

Recommendation: Seek third-party review of water demand forecasting and conservation model methodologies (near term, high level of effort)

In previous demand forecasting efforts, the SFPUC has used an end-use based modeling approach which requires assumptions of fixture efficiency, rates of use, and household occupancy to project customer water demands. This approach was changed for the 2020 update of the UWMP, and the SFPUC now uses an econometric modeling approach, which can require fewer assumptions and incorporates historical water use data to project water demands with statistical rigor. The increasing use of econometric models for long-term demand forecasting is a trend seen nationwide, though the approach is not without its limitations. The econometric approach requires extensive knowledge of model specification (i.e., input and output variables selected and the assumed relationships between them) and can produce erroneous demand forecasts if methodological best practices are not followed. We recommend the SFPUC solicit a third party to review the demand forecasting model assumptions, input data, and model specification to ensure forecast accuracy and adherence to best practices within the water demand forecasting industry. The following areas were identified for evaluation:

i. **Review forecast model specification for adherence to methodological best practices.**
In our review of the demand forecast model documentation, we identified the potential for inappropriate model specification. Specifically, the direct inclusion of marginal water rates in econometric models for water providers with tiered rate structures can introduce issues of endogeneity and/or serial correlation due to the possibility of dependency of effective marginal water rates on previous month water use (House-Peters and Chang 2011). The effective marginal water rate paid by the customer is determined by their monthly consumption, but marginal water rate also provides a price signal that influences monthly consumption. This results in circular dependence between rate and consumption that cannot be accurately estimated within the econometric model (which requires a one-way relationship of influence from independent to dependent variable). other In words, the direct inclusion of marginal water rate as an explanatory variable can cause biased estimates of model coefficients if ignored, which in turn affect projected water demand volumes. This issue is typically resolved using an

instrumental variable (IV) that is strongly correlated with the input variable in question (marginal water rate) but satisfies the condition of one-way influence on the dependent variable. A third-party review of the demand forecasting model can inform the selection of an appropriate IV.

ii. **Explore opportunities to further disaggregate commercial customer water demand by land use or CII category**.

The current forecasting model incorporates commercial customer land use as a classification category only in terms of responses to COVID-19 and water rates. However, evidence suggests that water demands can vary across commercial customer types/land uses and should be accounted for when projecting commercial water demands (Kiefer, Krentz, and Dziegielewski 2015; Fedak et al. 2019; Morales and Heaney 2014). Moreover, the state's proposed Rulemaking to Make Conservation a California Way of Life would require water suppliers to use a standard CII customer classification taxonomy. The SFPUC can use its previously collected land use data and CII customer categorization to proactively meet this requirement, while also improving its CII demand forecasts, by including the CII customer category as an explicit variable within their demand forecast model specification. Currently, the CII forecast accounts for the influence of CII customer category with respect to differences in customer response to changes in marginal price and effects of the COVID-19 pandemic (i.e., varying slopes). However, CII customer category can also be included as a "fixed effect," similar to how individual customer accounts are currently treated within the model, to examine difference in "baseline" per account consumption across CII customer categories (i.e. varying intercepts). Differences in this "baseline" consumption could reveal or provide rigorous evidence for major unexplained differences between CII customer categories and help direct additional outreach efforts targeted to specific industries.

iii. **Assess alternate model specifications (i.e., terms within regression model) and data transformations used to improve model fit.**

The distribution of residential account-level water use tends to follow a non-Gaussian distribution, as shown in Figure 3. This phenomenon can introduce statistical inference errors if not accounted for in model specification (e.g., transformation of data to obtain normally distributed residuals, use of generalized linear models over ordinary least squares, etc.). The documentation of the demand forecasting model provided in the 2020 UWMP does not mention if any data transformations were applied to improve model fit; this should be confirmed and rectified, if applicable. For example, Appendix G of the 2020 UWMP mentions a "trend term" in the forecast model specification meant to capture passive conservation savings over time; however, no such term is presented in the model description in Appendix E.

iv. **Validate passive conservation savings in demand forecast.**

In the current econometric demand forecast, passive conservations savings (e.g., water savings from natural replacement of fixtures, more stringent plumbing code requirements over time, and changes in water use behavior) are implicitly accounted for within historical water consumption data. The SFPUC also separately estimates passive savings using its conservation forecast model, a customized version of the Alliance for Water Efficiency Tracking model. During our review of the methods to estimate passive conservation, we found that current estimated

saturation rates of plumbing fixtures were informed by empirical studies for nearby water suppliers EBMUD and Valley Water. Each of these studies, cited in Appendix A of the SFPUC 2020 Retail Water Conservation Plan, use data that are relatively old and likely out-of-date for the area. We recommend that the current econometric model be adapted to explicitly estimate historical passive conservation over time through the inclusion of an additional time-related explanatory variable to estimate observed changes in water demand as a function of time.

