2023

DRINKING WATER NEEDS ASSESSMENT

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

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Acknowledgements

Contributors

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DEFINITION OF TERMS

Adequate Supply: means sufficient water to meet residents' health and safety needs at all times. (Health & Saf. Code, § 116681, subd. (a).)

Administrator: an individual, corporation, company, association, partnership, limited liability company, municipality, public utility, or other public body or institution which the State Water Board has determined as competent and performs the administrative, technical, operational, legal, or managerial services required for a water system to comply with Health and Safety Code section 116686, pursuant to the Administrator Policy Handbook adopted by the State Water Board. (Health & Saf. Code, §§ 116275, subd. (g), 116686, subd. (m)(1).)

Affordability Assessment: the evaluation of any community water system serving a disadvantaged community to ascertain if it must charge fees, directly or indirectly, that exceed the **Affordability Threshold** to supply, treat, and distribute potable water that complies with federal and state drinking water standards. The assessment utilizes several indicators to identify communities experiencing economic challenges which make them unable to incur additional costs. (Health & Saf. Code, § 116769, subd. (2)(B).

Affordability Threshold: the designated values used to assess the economic capacity of a community or household to pay for current drinking water charges and incur additional costs or fees in the future. This capacity is used in the **Affordability Assessment**. For the purposes of the 2023 Affordability Assessment, the State Water Board employed affordability thresholds for the following indicators independently and combined: Percent Median Household Income; Extreme Water Bill; and Household Socioeconomic Burden. Learn more about current and future indicators and affordability thresholds in Appendix D.

Arrearage: debt accrued by a water system's customer from failure to pay water service bill(s) which are at least 60 days or more past due.

At-Risk Public Water System (**At-Risk PWS):** a community water system with up to 30,000 service connections or 100,000 population served and K-12 schools and is confronting circumstances which threaten its ability to continue to meet one or more key **Human Right to Water** goals: (1) providing safe drinking water; (2) accessible drinking water; (3) affordable drinking water; and/or (4) maintaining a sustainable water system.

At-Risk State Small Water Systems (SSWS) and Domestic Wells (DW): State Small Water Systems and Domestic Wells located in areas where groundwater is threatened by: (1) encroaching contaminants which are likely to lead to concentration levels that exceed safe drinking water standards; (2) water shortage risk; and/or (3) socioeconomic risk. This definition may be expanded in future assessments as more data becomes available.

California Native American Tribe: socially-divided communities of California indigenous peoples recognized federally and non-federally and on the contact list maintained by the Native American Heritage Commission for the purposes of Chapter 905 of the Statutes of 2004. (Health & Saf. Code, § 116766, subd. (c)(1).) Typically, drinking water systems for federally recognized tribes fall under the regulatory jurisdiction of the United States Environmental Protection Agency (U.S. EPA), while public water systems operated by non-federally recognized tribes currently fall under the jurisdiction of the State Water Board.

Community Water System (**CWS):** a public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 yearlong residents of the area served by the system. (Health & Saf. Code, § 116275, subd. (i).)

Consistently Fail: a failure to provide an adequate supply of safe drinking water. (Health & Saf. Code, § 116681, subd. (c).)

Consolidation: the joining of two or more public water systems, state small water systems, or affected residences into a single public water system, either physically or managerially. For the purposes of this report, consolidations may include voluntary or mandatory consolidations. (Health & Saf. Code, § 116681, subd. (e).)

Constituents of Emerging Concern: synthetic or naturally occurring chemicals or materials detected in water bodies that cause public health impacts and are not regulated under current primary or secondary **Maximum Contaminant Level** (MCL). For purposes of the Risk Assessment, three chemicals are incorporated: hexavalent chromium, 1,4-dioxane, and per- and polyfluoroalkyl substances (PFAS).

Contaminant: any physical, chemical, biological, or radiological substance or matter in water. (Health & Saf. Code, § 116275, subd. (a).)

Cost Assessment: the estimation of funding needed for the Safe and Affordable Drinking Water Fund for the next fiscal year based on the amount available in the fund, anticipated funding needs, and other existing State Water Board funding sources. Thus, iterations of the Cost Assessment estimates anticipated expenditures related to the implementation of interim and/or emergency measures and longer-term solutions for **Failing** and **At-Risk Public Water Systems**, **State Small Water Systems**, and **Domestic Wells**. Some iterations of the Cost Assessment also include the identification of available funding sources and the funding and financing gaps that may exist to support interim and long-term solutions. (Health & Saf. Code, § 116769.)

Disadvantaged Community (DAC): the entire service area of a community water system, or a community therein, in which the median household income is less than 80% of the statewide annual median household income level. (Health & Saf. Code, § 116275, subd. (aa).)

Domestic Well: a groundwater well used to supply water for the domestic needs of an individual residence or a water system that is not a **Public Water System** and has no more than four service connections. (Health & Saf. Code, § 116681, subd. (g).)

Drinking Water Needs Assessment (**Needs Assessment**): the annual State Water Board report that provides a comprehensive identification of California drinking water challenges in achieving the **Human Right to Water**. The report analyzes and identifies drinking water infrastructure, managerial capacity, technical, and financial needs for communities served by public water systems, state small water systems, and domestic wells. The Needs Assessment consists of four core components: 1) Failing Water System List, 2) Risk Assessment, 3) Cost Assessment, and 4) Affordability Assessment. The Needs Assessment informs the annual **Fund Expenditure Plan** for the **Safe and Affordable Drinking Water Fund** and broader SAFER Program activities. (Health & Saf. Code, § 116769.)

Electronic Annual Report (EAR): the Water Board's annual survey of California's public water systems which collects critical information to assess their compliance with regulatory requirements, updates contact and inventory information (such as population and number of service connections), and captures information used to assess capacities, financial and otherwise, of water systems.

Failing: the inability of a public water system to provide an adequate and reliable supply of drinking water which is at all times pure, wholesome, and potable (Health & Saf. Code, § 116555).

Failing List (also **Human Right to Water List)**: the catalogue of public water systems that are out of compliance or consistently fail to meet primary drinking water standards. Systems that are assessed for meeting the Failing List criteria include **Community Water Systems** and **Non-Community Water Systems** that serve K-12 schools and daycares. The Failing List criteria were expanded in April 2021 to better align with statutory definitions of what it means for a water system to consistently fail to meet primary drinking water standards. (Health & Saf. Code, § 116275(c).)

Fund Expenditure Plan (**FEP):** based on the **Drinking Water Needs Assessment** and adopted annually by the State Water Board, describes how money from the **Safe and Affordable Drinking Water Fund** will be prioritized, documents past and planned expenditures, prioritizes projects for funding, and includes elements pursuant to Article 4 of Chapter 4.6 of the Health and Safety Code for the Safe and Affordable Drinking Water Fund, established pursuant to Health and Safety Code section 116766.

Human Consumption: the use of water for drinking, bathing or showering, hand washing, oral hygiene, or cooking, including, but not limited to, preparing food and washing dishes. (Health & Saf. Code, § 116275, subd. (e).)

Human Right to Water (HR2W) the recognition that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking and sanitary purposes," as defined in Assembly Bill 685 (AB 685). (California Water Code § 106.3, subd. (a).)

Human Right to Water List (**Failing List**): the catalogue of public water systems that are out of compliance or consistently fail to meet primary drinking water standards. Systems that are assessed for meeting the Failing List criteria include **Community Water Systems** and **Non-Community Water Systems** that serve K-12 schools and daycares. The Failing List criteria were expanded in April 2021 to better align with statutory definitions of what it means for a water system to consistently fail to meet primary drinking water standards. (Health & Saf. Code, § 116275(c).)

Intertie: an interconnection allowing the passage of water between two or more water systems.

Local Primacy Agency (LPA): the local health officer within a county to whom the State Water Board has delegated primary responsibility for the administration and enforcement of California Safe Drinking Water Act. An LPA is authorized by means of a local primacy delegation agreement if the local health officer demonstrates the capability to meet the local primacy program requirements established by the State Water Board pursuant to subdivision (h) of Health and Safety Code section 116375. (Health & Saf. Code, § 116330, subd. (a).)

Mandatory Consolidation: State Water Board-mandated **Consolidation** requiring two or more water systems to merge with, or receive an extension of service from another, public water system.

Maximum Contaminant Level (MCL): the highest permissible amount of a **Contaminant** statutorily allowed in water. (Health & Saf. Code, § 116275, subd. (f).)

Median Household Income (MHI): the financial level that represents the middle value of revenue for an entire community averaging the total money received per each home and its occupants. The methods utilized for calculating MHI are included in Appendices A and E. MHIs in this **Needs Assessment** are estimated values for the purposes of this statewide assessment. The State Water Board's Division of Financial Assistance determines funding eligibility using the MHI and on a system-by-system basis.

Medium Community Water System: a water system that has up to 30,000 service connections or up to 100,000 population served.

Non-Community Water System: a **Public Water System** and is not a **Community Water System**. (Health & Saf. Code, § 116275, subd. (j).)

Non-Transient, Non-Community Water System: a **Public Water System** that is not a **Community Water System** and regularly serves at least 25 of the same persons for six months or more during a given year, such as a school. (Health & Saf. Code, § 116275, subd. (k).)

Operations and Maintenance (O&M): collective term for the materials, functions, duties, and labor associated with the daily operations, normal repairs, replacement of parts and structural components, and other activities needed to preserve a water system's capital assets so that it can continue to provide safe drinking water.

Point-of-Use (**POU):** a treatment device located where the end user accesses the drinking water.

Point-of-Entry (POE): a treatment device located at the inlet to an entire building or facility.

Potentially At-Risk: categorical description of a **Community Water System** with 30,000 service connections or less, or population served up to 100,000 and K-12 schools that is potentially threatened by circumstances which could cause its failure to meet one or more key

Human Right to Water goals—all Californians have drinking water that is: (1) safe; (2) accessible; (3) affordable; and/or (4) sustainable.

Primary Drinking Water Standard: a set of established protocols for water intended for human consumption: (1) Maximum levels of contaminants that, in the judgment of the State Water Board, beyond which may have an adverse effect on the health of persons, (2) Specific treatment techniques adopted by the state board in lieu of maximum contaminant levels pursuant to Health & Saf. Code, section 116365, subd. (j), and (3) Monitoring and reporting requirements as specified in regulations adopted by the state board that pertain to maximum contaminant levels. (Health & Saf. Code, § 116275, subd. (c).)

Public Water System (PWS): a system for the provision of water to the public for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. A PWS includes any collection, pre-treatment, treatment, storage, and distribution facilities under control of the operator of the system that are used primarily in connection with the system; any collection or pretreatment storage facilities not under the control of the operator that are used primarily in connection with the system; and any water system that treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption. (Health & Saf. Code, § 116275, subd. (h).)

Resident: a person who physically occupies, whether by ownership, rental, lease, or other means, the same dwelling for at least 60 days of the year. (Health & Saf. Code, § 116275, subd. (t).)

Risk Assessment: The evaluation of **Public Water Systems**, with a focus on small and medium **Community Water Systems** and non-transient, non-community K-12 schools, for the identification of those at risk of failing to provide an adequate supply of safe drinking water. It includes an estimate of the number of households served by **Domestic Wells** or **State Small Water Systems** in areas of high risk for groundwater contamination; water shortage; and/or socioeconomic risk. Various methodologies have been developed for different system types: (1) public water systems; (2) state small water systems and domestic wells; and (3) tribal water systems. (Health & Saf. Code, § 116769)

Risk Indicator: the quantifiable measurements of key data points that allow the State Water Board to assess the potential for a community water system or a non-transient, non-community water system that serves a K-12 school to fail to sustainably provide an adequate supply of safe drinking water due to water quality, water accessibility, affordability, institutional, and/or TMF capacity issues.

Risk Threshold: the levels, points, or values associated with an individual indicator that delineates when a water system is threatening failure, typically based on regulatory requirements or industry standards.

Sanitary Survey: a comprehensive inspection to evaluate a water system's ability to provide safe drinking water to their customers and comply with the federal Safe Drinking Water Act (SDWA).

Significant Deficiencies: State Water Board staff or LPA staff observed shortcomings identified during a **Sanitary Survey** or other water system inspections. Significant Deficiencies include but are not limited to: defects in design, operation, or maintenance; failure or malfunction of the sources, treatment, storage; or use of a distribution system that U.S. EPA determines to be causing or has the potential to cause the introduction of contamination into the water delivered to consumers.

Safe and Affordable Drinking Water Fund (**SADWF):** the fund created through the passage of Senate Bill 200 (SB 200) to help provide an adequate and affordable supply of drinking water for both the near and long terms. SB 200 directs the annual transfer of five percent of the annual proceeds of the Greenhouse Gas Reduction Fund (GGRF) (up to $130 million) into the fund until June 30, 2030. (Health & Saf. Code, § 116766)

Safe and Affordable Funding for Equity and Resilience Program (**SAFER Program):** a set of State Water Board tools, funding sources, and regulatory authorities designed to ensure safe, accessible, and affordable drinking water for all Californians.

SAFER Clearinghouse: a database system, developed and maintained by the State Water Board to assist with the implementation, management, and tracking of the SAFER Program.

Safe Drinking Water: water that meets all primary and secondary drinking water standards, as defined in Health and Safety Code section 116275.

Score: a standardized numerical value scaled between 0 and 1, that quantifies risk across risk indicators. Scores enable the evaluation and comparison of risk indicators.

Secondary Drinking Water Standards: quantity levels that specify **Maximum Contaminant Levels** necessary to protect the public welfare. Secondary drinking water standards may apply to any contaminant in drinking water that may adversely affect the public welfare. Regulations establishing secondary drinking water standards may vary according to geographic and other circumstances and may apply to any contaminant in drinking water that adversely affects the taste, odor, or appearance of the water when the standards are necessary to ensure a supply of pure, wholesome, and potable water. (Health & Saf. Code, § 116275, subd. (d).)

Service Connection: the point of water access between the customer's piping or constructed conveyance, and the system's meter, service pipe, or constructed conveyance, with certain exceptions set out in the definition in the Health and Safety Code. (See Health & Saf. Code, § 116275, subd. (s).)

Senate Bill No. 200: the legislative bill signed into law in 2019 that established the **Safe and Affordable Funding for Equity and Resilience (SAFER) Program** that enabled the State Water Board to advance the goals of the **Human Right to Water**. (Senate Bill No. 200, CHAPTER 120)

Senate Bill No. 552: a legislative bill signed into law in 2021 that requires small water suppliers and non-transient non-community water systems, to apply draught resiliency measures subject to funding availability. (Senate Bill No. 552, CHAPTER 245)

Severely Disadvantaged Community (**SDAC):** the categorization of an entire water-system service area where the **Median Household Income** is less than 60% of the statewide **MHI**. (See Water Code § 13476, subd. (j))

Source Capacity: the total amount of water supply available, expressed as a flow, from all active sources permitted for use by a water system, including approved surface water, groundwater, and purchased water. (Title 22 of the California Code of Regulations, § 64551.40.)

Small Community Water System: a **CWS** that has no more than 3,300 service connections or a yearlong population of no more than 10,000 persons. (Health & Saf. Code, § 116275, subd. (z).)

Small Disadvantaged Community (Small DAC or **SDAC):** category for entire service area, or the community therein, with a community water system that serves no more than 3,300 service connections or a year-round population of no more than 10,000, and in which the **Median Household Income** is less than 80% of the statewide annual **MHI**.

State Small Water System (SSWS): a system for the provision of piped water to the public for human consumption that serves at least five, but not more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year. (Health & Saf. Code, § 116275, subd. (n).)

State Water Board: the California State Water Resources Control Board.

Technical, Managerial and Financial capacity (TMF capacity): the ability of a water system's administrators to plan for, achieve, and maintain long term compliance with drinking water standards, thereby ensuring the quality and adequacy of the water supply. This includes adequate resources for fiscal planning and management of the water system.

Waterworks Standards: regulations adopted by the State Water Board entitled California Waterworks Standards (Chapter 16 (commencing with § 64551) of Division 4 of Title 22 of the California Code of Regulations). (Health & Saf. Code, § 116275, subd. (q).)

Weight: numerical significance established by the application of a multiplying value to each risk indicator or category within the **Risk Assessment.** Allows for the accentuation of significance of certain risk indicators and categories deemed more critical than others.

EXECUTIVE SUMMARY

In 2016, the California State Water Resources Control Board (State Water Board) adopted a Human Right to Water Resolution[1] making the Human Right to Water (HR2W), as defined in Assembly Bill 685, a primary consideration and priority across all programs of the State Water Board and the nine Regional Water Quality Control Boards. The HR2W recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking and sanitary purposes."

In 2019, to advance the goals of the HR2W, California passed Senate Bill 200 (SB 200), which enabled the State Water Board to create the Safe and Affordable Funding for Equity and Resilience (SAFER) Drinking Water Program. SB 200 established a set of tools, funding sources, and regulatory authorities that the State Water Board harnesses through the SAFER Program to help struggling water systems sustainably and affordably provide safe drinking water. The SAFER Program is driven by collective responsibility: water systems, non-profit organizations, governments, a community advisory board, and other interested parties work together to develop and implement solutions.

Since the SAFER program began in 2019, 185 more water systems are providing safe and affordable drinking water, benefiting over 1.2 million Californians. As of April 2023, the State Water Board has distributed nearly $700 million in grants for drinking water projects, which is 95% more grant funding provided to water systems in disadvantaged communities than in the three years prior to the start of the program. In addition, 94 consolidations, serving 56,451 people, have now been completed through the program since July 2019.

The annual Drinking Water Needs Assessment (Needs Assessment), required to be carried out by the SAFER Program, provides foundational information and recommendations to guide this work.[2] The Needs Assessment is comprised of four core components: the Failing Water System List (Failing list), the Risk Assessment, the Cost Assessment, and the Affordability Assessment. Public input that the State Water Board received via workshops held in 2022 and February 2023 helped improve the 2023 Needs Assessment. The public feedback, all of which

[1] State Water Resources Control Board Resolution No. 2016-0010
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf
[2] California Health and Safety Code section 116769 (b) states "The fund expenditure plan shall be based on data and analysis drawn from the drinking water needs assessment..."

is detailed in publicly available documents online, was incorporated into the final methodology and results as appropriate.

Three different water system types— public water systems, state small water systems and domestic wells— are analyzed within the 2023 Needs Assessment. Different methodologies were developed for these system types based on system type characteristics, as well as data availability and reliability.

Figure 1: Needs Assessment Components

The results of the annual Needs Assessment are used by the State Water Board and the SAFER Advisory Group[3] to inform the prioritization of available state funding and technical assistance within the Safe and Affordable Drinking Water Fund (SADWF) Fund Expenditure Plan (FEP).[4] The State Water Board typically hosts a series of workshops throughout the year to inform the FEP.

Figure 2: How the Needs Assessment is Utilized by the SAFER Program

The Needs Assessment is not a static analysis. The State Water Board annually updates the Needs Assessment, and it provides a valuable snapshot of the overall resources needed to bring failing systems into compliance with drinking water standards and prevent At-Risk water

[3] SAFER Advisory Group
https://www.waterboards.ca.gov/safer/advisory_group.html
[4] Safe and Affordable Drinking Water Fund
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/safer.html

systems from failing. By incorporating this Needs Assessment into the SAFER Program and implementation of SADWF, the State Water Board will continue to lead long-term drinking water solutions. At the same time, this Needs Assessment gives clarity to the work that must collectively be done by state, federal, local and stakeholder partners. Only together can we be successful in achieving the Human Right to Water goal for all Californians.

2022 RETROSPECTIVE

FAILING WATER SYSTEMS

Since 2017, the State Water Board has been tracking community water systems and K-12 schools that meet the State Water Board's Failing criteria. The Failing criteria was expanded by the State Water Board in 2021 and may continue to evolve in the future. The evolving nature of the State Water Board's Failing criteria can make it challenging to analyze water systems on the Failing list over time. In 2022, there were 441 unique water systems on the Failing list at one point throughout the year as shown in Table 1. In 2022, there were 77 unique water systems that came onto the Failing list and 56 unique water systems were removed. 329 unique water systems remained on the list throughout the year.

Altogether, just over 1.2 million Californians were served by a failing water system at some point during 2022, but at any one time the number was far lower, fluctuating throughout the year as systems were removed or added to the Failing list. The Failing list from January 1, 2023, had 388 water systems, serving a population of approximately 938,000 people.

