Appendix J. Efficient Indoor Water Use and Practices

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Efficient Indoor Water Use and Practices

This appendix includes additional information to quantify efficient indoor residential water use and practices. The Department of Water Resources (the Department) and the State Water Resources Control Board (the State Water Board) recognize the work urban retail water suppliers have done and continue to do to promote water conservation, including measures to increase indoor residential water use efficiency. The Department and the State Water Board also recognize there is untapped potential and more Californians can do to make conservation a way of life.

The data and reports referenced in this appendix were collected before the COVID-19 pandemic. Shelter-in-place orders and remote work have affected urban water use patterns. According to one study, the water use of many households increased with more frequent hand washing and toilet flushing; in other households, it decreased as people washed fewer loads of laundry (P. Mayer, personal communication, January 2021). Another study suggests the pandemic may have resulted in a 1.4% increase in the residential water use sector, which the authors attribute to an increase in outdoor use (Li, 2021).

Efficient use

Starting in January 2024, California Water Code section 10609.20 directs each Urban Retail Water Supplier (URWS) to calculate an urban water use objective, which would be the sum of the following:

- Aggregate estimated efficient indoor residential water use.
- Aggregate estimated efficient outdoor residential water use.
- Aggregate estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use.
- Aggregate estimated efficient water losses.
- Aggregate estimated water use in accordance with variances, as appropriate.

- A bonus incentive for potable reuse water, not to exceed 15 percent of the urban water supplier's water use objective.

At the household scale, efficient indoor residential water use practices include, but are not limited to, actions such as the installation and maintenance of efficient fixtures and appliances, minimizing leaks, ensuring the efficient distribution of hot water, reusing gray water on-site, and water efficient behaviors (e.g., minimizing shower time). At the supplier scale, these practices include, but are not limited to, actions such as education and outreach, leak detection, surveys, showerhead and aerator distribution, rebates, and advanced metering infrastructure (AMI) (CUWCC, 2008).

While the California Water Code does not quantitatively define *efficient indoor residential water use,* existing standards, studies undertaken for this report, and previous analyses suggest efficient indoor residential water use for homes equipped with efficient fixtures and appliances ranges from 24 to 39 gpcd at the household level and from 28 to 43 gpcd (refer to Figure 1) when averaged across the service areas of California urban retail water suppliers. These values will be explained and referenced in the following sections.

Efficient Indoor Residential Water Use in Households

Based on the latest efficiency standards adopted by the California Energy Commission (CEC), specifications adopted by the U.S. Environmental Protection Agency's ENERGYSTAR program, and use patterns documented in the 2016 Residential End Use Study (De Oreo et al. 2016), the water use of a typical home equipped with efficient fixtures and appliances is approximately 35 gpcd. Table J-1 shows the hypothetical water use of a typical home with and without efficient appliances and fixtures. The column on the left shows the hypothetical indoor water use of a typical home using older or less efficient appliances and fixtures. The column on the right shows the hypothetical indoor water use of a home that has ENERGYSTAR appliances (ENERGYSTAR, 2019) and fixtures that meet the most recent efficiency standards adopted by the CEC (77 FR 32307, CCR Title 20). Assumptions regarding indoor water use habits--for example, the average number of times a person flushes a toilet per day as 5--come from the

Water Research Foundation's 2016 Residential End Use study (De Oreo et al. 2016).

Table J-1: Comparing the hypothetical water use of example homes between older and less efficient appliances and fixtures, and newer, highly-efficient appliances and fixtures.

Use	Modeled water use for a typical home with inefficient appliances & fixtures	Modeled water use for a typical home with efficient appliances & fixtures
Toilet	18 gpcd (3.5 Gallons per flush)	6 gpcd (1.28 Gallons per flush)
Clothes Washer	11 gpcd (37 Gallons per load)	6 gpcd (19 Gallons per load)
Shower	7 gpcd (2.5 Gallons per minute)	6 gpcd (1.8 Gallons per minute)
Faucets	14 gpcd (2.2 Gallons per minute)	10 gpcd (1.5 Gallons per minute)
In-home Leaks [64]	2 gpcd	2 gpcd
Other [65]	2.5 gpcd	2.5 gpcd
Bath	1.5 gpcd	1.5 gpcd
Dishwasher	1 gpcd (9 Gallons per load)	0.4 gpcd (3.6 Gallons per load)
TOTAL	~55 gpcd	~35 gpcd

[64] According to REUS 2016, households leak 17 gallons per day, on average. That average is heavily skewed by households with large leakage rates. Most households leak less than 5 gallons per day. Assuming an average of 2.64 persons per household, the per capita share of leakage, for most households, is less than 2 gpcd.