Before committing the resources to updating these assumptions, the SFPUC should review whether there are additional recent, industry-accepted data sources on fixture saturation rates to consult in updating its conservation model for the 2025 Retail Conservation Plan, and compare updated estimates of historical passive conservation savings to the passive conservation savings estimated by the demand forecasting model. If the difference between savings estimates is relatively large and/or increases demand forecast uncertainty in future years, a data collection effort to update these assumptions would be warranted.

Additionally, a sensitivity analysis of active conservation savings estimated with the Alliance for Water Efficiency (AWE) Tracking Model should be completed to better characterize the level of uncertainty in projected active conservation savings and the resulting impact of this uncertainty on projected water demands.

Recommendation: Explore a wider range of growth scenarios in demand forecasts (near term, medium level of effort)

The conception and selection of scenarios in water demand forecasting represents conditional dependencies of outcomes on assumptions about future conditions (Kiefer, Jones, and Dziegielewski, 2022). Scenarios can be defined independently of forecasting model structure/framework and integrated into the model to present multiple "alternate futures" to inform decision-making and characterize the level of uncertainty of forecasted demands. This approach to uncertainty differs from stochastic models, which can produce many possible outcomes by adjusting model inputs in a probabilistic fashion. While either approach can be suitable, the former can be used to reflect a discrete set of pathways determined exogenously, while the latter can be used to examine emergent trends not readily apparent in pre-selected scenarios (Donkor et al. 2014).

Some motivations for a scenario-based approach to water demand forecasting can include sensitivity analysis of critical model assumptions, incorporation of multiple climate change impact scenarios, alternative demographic scenarios, and effects of policy changes. The SFPUC already incorporates some level of scenario-based planning via anticipated impacts of conservation, demographics, water rates, and climate change, and additional scenario selection can be informed via implementation of other demand forecasting recommendations from this report. Examples of additional scenarios for consideration include:

1. Implementation of new water conservation policies at the local, state, and federal levels (e.g., non-functional turf restrictions, increased participation in incentive programs, changes to plumbing codes, etc.). Assessing such scenarios could require additional analysis outside of the econometric forecasting model, with the results incorporated in the baseline demand forecast, similar to how active conservation savings are currently incorporated.

2. Implementation of housing and urban planning policies that could alter the current makeup of the customer base.

3. Changes in water use patterns/rates related to shifts in the proportions of customer "archetypes" (e.g., "high water use" residential accounts, CII industry makeup and occupancy, etc.).

We recommend the SFPUC incorporate additional scenarios to reflect major sources of uncertainty expected through the 2045 planning horizon. For example, according to data reported by the City of San Francisco, occupancy rates in commercial office buildings were heavily impacted by the COVID-19 pandemic, and recovery has been slow to return to pre-COVID-19 levels (current estimates are 40% of pre-COVID-19 weekly average office attendance as of July 2023). This trend likely impacts commercial sector water demands and should be incorporated as a water demand forecast scenario to better understand the potential range of water demands to be met. A similar scenario for residential population growth should also be explored, to better understand the anticipated impacts of housing construction delays (and booms) on residential retail water demands.

Another example scenario could include customer segmentation into "archetypes" with different patterns/rates of water use, producing alternative forecasts that reflect changes in the proportion of these customer archetypes and resulting changes to water demands. The City of Phoenix, for example, has combined end-use and customer segmentation to define multiple possible scenarios of future customer make up and resulting demand forecasts for the CII sector (Frost et al. 2016). While the selection of scenarios of interest is ultimately a decision for the SFPUC, the resources discussed here can inform discussions among SFPUC staff to identify and prioritize which future conditions should be considered and implemented within the existing demand forecasting framework. Additional model improvements that could inform the development and selection of scenarios are summarized below.

i. **Further disaggregate water demand forecasts.**
SFPUC uses account-level data to forecast water demand. The account-level data could allow for disaggregation of future water demands by end-use for the residential sector because end-use breakdowns of water demand are well characterized. Using either assumptions informed by literature or analysis of existing customer water consumption data, approximate proportions of residential water use by end-use can be estimated to inform remaining potential for water demand reductions at a finer resolution than currently presented in the 2020 UWMP. Examination of demand reduction at the end-use level can also help quantify the uncertainty in potential water demands and savings into the future for planning purposes.