Table 1: Summary of Systems on the Failing List Throughout 2022

Water Systems	Number of Unique Systems	Total Population Served	Average Number of Service Connections	# of Systems on List Greater than 3-Yrs.
Small Water Systems[5]	353	318,209	249	195
Medium Water Systems[6]	23	893,557	9,868	11
K-12 Schools	65	17,905	6	45
TOTAL:	**441**	**1,229,671**	**715**	**251**

PROVIDING ASSISTANCE

The goal of the SAFER Program is to help Failing and At-Risk systems operate sustainably and achieve the HR2W. It does this by building local capacity through consolidations, administrators, technical assistance, and working with systems, the communities they serve

[5] 3,000 service connections or less.
[6] Greater than 3,000 service connections. No system with greater than 30,000 service connections has been on the Failing list since September 2019.

and other partners to find long-term solutions to their specific problems. In doing so, the SAFER program utilizes a diverse set of funding programs and regulatory authorities to build water system capacity. The following summarizes the support provided to California water systems in 2022:

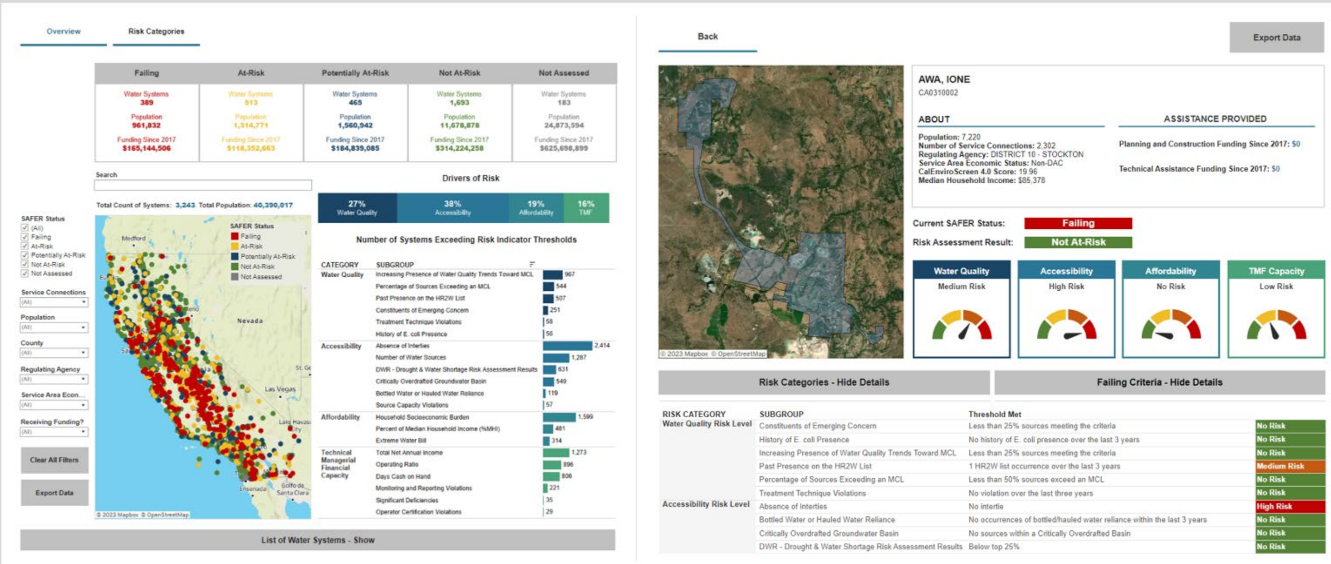
- 27 water systems, serving 7,663 residents were consolidated.
- The State Water Board's sent out over 3,000 letters to water systems recommending consolidation and hosted 12 Water Partnership Training events across the state.
- There are approximately 316 active consolidations either in early stages of development or in the funding process. There are an additional 56 potential consolidations in the early stages of engagement. Approximately 42% of water systems on the 2022 Failing list are considering consolidation or in full development of the consolidation alternative and progressing forward.
- Since 2020, the State Water Board has designated 16 public water systems in need of an administrator and held public meetings for all the impacted communities. This represents approximately 3,812 people and 1,140 service connections in 7 counties.
- Currently, there are 3 administrator projects with appointments and funding approved by the State Water Board. Eleven additional water systems have identified administrators and await executed funding agreements and/or are working through liability concerns before an administrator is ordered. The administrator process has just started for 2 water systems, for which an administrator is yet to be identified.
- The SAFER Program provided short-term solutions, such as emergency well repairs, and bottled and hauled water provision to nearly 24,000 individuals. Long-term solutions, such as construction and consolidation, were completed for 42 water systems, including nearly 8.5 million individuals. Planning assistance (towards construction of long-term solutions) was provided to 13 water systems, including over 33,000 individuals.
- The State Water Board provided $6,214,740 in planning and $751,823,022 in construction funding.
- In 2022, the State Water funded approximately $21,641,362 million for technical assistance to support 357 water systems.
- In 2022, the State Water Board and Local Primacy Agencies completed sanitary surveys for 900 community drinking water systems and 892 non-community drinking water systems. Identifying more than 30 significant deficiencies.

NEW TOOLS

In 2022, the State Water Board developed new publicly available Dashboards and datasets to improve access to the data and analysis contained in the Needs Assessment:

- **SAFER Dashboard (Failing and A-Risk Public Water Systems)**: https://bit.ly/3KhMZPB
- **Risk Assessment Results for State Small Water Systems & Domestic Wells Dashboard:** https://bit.ly/3nxWjGo
- **Water System Financial Capacity & Community Affordability Dashboard:** https://bit.ly/42C0xg7

Figure 3: SAFER Dashboard



ENHANCEMENTS TO THE 2023 NEEDS ASSESSMENT

AFFORDABILITY-RELATED ENHANCEMENTS

In response to stakeholder feedback after the release of the 2021 and 2022 Needs Assessments, the State Water Board in partnership with the Office of Environmental Health Hazard Assessment (OEHHA), hosted three public Affordability Workshops in 2022 to re-evaluate previously utilized affordability indicators, research new affordability indicators, and explore how to incorporate a new affordability indicator that measures disposable income limitations into the 2023 Needs Assessment and beyond.[7] These workshops also analyzed different approaches for determining DACs and establishing an “affordability threshold.” Based on feedback from the public workshops, the State Water Board revised its affordability indicators as follows:

- The State Water Board removed two affordability indicators from the Affordability Assessment: ‘Percent of Residential Arrearages’ and ‘Residential Arrearage Burden.’ Current data for these risk indicators is not available for use in the Needs Assessment because it was collected once for the COVID-19 pandemic Drinking Water Arrearage Payment Program.[8] This data is currently not collected annually from community water systems.

[7] Workshop 1 (August 8, 2022); Presentation: https://bit.ly/3jsI4k8
Workshop 2 (September 20, 2022); Presentation: https://bit.ly/3juZwEI; White Paper: https://bit.ly/3HXrliS
Workshop 3 (November 1, 2022); Presentation: https://bit.ly/3CKoBIG; White Paper: https://bit.ly/3HVIsll
[8] California Water and Wastewater Arrearage Payment Program https://www.waterboards.ca.gov/arrearage_payment_program/

- The State Water Board and OEHHA developed a new affordability indicator, incorporating stakeholder feedback from the three Affordability Workshops, "Household Socioeconomic Burden," a composite indicator that is a combined measure of Housing Burden and Poverty Prevalence that measures the extent to which low-income customers may have affordability challenges now or in the future because their disposable income is constrained by high housing costs. This allows for the first time, the inclusion of approximately 680 community water systems (i.e., mobile home parks. etc.) that do not charge customers directly for water in the assessment.[9]

ENHANCEMENTS TO THE RISK ASSESSMENT FOR STATE SMALL WATER SYSTEMS & DOMESTIC WELLS

The 2022 Risk Assessment included two categories: Water Quality and Water Shortage. In 2022, the State Water Board partnered with OEHHA to develop a third category of risk for state small water systems and domestic wells that analyzed socioeconomic risk. The purpose of the new Socioeconomic risk category is to (1) assess a counties' overall administrative, technical, and managerial capacity to assist communities served by state small water systems and domestic wells and (2) assess the ability of communities served by these systems to access and pay for water at a neighborhood level, especially when faced with a well experiencing water quality or water shortage issues.

A workshop was hosted in February 2023 to provide an opportunity for stakeholders to recommend how this new Socioeconomic risk category is combined with the Water Quality and Water Shortage risk categories to identify at-risk state small water systems and domestic well communities.[10]

2023 NEEDS ASSESSMENT RESULTS

RISK ASSESSMENT

The purpose of the Risk Assessment is to identify public water systems, state small water systems and regions where domestic wells are at-risk of failing to sustainably provide a sufficient amount of safe and affordable drinking water. Approximately 71 new water systems are added to the Failing list each year.[11] The identification of At-Risk water systems and domestic wells allows the State Water Board to proactively target technical assistance and funding towards communities to prevent systems from failing to achieve the goals of the HR2W.

[9] Since 2020, all affordability indicators have relied on the water systems charging for water. In 2022, nearly 40% of DAC water systems were excluded from the Assessment because they do not charge for water (i.e., mobile home parks that include their water bill in rental charge).
[10] February 3, 2023 Needs Assessment Workshop: Proposed Changes for the 2023 Needs Assessment: White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimneedsassessment.pdf; Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023/2023-Preliminary-Needs-Assessment-Results-Webinar-Presentation.pdf
[11] Average based on systems added to the Failing list between 01.01.2017 through 12.31.2022.

The State Water Board has developed two different Risk Assessment methodologies to identify At-Risk public water systems and communities served by state small water systems and domestic wells. Different methodologies were developed for these system types based on system type characteristics, as well as data availability and reliability.

The first methodology is for community water systems with up to 30,000 service connections or 100,000 population served and K-12 schools. The second methodology identifies state small water systems and domestic wells that are at a high risk of water shortage, accessing source water that may contain contaminants that exceed safe drinking water standards, and/or socioeconomic constraints in addressing challenges with accessing safe drinking water.

At-Risk Public Water Systems

In 2022, approximately 87% of systems that were on the Failing list were designed At-Risk or Potentially At-Risk in the 2022 Risk Assessment**.** The Risk Assessment continues to improve its ability to identify systems at-risk of failing.

The 2023 Risk Assessment was conducted for 3,053 public water systems and analyzes water system risk across four categories: Water Quality, Accessibility, Affordability, and TMF (technical, managerial, and financial) Capacity. On January 1, 2023 there were 381 water systems included in the analyses that were on the Failing list. The Risk Assessment results, after excluding Failing list systems,[12] are: 512 (17%) At-Risk water systems, 453 (15%) Potentially At-Risk water systems, and 1,707 (56%) Not At-Risk water systems (Figure 4).

Compared to the 2022 Risk Assessment results, the 2023 Assessment identifies 113 more At-Risk water systems (including Failing system performance in the Risk Assessment) and a statewide increase in total average risk scores. The increase in the number of At-Risk water systems and total average statewide risk scores is mostly attributed to the addition of the new Affordability Category risk indicator 'Household Socioeconomic Burden.'[13] Furthermore, 119 (4%) of At-Risk systems were automatically at-risk, regardless of their performance across all risk indicators because they have relied on bottled and/or hauled water to meet customer demand within the last three years. This is 30 more systems when compared to the 2022 Risk Assessment results, which had 89 (3%) of systems automatically At-Risk. Learn more about this in Appendix A.

Since the State Water Board began identifying At-Risk water systems in the Risk Assessment in the 2021 Needs Assessment, the total number of unique At-Risk water systems has remained fairly constant. This is due to a number of factors, including expanding Failing criteria, improved risk indicators and data, and the expansion of the inventory of systems included in the Risk Assessment.

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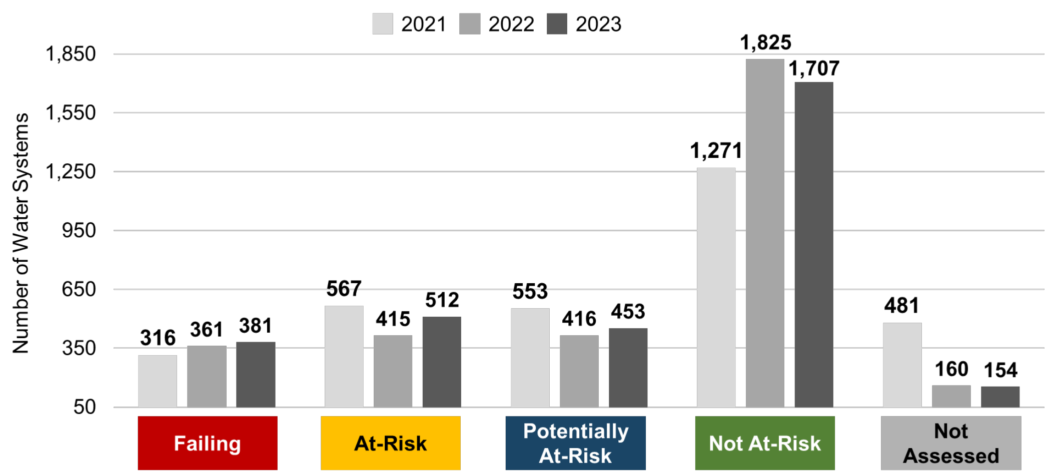
[12] Of the 381 Failing water systems, 302 (79%) meet the At-Risk threshold. If these systems come off the Failing list, they will be considered At-Risk systems.
[13] Comparing the 2023 Risk Assessment results to the 2022 results, 359 (12%) of water systems experienced no change in their performance, 1,648 (55%) systems accumulated more risk points, and 1,010 (33%) accumulated less risk points. The increase in the risk points in the 2023 Risk Assessment is attributed to the changes made to the Affordability category in the Risk Assessment. Learn more in Appendix A.

The results of the Risk Assessment and the current list of Failing water systems are accessible online through the State Water Board's SAFER Dashboard. The Dashboard updates the Failing list daily and the Risk Assessment results will be updated on a quarterly basis with new data as it becomes available. Learn more about the SAFER Dashboard in Appendix E.

Figure 4: Risk Assessment Results Since 2021[14, 15]



At-Risk State Small Water Systems & Domestic Wells

The Risk Assessment methodology developed for state small water systems and domestic wells is focused on identifying areas where groundwater is at high-risk of containing contaminants that exceed safe drinking water standards, is at high-risk of water shortage, and where there is high socioeconomic risk. Statewide, the top contaminants that contributed to higher risk designations in domestic wells and state small water systems are nitrate, arsenic, 1,2,3-trichloropropane, gross alpha, uranium, and hexavalent chromium. The analysis found high water shortage risk areas are highly correlated with reported dry wells. Of the dry well reports[16] made to the Department of Water Resources within the past year, 85% are located within an area with high water shortage risk. Table 2 shows the approximate counts of state small water systems and domestic wells statewide located in different risk areas based on data from the 2023 Risk Assessment.

Table 2: State Small Water System and Domestic Well Results (Statewide)

Assessment	At-Risk	Potentially At-Risk	Not At-Risk
State Small Water Systems	245 (19%)	620 (48%)	432 (33%)
Domestic Wells	81,588 (28%)	103,986 (36%)	105,827 (36%)

[14] Not Assessed includes: in 2021, wholesalers and community water systems with greater than 3,300 service connections; in 2022 and 2023, wholesalers and community water systems with greater than 30,000 service connections or 100,000 population served.
[15] In 2023, Not Assessed includes 86 large community water systems that serve greater than 30,000 service connections or 100,000 population served and 68 wholesalers.
[16] Households report well outages or issues to the Department of Water Resources
https://mydrywatersupply.water.ca.gov/report/

Proximity to a nearby community water system is important information for Counties and communities served by state small water systems and domestic wells in case of emergencies and potential codependences. For the first time, the State Water Board has included an analysis of this information:

- Approximately 14,675 domestic wells (18% at-risk domestic wells) and 81 state small water systems (33% of at-risk state small water systems) are located within the boundary of a community water system.
- Approximately 26,579 domestic wells and 99 state small water systems are located within one mile of a community water system boundary.

COST ASSESSMENT UPDATE

This 2023 Needs Assessment does not include an updated Cost Assessment. The State Water Board is currently updating the full Cost Assessment Model for Failing and At-Risk public water systems, state small water systems, and domestic wells for the 2024 Needs Assessment. This 2-year enhancement effort includes:

1. Updating how the Cost Assessment Model identifies and selects interim and long-term solutions for Failing and At-Risk systems.
2. Updating and enhancing the cost assumptions and formulas used in the Model to estimate costs – both capital and non-capital.
3. Improving the analysis of the Cost Assessment results.
4. Improving transparency by making the underlying data, formulas, etc. more accessible.

The State Water Board began hosting public workshops in 2022 to start soliciting public feedback on the proposed enhancements to the Cost Assessment.[17] Additional workshops are planned for 2023.

AFFORDABILITY ASSESSMENT

The Affordability Assessment identifies community water systems that serve disadvantaged communities (DAC/SDAC) that must charge their customers' fees which exceed the affordability threshold established by the State Water Board to provide adequate safe drinking water. The 2023 Affordability indicators included are the same that are utilized in the Risk Assessment, which also includes indicators in three additional categories: water quality, accessibility, and TMF capacity. In the Affordability Assessment, Affordability indicators are analyzed independently from the other category indicators in the Risk Assessment:

[17] August 8, 2022 Workshop: Proposed Changes for the Cost Assessment: White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/cost-assessment-white-paper.pdf; Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/2022-proposed-changes-to-cost-model-bt.pdf

- **Percent Median Household Income**: average residential customer charges for 6 hundred cubic feet (HCF) per month[18] that meet or exceed 1.5%[19] of the annual Median Household Income (MHI) within a water system's service area.
- **Extreme Water Bill**: customer charges that meet or exceed 150% and 200% of statewide average drinking water customer charges at the 6 HCF level.
- **Household Socioeconomic Burden**: measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).

To assess which systems may be facing the greatest affordability burden, the State Water Board analyzed how many water systems exceeded thresholds for multiple affordability indicators. Affordability burden is ranked from low (only one affordability indicator threshold exceeded), medium, (two affordability indicator thresholds exceeded), or high (three affordability indicator thresholds exceeded).

For the 2023 Affordability Assessment, State Water Board staff analyzed 2,845 community water systems.[20] The majority were identified as having low affordability burden (45%) followed by a medium affordability burden (12%) and a high affordability burden (3%). Overall, there is a higher proportion of DAC/SDAC systems that have a high or medium affordability burden compared to non-DAC and missing DAC status systems.[21]

Table 3: 2023 Affordability Assessment Results

Community Status	Total Systems Assessed	High Affordability Burden[22]	Medium Affordability Burden[23]	Low Affordability Burden[24]	None
DAC/SDAC	1,483	75 (5%)	246 (17%)	889 (60%)	272 (18%)
Non-DAC	1,347	19 (1%)	107 (8%)	394 (29%)	828 (61%)
Missing DAC Status	15	0 (0%)	1 (7%)	8 (53%)	6 (40%)
TOTAL:	**2,845**	**94 (3%)**	**354 (12%)**	**1,291 (45%)**	**1,106 (39%)**

[18] 6 HCF indoor water usage per month is roughly equivalent to 50 gallons per person per day for a three-person household for 30 days. It is commonly used to estimate household consumption.
[19] 1.5% %MHI threshold is utilized by the State Water Board's Division of Financial Assistance to assess affordability and inform funding decisions for state funding programs.
[20] Compared to the Risk Assessment which analyzed 3,053 systems, the Affordability Assessment *excludes* non-transient, non-community schools and *includes* large community water systems (greater than 30,000 service connections or 100,000 population served).
[21] A water system (1) may not have enough U.S. Census data associated with its service area for the State Water Board to estimate its median household income to make a DAC/SDAC determination, or (2) may lack any useable geographic data to determine median household income with the current method utilized by the State Water Board.
[22] Community water system met the minimum threshold for 3 of the affordability indicators.
[23] Community water system met the minimum threshold for 2 of the affordability indicators.
[24] Community water system met the minimum threshold for 1 of the affordability indicators.

DEMOGRAPHIC ANALYSIS OF NEEDS ASSESSMENT RESULTS

The State Water Board has compared the results of the Risk and Affordability Assessments to socio-economic data to better understand the communities most in need. The results of this analysis are summarized below:

- Communities served by Failing list systems on average experience 9% higher pollution burden, 3.2% greater linguistic isolation, and serve a 4.2% greater proportion of non-white households than systems non-Failing systems.
- Communities served by At-Risk public water systems on average experience 13% higher pollution burden, 4.6% greater linguistic isolation, and serve a 21.7% greater proportion of non-white households than systems not At-Risk.
- Communities served by At-Risk state small water systems and domestic wells on average experience 9.6% higher CalEnviroScreen 4.0 scores, 9.1% higher pollution burden, and serve a 3.9% greater proportion of non-white households than systems not At-Risk communities served by state small water systems and domestic wells.
- When compared with Non-DAC/SDAC public water systems, DAC/SDAC water system service areas tend to have 2.7% higher pollution burdens, 22% higher percentage of households in poverty, 4.9% higher percentage of limited English-speaking households, and are 8.2% likely to serve a greater proportion of non-white communities.

INTRODUCTION

ABOUT THE NEEDS ASSESSMENT

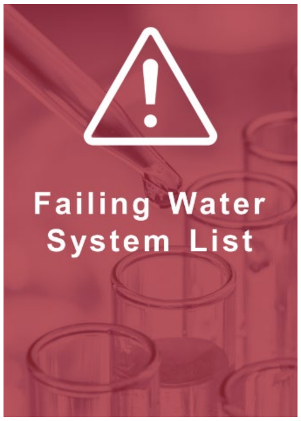
In 2016, the State Water Board adopted a Human Right to Water Resolution making the Human Right to Water (HR2W), as defined in Assembly Bill 685, a primary consideration and priority across all of the state and regional boards' programs.[25] The HR2W recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking and sanitary purposes."

In 2019, to advance the goals of the HR2W, California passed Senate Bill 200 (SB 200) which enabled the State Water Board to establish the Safe and Affordable Funding for Equity and Resilience (SAFER) Program. SB 200 established a set of tools, funding sources, and regulatory authorities the State Water Board can harness through the SAFER Program to help struggling water systems sustainably and affordably provide safe drinking water to their customers. Among the tools created under SB 200 is the Safe and Affordable Drinking Water Fund (Fund). The Fund provides up to $130 million per year through 2030 to enable the State Water Board to develop and implement sustainable solutions for underperforming drinking water systems.