[65] The “other” category includes evaporative cooling, humidification, water softening, and other uncategorized indoor uses.

Previous analyses have sought to understand efficient indoor water use in homes in California and across the country. In *Analysis of Water Use in New Single-Family Homes*, which includes homes in California cities such as Roseville, De Oreo et al. (2011) measured the indoor water use of WaterSense New Homes at 35.6 gpcd and existing homes retrofitted with water efficient devices at 39 gpcd. In *Residential End Uses of Water, Version 2*, the authors found that demand would drop to 37 gpcd for homes retrofitted with most recent industry-standard water efficient devices. If household leaks were reduced, demand would drop further to 34 gpcd. If toilets were flushed with greywater rather than potable water, demand would drop to 27.9 gpcd (De Oreo et al., 2016). In *Measuring Progress Toward Universal Access to Water and Sanitation in California* (2018), the Pacific Institute, extrapolating from 2018 appliance and fixture standards, estimated efficient indoor water use to be 37 gpcd (Feinstein, 2018). Based on leading edge flow ratings, meaning those even more efficient than current standards (e.g., toilets using just 0.8 gallons per flush), they estimated efficient indoor water use would be 24 gpcd (Feinstein, 2018). Table J-2 summarizes the efficient indoor residential water use rates that have been documented in previous analyses.

As seen above, customer best practices, such as the installation and maintenance of efficient fixtures and appliances, minimal leaks, the efficient distribution of hot water, and on-site reuse of grey water can contribute to efficient indoor residential water use rates ranging from 24 to 39 gpcd. Water use that falls within this range may be considered to reflect best practices at the household level.

Table J-2: Summary of efficient indoor residential water use rates at the household scale.

Efficiency Measure	R_i-gpcd	Year	Source
WaterSense New Home	36	2011	De Oreo et al. (2011)
Existing home retrofitted with water efficient devices	39	2011	De Oreo et al. (2011)
Existing home retrofitted with water efficient devices	37	2016	Residential End Uses of Water, Version 2
Existing home retrofitted with water efficient devices, plus leak detection	34	2016	Residential End Uses of Water, Version 2
Existing home retrofitted with water efficient devices, plus leak detection and greywater use	28	2016	De Oreo et al. (2016)
Extrapolation of existing fixture and appliance standards	37	2018	Pacific Institute
Leading edge flow rated appliances	24	2018	Pacific Institute

Efficient Indoor Residential Water Use at the Community Scale

As described in Section 2.0, the Department collected and analyzed monthly water data from customer accounts for 2017, 2018, and 2019--the three years following the last drought. The customer-level water use data was then aggregated to the geographic scale of census tracts. To calculate per capita use, the Department divided the aggregated census tract water use data by census tract population. Using four different methods (as described in Section 2.4), the Department estimated indoor residential water use for

18 Urban Retail Water Suppliers. One of those agencies is a municipal leader in water efficiency, with robust programs encouraging efficiency across sectors (e.g., rebates, audits, give-a-ways, resale ordinances, etc.) and effective messaging. Using each method, the Department estimated the average baseline indoor water use rate across this agency's entire service area was below 40 gpcd.

For the 17 other agencies participating in the Department's study, estimates of per capita use based on service area wide averages were not as low. In any given service area however, there exists a distribution of per capita use values. According to the Seasonal Adjustment Method, SAM[66], homes in the lowest water-using quartile tracts use 44 gpcd on average or less, with rates ranging from 34 to 58 gpcd. These data suggest that, even if an agency's average estimated indoor residential water use is high, there is a percentage of customers within their service area that appear to be using water more efficiently indoors, i.e., at rates more similar to those of the highly efficient homes modeled through the Water Research Foundation (2016) and Pacific Institute (Feinstein, 2018) studies. Table J-3 summarizes these data.