While the residential sector is relatively well-studied, end-use disaggregation of water demands for the commercial sector is less understood and is much more difficult to accurately estimate. However, disaggregation of commercial water accounts by sector/industry/land use can reveal differences in water use rates across commercial customer types and can improve model accuracy (Kiefer, Krentz, and Dziegielewski 2015; Fedak et al. 2019; Morales and Heaney 2014). Commercial customer classification based on land use is already used within the SFPUC's demand forecasting model and could be used to further classify commercial customers' water demands for forecasting purposes.

ii. Validate and expand utility-side water loss projections and methods.

In the 2020 UWMP, utility-side water loss (i.e., non-revenue water) is assumed to remain near current levels (approx. 6 MGD) through the 2045 planning horizon (SFPUC 2021b). This assumption of near-constant water loss in the future is valid if minimal changes to operating pressure, number of connections, and miles of transmission/distribution pipeline are expected, which should be validated with each update of the UWMP. Based on data provided in Appendix F of the UWMP, the SFPUC reports an Infrastructure Leakage Index (ILI) value of 2.34. This value is much lower than the most recent national average estimate of 3.3, indicating that SFPUC is already a top performer in the industry. However, additional savings from further reductions in water loss volumes should be investigated.

While the SFPUC does not currently have a water loss reduction requirement assigned by the California State Water Board, we recommend that the SFPUC explore opportunities to go beyond state standards/national averages to determine what water loss performance targets are technically feasible.

V. Summary and Conclusions

The SFPUC has demonstrated a longstanding commitment to water conservation and efficiency and manages a portfolio of local water supply projects and programs, such as onsite water reuse, non-potable recycled water, and groundwater. Together, these efforts have supported water supply reliability, especially during recent droughts, and enhanced San Francisco's resilience to climate change and other shocks and stresses. Climate change and regulatory uncertainties are prompting the SFPUC to examine new technologies, practices, and programs that can help further extend and augment dry year supplies. The Pacific Institute conducted a review of the SFPUC's water efficiency and local supply programs and related policies and provided recommendations for updating and/or expanding these programs and policies to secure additional water savings, especially in dry years.

Overall, we conclude that the SFPUC offers a robust portfolio of policies and programs to support water efficiency and alternative water supplies, and these efforts have achieved significant reductions in potable water demand. We offer a high-level summary of our findings and recommendations:

- On average, residential water use is among the lowest in California due, in part, to the SFPUC's water efficiency policies and programs. Some use far more water than the average and focused effort on a larger proportion of these customers would provide the greatest water savings opportunities. Further, enhancements to existing incentive programs, careful application of future incentives, collaborative programming on green infrastructure, and updates to the Residential Water Conservation Ordinance would help to realize additional savings.

- Non-residential sectors represent a large and growing percentage of water use within the SFPUC retail service area. Participation in the SFPUC 's existing commercial equipment rebate program has been low, though participation has been higher in other available programs. There are additional opportunities to expand outreach to high-use sectors and accounts, and increase participation in existing programs by increasing incentive levels, offering greater flexibility, and using a third-party vendor. Additionally, implementation of new regulations—including those related to the proposed Rulemaking to Make Conservation a California Way of Life—will require additional efforts focused on non-residential sectors.

- There are a growing number of tools available to help customers better understand and manage their water use. The SFPUC has been a leader in adopting these tools, including advanced metering infrastructure and a novel approach for identifying leaks in large multi-family and commercial customers. Improving the functionality of the online portal, providing leak repair incentives, and improving the sensitivity of meters offer additional opportunities for enhancing the effectiveness of existing water management tools.

- The SFPUC offers a wide array of efficiency programs. Awareness of and participation in these programs could be increased by engaging marketing and outreach experts to develop an ongoing communications and outreach strategy and marketing materials that use clear and compelling messages targeted to key audiences.