The SAFER Program harnesses the Fund together with other State Water Board funding programs to advance the implementation of interim and long-term solutions for communities across the state. The State Water Board prioritizes SAFER Program funding annually through the Fund Expenditure Plan (FEP). The annual FEP is to be informed by "data and analysis drawn from the drinking water **Needs Assessment,**" per California Health and Safety Code section 116769.

The State Water Board's Drinking Water Needs Assessment (Needs Assessment) consists of four core components: the Failing Water System List (Failing list), Risk Assessment, Cost Assessment, and Affordability Assessment.

[25] State Water Board Resolution No. 2016-0010
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf



Since 2017, the State Water Board has assessed water systems that fail to meet the goals of the HR2W and maintains a list and map of these systems on its website.[26] Systems that are on the Failing list are those that are out of compliance or consistently fail to meet primary drinking water standards. Systems that are assessed for meeting the Failing list criteria include Community Water Systems (CWSs) and non-transient non-community (NTNC) that serve schools and daycares.[27] The Failing list criteria was expanded in April 2021 and may be refined over time.

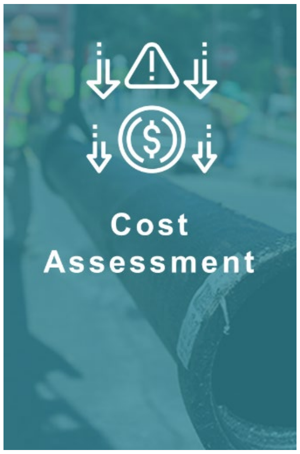
SB 200 calls for the identification of "public water systems, community water systems, and state small water systems that may be at risk of failing to provide an adequate supply of safe drinking water." As well as "an estimate of the number of households that are served by domestic wells or state small water systems in high-risk areas."[28] Therefore, different Risk Assessment methodologies have been developed for different system types:

Public Water Systems
The Risk Assessment methodology currently utilizes risk indicators to identify At-Risk K-12 schools and community water systems servicing up to 30,000 service connections and no more than 100,000 population served. Risk indicators assess risk in the following categories: water quality, accessibility, affordability, and TMF (technical, managerial, and financial) capacity.

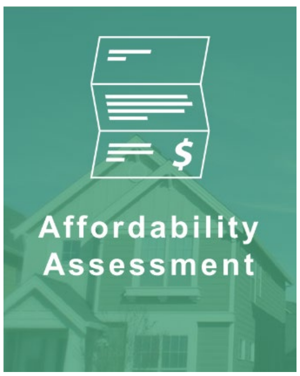
State Small Water Systems & Domestic Wells
The Risk Assessment methodology for state small water systems and domestic wells utilizes risk indicators in the following categories: water quality, water shortage, and socioeconomic risk.

Tribal Water Systems
The State Water Board is partnering with Indian Health Services, U.S. Environmental Protection Agency, and tribal communities to understand the best way to integrate tribal drinking water needs into the Needs Assessment.

[26] SAFER Dashboard
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/saferdashboard.html
[27] California Health and Safety Code section 116275(c)
[28] California Health and Safety Code section 116769



SB 200 directs the State Water Board to “estimate the funding needed for the next fiscal year based on the amount available in the fund, anticipated funding needs, other existing funding sources.”[29] Thus, the Cost Assessment estimates the costs related to the implementation of interim and/or emergency measures and longer-term solutions for Failing and At-Risk systems. The State Water Board is currently re-building the Cost Assessment Model and updating its underlying cost assumptions with more recent data and feedback from public workshops. The results of the updated Cost Assessment will be published in the 2024 Needs Assessment.



SB 200 calls for the identification of “any community water system that serves a disadvantaged community that must charge fees that exceed the affordability threshold established by the board in order to supply, treat, and distribute potable water that complies with federal and state drinking water standards.”[30] The Affordability Assessment evaluates several different affordability indicators to identify communities that may be experiencing affordability challenges.

DEVELOPMENT AND ENHANCEMENT PROCESS

The State Water Board’s Needs Analysis Unit in the Division of Drinking Water (DDW) leads the implementation of the Needs Assessment in coordination with the Division of Water Quality (DWQ), Division of Financial Assistance (DFA), and Division of Information Technology (DIT).

The foundational methodologies utilized in the Needs Assessment were initially developed in 2019 and 2020 through multiple public workshops and a one-time contract with the University of California, Los Angeles Luskin Center for Innovation (UCLA) (agreement term: 09.01.2019 through 03.31.2021).[31] The State Water Board has also partnered with the Department of

[29] California Health and Safety Code section 116769

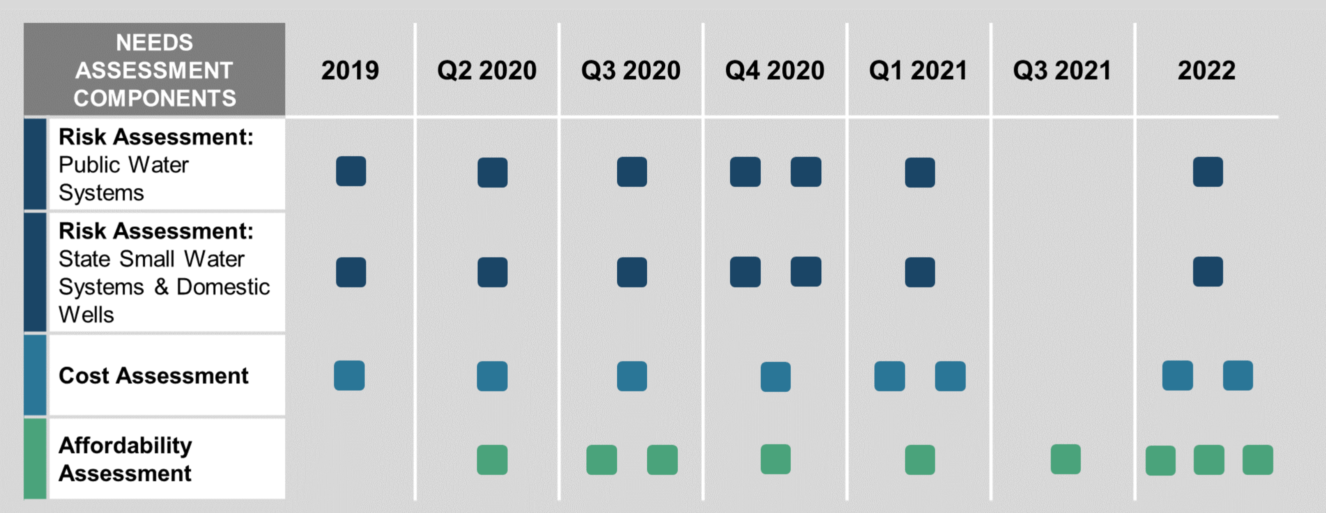
[30] California Health and Safety Code section 116769 (2) (B).

[31] Before SB 200 was passed in 2019, the State Water Board was appropriated $3 million in funding in 2018 from the state legislature via Senate Bill 862 (Budget Act of 2018) to implement a “Needs Analysis” on the state of drinking water in California. The State Water Board contracted the UCLA to support the initial development of Needs Assessment methodologies for the Risk Assessment and Cost Assessment from September 1, 2019 to March 31, 2021. UCLA in turn collaborated with subcontractors Corona Environmental Consulting (Corona), the Sacramento State University Office of Water Programs (OWP), the Pacific Institute, and the University of North Carolina Environmental Finance Center (UNC EFC) to produce a portion of the work contained in the 2021 Needs Assessment and previous white papers.

Water Resources (DWR) and the Office of Environmental Health Hazard Assessment (OEHHA) to further enhance the Needs Assessment.

The State Water Board is committed to engaging the public and key stakeholder groups to solicit feedback and recommendations to inform the development of the Needs Assessment methodologies. Since 2019, 21 workshops (some covering multiple component topics) have been hosted, two in-person, and 19 webinars to inform the core methodologies (Figure 5). White papers, presentations, public feedback received, and webinar recordings can be found on the State Water Board's Needs Assessment webpage. The State Water Board will continue to host public workshops to provide opportunities for stakeholders to learn about and contribute to the State Water Board's efforts to enhance and develop a more robust Needs Assessment.

Figure 5: Public Workshops on Needs Assessment Methodologies



HOW THE NEEDS ASSESSMENT IS UTILIZED BY THE STATE WATER BOARD

The State Water Board conducts the Needs Assessment annually to inform the annual SAFER Fund Expenditure Plan, support implementation of the SAFER Program, and advance its water system Technical, Managerial, Financial (TMF) Capacity Development Strategy.

SAFER PROGRAM

The results of the Needs Assessment are used by the State Water Board and the SAFER Advisory Group[32] to inform prioritization of public water systems, tribal water systems, state

[32] SAFER Advisory Group
https://www.waterboards.ca.gov/safer/advisory_group.html

small water systems, and domestic wells for funding in the Safe and Affordable Drinking Water Fund Expenditure Plan; inform direction for State Water Board technical assistance; and to develop strategies for implementing interim and long-term solutions (Figure 5).

Figure 6: How the Needs Assessment is Utilized by the SAFER Program

Over 95% of Californians are served by water systems which meet drinking water standards, but this leaves almost a million people being served by failing water systems and over a million more getting their drinking water from at-risk public water systems, or at-risk state small water systems or domestic wells. The SAFER Program's goal is to ensure that all Californians can access safe drinking water in their homes. Meeting this goal requires solving many difficult and multi-faceted problems and addressing aspects of long-term disparities, especially in disadvantaged communities. Meeting this goal would fulfill an important pillar of the HR2W.

PUBLIC WATER SYSTEM CAPACITY DEVELOPMENT STRATEGY

The Capacity Development program was established as a key component of the 1996 Federal Safe Drinking Water Act (SDWA) Amendments. The Amendments were passed by Congress in part because of the significant problems small public water systems were having providing safe and reliable drinking water to their customers. The SDWA emphasizes prevention and assistance, both financial and technical, to resolve these problems. The Amendments have provided incentives (including funding) for each state to develop a Capacity Development program to assist public water systems in building technical, managerial, and financial capacity.[33] The Capacity Development program provides a framework for states and water systems to work together to protect public health.

The SDWA allows the states the flexibility to develop their own strategy to meet the individual needs of the state. California's initial Capacity Development Strategy was adopted in 2000[34] and in 2022 the State Water Board engaged with stakeholders through two public workshops to update the Strategy to better align with the SAFER Program and new federal

[33] State Water Board Capacity Development Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/TMF.html
[34] 2020 Capacity Development Strategy
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/cd_strategy.pdf

requirements.[35] Stakeholders helped identify barriers to capacity development and shaped the Strategy's eight core Elements (Table 4).

Many Elements from the previous Strategy have been revised to incorporate the activities implemented through the SAFER Program. The Needs Assessment is a core component of Element 2, "Identification & Prioritization of EXISTING Systems in Need of Improved TMF Capacity" and Element 8, "Measuring TMF Capacity Building Success." The results of the Needs Assessment help ensure the State Water Board and the public have the information needed to advance capacity development activities for Failing and At-Risk water systems. The Retrospective section of the Needs Assessment provides an annual update on State Water Board activities and progress in implementing the State Water Board's Capacity Development Strategy Elements.

Table 4: Capacity Development Strategy Elements

Number	Capacity Development Strategic Element
Element 1	Ensuring NEW Public Water Systems have TMF Capacity
Element 2	Identification & Prioritization of EXISTING Systems in Need of Improved TMF Capacity • Failing Water Systems • Risk Assessment • Cost Assessment • Affordability Assessment
Element 3	Supporting Direct Capacity Building • Water System Partnerships & Consolidation • Administrators • Engagement Units • Operator Certification • Sanitary Surveys
Element 4	Supporting Capacity Building Work of Third-Party Organizations • Technical Assistance
Element 5	Ensuring TMF Capacity of State Funding & Financing Recipients
Element 6	Promoting Asset Management
Element 7	Building Capacity Through Complete and Accurate Data Gathering and Reporting
Element 8	Measuring TMF Capacity Building Success

[35] California Capacity Development Strategy for Public Water Systems (2022)
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/2022-capdev-strategy-v2.pdf

SYSTEMS ANALYZED IN THE NEEDS ASSESSMENT

California has more than 7,000 active water systems, 1,297 state small water systems, and more than 300,000 known domestic wells (estimates for domestic wells are much higher, but data for locations and activity status are missing). The State Water Board classifies water systems into different water systems "types" or "classifications," which often correspond to different regulatory requirements.

Table 5: Water System Classifications[36]

Water System Type	Definition[37]	# of Active Systems
Public Water System (PWS)	A system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.	7,284
Community Water System (CWS)	A public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 yearlong residents of the area served by the system.	2,845
Non-Community Water System (NCWS)	A public water system that is not a community water system.	4,439
Non-Transient, Non-Community Water System (NTNC)	A public water system that is not a community water system and that regularly serves at least 25 of the same persons over six months per year (e.g., K-12 school, year around business, etc.).	2,963
Transient, Non-Community Water System (TNC)	A public water system that does not meet the definition of a community water system or non-transient, non-community water system, which serves 25 or more people at least 60 days out of a year or there are 15 or more service connections that are not used by yearlong residents (e.g., restaurants, gas stations, parks, etc.).	1,476
State Small Water System (SSWS)	A system for the provision of piped water to the public for human consumption that serves at least five, but not more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year.	1,297[38]

[36] Numbers reflect current inventory of water systems as of 02.24.2023.
[37] California Health and Safety Code Section 116275.
[38] There are1,297 state small water systems with sufficient data to be included in the 2023 Needs Assessment.

Water System Type	Definition[37]	# of Active Systems
Domestic Well (DW)	A groundwater well used to supply water for the domestic needs of an individual residence or a water system that is not a public water system and that has no more than four service connections. (Health & Saf. Code, § 116681, subd. (g).)	291,401[39]

The 2023 Needs Assessment's components analyze different inventories of water system types. Table 6 summarizes the water system types included in each component.

Table 6: Systems Included in the 2023 Needs Assessment Components

Needs Assessment Component	Water Systems Included
Failing List	• All community water systems. • Non-transient Non-community K-12 schools.
Risk Assessment for Public Water Systems	• Community water systems up to 30,000 service connections and up to 100,000 population served. ○ Wholesalers are excluded. • Non-transient Non-community K-12 schools.
Risk Assessment for State Small Water Systems and Domestic Wells	• All state small water systems where location data is available. • All domestic wells with "domestic" well completion reports in the Department of Water Resources Online System for Well Completion Reports.
Affordability Assessment	• All community water systems

[39] This represents the number of domestic well records identified using the Department of Water Resources Online System for Well Completion Reports (OSWCR). The actual count and location of active domestic wells is currently unknown.

2022 RETROSPECTIVE

The SAFER program uses a set of tools, funding sources, and regulatory authorities to ensure California communities develop local compacity to ensure access to safe and affordable drinking water. Informed by Drinking Water Needs Assessment, State Water Board staff and SAFER partner organizations proactively identify and reach out to water systems that are on the Failing list or At-Risk list to walk them through the SAFER funding and/or technical assistance application process and to collaborate on interim and long-term solutions, which are developed with input from the community.

Since the SAFER program began in 2019, 185 more water systems are providing safe and affordable drinking water, benefitting over 1.2 million Californians. As of April 2023, the State Water Board has distributed nearly $700 million in grants for drinking water projects, which is 95% more grant funding provided to water systems in disadvantaged communities than in the three years prior to the start of the program. In addition, 94 consolidations, serving 56,451 people, have now been completed through the program since July 2019. The following provides a high-level summary of the tools and resources employed by the SAFER program in 2022 and the systems that were prioritized for State Water Board engagement and support.

REGULATED WATER SYSTEMS

The State Water Board and Local Primacy Agencies regulate approximately 7,284 public water systems. In 2022 36 new public water systems were created (Table 7), 72 were deactivated, and 137 went from public to non-public (regulated by Counties).

Table 7: Newly Permitted Public Water Systems in 2022

System Name	Regulating Agency	County	Service Connections	Population Served
Southern Trinity Health Services, Inc.	District 01 - Klamath	Trinity	1	30
Blue Victorian Winery	District 04 - San Francisco	Solano	2	100

System Name	Regulating Agency	County	Service Connections	Population Served
Stars Holding	District 04 - San Francisco	Solano	1	104
Blood Gulch	District 10 - Stockton	Amador	3	50
California Olive Ranch	District 21 - Valley	Glenn	1	50
Mccall And Kings Canyon Plaza	District 23 - Fresno	Fresno	1	75
Huebert Farms	District 23 - Fresno	Fresno	4	60
Country Corner Market	District 23 - Fresno	Fresno	1	51
Quesadilla Gorilla	District 24 - Tulare	Tulare	2	40
Chevron Lindsay	District 24 - Tulare	Tulare	2	28
Truck Tops USA	District 25 - Marin	Sonoma	0	40
Nalle Winery	District 25 - Marin	Sonoma	1	25
Dg Campo	District 26-Imperial	San Diego	2	68
Somerset Dollar General	LPA 39	El Dorado	1	25
Adoption Center	LPA 50	Madera	1	25
Royal Oaks Market	LPA 57	Monterey	1	25
Antinori California	LPA 58	Napa	1	25
Baldacci Family Vineyards	LPA 58	Napa	2	110
Newberry Springs Gas Station & Mini-Mart	LPA 66	San Bernardino	1	306
8986 Deep Creek Road	LPA 66	San Bernardino	1	300
Dollar General Store # 14280	LPA 66	San Bernardino	1	400
Gables Water Company	LPA 66	San Bernardino	2	250
Fc Tracy Holdings, LLC	LPA 69	San Joaquin	2	219
Jahant Woods Cellars	LPA 69	San Joaquin	5	115
Zinc House Farm Winery	LPA 69	San Joaquin	3	220
Starbucks	LPA 69	San Joaquin	1	1200
Ada'S Vineyard LLC	LPA 70	San Luis Obispo	1	25

System Name	Regulating Agency	County	Service Connections	Population Served
Coastal Christian School	LPA 70	San Luis Obispo	1	650
Caelesta Winery	LPA 70	San Luis Obispo	1	30
Booker Winery	LPA 70	San Luis Obispo	1	56
Harmony Water Works	LPA 70	San Luis Obispo	1	25
Eleven Confessions Winery	LPA 72	Santa Barbara	3	29
Neighborhood Church Anderson Cottonwood	LPA 75	Shasta	1	400
Eco Shell	LPA 82	Tehama	1	60
Apex Agriculture	LPA 87	Yolo	2	38
Dollar General - Smartsville	LPA 88	Yuba	1	50
TOTAL:			**56**	**5,304**

Of the approximately 7,284 public water systems, 2,845 are community water systems. Community water systems serve at least 15 service connections used by yearlong residents or regularly serve at least 25 yearlong residents. It's important to note that 86% of regulated community water systems in the State are considered "small," servicing less than 3,300 service connections (Figure 7). However, these small water systems serve approximately 8% of the population (Figure 8).