[66] As described in Appendix A, each of the methods used to calculate indoor residential have limitations. SAM, for example, may not accurately remove outdoor water use. For agencies that participated in the Department's study and have independently estimated l indoor residential use rates, SAM appears to overestimate indoor use.

Table J-3: Average and first-quartile indoor residential water use, using monthly data, and the percentage of the service area population associated with tracts averaging 44 gpcd or less.

Agency	Average Use (Ri-gpcd)	Lowest Water Using Quartile Tracts (Ri-gpcd)	% Population in Tracts Averaging 44 gpcd or Less
18 Agency Average	48	44.0	42%
Agency A	44.4	40.9	43%
Agency B	39.0	35.7	76%
Agency C	48.9	44.6	22%
Agency D	57.8	53.1	8%
Agency E	44.4	42.3	23%
Agency F	43.5	38.7	61%
Agency G	44.7	40.4	35%
Agency H	41.9	38.5	83%
Agency I	49.1	44.6	21%
Agency J	40.3	34.2	62%
Agency K	51.6	48.2	11%
Agency L	53.7	49.7	3%
Agency M	39.4	38.0	100%
Agency N	69.8	57.7	4%
Agency O	42.7	39.9	65%
Agency P	51.6	48.7	1%

Agency	Average Use (Ri-gpcd)	Lowest Water Using Quartile Tracts (Ri-gpcd)	% Population in Tracts Averaging 44 gpcd or Less
Agency Q	63.2	55.5	0%
Agency R	36.8	33.6	100%

As described in Section 2.3, the Department also collected and analyzed hourly water data from customer accounts for 4 of the 18 suppliers (Table J-4). According to SAM, tracts in the lowest water-using quartile used an average of 42 gpcd for these suppliers, with values ranging from 31 to 52 gpcd.

Table J-4: Service are average and first-quartile tracts indoor residential water use, using hourly data, and the percentage of the service area population associated with tracts averaging 44 gpcd or less.

Agency	Average Use (R_i-gpcd)	Lowest Water-Using Quartile Tracts (R_i-gpcd)	% Population in Tracts Averaging 44 gpcd or Less
4 Agency Average	47	42	43%
Agency K	57.9	51.6	0%
Agency L	51.4	46.8	9%
Agency 0	42.4	39.8	62%
Agency R	34.4	31.1	100%

As described in Section 5.0 of this report, the Department and the State Water Board also analyzed single-family water delivery volumes using data reported in the electronic Annual Report (eAR), according to the SAM. Based on this analysis of 2017-2019 data from 157 urban retail water suppliers, average and median indoor residential water are 51 and 48 gpcd, respectively. For urban retail water suppliers (Suppliers) at the lowest water using quartile, residential customers are estimated to be using 43 (or lower) gpcd indoors. Figure J-1 shows the residential water use continuum using Electronic Annual Report (eAR) data and SAM analysis.

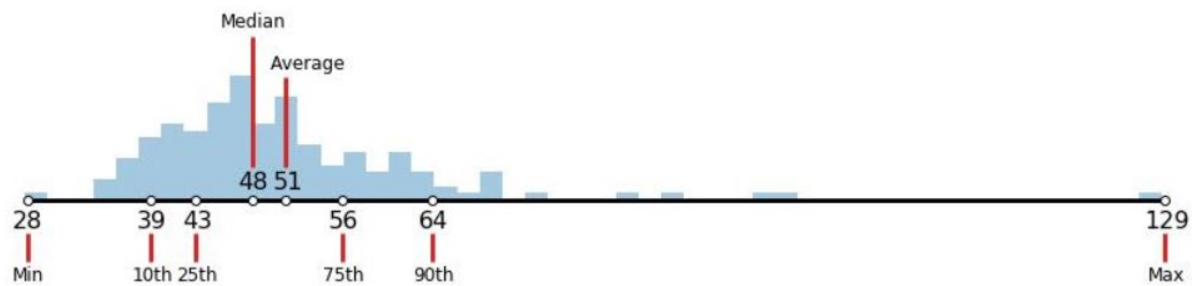

Figure J-1: Today's indoor residential water use continuum using data from the eAR and SAM, showing the 2017-2019 range in gpcd.