- The SFPUC has established several projects to make use of alternative water sources, including onsite reuse, recycled water, and groundwater. The onsite reuse program is one of, if not the most, advanced in the country, yet additional water savings might be possible through voluntary adoption of onsite reuse systems for buildings not currently required to implement them. Other existing efforts to assess the feasibility and benefits of alternative water supply strategies should continue.

- The SFPUC has demonstrated its commitment to evaluating innovative ways to conserve water and diversify its water supply and promoting those deemed safe and effective. Continued evaluation within the SFPUC, along with participation in a grant program to support innovative research, would further enhance this commitment.

- Several opportunities for improvements to demand forecasts can be implemented in the near term, as SFPUC begins updating its UWMP for 2025. Third-party review of the existing model can validate the underlying assumptions that drive projected demands and improve model accuracy. Additionally, a scenario-based approach to explore multiple population/employment growth projections can help the SFPUC assess the uncertainty of their demand forecast and plan for deviations from a “business as usual” scenario.

We identified 26 recommendations for adjustments to the SFPUC’s programs and policies for water efficiency and local water supply portfolio to further enhance these offerings. Appendix A provides these recommendations, along with the estimated potential level of effort required, timeframe for implementation, and rationale. Some of these recommendations may represent relatively minor changes to existing programs while others would require a new program or policy and/or engagement with other departments or divisions within the SFPUC.

Additional evaluation, including of the potential water savings, feasibility, and cost, is needed to determine which of these to pursue and how to prioritize among them. We note, however, that the water savings from some recommendations may be difficult to quantify because of lack of verified studies and data or because they depend on assumed levels of participation and resources available. Additionally, some may offer lower water savings but provide additional co-benefits that could make them worthwhile to pursue. Some of these, such as customer energy savings, are quantifiable benefits, whereas others, such as improving customer satisfaction and fostering trust, represent benefits difficult to quantify in terms of water savings.

Finally, additional resources, including staff, will be required to effectively implement these recommendations. In 2024, SFPUC will launch its 2025 Retail Conservation Plan, providing an opportunity to evaluate and integrate these recommendations and considerations into planning and budgeting processes.

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VII. Appendix A: Summary of Recommendations