Figure 7: Number of Community Water Systems by Service Connections

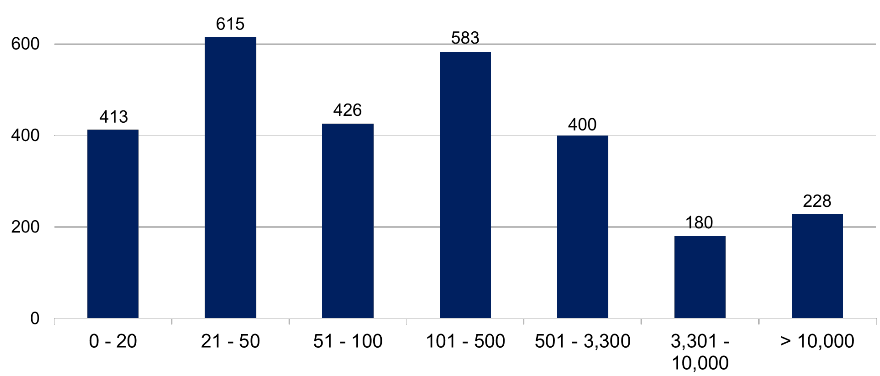
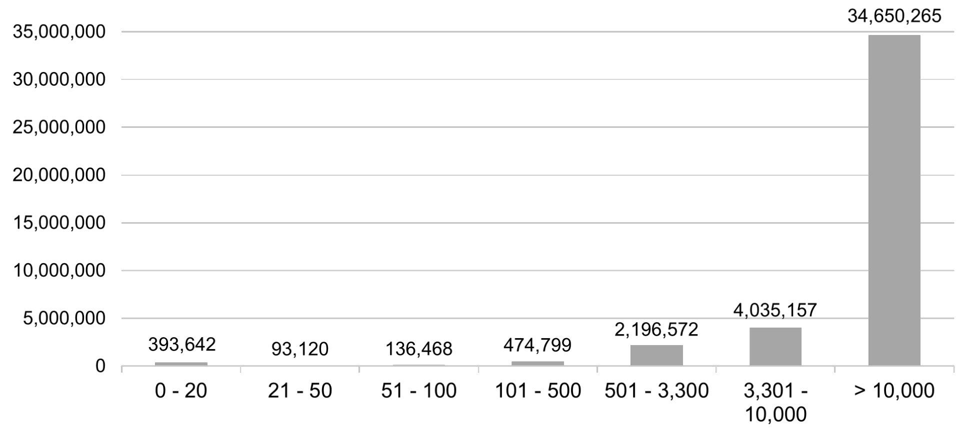


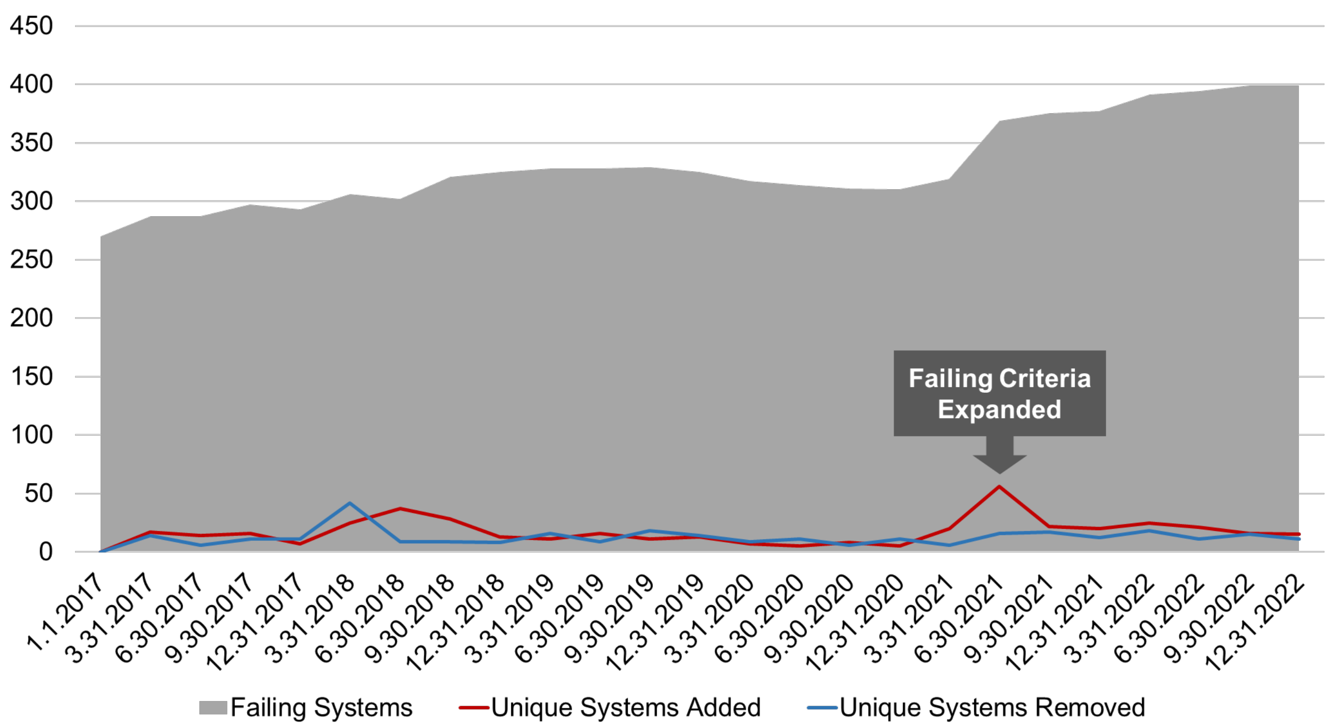
Figure 8: Total Estimated Population Served by Service Connections



2022 FAILING SYSTEMS

The State Water Board tracks community water systems and K-12 schools that meet the Failing list criteria and when they removed from the list. Since January 2017, there have been 633 unique water systems on the Failing list and 250 have come off the list. Figure 8 depicts the unique number of systems that have been on the list from January 2017 through December 2022. On average, 71 unique systems are added to the Failing list each year.

Figure 9: Number of Systems on the Failing List 1.1.2017 through 1.1.2023



In 2022 there were 441 unique water systems on the Failing list at one point throughout the year (Table 8). This includes systems that were on the Failing list prior to 2022 but had yet to come off the list.

Table 8: 2022 Failing List Systems

Water Systems	Number of Unique Systems	Total Population Served	Average Number of Service Connections	# of Systems on List Greater than 3-Yrs.
Small Water Systems[40]	353 (80%)	318,209 (26%)	249	195 (44%)
Medium Water Systems[41]	23 (5%)	893,557 (73%)	9,868	11 (3%)
K-12 Schools	65 (15%)	17,905 (1%)	6	45 (10%)
TOTAL:	**441**	**1,229,671**	**715**	**251 (57%)**

In 2022 there were 77 unique water systems that came onto the Failing list. In 2022, 56 unique water systems were removed from the Failing list. Table 9 summarizes the Failing criteria met by water systems that were on the list in 2022. Approximately 37 water systems were meeting more than one criterion.

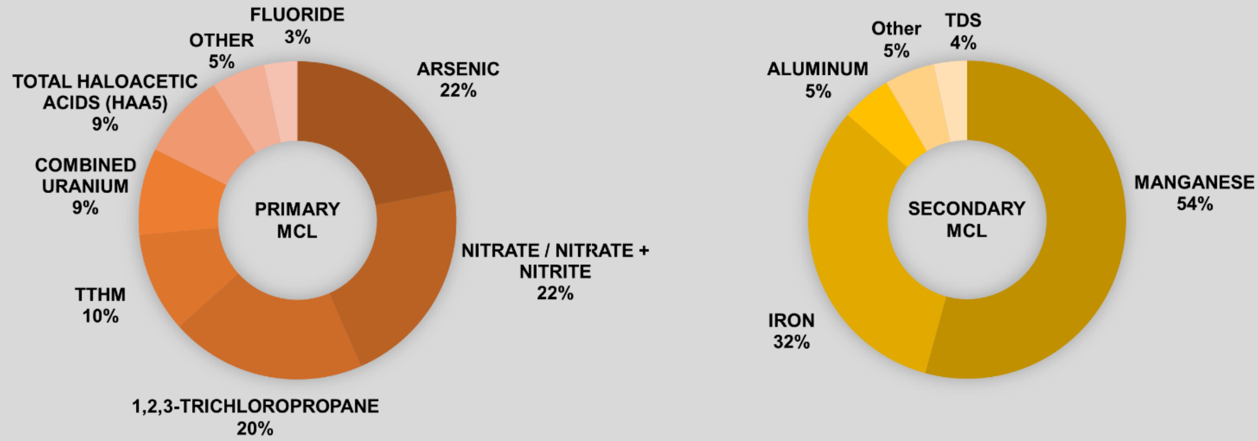
Table 9: Number of Instances of Failing List Criteria Met in 2022

Water Systems	Primary MCL Violation	Secondary MCL Violation	*E. coli* Violation	Treatment Technique Violation	Monitoring & Reporting Violations
Small Water Systems	259	38	12	27	53
Medium Water Systems	18	2	0	4	2
K-12 Schools	54	0	2	4	8
TOTAL:	**331**	**40**	**14**	**35**	**63**

Statewide, the top contaminants that contributed to higher proportions of systems on the Failing list in 2022 is unchanged from 2021 and are: arsenic, 1,2,3-trichloropropane, and nitrate / nitrate + nitrite for primary MCL violations and manganese and iron for secondary MCL violations.

[40] 3,000 service connections or less.
[41] Greater than 3,000 service connections. No system with greater than 30,000 service connections has been on the Failing list since September 2019.

Figure 10: Primary and Secondary MCL Violation Contaminants



FAILING LIST PREDICTIVE POWER OF THE 2022 RISK ASSESSMENT

In 2022, the State Water Board's Risk Assessment results identified 701 At-Risk and 481 Potentially At-Risk water systems. **Approximately 87% of systems that were on the Failing list in 2022 were designed At-Risk or Potentially At-Risk in the 2022 Risk Assessment.** The Risk Assessment continues to improve its ability to identify systems at-risk of failing.

Table 10: Predictive Power of the 2022 Risk Assessment

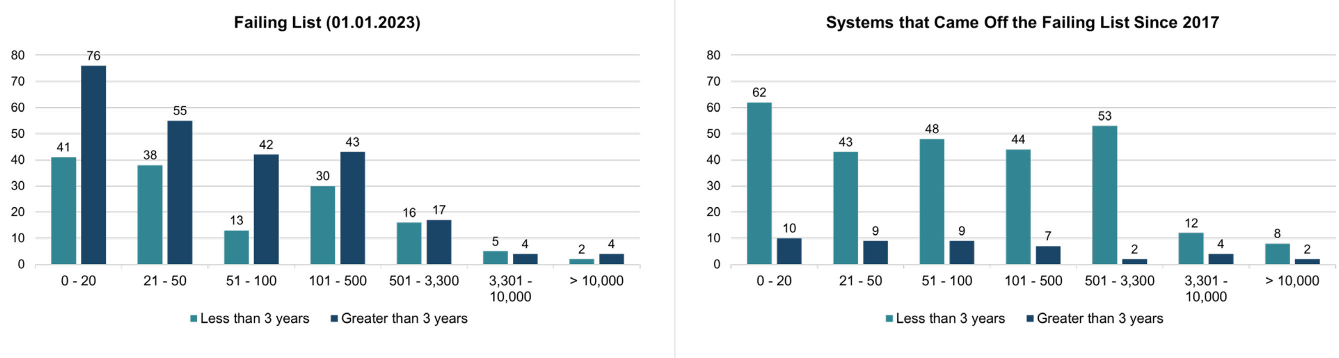
2022 Risk Assessment Result *(based on 2021 data)*	Total Systems	Systems on the 2022 Failing List	Predictive Power of Risk Assessment
At-Risk	701	281	69.21%
Potentially At-Risk	481	71	17.49%
Not At-Risk	1,884	54	13.30%
TOTAL:	**3,066**	**406**	**100%**

ENTRENCHED FAILING SYSTEMS

On January 1, 2023, there were 241 unique water systems on the Failing list for three years or more. These entrenched failing water systems represent 62% of systems on the list at that time. The largest concentration of these systems is in the Central Valley: Kern County (51 systems); Fresno County (25 systems); Tulare County (22 systems); and Madera County (20 systems).

When compared to all the Failing list systems that have come off the Failing list since 2017, systems that have been on the list for less than three years are more likely to come off the list regardless of system size.

Figure 11: Current Failing List Compared to Systems that Have Come Off the List by Service Connections



To better understand these entrenched failing water systems, the State Water Board analyzed the failing criteria met for the systems on the list greater than three years (Figure 11) and compared it to the criteria met for systems that have come off the list since 2017 (Figure 12). This analysis indicated water systems are come off the failing list for Treatment Technique and Monitoring and Reporting violations more than other failure types when comparing entrenched failing water systems.

Figure 12: Count of Failing Criteria Met by Current Failing Systems on List for Greater than 3 Years by Service Connections

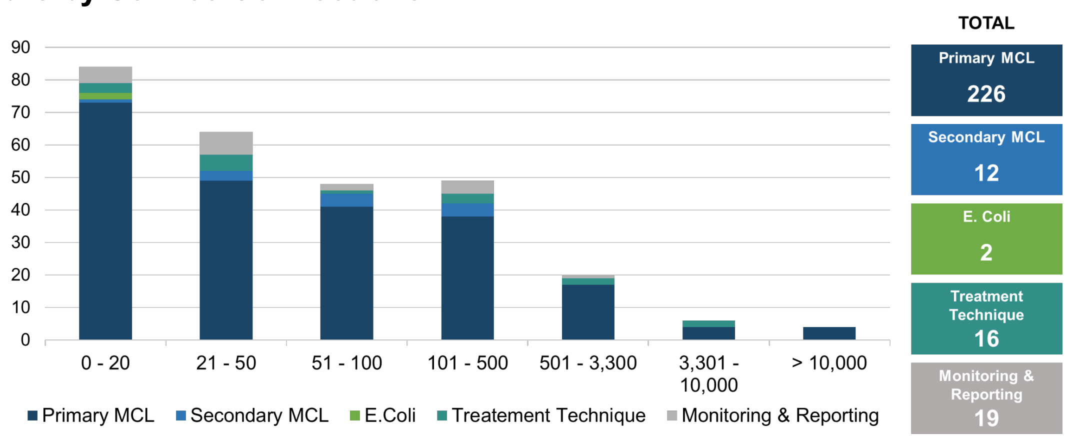
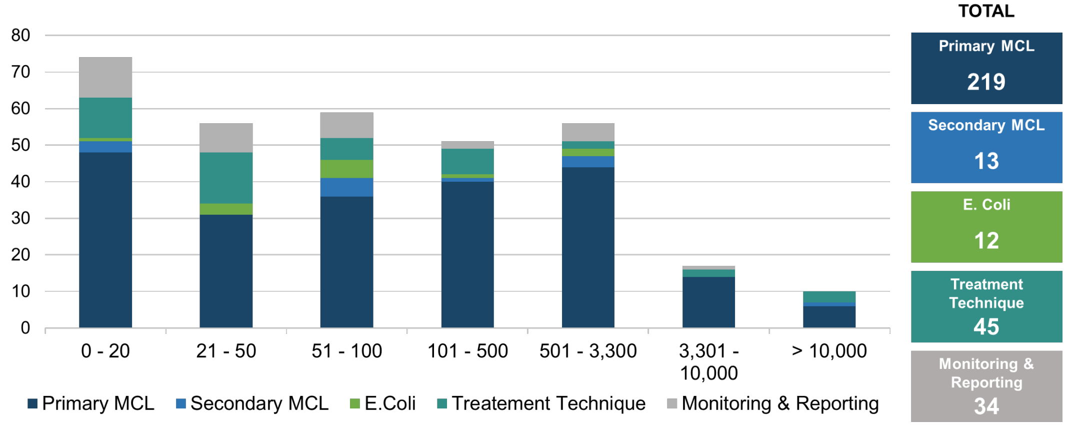


Figure 13: Failing Criteria Met by Systems that Have Come Off the Filing List Since 2017 by Service Connections



Compared to water systems that have come off the Failing list, a greater proportion of entrenched failing water systems are out of compliance for arsenic, total trihalomethanes (TTHM), and Haloacetic Acids (HAA5), manganese, and turbidity.

Figure 14: Primary and Secondary Contaminants for Entrenched Failing Water Systems

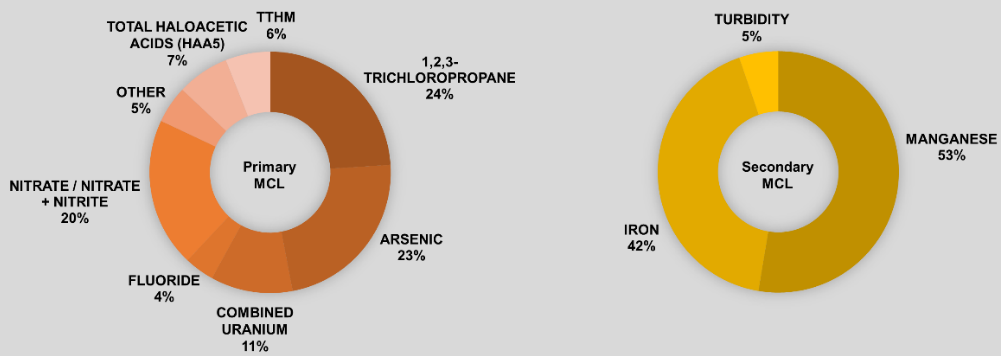
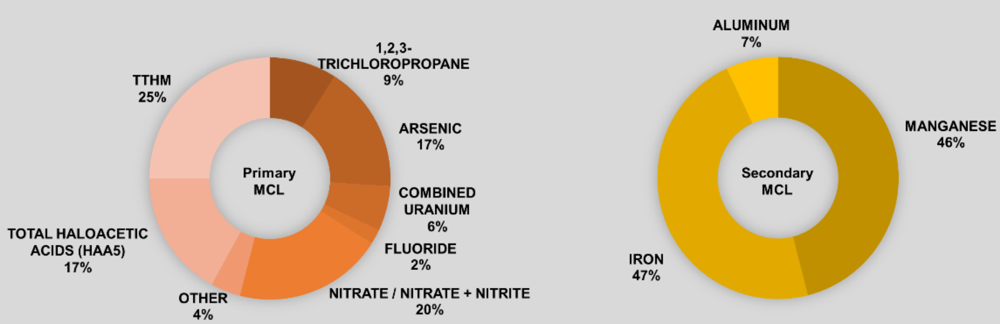


Figure 15: Primary and Secondary Contaminants Failing Systems Have Come Back Into Compliance For Since 2017



Further analysis of entrenched failing water systems is needed to better understand the circumstances leading these systems to remain on the Failing list for longer than other systems that come off the list. Water systems size, Failing criteria, and contaminant of concern do not seem to have a strong correlation to how long it takes a system to come off the Failing list.

ENHANCING WATER SYSTEM CAPACITY

The goal of the SAFER Program is to help address Failing and At-Risk systems – building local capacity through consolidations, administrators, and/or technical assistance to ensure systems are able to operate sustainably and achieve the HR2W. The State Water Board utilizes a diverse set of programs and tools to help support water system capacity. The following sections summarize how they were utilized in 2022 to support California water systems.

WATER SYSTEM PARTNERSHIPS & CONSOLIDATIONS

Small water systems are often less resilient to natural disasters like drought and wildfire, have more difficulty adjusting to regulatory changes, and struggle to fund infrastructure maintenance and replacement. Consolidating water systems leverages economies of scale and can result in cost savings from resource sharing. SAFER funds help pay for consolidations of small water systems and provide incentives for larger water systems agreeing to consolidate small water systems where feasible. Consolidations typically require community engagement, water system governance changes, complex engineering and multiple agreements between numerous parties. State Water Board Division of Drinking Water Engagement Unit staff and engineers assist with initiating partnership discussions, outreach to other agencies and stakeholders, and help to help to facilitate possible consolidation alternatives possible consolidation alternatives.

In 2022, the State Water Board hosted 12 Water Partnership workshops[42] and sent over 3,000 outreach letters to public drinking water systems to engage water system managers and community partners in achieving sustainable solutions across the State. In 2022, 27 water systems were consolidated, serving water that meets all regulatory standards to an additional 7,663 Californian residents (Table 11). A full list of the systems is available on the State Water Board's website.[43]

Table 11: 2022 Consolidated Water Systems

2022 SAFER Status	# of Systems	Total Population Served	State Water Board Funding[44]
Failing	4	1,720	$1,097,630

[42] Water Partnership and Consolidation Events
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/wpc_events.html
[43] List of consolidated water systems:
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/dashboard.html
[44] This funding amount represents the proportion of funding provided by the State Water Board used for consolidation projects and does not reflect the total cost of the consolidation projects. Some systems either partially or fully-funded the consolidation project.

2022 SAFER Status	# of Systems	Total Population Served	State Water Board Funding[44]
At-Risk	3	1,182	$77,632
Potentially At-Risk	6	2,399	$2,420,297
Not At-Risk or Not Assessed	14	2,362	$733,232
TOTAL:	**27**	**7,663**	**$4,328,791**

In addition to the water systems successfully consolidated in 2022, the SAFER program has approximately 316 ongoing consolidation projects and an additional 56 potential consolidations in the early stages of engagement. The State Water Board initiated nine new mandatory consolidation actions in 2022 (Table 12).

Table 12: Mandatory Consolidation Water Systems

System Name	Receiving System	Population	County	Water Quality Concern
Athal MWC	Lamont PUD	150	Kern	Nitrate & 1,2,3-TCP
Fuller Acres MWC	Lamont PUD	545	Kern	1,2,3-TCP
East Wilson Road WC	East Niles CSD	35	Kern	Nitrate & 1,2,3-TCP
Oasis Property Owners Assoc.	East Niles CSD	100	Kern	Arsenic
San Joaquin Estates MWC	East Niles CSD	165	Kern	Nitrate & 1,2,3-TCP
Wilson Road WC	East Niles CSD	66	Kern	Nitrate & 1,2,3-TCP
Wini Mutual Water Company	East Niles CSD	29	Kern	Nitrate & 1,2,3-TCP
Del Oro WC – Country Estates District	East Niles CSD	297	Kern	1,2,3-TCP
Victory MWC	East Niles CSD	849	Kern	1,2,3-TCP
TOTAL:		**2,236**		

Approximately 42% of Failing water systems are considering consolidation or are moving forward with a full physical consolidation project, including 19 schools. SAFER Engagement staff actively manage consolidation projects for failing water systems, including ongoing engagement with State Water Board staff, water systems involved in the project, and other stakeholders and partners to ensure projects progress and to identify and provide additional needed support.

ADMINISTRATORS

In September 2019 (Revised in 2023), the State Water Board adopted an Administrator Policy Handbook[45] to provide direction regarding the appointment of administrators by the State Water Board of designated water systems.

Administrators may be individual persons, businesses, non-profit organizations, local agencies like counties or nearby larger utilities, and other entities. Administrators generally act as a water system general manager, or may be assigned limited specific duties, such as managing an infrastructure improvement project on behalf of a designated water system. Administrators are named for a limited term to help a water system through the consolidation process or to otherwise come into compliance.

The appointment of an administrator is an authority that the State Water Board considers when necessary to provide an adequate supply of affordable, safe drinking water. Water systems in need of an administrator are identified based on the Needs Assessment and the direct local knowledge and expertise of State Water Board staff. The State Water Board recognizes the significance and, in some cases, the potentially disruptive effect of ordering acceptance of an administrator and therefore uses the authority carefully and incorporates significant community engagement as outlined in the Administrator Policy Handbook.