Alignment across these datasets does not explain why water use is 44 gpcd or less for tracts (Tables J-3 and J-4) and 43 gpcd for Suppliers (Figure J-1) at the 25th percentile. One explanation is that these customers and communities are using water more efficiently indoors. In-depth End Use studies would help us to better understand these trends.

Efficient Indoor Residential Water Use as Reported by Water Agencies

Some agencies have also independently sought to understand indoor residential water use trends in their service area (Table J-5). Based on a single-family residential end use study, the City of San Francisco estimates per capita residential use to be 44 gpcd, including both indoor and outdoor use (SFWPP, 2016). Using a combination of the minimum month method and the seasonal adjustment method, the Inland Empire Utility Agency (IEUA) estimated indoor residential use is 37 gpcd in housing built after 2013 (IEUA, 2016). The City of Santa Cruz used the minimum month method and estimated indoor residential water use to be 36 gpcd (B. Pink, personal communication, September 2020). In their draft Urban Water Management Plan, the City of Los Angeles estimates that on average, indoor use represents 49 - 56% and 70 - 80% of single-family and of multi-family residential use, respectively (LADWP, 2021 and T. McCarthy, personal communication, April 2021). The reported volume of deliveries by sector and service area characteristics, such as average number of persons per household, suggests LADWP's indoor residential water use is somewhere between 40 and 46 gpcd.[67]

Table J-5: Summary of efficient indoor residential use rates from various agency studies

Agency name	R_i-gpcd	Year	Method	Source
Santa Cruz	36	2020	Winter minimum	City of Santa Cruz
San Francisco WPP	44	2015	End Use study	City of San Francisco Water Conservation Plan
IEUA	37	2015	Winter Min/SAM	Inland Empire Utility Agency Integrated Water Resources Plan
LADWP	40-46	2021	Percent indoor/outdoor use based on an end use study, a saturation study, and sewage flow data.	LADWP 2021 UWMP drafts

[67] Single-family and multi-family water demand (FYE average 2016-2020), indoor and outdoor water use percentage breakdowns by sector (FYE average 2015-2020), and 2020 demographic projections for the LADWP service area (housing units and persons per household) from LADWP's Draft Urban Water Management Plan 2020 were used to calculate an indoor residential use of about 40 gpcd (LADWP 2021).

Efficient Indoor Residential Water Use in Australia

Australia provides a relevant comparative case study to California for understanding indoor water use trends. Like California, Australia is affluent and industrialized; it has also endured severe drought and invested considerable resources in managing water resources more efficiently. Several Australian states with characteristics akin to communities here in California have achieved efficient indoor water use rates across large areas.

In Australia, average indoor household water use was measured at 38 gpcd across southeast Queensland cities such as Brisbane and Gold Coast (Beal et al., 2012) and 35 gpcd in Adelaide, South Australia (Arbon et al., 2014). In Melbourne, Victoria, City West Water conducted two residential end use measurement studies in the last decade, documenting that average indoor residential water use ranges from 25 to 32 gpcd (City West Water, 2019). In the period immediately following the Millennium Drought, indoor residential water use averaged 25 gallons per person per day. Since then, indoor water use has increased; between 2017 and 2018, it averaged 32 gpcd (City West Water, 2019). Table J-6 below summarizes the total and fixture-specific water use trends.

Table J-6: Melbourne's average residential indoor water use according to City West Water's 2010-2012 and 2017-2018 residential end use studies.

Fixture	Residential End Use Study 2010-2012 (gpcd)	Residential End Use Study 2017-2018 (gpcd)
Shower	9	11
Toilet	7	9
Tap	3	5
Washing Machine	2	3
Bath	2	3
Leaks/drips	2	1
Dishwasher	0.05	0.1
Total	25	32

In August 2020, typically Melbourne's wettest month[68], water use was 33 gpcd (Melbourne Water, 2020), suggesting residents have been beating their "winter Target" of 130 liters (34 gallons) per day, even in the throes of the COVID-19 pandemic. During and following the Millennium Drought, Australian states and water purveyors set ambitious residential water consumption targets. "Target 155" initiatives encourage limiting household (indoor and outdoor) use to 155 liters (40 gallons) or less per person per day (Figure 2). Because demand varies depending on the season, Australia's water managers concluded that 155 liters would represent an ideal annual average (Fitzgerald, 2009). In Melbourne, the target is 130

[68] In areas like Melbourne, where winter precipitation eliminates the need for outdoor irrigation, winter water use is an imperfect, but reasonable gauge of indoor water use.

liters (34 gallons) in the winter and 190 liters (50 gallons) in the summer (Weinstein Bloome and de Guzman, 2017).