Category or Sector	Recommendation	Time Frame for Implementation	Implementation Level of Effort	Rationale
Residential	Expand high-use alerts and direct messages to a larger group of residential households	Near term	Low	A larger group of households than those currently targeted for high-use alerts (which has generally been the top two percent) may be good candidates for additional assistance with saving water. This recommendation is focused on expanding the existing outreach program to include a larger number of customers, up to the 20th percentile. Messaging can be tailord and targeted to continue high-use alerts to the top two percent while others within the top 10th and 20th percentiles may benefit from direct mailers and other forms of outreach that focus on core conservation services withou using the "high-use" or "top user" designation. This recommendation would require relatively low effort to implement and could be implemented in the near term.
Residential	Expand programs that support replacement of inefficient toilets in residential households.	Near term (for current direct install program modification), Mid term (for new program)	Low (for current direct-install program modification), High (for new program)	See individual recommendations related to replacment of inefficient toilets in residential households, below.
Residential	Replace 1.6 gpf toilets within current residential direct installation program.	Implemented August 2023	Low	The SFPUC estimated 14% of single-family and 13% of multi-family households will still have 1.6 gpf or higher toilets in 2025. Replacing these toilets with 1.0 gpf (or lower) represents an opportunity to increase water savings from the SFPUC's current residential direct-install program. This recomendation was implmented in August 2023.
Residential	Consider establishing a new direct-install toilet program for residential customers after the current program expires in 2025 and evaluate feasibility of adding toilet replacements into leak repair assistance.	Mid term	High	A new direct-install toilet program will allow residential households that, up until August 2023, had not been eligible for the program due to the 3.5 gpf replacment requirement. Direct-install programs help reduce the finanical barriers for upgrading a toilet, which may be especially important for low-income households. The SFPUC should also consider adding toilet replacements into leak repair assistance to streamline this assistance offering. All new programs require a vote by the Commission and therefore, this recommendation is for the mid-term and requires a high level of effort.
Residential	Provide an incentive for ultra-high efficiency toilets (UHETs)	Mid term	High	A voucher or rebate can help further incetivize residential customers to replace 1.6 gpf or higher toilets with new, UHET (1.0 gpf or lower) toilets. This will help incentivize customers who may not want to participat in a direct-install program. All new programs require a vote by the Commission and therefore, this recommendation is for the mid-term and requires a high level of effort.
Residential	Target outreach for WBIC rebates to customers with inefficient outdoor water use	Near to mid term	Medium	Research indicates that weather-based irrigation controllers achieve water savings for households that historically have had inefficient outdoor water use (i.e. using more water than is requiremd based on irrigation demand) and a well maintained irrigation system, but for those who historically have watered efficiently and/or have a poorly functioning irrigation system, weather-based irrigation controllers can cause water use to increase. This recommendation is focused, therefore, on targeting households with inefficient outdoor water use and a properly functioning irrigation system once the SFPUC has established a weather-based irrigation controllers rebate program. This recommendation is contingent on the SFPUC establishing a weather-based irrigation controllers rebate program and therefore may occur in the near or mid-term and requires a medium level of effort.
Residential	Explicitly integrate water conservation as a goal of the Green Infrastrucutre Grant Program	Mid term	Medium	Green infrastructure measures, such as rain barrels and cisterns, can help reduce stormwater runoff *and* achieve water savings by capturing rainwater for use for landscape irrigation. If the pilot program is renewed and expanded, setting water conservation as a goal of the program will help to motivate both program implementers and participants to explicityly incorproate water conservation infrastructure into the design and implementation of projects. This recommendation will require engagment and buy-in from Wastewater Enterprise colleagues as well as coordination across teams, and thefore will require a medium level of effort to implement and be implemented in the mid term.
Residential	Update the Residential Water Conservation Ordiance to repalce all fixtures that exeed the current California Plumbing Code	Long term	High	The current ordinance was written to be aligned with SB 407 and has flow rates that are now out of date and above the current California Plumbing Code. Revising this ordinance would require an extensive stakeholder engagement process as well as approval from the City and County board supervisors and approval from SFPUC Commission, therefore this recommendation requires a high level of effort and implementation in the long term. The SFPUC should purse this recommendation once they estimate the remaining population of 1.6 gpf toilets and water savings from replacment.