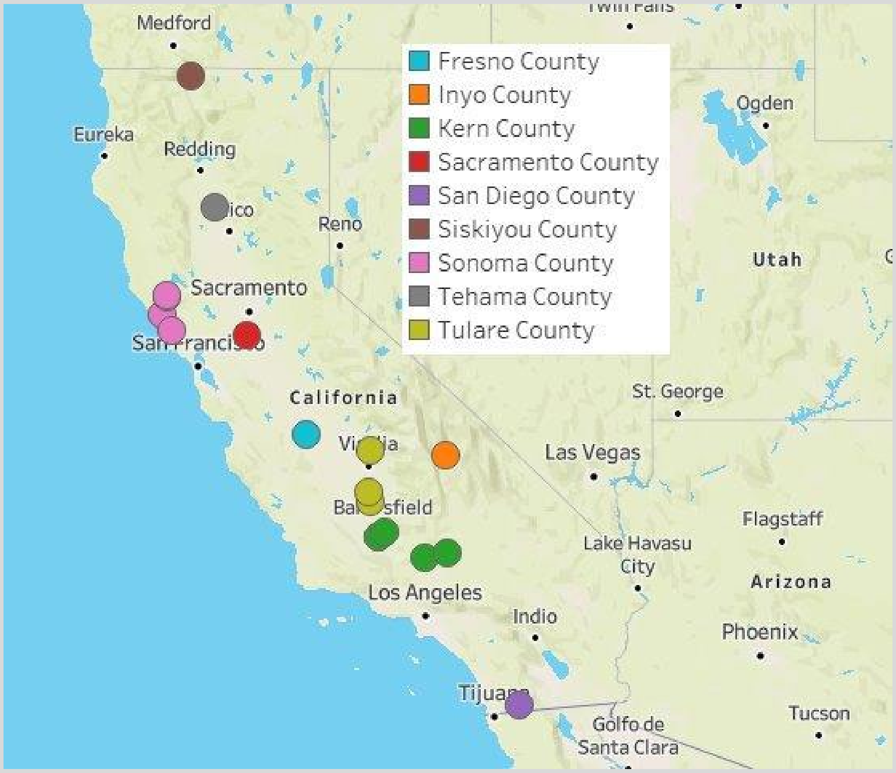
At present, qualified administrators include:

- non-profit technical assistance providers (e.g., CRWA)
- counties (e.g., Sonoma and Tulare)
- for-profit water systems (e.g., Russian River Utilities), and
- engineering services providers (e.g., Provost and Prichard, Stantec)

Since obtaining a list of qualified administrators in 2020, the State Water Board has designated 16 public water systems[46] in need of an administrator and held public meetings for the impacted communities, representing approximately 3,812 people and 1,140 service connections in 7 counties, as shown in Figure 15.[47]

[45] Administrator Policy Handbook
https://www.waterboards.ca.gov/board_info/agendas/2019/sept/091719_6_cs1_cleanversion.pdf
[46] Ten systems in 2020, three were initiated in 2021, and three were initiated in 2022.
[47] Water System Administrators
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/administrator.html

Figure 16: Current Administrator Projects



Currently, there are three administrator projects with appointments and funding approved by the State Water Board (Table 13). Eleven additional water systems have identified administrators and await executed funding agreements and/or are working through liability concerns before being ordered the administrator is ordered (Table 14). The administrator process has just started for two water systems, which do not have an administrator identified yet.

Table 13: Administrator Projects with Appointments

System Name	Population	County	Funding Approved by State Water Board	Administrator Appointed
East Orosi CSD	932	Tulare	**$585,923**	County of Tulare
North Edwards Water District	944	Kern	**$309,457**	California Rural Water Association
Six Acres Water Company	66	Sonoma	**$214,472**	Marlene Demery & Associates
TOTAL:	**1,942**		**$1,109,852**	

Table 14: Administrator Projects - In Process

System Name	Population	County	Administrator Identified
Sierra Vista Water Association	44	Tulare	Provost and Pritchard
Teviston Community Services District	343	Tulare	Stantec
Valley Ford Water Association	61	Sonoma	Russian River Utilities
South Kern Mutual Water Company	32	Kern	Provost and Pritchard
Old River Mutual Water Company	128	Kern	Provost and Pritchard
Las Deltas Mutual Water System	375	Fresno	Provost and Pritchard
NorCal Water Works	45	Tehama	Provost and Pritchard
Cazadero Water Company	250	Sonoma	Russian River Utilities
West Water Company	40	Sonoma	County of Sonoma
Keeler Community Service District	66	Kern	Provost and Pritchard
William Fisher Memorial Water Company	56	Kern	Provost and Pritchard
Athal Mutual Water Company	150	Kern	*Pending*
Hornbrook Community Service District	280	Siskiyou	*Pending*
TOTAL:	**1,870**		

The State Water Board is currently working with administrators that are likely to have multiple administrator projects spanning multiple years, which led to the development of administrator master agreements to simplify the process and create expedited future administrator appointments for multiple water systems.

In 2022, the State Water Board developed administrator master agreements with Provost & Pritchard Consulting Group and Stantec. The State Water Board continues to accept Statements of Qualifications from potential administrators. More information about the administrator program is found on the State Water Board's administrator webpage.[48]

RURAL SOLUTIONS ENGAGEMENT UNIT

In 2022, the SAFER Program established the Rural Solutions Engagement Unit (RSU) with the primary objective of assisting Failing water systems with no potential for consolidation. These projects may include administrator projects, pilot testing, treatment processes, development of

[48] State Water Board Administrators – Information for Potential Administrators
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/future-administrator.html

new or additional sources, and/or other innovative solutions throughout the State. The RSU works with State Water Board's Division of Financial Assistance, public water systems, domestic well owners, technical assistance providers, engineering firms, device manufacturers, and other stakeholders to develop and implement drinking water solutions to meet individual community needs.

In 2022, the RSU led a State Water Board effort developing a report[49] which identifies and addresses the potential success and shortcomings of Point of Use (POU) and Point of Entry (POE) treatment as an interim solution to drinking water contamination in public water systems and domestic wells. The report addresses equity, technical, social, regulatory, and financial aspects of POU/POE treatment. The report includes recommendations and identifies areas for further study to assist the State Water Board and stakeholders in successful implementation of POU/POE treatment.

FUNDING

In 2022, the SAFER Program provided short-term solutions, such as emergency well repairs, and bottled and hauled water provision to nearly 24,000 individuals. Long-term solutions, such as construction and consolidation, were provided to 42 water systems serving nearly 8.5 million individuals. Planning assistance (towards construction of long-term solutions) was provided to 13 water systems serving approximately 33,000 individuals. Table 15 summarizes the amount of funding provided for planning and construction projects in 2022.

Table 15: 2022 Planning and Construction Assistance Funding Provided by the State Water Board

Funding Sources	Planning Funding	Construction Funding
Drinking Water State Revolving Fund	$2,023,203	$689,017,945
Drinking Water Bonds	$2,089,137	$13,092,505
General Fund	$2,102,400	$42,464,912
Safe and Affordable Drinking Water Fund	$0	$7,247,660
TOTAL:	**$6,214,740**	**$751,823,022**

The Budget Act of 2021, as amended in 2022, added another $50 million for technical and financial assistance to drinking water systems to address Per- and Polyfluoroalkyl Substances (PFAS)[50] and an additional $50 million to respond to drinking water emergencies exacerbated by drought, from the new California Emergency Relief Fund. The State Water Board continues

[49] 2022 SWRCB - Point of Use/Point of Entry Report
https://www.waterboards.ca.gov/safer/docs/2022/draft-2022-pou-poe-report.pdf
[50] Per- and Polyfluoroalkyl Substances (PFAS) Funding
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/pfas.html

to implement a County-wide and Regional Funding Program,[51] intended to assist counties in developing programs for communities and households served by state small water systems and domestic wells to address both drought and water quality issues. The goal is to expand geographically on an already robust program being implemented in eight counties in the San Joaquin Valley.

The State Water Board continued to work on several funding process improvements that are currently being implemented. These are described further in the FY 2022-23 Safe and Affordable Drinking Water FEP,[52] which was adopted by the Board October 3, 2022. The FEP continues to include data on racial and other demographics for projects funded by the SADWF, and staff will continue to further evaluate racial equity in the program.

TECHNICAL ASSISTANCE

In 2022, the State Water Board funded technical assistance for 357 water systems through agreements with several technical assistance providers.[53] This information is summarized in Table 16. Table 17 summarizes the amount of funding provided to support technical assistance in 2022.

Table 16: Number of SAFER Systems that Received Technical Assistance in 2022

2022 SAFER Status	Number of Systems
Failing	111
At-Risk	58
Potentially At-Risk	39
Not At-Risk or Not Assessed	149
TOTAL:	**357**

Table 17: Technical Assistance Funding in 2022

Funding Sources	Funding Provided
Drinking Water State Revolving Fund Set-Aside	$0
Prop 1	$4,301,824
Safe and Affordable Drinking Water Fund	$17,339,583
TOTAL:	**$21,641,362**

[51] County-wide and Regional Funding Programs
https://www.waterboards.ca.gov/safer/funding_solicitation.html
[52] FY 2022-23 Safe and Affordable Drinking Water Fund Expenditure plan
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/2022/final-2022-23-sadw-fep.pdf
[53] Four water systems had a Technical Assistance request approved in 2022 that were ultimately cancelled, with little to no technical assistance provided.

Under the SAFER Program new types of services and pilot programs are being provided and will continue to be developed. New services include providing 0% interest revolving bridge loans (via a third-party provider) for interim construction financing, and emergency fund grants. Technical Assistance (TA) providers will also be partnering with small water systems and providing assistance through technical experts who will assist by providing mutual aid and assistance, leveraging their expertise to assist in consolidation efforts with larger entities when feasible. These services will be provided consistent with the scope of work that is developed for each program, and the capabilities of the current TA providers, and may not be available at the statewide level. The State Water Board's Division of Financial Assistance (DFA) plans to expand access to these programs by continuing to work with and provide funding to new and existing TA providers.

The State Water Board continues to expand investments in the TA program, with a focus on small, disadvantaged communities and consolidations. Legislation enacted in Fall 2021 added qualified 'Technical Assistance Providers' as a new eligible funding recipient for monies from the Safe and Affordable Drinking Water Fund. The State Water Board developed a Request for Qualifications (RFQ) process to identify qualified TA Providers,[54] including for-profit entities. In 2022, DFA approved $64 million to be awarded to 6 new TA providers. An expanded list of qualified TA Providers will potentially allow for new types of and a greater volume of services to be available to communities and public water systems as well as expansion of services to other areas of the state.

To accelerate the implementation of long-term solutions, the State Water Board will use TA providers to accelerate the planning efforts for small systems prioritizing those serving small DACs or low-income households by providing planning through TA to support the submittal of a complete application for construction funding. Consistent with the priorities established in the FEP, planning through TA may be provided for systems out of compliance and consolidation projects. Additionally, now equipped with the results of the annual Needs Assessment, TA will also be utilized to accelerate planning for At-Risk systems as program capacity permits. In general, planning tasks will include development of an engineering report, a cost estimate, plans and specifications, and necessary environmental documentation for the most feasible solution.

In addition, for greater efficiency under the SAFER Program, the State Water Board may use a regional approach where appropriate and provide pooled services to multiple systems within an area to reduce costs.[55] In all cases, DFA staff will be assigned to oversee and manage the scope, cost, and progress of all TA work, with increased attention given to new types of services that have been approved under the SAFER Program.

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[54] Drinking Water Technical Assistance Provider Request for Qualifications Guidelines
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/2022/rfq-guidelines.pdf

[55] Policy for Developing the Fund Expenditure Plan
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/2021/final_policy_for_dev_fep_sadwf_1221.pdf

SANITARY SURVEYS

A sanitary survey is a comprehensive inspection to evaluate a water system's capability to provide safe drinking water to their customers and to ensure compliance with the federal Safe Drinking Water Act (SDWA). The evaluation includes assessing eight core elements: source, treatment, distribution system, finished water storage, pumps, monitoring and reporting, management and operation, and operator compliance. This evaluation includes both a file review and physical site visit to inspect the water system's facilities. Sanitary surveys and their findings are critical to ensuring compliance with the SDWA and the provision of safe drinking water.

U.S. EPA requires that community water systems be inspected every three years and non-community water systems be inspected every five years. The State Water Board's Division of Drinking Water (DDW) usually conducts inspections and documents the findings in sanitary survey reports. However, in some counties, authority has been delegated to Local Primacy Agency (LPA) staff to conduct those inspections.

On March 4, 2020, Governor Newsom declared a State of Emergency in California as a result of the threat of COVID-19.[1] Shortly after, State Water Board staff transitioned to telework to protect staff and decrease the potential spread of the disease. Protective measures were implemented, and some sanitary surveys were delayed. This ensured the continuity of operations and water supplies by protecting the safety of water treatment operators and State Water Board staff.

The State Water Board tracks the numbers of sanitary surveys completed annually. Table 18 and Table 19 shows the number of sanitary surveys completed in 2022, and the number of surveys completed during the required time frame of 3 years for community water systems and 5 years for non-community water systems.

Significant Deficiencies are identified by State Water Board staff or LPA staff during a Sanitary Survey and other water system inspections. Significant Deficiencies include, but are not limited to, significant defects in the design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that U.S. EPA determines to be causing or have the potential for causing the introduction of contamination into the water delivered to consumers. Significant Deficiencies can be identified for both groundwater and surface water systems, although the compliance deadlines and requirements differ depending on the applicable rule (Groundwater Rule vs. Long Term 2 Enhanced Surface Water Treatment Rule.

Table 18: Community Water System Sanitary Surveys

Regulating Agency	# of Systems	2022 Inspections	Sig. Def. Identified in 2022	# of Inspections 2020-2022	# Sig. Def. Identified 2020-2022
State Water Board	2,007	609	26	2,196	88
LPAs	848	291	2	1,200	10

Regulating Agency	# of Systems	2022 Inspections	Sig. Def. Identified in 2022	# of Inspections 2020-2022	# Sig. Def. Identified 2020-2022
TOTAL:	**2,855**	**900**	**28**	**3,396**	**98**

Table 19: Non-Community Water System Sanitary Surveys

Regulating Agency	# of Systems	2022 Inspections	Sig. Def. Identified in 2022	# of Inspections 2020-2022	# Sig. Def. Identified 2020-2022
State Water Board	2,170	403	2	1,494	59
LPAs	2,269	489	3	2,236	24
TOTAL:	**4,439**	**892**	**5**	**3,730**	**83**

SAFER PROGRAM PUBLIC ENGAGEMENT

The State Water Board hosted 32 SAFER program related public meetings with 1,484 participants. 29 meetings were held virtually and 3 in-person. Interpretation serves are provided upon request.

Table 20: 2022 SAFER Program Public Engagement

Type of Meeting[56]	# of Meetings	# of Participants[57]	# of Meetings with Interpretation Services[58]
SAFER Advisory Group Meetings	4	123	4
SAFER Advisory Group Application Workshops	2	10	0
SAFER Advisory Group Onboarding Sessions	2	12	2
Consolidation	5	68	2
Administrator	2	38	0
Funding Partners Workshop	2	64	0
Technical Assistance Request for Qualifications Workshop	1	25	0
County-wide and Regional Funding Program Workshop	1	88	0

[56] Meeting may be in-person or virtual.
[57] Count includes unique participants or registrants per event. If an attendee participated in multiple meetings, their participation is included for each event.
[58] The State Water Board provided interpretation services upon request.

PFAS Funding Workshop	1	164	0
POU/POE Report Workshop	1	12	1
POU/POE Report Webinar	2	49	
Needs Assessment Webinar Workshops	6	588	1
Capacity Development Strategy Webinar Workshops	2	230	0
Klamath Community Services District Presentation on SAFER status	1	13	0
TOTAL:	**32**	**1,484**	**10**

NEW PROGRAMS & TOOLS

The State Water Board implements and enforces legislative and regulatory requirements to ensure the HR2W is achieved. In 2022, there were no new regulatory developments that were relevant to the SAFER Program or the broader Capacity Development Strategy. There were also no modifications to the State's control points for assessing capacity for new public water systems. In 2022, new legislation was passed and is summarized below.

NEW LEGISLATION

Assembly Bill 1642[59] – California Environmental Quality Act: water system well and domestic well projects: exemption

This legislation creates an exemption from the requirements of the California Environmental Quality Act (CEQA) for well projects connected to a water system categorized as "high" or "medium" risk by the State Water Board's Needs Assessment. To be eligible for the exemption, the law requires applicants to first consult with the State Water Board to determine whether it would affect their eligibility for federal financial assistance. The well project must also be designed to mitigate or prevent failure of a well that would leave residents, or the water system to which the well is connected, without an adequate supply of safe drinking water.

Senate Bill 1254[60] – Drinking water: administrator: managerial and other services.

Existing law authorizes the State Water Board contract with, or provide grant funding for, an administrator to provide administrative, technical, operational, legal, or managerial services to a "designated"[61] public water system. Administrators are vital to assisting in the development of such water system's TMF capacity. The newly enacted legislation authorizes the State Water

[59] Assembly Bill 1642: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB1642
[60] Senate Bill 1254: Bill Text - SB-1254 Drinking water: administrator: managerial and other services. (ca.gov)
[61] Under the law, "Designated water system" means any of the following: (A) A public water system or state small water system that has been ordered to consolidate pursuant to Section 116682. (B) A public water system or state small water system that serves a disadvantaged community and that the state board finds consistently fails to provide an adequate supply of affordable, safe drinking water. (C) An at-risk water system.

Board to appoint an administrator to oversee construction or development projects related to a consolidation or extension of service for such systems. The law further provides liability protection to water system administrators who are appointed by the State Water Board against claims against the administrator, if good faith, reasonable effort, and ordinary care were used by the administrator to assume possession of, or to operate, the water system. Additionally, the law clarifies the liability of the State Water Board when appointing administrators.

Assembly Bill 2877[62] – Safe and Affordable Drinking Water Fund: tribes.

This newly enacted legislation requires that the State Water Board collaborate with California Native American tribes to:

- Eliminate obstacles hindering their access to funding from the Safe and Affordable Drinking Water Fund (SADW Fund).
- Ensure that any waiver of tribal sovereignty necessary for tribes to obtain funding is narrowly and specifically tailored to address the unique needs of each tribe and that the funding agreement is enforceable.
- Publish all data regarding funding for tribes.

Additionally, the law requires the State Water Board's tribal liaison to participate in all discussions with tribes regarding SADW Fund disbursement, including negotiations concerning waivers of tribal sovereignty.

Senate Bill 1188[63] – Safe Drinking Water State Revolving Fund: financial assistance.

This bill permits the State Water Board to dispense grants, principal forgiveness funding, and zero percent financing from the Drinking Water State Revolving Fund to the maximum extent authorized by federal law. These modifications enable the State Water Board to provide additional funding for consolidation projects, public health drinking water projects, and encourage consolidation between larger non-disadvantaged communities and smaller water systems.

NEW STATE WATER BOARD RESOLUTIONS

Racial Equity Resolution

On August 18, 2020, the State Water Board publicly acknowledged that the historical effects of institutional racism must be confronted throughout government, and it directed staff to develop a priority plan of action. The Water Boards Racial Equity Team held public and employee listening sessions to help develop a draft resolution. After a public comment period on the draft resolution in spring 2021, the Racial Equity Team made significant updates to the resolution. On November 16, 2021, the State Water Board adopted Resolution No. 2021-0050,[64] “Condemning Racism, Xenophobia, Bigotry, and Racial Injustice and Strengthening Commitment to Racial Equity, Diversity, Inclusion, Access, and Anti-Racism" which affirms the

[62] AB 2877: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB2877
[63] SB 1188: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB1188
[64] Racial Equity Resolution
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2021/rs2021_0050.pdf

State Water Board's commitment to racial equity in its policies, programs, and service to communities. It also directs staff to undertake a variety of actions to achieve racial equity throughout all Water Boards programs and activities. Primary among these actions is the implementation of a Racial Equity Action Plan, which the Racial Equity Team is in the process of developing.[65]

NEW TOOLS AND DATA

The State Water Board has been making great progress in improving data collection, data quality, and access to data analysis. Below is a highlight of new and ongoing activities that support the SAFER Program.

electronic Annual Report (eAR)

The electronic Annual Report (eAR)[66] is a required annual survey of public water systems that collects critical water system information intended to assess the status of compliance with specific regulatory requirements, provide updated contact and inventory information (such as population served and number of service connections), and provide information that is used to assess the financial capacity of water systems, among other information reported. Data collected through the eAR is utilized throughout the Needs Assessment and supports many other State Water Board and external programs.

In 2022, the State Water Board began exploring opportunities to optimize reporting requirements currently met by the eAR through evaluating the rationale of questions be asked, appropriate frequency of questions, applications being used to gather data, and working to minimize duplicative reporting. There will be ongoing advancements to the eAR to improve data collection, data quality, and enhance the user experience. Throughout these enhancements, the State Water Board will continue to solicit feedback from stakeholders on the eAR to ensure meaningful and accurate data is collected, through avenues such as the eAR Input Forum which was formed in 2018. The eAR Input Forum is comprised of representatives from public water systems, water industry organizations, and non-governmental organizations. The eAR will continue to be a valuable source of data to support the SAFER Program and the Needs Assessment.

SAFER Clearinghouse

Since 2020, the State Water Board has been developing a database system, known as the SAFER Clearinghouse. The purpose of the SAFER Clearinghouse is to assist with the implementation, management, and tracking of the SAFER Program. The SAFER Clearinghouse will pull data from SDWIS, the eAR, DFA's databases, and other data sources to assist the State Water Board in analyzing water system performance, quickly assess water system needs, track State Water Board engagement with water systems, facilitate

[65] Racial Equity Action Plan
https://www.waterboards.ca.gov/racial_equity/resolution-and-actions.html
[66] Electronic Annual Report (EAR) | California State Water Resources Control Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html

consolidation and administrator projects, etc. The SAFER Clearinghouse is also the database of record for state small water system and domestic well data collected from counties.