Figure J-2: Printed material used to encourage residents to conserve water (NY Times, 2016)

In drought or not, states such as South Australia, South East Queensland, and Victoria are institutionalizing efficient urban indoor water use. They demonstrate that with adequate funding, efficient levels of indoor water use are possible across large areas with big populations — and that such levels of water use are possible in places that resemble California, not only culturally and economically, but also climatically for some regions (e.g., Melbourne's climate is similar to San Jose's climate). Many California cities and suburbs developed around the same time as those in Australia, with parallel trajectories in terms of urban design and infrastructure. Perhaps most importantly, California and Australia share a need to prepare for longer and more intense periods of water scarcity. One key lesson from Australia's Millennium Drought and drought responses is that efficient indoor residential use is as achievable as it is important. Table J-7 summarizes the efficient indoor residential water use rates documented at the household and community scale in three regions in Australia.

Table J-7: Summary of efficient indoor residential use rates documented in Australia.

Ri-gpcd	Year	Location
38	2012	Southeast Queensland (e.g., Brisbane, Gold Coast, etc.), Queensland
35	2014	Adelaide, South Australia
25	2012	Melbourne, Victoria
32	2018	Melbourne, Victoria
33	2020	Melbourne, Victoria

Green Building Standards and Rating Systems

Several green building rating systems encourage efficient water use. While compliance with the standards may be voluntary (or partially voluntary), they may be used for new construction and existing homes. Leadership in Energy and Environmental Design (LEED) is the most widely used green building rating system in the world, but there are others and they all include criteria to ensure water is being used efficiently in new and existing homes. Table J-8a and J-8b, below, summarize the water criteria currently used by LEED, WaterSense, CalGreen, and Build It Green's Green Point Standard.

Table J-8a: Water use efficiency criteria for several efficiency program standards. Appliance and fixture efficiencies are generally measured in gallons per flush (gpf) or gallons per minute (gpm).

	CalGreen	Green Point Standard	WaterSense (Ver 2.0, 2019)	LEED* 1 pt	LEED* 2 pts	LEED* 3 pts
Toilets	1.28 gpf	1.28 gpf or less	1.28 gpf	1.28 gpf	1.1 gpf	0.8 gpf
Faucets	1.2 /1.8 gpm	1.5 gpm or less	1.5 gpm	1.5 gpm	1.5 gpm	1.0 gpm
Showerhead	1.8 gpm	2.0 gpm or less	2.5 gpm	2.0 gpm	1.75 gpm	1.5 gpm
Clothes washer	ENERGYSTAR (voluntary)	ENERGYSTAR	n/a	n/a	ENERGYSTAR'S IWF Top-loading, IWF ≤ 4.3 Front-loading, IWF ≤ 3.2	n/a
Dishwasher	ENERGYSTAR (voluntary)	ENERGYSTAR	n/a	n/a	n/a	n/a

*LEED = Leadership in Energy & Environmental Design, Vol. 4.1, updated January 10, 2020

Table J-8b: **Water use efficiency criteria for several efficiency program standards continued. Appliance and fixture efficiencies are generally measured in gallons per flush (gpf) or gallons per minute (gpm).**

	CalGreen	Green Point Standard	WaterSense (Ver 2.0, 2019)	Leadership in Energy & Environmental Design Vol 4.1, updated January 10, 2020
Leaks	n/a	No leaks	No leaks	The water pressure in the house must be tested, with no detectable water leaks; projects are recommended, but not required, to reduce water pressure in the house to 60 pounds per square inch.
Hot water delivery	On-demand hot water circulation system (voluntary)	Insulate all hot water pipes; locate water heater within 12 ft of all fixtures; and install on-demand circulation control pump.	n/a	Design and install an energy-efficient hot water distribution system; All heat traced piping must be insulated.
Other	Greywater reuse, rainwater capture (voluntary)	Greywater reuse, rainwater capture (innovation, extra pts)	Homes must be at least 30% more efficient than typical new construction	Water metering Water softeners must be demand initiated.