Category or Sector	Recommendation	Time Frame for Implementation	Implementation Level of Effort	Rationale
Non-Residential	Provide greater flexibility, increase the incentive, and expand outreach in the Commercial Equipment Rebate program to increase participation	Mid term	Medium	The Commercial Equipment Rebate program provides the opportunity for significant water savings to customers that participate and is highly cost effective. However, through this program, the SFPUC approves, on average, just one project a year. Providing greater flexibility, increasing the incentive, and expanding outreach may help to increase participation. These changes would require a medium level of effort. Because of the water savings opportunities and relative low cost of this program, we recommend it be implemented in the mid term.
Non-Residential	Expand targeted outreach to water-intensive accounts	Mid term	Low	While continued effort on the highest overall water use sectors is essential, we recommend the SFPUC expand its outreach to other water-intensive non-residential sectors. Greater outreach to these customers could result in greater awareness of and participation in SFPUC incentive programs. This recommendation does not require any new analysis and can be built on existing outreach efforts. Therefore, this will be require low effort and we recommend implementing this in the mid term.
Non-Residential	Send annual notifications to high-use non-residential customers and more frequent notifications during water shortages	Mid term	Low to Medium	The SFPUC sends high-use notifications to the top two percent of single-family and small multi-family water users annually in non-drought years. We recommend the SFPUC send annual notifications to high-use non-residential customers and more frequent notifications during water shortages. High use alerts coupled with technical assistance resources will encourage customers to make use of incentives and other programs offered by the SFPUC. This will require low effort to set up but follow up may require more effort. We recommend implementing this in the mid term. Any adjustments to existing efforts should be aligned with State CII Sector performance measures requirements.
Non-Residential	Provide assistance to navigate the large landscape program application process	Near term	Low	The application process for this program requires multiple steps and is subject to several administrative requirements. Businesses often lack the experience and staff to dedicate to this process, creating a significant administrative burden. We recommend providing additional assistance including clearer marketing and guidance to increase program participation and engagement. This recommendation involves only adding support to an existing program and therefore could be implemented in the near-term with a low level of effort.
Non-Residential	Expand outdoor device offerings to include weather-based irrigation controllers and soil moisture sensors for non-residential customers	Near term	Medium	There are limited options for outdoor device offerings for non-residential customers. We recommend expanding outdoor device offerings to include weather-based irrigation controllers and soil moisture sensors for non-residential customers that overirrigate their landscapes. The SFPUC has already studied and determined that a rebate program is the best approach to distribute these devices and is planning to launch a WBIC program in 2024-2025. We recommend moving this program forward and expanding it to include soil moisture sensors. Because work has already been done to develop this program, this recommendation would require a medium level effort and could be implemented in the near term.
Non-Residential	Support removal of non-functional turf through design incentives and active enforcement	Mid term	High	We recommend that the SFPUC provide incentives for sustainable landscape design for businesses required to replace non-functional turf. Without appropriate guidance, there is a risk that property managers will replace turf with hardscape, poorly designed irrigation systems, etc.. Since this requires the creation of a new program, it would require a high level of effort. However, we recommend that this program be created in the mid term, to align with the non-functional turf ban from the state. We note that this recommendation is intended to be complementary to the ban on non-functional turf and should be implemented to align with the statewide ban.
Non-Residential	Feature water savings more prominently in the San Francisco Green Business Program	Near term	Low	The San Francisco Green Business Program is a recognition program for businesses, non-profit organizations, and institutions. We recommend that SFPUC continue collaborating with SF Environment to more prominently feature water savings in the San Francisco Green Business Program. Making this connection clear would encourage businesses to participate in SFPUC technical assistance and incentive programs and inspire other businesses to do the same. This recommendation involves leveraging a program already in existence. Therefore, it requires low effort and we recommend it be implemented in the near term.
Non-Residential	Update the Commercial Water Conservation Ordinance to require replacement of fixtures that exceed current CA standards	Long term	High	The current Commercial Water Conservation Ordinance is aligned with SB 407 and has flow rates that are now out of date and above the current California Plumbing Code. We recommend that SFPUC update the Commercial Water Conservation Ordinance to require replacement of any fixtures that exceed current California plumbing code. Before updating, we recommend that the SFPUC study the potential estimated population of remaining CII toilets using 1.6 gpf, and the potential water and cost savings of replacing these with 1.28 gpf toilets. We recommend this is implemented in the long-term, in conjunction with updates to the Residential Water Conservation Ordinance.