In 2021-22, the State Water Board developed a new drought reporting portal for water systems which is housed in the SAFER Clearinghouse. In the future, data collected from this portal will be incorporated into the Needs Assessment. Ultimately, the data collected and managed in the SAFER Clearinghouse will be publicly available, allowing water systems and communities to explore water system performance and track State Water Board engagement and funding activities. The State Water Board anticipates a multiphase, multi-year development process.

Drought & Conservation Technical Reporting

Three consecutive years of drought has led to decreased water in lakes, streams, and domestic wells, affecting people who rely on these resources to maintain their standard of living. Governor Newsom declared a drought state of emergency in October 2021, and the State Water Board Division of Drinking Water has maintained a Drought Watch List to identify drinking water systems likely to experience drought impacts.

On July 21, 2022, the State Water Board's Division of Drinking Water issued a Drought Technical Order[67] to more than 200 water systems to help track and prepare for potential water shortages. This Order was replaced with the Drought and Conservation Technical Reporting Order[68] on January 1, 2023, which expanded drought and conservation data reporting to the State Water Board to all community water systems and non-transient non-community schools.[69] The newly launched SAFER Clearinghouse is the reporting platform used to submit this data.

Water systems that are experiencing a severe water shortage, or systems that have been identified by the State Water Board or Local Primacy Agency staff to be at-risk of experiencing a severe water shortage, may be required to submit drought-related data more frequency to the State Water Board to facilitate better coordination of assistance and emergency tracking.

System Area Boundary Layer (SABL)

The State Water Board maintains a geospatial dataset of water service area boundaries for California public water systems, known as System Area Boundary Layer (SABL).[70] To provide an accurate data set of service area boundaries for California public water systems, the State Water Board has undertaken a project to review, add, and correct public water system

[67] 2022 Drought Technical Order
https://www.waterboards.ca.gov/drought/resources-for-drinking-water-systems/docs/20220721-drought-technical-order-ddw-hq-22d-001-ada-signed.pdf
[68] 2023 Drought and Conservation Technical Reporting Order
https://www.waterboards.ca.gov/drought/resources-for-drinking-water-systems/docs/2023-drought-technical-order-ddw-hq-drought2023-001.pdf
[69] Drought & Conservation Reporting Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/clearinghouse_drought_conservation_reporting.html
[70] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

boundaries that were collected by previous efforts.[71] This project is anticipated to be completed in 2024.

In 2022, the State Water Board added 46 new public water system boundaries, for a total of 4,960. Furthermore, nearly 58 existing boundaries were verified (versus pending or not verified). SABL is an essential dataset utilized in the Needs Assessment to calculate risk indicator datapoints for water systems such as median household income, location in critically over drafted groundwater basin, etc. SABL is also used to determine potential consolidation or intertie projects. Accurate system boundaries improve the results of the Needs Assessment.

State Small Water Systems & Domestic Well Inventory & Water Quality Data

SB 200 (Health and Safety Code § 116772) requires county local health officers and other relevant local agencies to electronically submit to the State Water Board state small water system and domestic well inventories and water quality testing results (performed by accredited laboratories). The collection and submittal of water quality testing and associated data for state small water systems and domestic wells has, historically, been performed at the county level with little to no oversight or support from the State Water Board. In 2021, the State Water Board developed and shared with counties, a guidance document on how to comply with SB 200 reporting requirements.[72]

In 2021, the State Water Board focused its efforts on supporting counties in submitting inventory data related to state small water systems and domestic wells. It is important for an inventory record to exist to associate water quality data to a system or well location. The State Water Board hosted webinar workshops and released data templates to support this effort.[73]

Since 2021, 57 of the 58 counties provided information for approximately 1,300 active state small water systems to the State Water Board. Table 20 provides a summary of the counties that have submitted state small water systems data and the total number of active systems that have been reported.

Table 21: Submitted State Small Water Systems Inventory by County

County	# of Systems	County	# of Systems	County	# of Systems
Alameda	1	**Marin**	4	**San Luis Obispo**	27
Alpine	1	**Mariposa**	7	**San Mateo**	10
Amador	6	**Mendocino**	26	**Santa Barbara**	41
Butte	11	**Merced**	18	**Santa Clara**	65

[71] System Area Boundary Layer (SABL) Look-up Tool
https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=272351aa7db14435989647a86e6d3ad8
[72] State Small Water System and Domestic Well Water Quality Data Submission Guidance for Counties
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/ssws_dw_data_submittal_guidance.pdf
[73] State Small Water Systems and Domestic Well Water Quality Data Website
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/small_water_system_quality_data.html

County	# of Systems	County	# of Systems	County	# of Systems
Calaveras	0	**Modoc**	*Missing*	**Santa Cruz**	29
Colusa	6	**Mono**	5	**Shasta**	14
Contra Costa	15	**Monterey**	282	**Sierra**	7
Del Norte	0	**Napa**	7	**Siskiyou**	19
El Dorado	17	**Nevada**	5	**Solano**	8
Fresno	22	**Orange**	0	**Sonoma**	50
Glenn	3	**Placer**	7	**Stanislaus**	20
Humboldt	15	**Plumas**	34	**Sutter**	13
Imperial	1	**Riverside**	93	**Tehama**	15
Inyo	14	**Sacramento**	5	**Trinity**	24
Kern	119	**San Benito**	13	**Tulare**	28
Kings	5	**San Bernardino**	26	**Tuolumne**	7
Lake	17	**San Diego**	17	**Ventura**	25
Lassen	4	**San Francisco**	0	**Yolo**	4
Los Angeles	8	**San Joaquin**	27	**Yuba**	15
Madera	15				
				TOTAL:	**1,317**

Since 2021, 15 of the 58 counties provided approximately 36,000 domestic well inventory records to the State Water Board. Table 21 provides a summary of the counties that have submitted domestic well data and the total number of wells that have been reported. The State Water Board estimates there may be more than 350,000 domestic wells in California. The State Water Board will continue to support counties in providing this information.

Table 22: Submitted Domestic Well Inventory by County

County	# of Domestic Wells	County	# of Domestic Wells	County	# of Domestic Wells
Alameda	*Missing*	**Marin**	*Missing*	**San Luis Obispo**	320
Alpine	*Missing*	**Mariposa**	*Missing*	**San Mateo**	*Missing*
Amador	282	**Mendocino**	4,092	**Santa Barbara**	79
Butte	*Missing*	**Merced**	*Missing*	**Santa Clara**	*Missing*
Calaveras	*Missing*	**Modoc**	*Missing*	**Santa Cruz**	*Missing*
Colusa	145	**Mono**	*Missing*	**Shasta**	*Missing*

County	# of Domestic Wells	County	# of Domestic Wells	County	# of Domestic Wells
Contra Costa	*Missing*	**Monterey**	*Missing*	**Sierra**	*Missing*
Del Norte	*Missing*	**Napa**	1,239	**Siskiyou**	*Missing*
El Dorado	3,632	**Nevada**	5,480	**Solano**	*Missing*
Fresno	*Missing*	**Orange**	80	**Sonoma**	*Missing*
Glenn	*Missing*	**Placer**	*Missing*	**Stanislaus**	*Missing*
Humboldt	984	**Plumas**	187	**Sutter**	*Missing*
Imperial	*Missing*	**Riverside**	*Missing*	**Tehama**	*Missing*
Inyo	*Missing*	**Sacramento**	18,266	**Trinity**	*Missing*
Kern	*Missing*	**San Benito**	Missing	**Tulare**	*Missing*
Kings	*Missing*	**San Bernardino**	504	**Tuolumne**	*Missing*
Lake	*Missing*	**San Diego**	238	**Ventura**	*Missing*
Lassen	*Missing*	**San Francisco**	*Missing*	**Yolo**	986
Los Angeles	*Missing*	**San Joaquin**	*Missing*	**Yuba**	*Missing*
Madera	*Missing*				
				TOTAL:	**36,514**

In 2021, the State Water Board made enhancements to its California Laboratory Intake Portal (CLIP)[74] to begin collecting state small water system and domestic well water quality data electronically from accredited laboratories in 2022. In 2022, 929 water quality samples were received for 115 unique state small water systems in 32 counties (Table 22). In 2022, the State Water Board received one water quality sample result from Tulare County for a domestic well through the domestic well CLIP. The State Water Board will continue to support counties to comply with SB 200 reporting requirements.

Table 23: State Small Water System Water Quality Samples by County

County	# Water Quality Samples	County	# Water Quality Samples	County	# Water Quality Samples
Alameda	0	**Marin**	3	**San Luis Obispo**	7
Alpine	38	**Mariposa**	2	**San Mateo**	0
Amador	0	**Mendocino**	0	**Santa Barbara**	10
Butte	15	**Merced**	2	**Santa Clara**	0
Calaveras	1	**Modoc**	0	**Santa Cruz**	0

[74] California Laboratory Intake Portal (CLIP)
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/clip.html

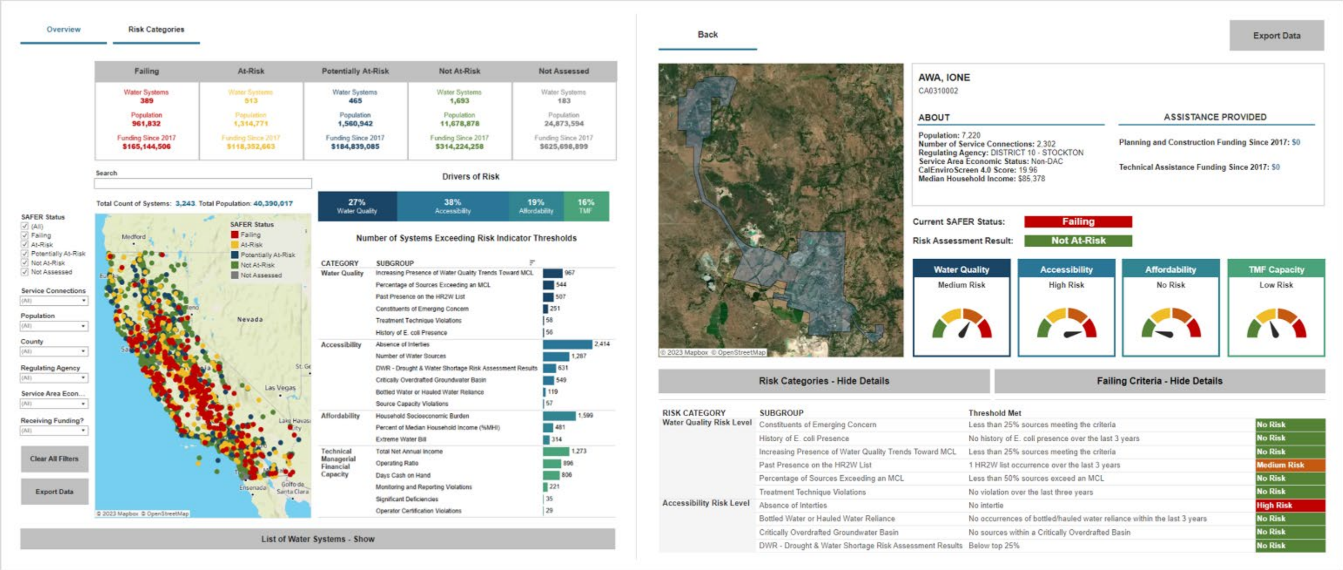
County	# Water Quality Samples	County	# Water Quality Samples	County	# Water Quality Samples
Colusa	0	**Mono**	0	**Shasta**	7
Contra Costa	5	**Monterey**	272	**Sierra**	1
Del Norte	0	**Napa**	10	**Siskiyou**	1
El Dorado	1	**Nevada**	0	**Solano**	29
Fresno	0	**Orange**	0	**Sonoma**	0
Glenn	0	**Placer**	0	**Stanislaus**	23
Humboldt	0	**Plumas**	23	**Sutter**	1
Imperial	6	**Riverside**	277	**Tehama**	1
Inyo	0	**Sacramento**	17	**Trinity**	0
Kern	0	**San Benito**	74	**Tulare**	0
Kings	2	**San Bernardino**	41	**Tuolumne**	0
Lake	1	**San Diego**	22	**Ventura**	6
Lassen	0	**San Francisco**	0	**Yolo**	0
Los Angeles	0	**San Joaquin**	7	**Yuba**	4
Madera	20				
				TOTAL:	**929**

SAFER Dashboard

In 2022, the State Water Board developed and launched the SAFER Dashboard.[75] The Dashboard illustrates the current failing water systems and results of the Risk Assessment. The Dashboard can be searched or filtered by public water system ID (PWSID), system name, county, regulating agency, system size, etc. The Dashboard is updated daily for current failing water systems and annually for results of the Risk Assessment. Learn more about the Dashboard in Appendix E. The State Water Board continues to implement enhancements to the Dashboard based on stakeholder feedback.

[75] SAFER Dashboard
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/saferdashboard.html

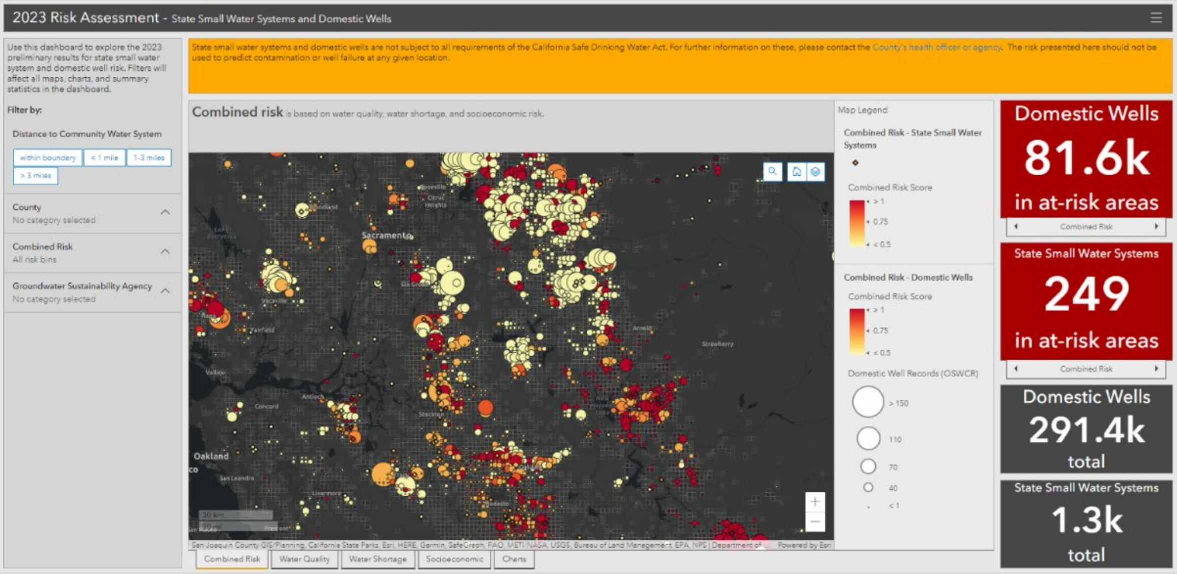
Figure 17: SAFER Dashboard



Risk Assessment - State Small Water System & Domestic Well Dashboard

As part of the 2023 Needs Assessment development, the State Water Board developed a new dashboard to display the results of the Risk Assessment for state small water systems and domestic wells.[76] This dashboard is publicly available online and currently updated annually. Learn more about the Dashboard in Appendix F.

Figure 18: Risk Assessment – State Small Water System & Domestic Well Dashboard

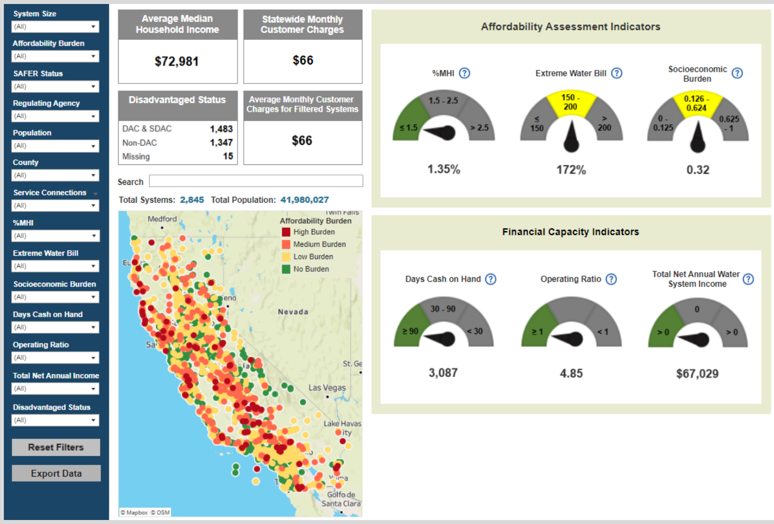


[76] State Small Water System and Domestic Well Risk Assessment Dashboard https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a

Water System Financial Capacity & Community Affordability Dashboard

In 2022-2023, the State Water Board developed a new Water System Financial Capacity & Community Affordability Dashboard.[77] The purpose of this dashboard is to allow users to explore the relationships between water system financial capacity and affordability. The dashboard displays and auto-calculates averages of the financial capacity and affordability risk indicators for community water systems used in the Risk Assessment and Affordability Assessment. Users can filter the water systems and data displayed in the dashboard to better understand how water system characteristics, customer affordability challenges, and water system financial capacity are related. Learn more in Appendix G.

Figure 19: Water System Financial Capacity & Community Affordability Dashboard



Drinking Water System Outreach Tool

In 2021, the State Water Board developed the Drinking Water System Outreach Tool for public use.[78] The web-based map application shows the locations of public water systems and state small water systems, with risk statuses and administrative contact information to allow stakeholders to evaluate potential for consolidation or regionalization projects. The Outreach Tool also includes layers for successfully completed consolidations, disadvantaged status, and Aquifer Risk Map data. In 2022, SAFER added additional layers, as requested by stakeholders and partners, to include contextual layers with DWR's Dry Household Well reports; Bureau of Indian Affairs Tribal Land Designations; United States Geological Survey Watersheds; and Office of Environmental Health and Hazard Assessment California EnviroScreen 4.0 scores.

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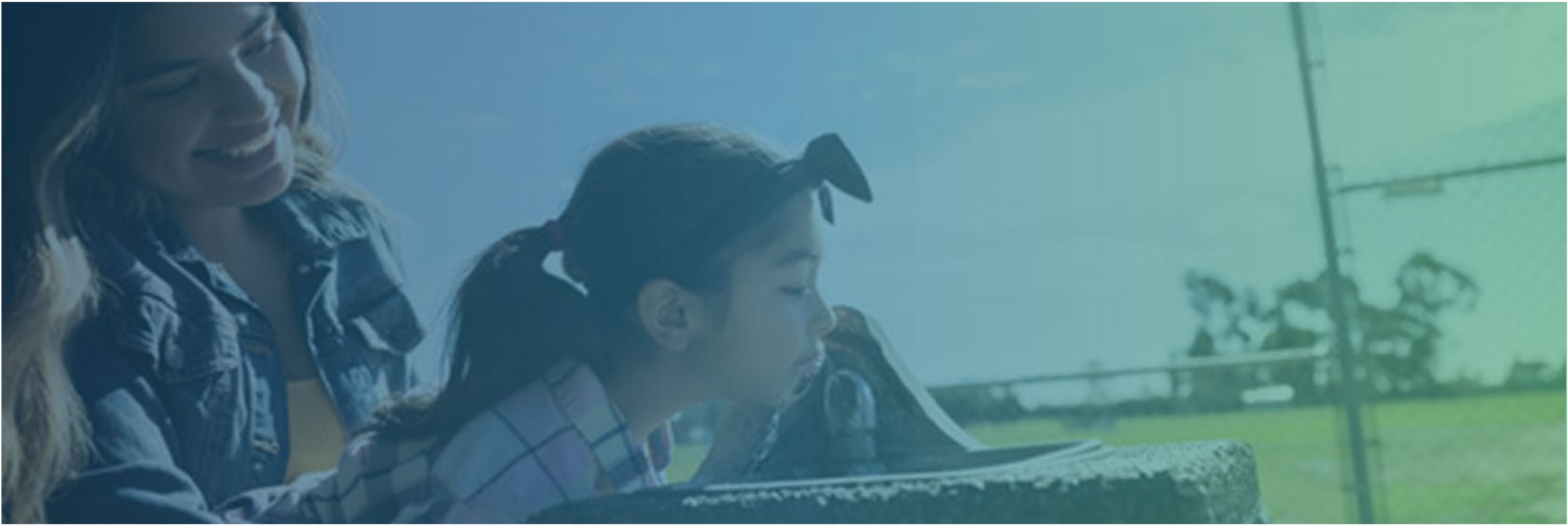
[77] [Water System Financial Capacity & Community Affordability Dashboard](https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/afforddashboard.html)
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/afforddashboard.html
[78] [Drinking Water Outreach Tool](https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=70d27423735e45d6b037b7fbaea9a6a6)
https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=70d27423735e45d6b037b7fbaea9a6a6



FAILING PUBLIC WATER SYSTEMS

OVERVIEW

Many Californians still do not have access to safe, affordable drinking water. California is the first state to do an in-depth study of this issue. It follows California's leadership in adopting the first Human Right to Water policy in the nation 10 years ago.