Other examples of customer water use efficiency criteria and ratings not summarized in Tables J-1a and J-1b include RESNET's HersH20[69], Water Efficiency Rating Score (WERS)©[70], and The Living Building Challenge[71]. Some certification schemes, such as the Living Building Challenge, have very robust requirements for existing buildings, calling both for responsible water use as well as buildings being "net positive" with respect to water. As used by energy resource managers, being net positive means making or using more than you take. Some Californians have already taken steps to this end and offset indoor and outdoor needs with greywater and captured rainwater.

As described in Appendix F, passive conservation is estimated to have contributed to an average statewide decrease in indoor residential water use of 0.58 gpcd per year from 2015 through 2020; from 2020 to 2025, passive conservation is expected to drive indoor gpcd down by a statewide average of 0.38 gpcd per year; and, from 2025 to 2030, by 0.26 gpcd per year (Mitchell 2016). These projections may underestimate passive conservation's role in the future because they do not account for ultra-high-efficiency fixtures and appliances (e.g., toilets that use 0.8 gpf) or even showerheads and faucets that meet today's standards[72]. However, these statewide estimates may also overestimate the passive conservation potential of communities that have low indoor residential water use rates today (e.g., San Francisco) and may underestimate the passive conservation potential of communities with high indoor residential water use rates today.

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[69] Residential Energy Services Network. 2021. RESNET's Water Efficiency Rating System HERSH2O. Available at: https://www.resnet.us/about/hersh2o/. Accessed May 6, 2021.

[70] Water Efficiency Rating Score (WERS)©. Available at: https://www.wers.us/about-2/. Accessed May 6, 2021.

[71] International Living Future Institute.2021. Living Building Challenge. Available at: https://living-future.org/lbc/. Accessed May 6, 2021.

[72] The 2016 Mitchell analysis did not include ultra-efficient fixtures because they are not required by code; it did not include showerheads and faucets because end use studies have suggested more efficient showerheads and faucets result in relatively minimal savings.

Conclusion

Existing standards, studies undertaken for this report, and previous analyses suggest efficient indoor residential water use ranges from 24 to 39 gpcd at the household level. Many California households appear to be using water efficiently indoors, with use rates mirroring those of homes equipped with fixtures and appliances that meet current CEC standards and U.S. EPA ENERGYSTAR performance criteria.

Studies undertaken for this report and previous analyses suggest efficient indoor residential water use ranges from 28 to 43 gpcd when averaged across the service areas of California urban retail water suppliers. Using data from the electronic Annual Report, 25% of California Urban Retail Water Suppliers are estimated to have indoor residential water rates of 43 gpcd or less.

Section 10817 of the California Water Code defines “water use efficiency” as the efficient management of water resources for beneficial uses, preventing waste, or accomplishing additional benefits with the same amount of water. Using less water indoors to complete the same domestic tasks — without comprising water quality or the user experience — is a clear example of water use efficiency.

References

77 F.R. 32307. (2012). Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers. Department of Energy. https://www.govinfo.gov/content/pkg/FR-2012-05-31/pdf/2012-12320.pdf

Arbon, N., Thyer, M., Hatton MacDonald, D., Beverley, K., & Lambert, M. (2014). Understanding and predicting household water use for Adelaide. Goyder Institute for Water Research Technical Report Series, 14, 15.

Beal, C. D., Makki, A., & Stewart, R. A. (2012). Identifying the Drivers of Water Consumption: a Summary of Results from the South East Queensland Residential End Use Study. In Science Forum and Stakeholder Engagement: Building Linkages, Collaboration and Science Quality (pp. 19-20).

California Green Building Resources Code (2020). CalGreen's 2019 Residential Measures, Mandatory and Voluntary. Accessed from: https://codes.iccsafe.org/content/CAGBSC2019/chapter-4-residential-mandatory-measures

California Green Building Standards Code. (2016). California Code of Regulations, Title 20, Sections 1601 through 1609.

https://www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20

C.W.C. , § 10609.2, subdivision (a). Chapter 9. Urban Water Use Objectives and Water
Use Reporting. http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=10609.&lawCode=WAT

DeOreo, William B. (2011). Analysis of water use in new single family homes. By Aquacraft. For Salt Lake City Corporation and US EPA.