Category or Sector	Recommendation	Time Frame for Implementation	Implementation Level of Effort	Rationale
Water Management Tools	Enhance functionality of the My Account online portal	Near term for lowering the gpcd goal; Mid term for changing platforms	Low for altering the water use goal; High for changing platforms	The online portal is an important tool for customers to manage their water use and allowing customers to compare their water usage with the average and most efficient households and set custom automatic high-use alerts would enhance its functionality. Within the existing MyAccount platform, we recommend lowering the residential GPCD goal (from maintaining efficient use below 50 to 45 gpcd). This would require a low level of effort and be implemented in the near term. Switching platforms would require a high level of effort and could implemented in the mid term.
Water Management Tools	Expand leak repair assistance program	Near term for messaging; Mid term for direct assistance	Low for messaging; High for new direct assistance	The SFPUC currently offers some leak repair assistance - including repair for leaks identified during water-wise evaluations and indirect financial assistance through a high bill adjustment after a leak is fixed. The SFPUC should better communicate the leak repair assistance available using clear and compelling messages, including for high bill adjustments, and consider offering additional direct incentives to help accelerate repairs inside and outside the building. Additional leak repair assistance could be bundled with the toilet direct installation program, should that program continue beyond 2025 to help reduce the administrative burden of increasing program offerings. Improving messaging would require a low level of effort, and we recommend implementing this program in the near term. Developing a new incentive program for leak repair would require a high level of effort, and we recommend this program be implemented in the mid term.
Water Management Tools	Pilot leak detection innovations	Mid term	Medium	The SFPUC has a robust customer leak alert program. To further enhance this program, we recommend that the SFPUC pilot innovations like artificial intelligence (AI) to identify leaks for large multi-family and commercial customers. This would requie a medium level of effort to implement because of the need to identify partners and to develop and implement the pilot. We recommend beginning the pilot in 2 to 4 years, which would allow for collecting basdeline data from the existing program.
Water Management Tools	Evaluate installation of more sensitive water meters	Long term	High	The SFPUC's threshold for triggering leak alerts is relatively high but is constained by the the sensitivity of meters installed throughout its service area. As meters are replaced, we recommend SFPUC consider installation of more sensitive meters that would allow for a lower volumetric threshold for leak alerts. Replacment of meters would require a high level of effort and need to be implemented in the long term.
Marketing and Outreach	Engage marketing and outreach experts to develop a robust strategic communications and outreach strategy and marketing materials	Near term	Medium	We recommend that the SFPUC engage marketing and outreach experts to develop an ongoing communications and outreach strategy, along with marketing materials that use clear and compelling messages targeted to key audiences. These efforts would promote increased awareness of and action to improve water stewardship in San Francisco and support increased participation in the SFPUC's existing programs. This is a near-term priority that would require a medium level of effort.
Alternative Water Supply	Lower threshold for water Budget Calculator submittal to developments great than 10,000 square feet (current threshold is 40,000 square feet)	Mid Term	Medium	Updating the Non-Potable Water Ordinace to lower the threshold for required water budget calculator submittals can provide the SFPUC with additional data and opportunities for engagement for developments that would otherwise not be required to install onsite reuse systems but might voluntarily choose to adopt them. While updating the ordinance itself would take minimal effort, the admisitrative burden of reviewing additional water budget calculator submittals could require a medium effort. This recommendation can be implemented in the near term.
Innovative Water Management Strategies	Continue investigating devices potentially eligible for incentives	Near term	High	The SFPUC should continue to evaluate advanced technologies that offer opportunities to secure deeper water savings to ensure they are safe and effective. Once vetted, these technologies may be good candidates for integration into new incentive offerings, such as through rebates, vouchers, or direct installation. This process requires a high level of effort to ensure it is robust and can be implemented in the near term.
Innovative Water Management Strategies	Expand the Innovations Program	Near term	Low to Medium	The SFPUC could expand its existing Innovations Program, including through a grant program to fund resarch on emerging strategies and approaches for conserving water and diversifying its supply. This would require a low to medium effort, depending on whether the SFPUC partners with an existing program or develops a stand-alone program. We recommend this be done in the near term to build on the support the SFPUC is already providing for innovation.
Demand Forecasts	Seek third-party review of water demand forecasting and conservation model methodologies	Near term	High	The SFPUC will revisit its demand forecasts as part of the 2025 UWMP development, and we have identified several opporutnities to enhance the current demand forecasting model. These opportunities involve evaluation of the econometric modeling approach against methodological best practices (e.g., direct inclusion of marginal water rate vs. use of instrumental variable to address potential endogeneity in model terms; inclusion of time-series term to capture long-term trends in historical water demands; validation of passive conservation savings estimated separately via comparison to implicitly estiamted passive conservation from forecasting model, etc.) and validation of underlying model assumptions, dependent variables, and structure. While a third-party review of the water demand forecast and conservation model methodlogies represent a high level of effort, this recommendation could be implemented in the near term to ensure inclusion in the current UWMP udpate.
Demand Forecasts	Explore a wider range of scenarios into demand forecasts.	Near term	Medium	Motivations for scenario selection can include sensitivity analysis of model assumptions, incorporation of climate change impacts, alternative demographic projects, and impacts of proposed policy changes. Most of these motivations are identified in the recommendation for 3rd party review of current demand forecasting methodology and can be incorporated in the upcoming demand forecast update for the 2025 UWMP. Additional scenarios can be informed by enacting the following recommended model improvements: - Disaggregation of water demand forecasts by end-use (for residential sectors) and by commercial subsector/industry (for non-residential sectors) can help inform opportunities for further water efficiency savings and non-potable demand reductions via reuse. Additional customer segmentation within these sectors can also provide a basis for alternate growth scenarios. - As the SFPUC revisits the demand forecasts for the update of the 2025 UWMP, it should validate and revisit assumptions for future water loss, based on anticipated changes to distribution system characteristics (number of connections, length of pipe, operating pressure, etc.) and translate these assumptions to performance targets using industry-accepted metrics to understand the extent of technically feasible water loss reductions going forward. Because the SFPUC already uses the AWWA M36 recommended water loss audit framework, this effort will be relatively easy to implement and update in future iterations of the UWMP.