FAILING CRITERIA

The State Water Board assesses water systems that fail to meet the goals of the Human Right to Water and maintains a list and map of these systems on its website. The Failing list is updated and refreshed daily as violations and enforcement actions are issued or updated. Systems that are on the Failing list are those that are out of compliance or consistently fail to meet primary drinking water standards. The Failing list criteria were expanded in April 2021 to better align with statutory definitions of what it means for a water system to "consistently fail" to meet primary drinking water standards.[79]

Table 23 summarizes the new expanded criteria. Additional details regarding the history of the Failing list and criteria methodology can be found on the State Water Board's Failing webpage.[80]

Table 24: Expanded Criteria for Failing Water Systems

Criteria	Before April 2021	After April 2021
Primary MCL Violation with an open Enforcement Action	Yes	Yes
Secondary MCL Violation with an open Enforcement Action	Yes	Yes
***E. coli* Violation with an open Enforcement Action**	No	Yes

[79] California Health and Safety Code section 116275(c)
[80] Human Right to Water | California State Water Resources Control Board https://www.waterboards.ca.gov/water_issues/programs/hr2w/

Criteria	Before April 2021	After April 2021
Treatment Technique Violations (in lieu of an MCL): • One or more Treatment Technique violations (in lieu of an MCL), related to a primary contaminant, with an open enforcement action; and/or • Three or more Treatment Technique violations (in lieu of an MCL), related to a primary contaminant, within the last three years.	Partially	Expanded
Monitoring and Reporting Violations (related to an MCL or Treatment Technique): • Three Monitoring and Reporting violations (related to a MCL) within the last three years where at least one violation has been open for 15 months or greater.	No	Yes

WATER SYSTEMS ASSESSED

Systems that are assessed for meeting the Failing list criteria include all Community Water Systems (CWSs) and Non-Transient, Non-Community (NTNC) water systems that serve schools and daycares. The current and historical Failing list is refreshed daily and publicly available on the SAFER Dashboard.[81]

FAILING LIST

FAILING LIST USED IN THE REPORT

Multiple components of the Needs Assessment rely on the Failing list of systems. For the purposes of the Risk Assessment, Failing systems are excluded from the Assessment's results, except for comparison purposes. If a water system meets one or more of the Failing criteria, then that system is considered a failing water system and cannot be considered "at-risk" of failing. However, once a water system is removed from the Failing list, it may be added to the At-Risk list of water systems if it meets the Risk Assessment criteria. Failing systems are included in the Cost Assessment and Affordability Assessment results.

The Needs Assessment represents an analysis of data at a snapshot in time. For purposes of the 2023 Needs Assessment, the State Water Board utilized the Failing list as of January 1, 2023. The Failing list from January 1, 2023, had 388 water systems, serving 937,907 people.

[81] SAFER Dashboard
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/saferdashboard.html

Table 25: Failing List from January 1,2023

System Type		Number
Small Community Water Systems[82]		311
Medium Community Water Systems[83]		12
K-12 Schools[84]		58
	TOTAL:	**381**[85]

FAILING LIST DEMOGRAPHICS

The State Water Board has conducted an analysis of Failing water systems and their demographic data to better understand the populations served by these systems. However, there are several limitations to this demographic analysis. Demographic data is collected at the census block group or census tract level, and current census surveys do not indicate household drinking water source type. Therefore, the demographic information presented in the tables below may not represent the actual population served by public water systems. Any interpretation of these results should keep in mind the limitations of the analysis.

Demographic data (household size, linguistic isolation, poverty, median household income, and race/ethnicity) was taken from the 2021 American Community Survey. CalEnviroScreen 4.0 data is from OEHHA.[86] The CalEnviroScreen 4.0 data is displayed as percentiles, with higher percentiles indicating areas that are most affected by pollution and where people are especially vulnerable to the effects of pollution. The socioeconomic analysis was calculated using water service area boundaries, area-weighted census tract data where appropriate, and calculating weighted averages. This methodology means that there may be a bias towards demographic data from larger, rural tracts/block groups as these areas are often larger than smaller, urban tracts/block groups.

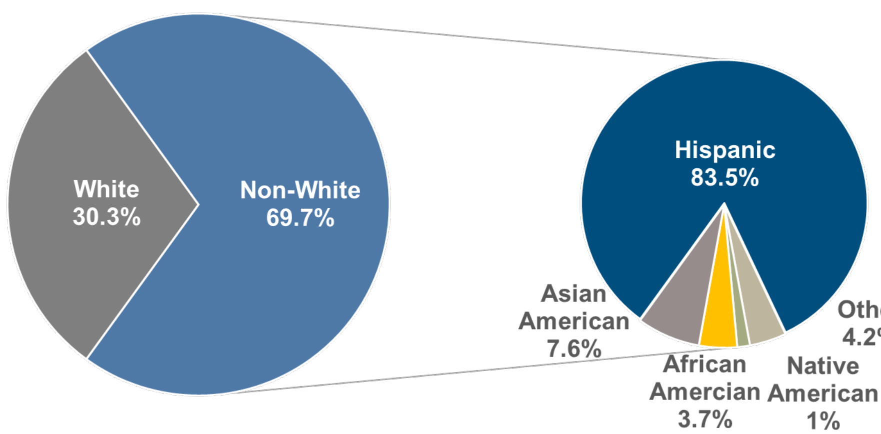
When compared with non-Failing water systems, Failing water system areas tend to have higher CalEnviroScreen scores, a higher percentage of households in poverty, a higher percentage of limited English-speaking households, a larger household size, non-white communities, and are equally likely to be in a DAC or SDAC area.

[82] 3,000 service connections or less.
[83] Greater than 3,000 service connections
[84] Community and non-community public water systems that serve K-12 schools.
[85] 7 failing water systems are excluded from this list because they do not meet the Risk Assessment inventory. 1 system is a large water system serving more than 100,000; 3 are wholesalers; and 3 are non-transient, non-community systems that do not serve K-12 schools.
[86] OEHHA CalEnviroScreen
https://oehha.ca.gov/calenviroscreen

Table 26: Demographic Analysis for Failing Systems[87]

	Statewide (all areas)	Failing
Total Count of Systems	**3,053**	**381**
Average CalEnviroScreen 4.0 Percentile	42.7	53.4
Average CalEnviroScreen 4.0 Population Characteristics Percentile	49.1	51.7
Average CalEnviroScreen 4.0 Pollution Burden Percentile	45.4	53.6
Average percentage of households 2x below federal poverty	30.4%	36.9%
Average percentage of households with limited English speaking	6%	9.6%
Average household size	2.8	3
Percent of systems in DAC/SDAC areas	53.7% (1,639)	61.7% (235)
Percent of non-white customers served	57.8%	69.7%

Figure 20: Distribution of Failing Water Systems by Majority Race/Ethnicity of Census Tract



[87] The three CaleEnviroscreen 4.0 data categories in this assessment utilize 2015-2019 American Community Survey (ACS) data. The following data categories in this assessment utilize updated 2016-2021 ACS data: Average percentage of households 2x below federal poverty, Average percentage of households with limited English speaking, Average household size, Percent of systems in DAC/SDAC areas, and Percent of non-white customers served.

RISK ASSESSMENT RESULTS FOR PUBLIC WATER SYSTEMS

OVERVIEW

The purpose of the Risk Assessment for public water systems is to identify systems at-risk or potentially at-risk of failing to meet one or more key Human Right to Water goals: (1) providing safe drinking water; (2) accessible drinking water; (3) affordable drinking water; and/or (4) maintaining a sustainable water system. Data on performance and risk is most readily available for public water systems and thus the Risk Assessment methodology for public water systems allows for a multi-faceted examination across four risk indicator categories: Water Quality, Accessibility, Affordability; and TMF (technical, managerial, and financial) Capacity.

KEY 2023 RISK ASSESSMENT METHODOLOGY UPDATES

Minimal changes have been made to the Risk Assessment methodology when compared to the methodology used in the 2022 Needs Assessment. The following summarizes the enhancements the State Water Board has made to the 2023 Risk Assessment methodology for public water systems. See Appendix A for more information:

- **Removed two affordability risk indicators** from the Risk Assessment due to outdated data. These risk indicators include: 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden.' Learn more in Appendix A.
- **Incorporated one affordability new risk indicator** into the Risk Assessment: 'Household Socioeconomic Burden.' Learn more in Appendix A.
- **Updated the risk indicator calculation methodology** for 'Increasing Presence of Water Quality Trends Toward MCL', 'Contaminants of Emerging Concern', and 'Bottled or Hauled Water Reliance' Learn more in Appendix A.

WATER SYSTEMS ASSESSED

The Risk Assessment is conducted for community water systems up to 30,000 service connections or 100,000 population served and non-transient, non-community systems that serve K-12 schools. Large community water systems are excluded from the Assessment. The inventory of systems included in the Risk Assessment align with State Water Board expanded funding eligibilities in the 2021-22 Intended Use Plan to medium disadvantaged community water systems.[88] The 2023 Risk Assessment excludes 68 wholesalers because they do not provide direct service to residential customers. Some water system types have also been excluded from certain risk categories or specific risk indicators (Table 26).

Table 27: Public Water Systems Analyzed in the 2023 Risk Assessment

Water System Type[89]	Number	Water Quality	Accessibility	Affordability	TMF Capacity
Community Water Systems[90]	2,695	Yes	Yes	Yes	Yes[91]
K-12 Schools[92]	358	Yes	Yes	No[93]	Yes
TOTAL ANALYZED:	**3,053**				

RISK ASSESSMENT METHODOLOGY

The first Risk Assessment published in the 2021 Needs Assessment was developed in partnership between the State Water Board and UCLA though a phased public process from January 2019 through January 2021. Since the initial Risk Assessment, many enhancements have been made to the methodology to accommodate for new or missing data, respond to stakeholder feedback, and improve the predictive power of the analysis. In 2022, the State Water Board hosted three public workshops to develop and solicit public feedback on the development of a new affordability risk indicator: 'Household Socioeconomic Burden.' Appendix A contains an in-depth overview of the Risk Assessment methodology which relies on three core elements that are utilized to calculate an aggregated risk score for the public water systems assessed (Figure 19):

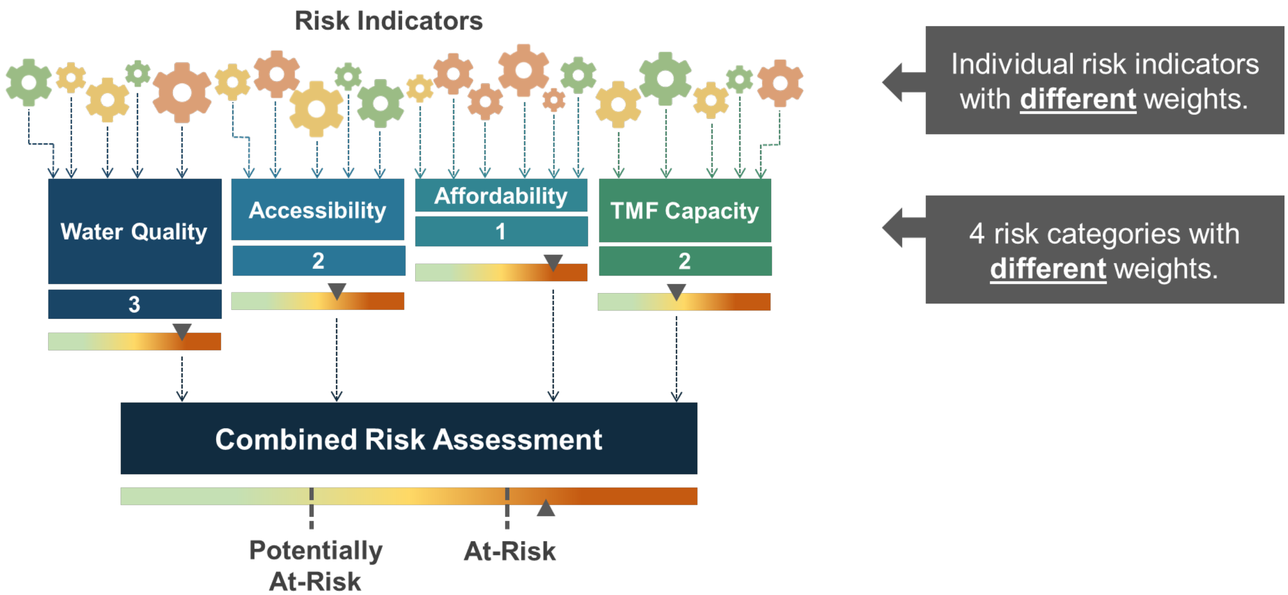
Risk Indicators: quantifiable measurements of key data points that allow the State Water Board to assess the potential for a water system to fail to sustainably provide an adequate supply of safe drinking water due to water quality, water quantity, infrastructure, and/or institutional issues.

Risk Indicator Thresholds: the levels, points, or values associated with an individual risk indicator that delineates when a water system is more at-risk of failing, typically based on regulatory requirements or industry standards.

[88] Drinking Water State Revolving Fund (DWSRF) Intended Use Plan
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/dwsrf_iup_sfy2021_22_final2.pdf
[89] Systems on the Failing list were included in the Risk Assessment analysis, however, they were excluded from the final Risk Assessment results.
[90] Wholesalers were excluded.
[91] Military bases are excluded from the financial risk indicators: Days Cash on Hand, Operating Ratio, & Income.
[92] These systems were manually identified by the State Water Board.
[93] Schools do not typically charge for water; therefore, schools received a risk score of zero in the Affordability category for the Risk Assessment.

Scores & Weights: the application of a multiplying value or weight to each risk indicator and risk category, as certain risk indicators and categories may be deemed more critical than others and/or some may be out of the control of the water system.

Figure 21: Illustration of the Risk Assessment Methodology



RISK INDICATORS

The initial 2021 Risk Assessment utilized 19 risk indicators. These risk indicators were identified and developed from 2019-2021 in partnership between the State Water Board and UCLA and with public feedback.[94] A concerted effort was made to select a range of risk indicators that measure water quality, accessibility, affordability, and TMF capacity based on their criticality as it relates to a water system's ability to remain in compliance with safe drinking water standards. In 2021, the State Water Board made significant changes to the indicators used in the 2022 Risk Assessment. In an effort to keep the Risk Assessment methodology static, minimal changes were made to the 2023 risk indicators (Table 27). The State Water Board removed two affordability indicators and added one new indicator to accommodate for missing data. Information on each risk indicator calculation methodology, thresholds, scores, and weights can be found in Appendix A.

[94] The effort to identify and select the initial 2021 risk indicators included full consideration of indicators identified in efforts conducted by the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Water Resources (DWR), and the California Public Utilities Commission. Risk indicators were also assessed based on the availability of quality statewide data. Information on how the 19 risk indicators were selected from a list of 129 potential risk indicators is detailed in the October 7, 2020 white paper: Evaluation of Potential Indicators and Recommendations for Risk Assessment 2.0 for Public Water Systems https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

Table 28: Risk Indicators

Category	2023 Risk Indicators
Water Quality	History of *E. coli* Presence
	Increasing Presence of Water Quality Trends Toward MCL
	Treatment Technique Violations
	Past Presence on the HR2W List
	Percentage of Sources Exceeding a MCL
	Constituents of Emerging Concern
Accessibility	Number of Sources
	Absence of Interties
	DWR – Drought & Water Shortage Risk Assessment Results
	Critically Over drafted Groundwater Basin
	Bottled or Hauled Water Reliance
	Source Capacity Violations
Affordability	Percent of Median Household Income (%MHI)
	Extreme Water Bill
	NEW: Household Socioeconomic Burden
TMF Capacity	Operator Certification Violations
	Monitoring and Reporting Violations
	Significant Deficiencies
	Days Cash on Hand
	Operating Ratio
	Net Annual Income

RISK ASSESSMENT RESULTS

AT-RISK WATER SYSTEMS

The 2023 Risk Assessment was conducted for 3,053 public water systems. After removing the 381 Failing list systems,[95] the 2023 Risk Assessment results identified 512 (17%) At-Risk water systems, 453 (15%) Potentially At-Risk water systems, and 1,707 (56%) Not At-Risk water

[95] There were 388 Failing systems on January 1, 2023. This number excludes seven large water systems that are not included in the Risk Assessment.

systems (Figure 20).[96] Of the 381 Failing water systems, 302 (79%) meet the At-Risk threshold. If these systems come off the Failing list, they will be considered At-Risk systems.

Figure 22: 2023 Risk Assessment Results (n=3,053)[97]

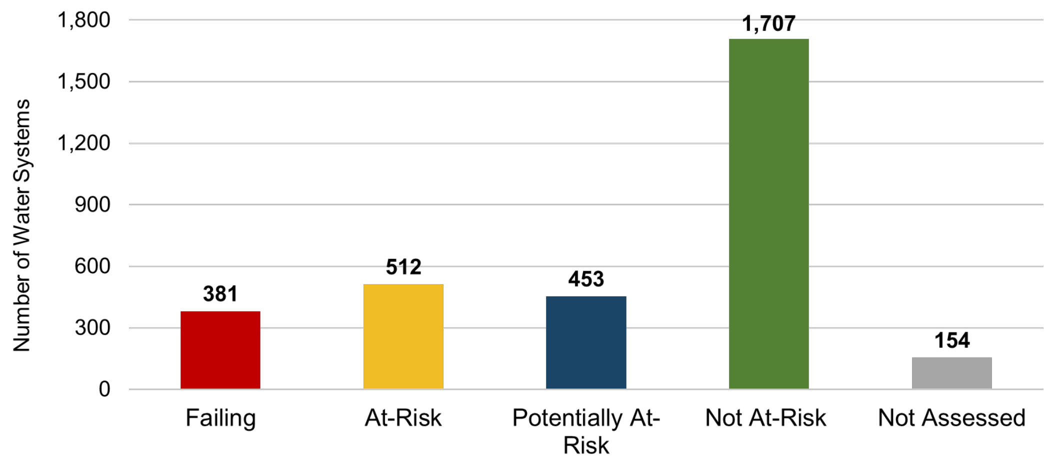
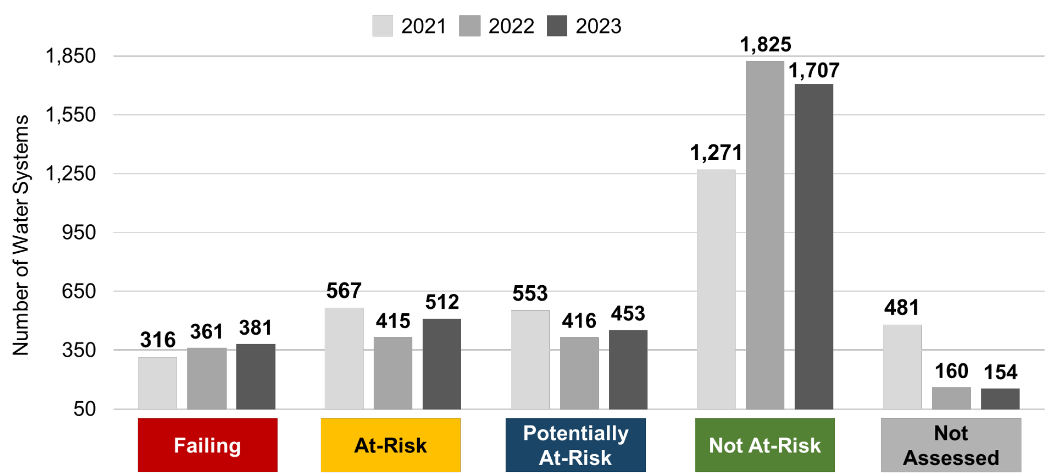


Figure 23: Risk Assessment Results Since 2021[98]



Compared to the 2022 Risk Assessment results, the 2023 Assessment identifies 113 more At-Risk water systems (including Failing system performance in the Risk Assessment) and a statewide increase in total average risk scores from 0.56 to 0.61. The increase in the number of At-Risk water systems and total average statewide risk scores is mostly attributed to the addition of the new Affordability Category risk indicator 'Household Socioeconomic Burden.'

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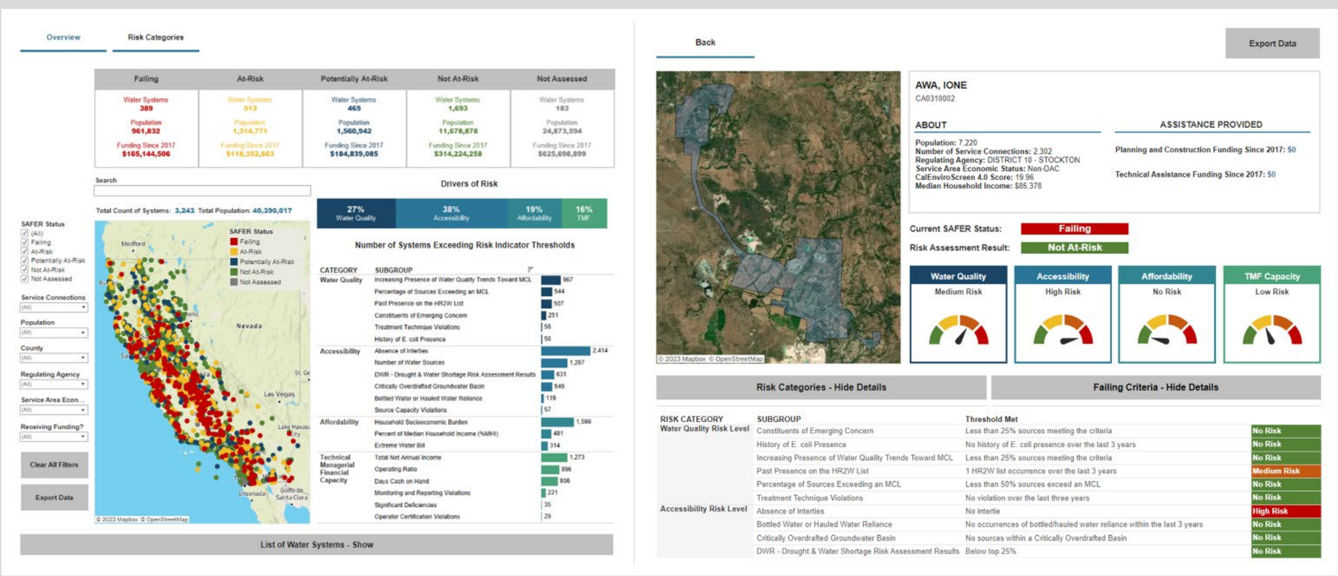
[96] Attachment A1: Risk Assessment Data and Results
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023risk.xlsx
[97] Not Assessed includes 86 large community water systems that serve greater than 30,000 service connections or 100,000 population served and 68 wholesalers.
[98] Not Assessed includes: in 2021, wholesalers and community water systems with greater than 3,300 service connections; in 2022 and 2023, wholesalers and community water systems with greater than 30,000 service connections or 100,000 population served.