DeOreo, W., Mayer, P., Dziegielewski, B., and J. Kiefer. (2016). Residential End Uses of Water, Version 2. Water Research Foundation.

ENERGY STAR. (2019) Unit Shipment and Sales Data Archives. Accessed from:
https://www.energystar.gov/partner_resources/products_partner_resources/brand_owner_resources/unit_shipment_data/archives

Feinstein, L. (2018). Measuring Progress Toward Universal Access to Water and Sanitation in California: Defining Goals, Indicators, and Performance Measures. Pacific Institute.

FitzGerald, C. (2009). Implementing Residential Water Use Targets – A Melbourne Perspective.

Presented at the 2009 IWA Water Efficiency conference in Sydney by City West Water, Sunshine, VIC.

Green Point Standard. Build It Green's GreenPoint Rated Existing Home. Accessed From:https://www.builditgreen.org/greenpoint-rated/documents-checklists

Inland Empire Utilities Agency. (2016). Integrated Water Resources Plan: Water Supply & Climate Change Impacts 2015-2040.

International Living Institute, Living Building Challenge. Accessed from:https://living-future.org/lbc/

Jennings, E. T. (2007). Best practices in public administration: how do we know them? How can we use them? Administratie SI Management Public, 9, 73-80.

Leadership in Energy and Environmental Design (LEED), (2020). LEED v4.1 Residential: Single Family Homes rating system. Accessed from: https://www.usgbc.org/leed/v41?creative=340482139151&keyword=leed%20building%20standards&matchtype=b&network=g&device=c&gclid=Cj0KCQjw1qL6BRCmARIsADV9JtZ7vrPS-tYFqPQiyvkTkZA5OVJplWzPnweEyxkk8deSetiefx2wFdsaAtsOEALw_wcB#residential

Li, D., Engel, R.A., Ma, X., Porse, E., Kaplan, J.D., Margulis, S.A. and D. P. Lettenmaier. (2021).

Stay-at-Home Orders during the COVID-19 Pandemic Reduced Urban Water Use. Environmental Science and Technology Letters. (n.d.) https://dx.doi.org/10.1021/acs.estlett.0c00979

Los Angeles Department of Water & Power (LADWP). (2017). Water Conservation Potential Study. Accessed March 2021 from https://www.ladwp.com/waterconservation

Los Angeles Department of Water & Power (LADWP). (2021). 2020 Urban Water Management Plan for the Los Angeles Department of Water& Power. Accessed March 2021 from: Urban Water Management Plan: 2020 Draft

Mayer, P. Principal and Founder, Water DM., personal communication, January 2021.

McCarthy, T., Manager of Water Resources Policy, Water Resources Division, LADWP, personal communication, April 2021.

Melbourne Water, 2020. Accessed from:
https://www.melbournewater.com.au/water-data-and-education

N.Y. Times. (2016). Australia's Lesson for a Thirsty California. Accessed September 9, 2020 https://www.nytimes.com/2016/11/01/opinion/australias-lesson-for-a-thirsty-california.html

Pink, B., City of Santa Cruz Water Department, personal communication, September 2, 2020.

RESNET, RESNET's Water Efficiency Rating System HERSH2O, accessed from https://www.resnet.us/about/hersh2o/

San Francisco Water, Power, Sewer. (2016). 2015 Retail Water Conservation Plan. Accessed from https://sfwater.org/modules/showdocument.aspx?documentid=8760

State of Victoria. Livable Towns and Cities: Target 155. Accessed November 24, 2020:https://www.water.vic.gov.au/liveable-cities-and-towns/using-water-wisely/target-155-target-your-water-use

Siriwardene, N. (2019). CWW Residential End Use Measurement Study (REUMS): September 2017 to August 2018 data. Strategy & Planning Group, City West Water.

Water Efficiency Rating Score (WERS), The WERS Tool: Predictive Based Modeling, accessed from https://www.wers.us/about-2/

WaterSense (2020). New Home Specification 2.0 Accessed from: https://www.epa.gov/watersense/watersense-labeled-homes

Weinstein Bloome, D., de Guzman, E. (2017). Transferring Water and Climate Resilience Lessons from Australia's Millennium Drought to Southern California. *Cities and the Environment* (CATE) 10.2: 5.