Furthermore, 119 (4%) of At-Risk systems were automatically at-risk, regardless of their performance across all risk indicators because they have relied on bottled and/or hauled water to meet customer demand within the last three years. This is 30 more systems when compared to the 2022 Risk Assessment results, which had 89 (3%) of systems automatically At-Risk. Learn more about this in Appendix A.

Since the State Water Board began identifying At-Risk water systems in the Risk Assessment in the 2021 Needs Assessment, the total number of unique At-Risk water systems has remained fairly constant. This is due to a number of factors, including expanding Failing criteria, improved risk indicators and data, and the expansion of the inventory of systems included in the Risk Assessment.

The results of the Risk Assessment and the current list of Failing water systems are accessible online through the State Water Board's SAFER Dashboard.[99] The Dashboard updates the Failing list daily and the Risk Assessment results will be updated on a quarterly basis with new data as it becomes available. Learn more about the SAFER Dashboard in Appendix E.

Figure 24: SAFER Dashboard



The Risk Assessment results for public water systems indicated that Failing systems have more than double the average risk score (1.15 vs. 0.53) when compared to non-Failing systems. Furthermore, 301 (79%) Failing systems exceeded the At-Risk threshold compared to 495 (19%) non-Failing systems (Figure 23).

[99] SAFER Dashboard
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/saferdashboard.html

Figure 25: Distribution of Total Risk Score for Water Systems (n=3,053)

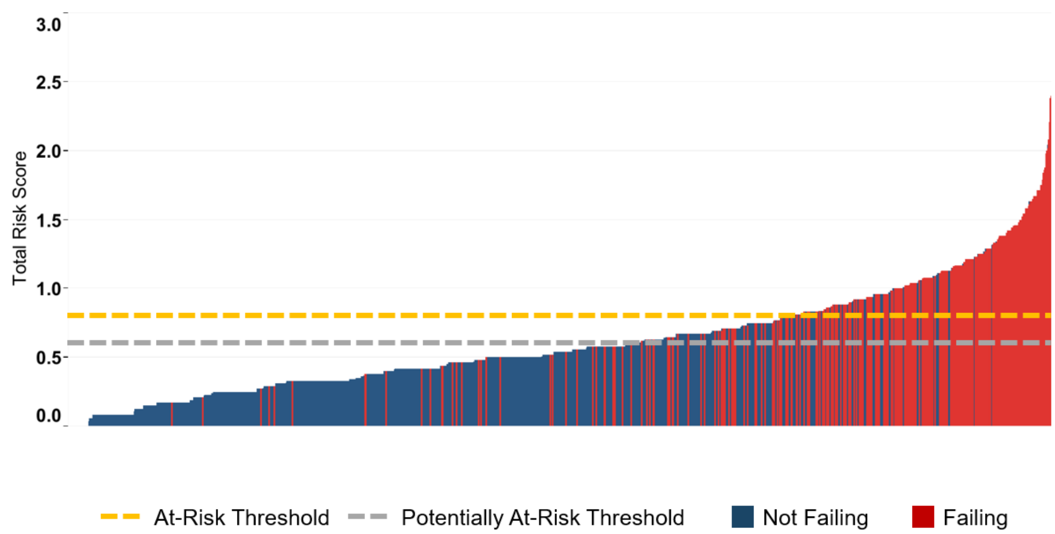
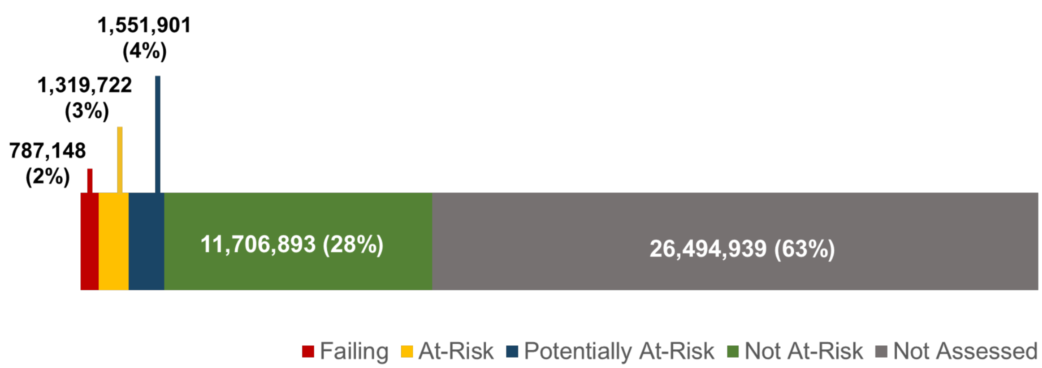


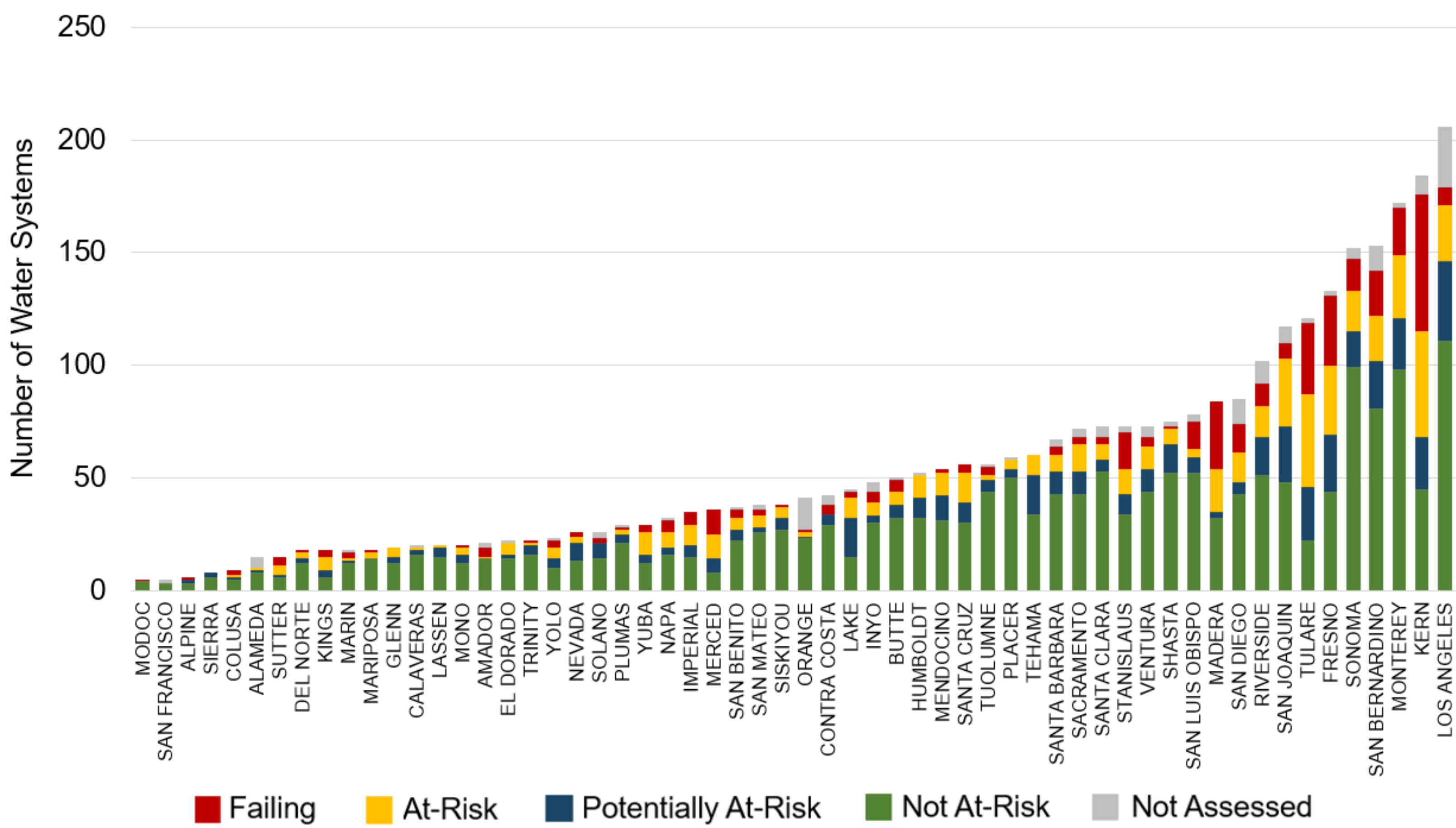
Figure 24 shows the proportion of population served by SAFER status of water systems included in the Risk Assessment. The majority of the population, approximately 28%, is served by Not At-Risk water systems. Both At-Risk and Potentially At-Risk water systems serve approximately 7% of the population compared to systems included in the Risk Assessment and Failing systems serve 2%. 63% of the population served by community water systems is not assessed in the Risk Assessment.

Figure 26: Population of Communities by SAFER Status



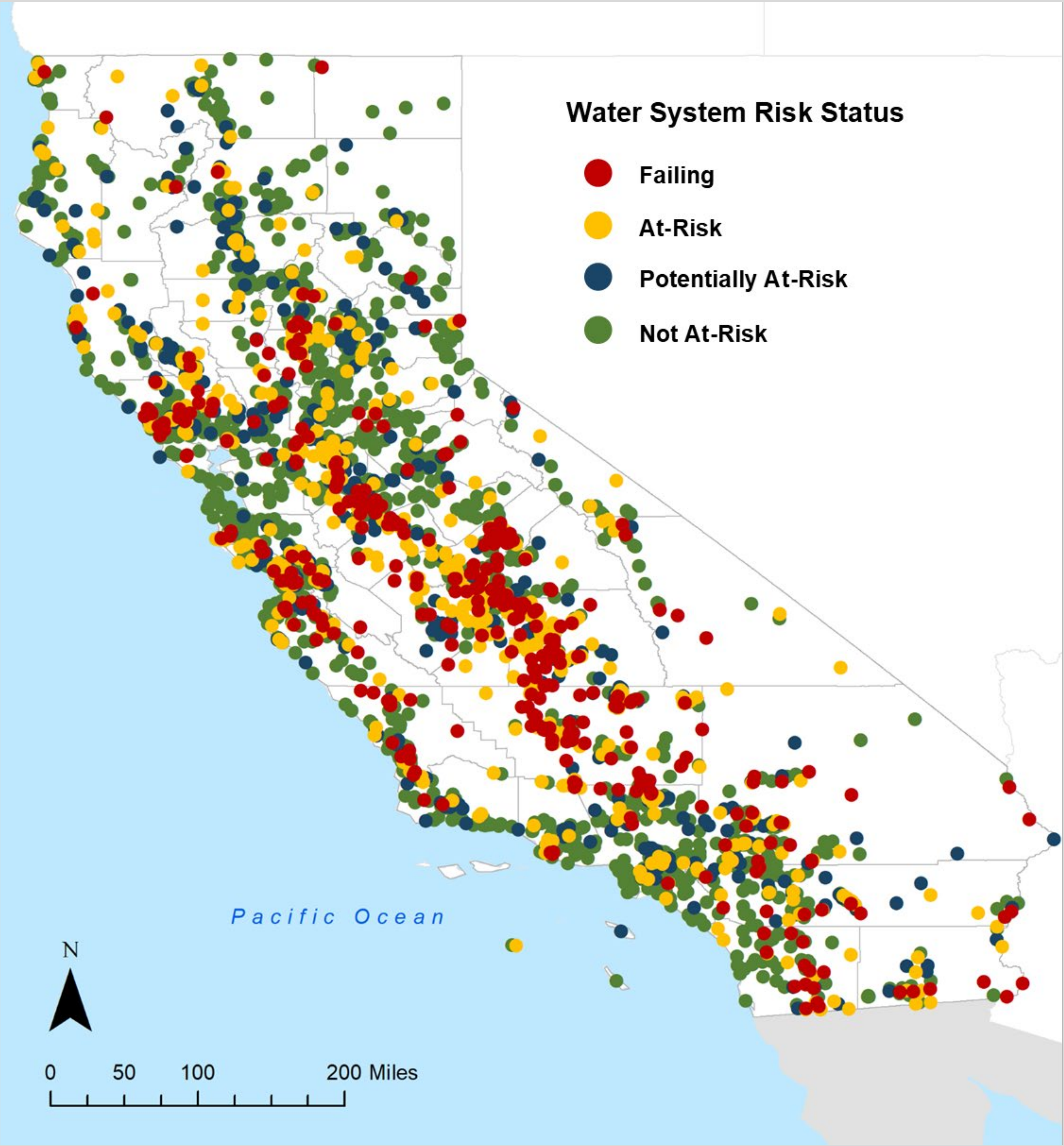
The distribution of At-Risk and Potentially At-Risk systems also varies substantially across the state, as shown in Figure 25 and Figure 29. For instance, Yuba County has the highest proportion of At-Risk systems (34.5%), whereas Alpine County, Contra Costa County, Modoc County, San Francisco County, Sierra County, and Solano County have the lowest proportion of At-Risk systems (0%).

Figure 27: Proportion of Failing and At-Risk Water Systems in Each County[100]



[100] Not Assessed represents large community water systems with service connections greater than 30,000 or population serves greater than 100,000. It also includes wholesalers.
Attachment A1: Risk Assessment Data and Results
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023risk.xlsx

Figure 28: Map of Public Water Systems Evaluated for the Risk Assessment (n=3,053)



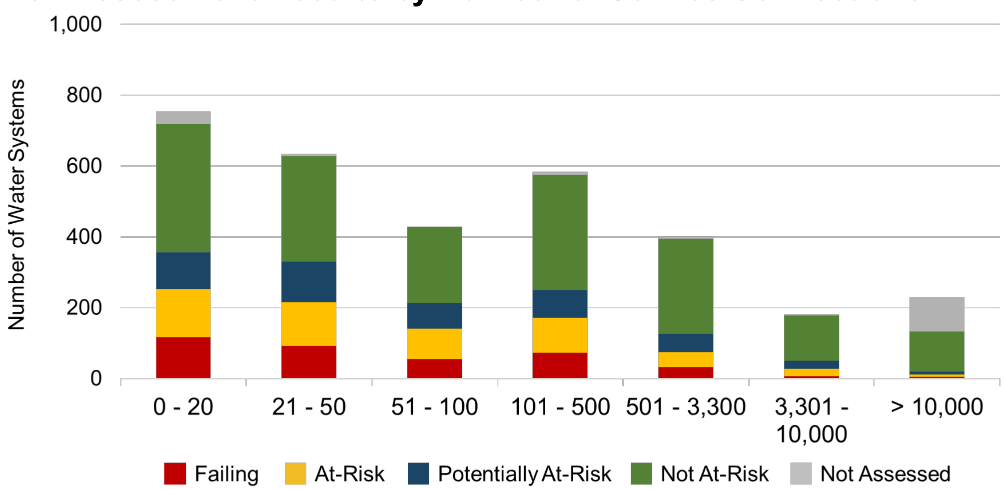
RESULTS BY SYSTEM SIZE

The analysis of the Risk Assessment results indicates the majority (86%) of At-Risk water systems are small water systems with 3,000 service connections or less (Table 28).

Table 29: 2023 Risk Assessment Results by Systems Size and Type

System Type	Small Systems[101]	Medium Systems[102]	K-12 Schools[103]
Failing	311	12	58
At-Risk	442	26	44
Potentially At-Risk	377	32	44
Not At-Risk	1,254	241	212
TOTAL:	**2,384**	**311**	**358**

Figure 29: Risk Assessment Results by Number of Service Connections



RISK DRIVERS

As Figure 28 below shows, all At-Risk systems exceed a threshold of concern for at least three risk indicators, with the average At-Risk system exceeding more than seven risk indicator thresholds of concern. This means that systems were not designated as At-Risk based on a single or even a handful of risk indicators. Moreover, At-Risk systems tended to have many more indicator concerns than Not At-Risk systems.

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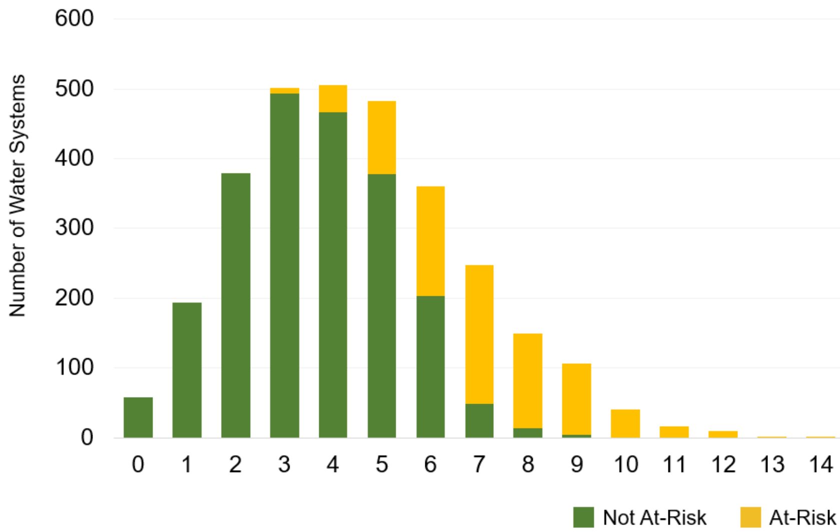
[101] 3,000 service connections or less.
[102] Greater than 3,000 service connections (Risk Assessment results limited to systems up to 30,000 connections and 100,000 population served).
[103] Community and non-community public water systems that serve K-12 schools.

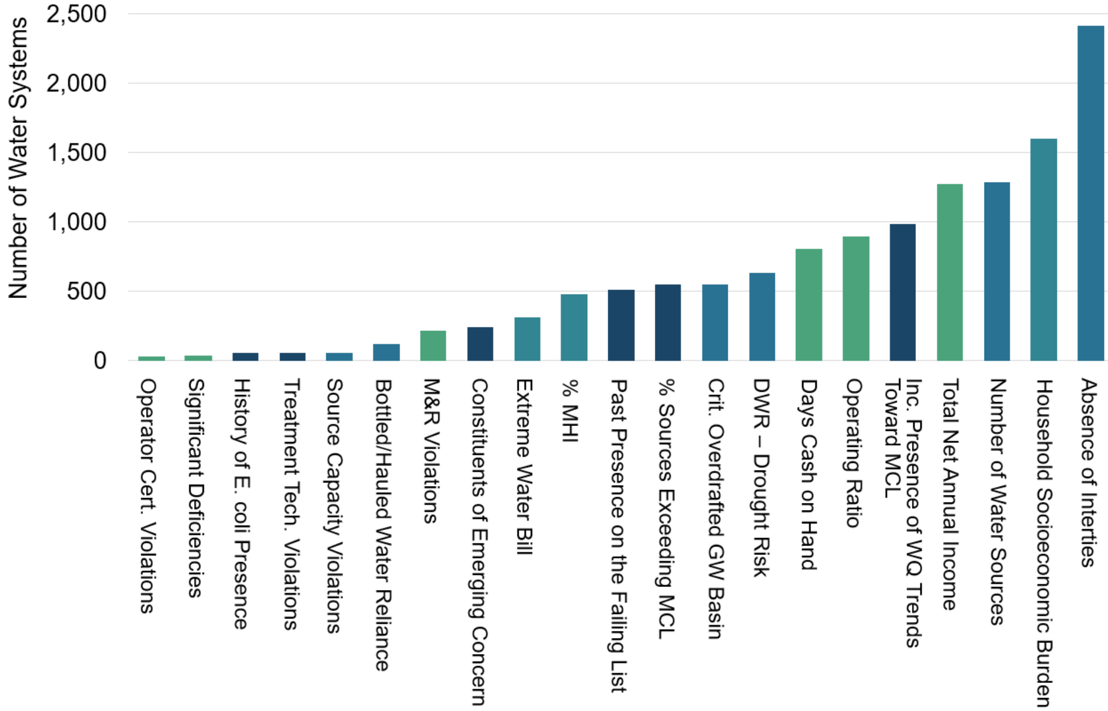
Figure 30: Distribution of the Number of Risk Indicator Thresholds Exceeded by At-Risk and Not At-Risk Water Systems (n=3,053)[104]



An analysis was also conducted to identify which risk indicator minimum thresholds were exceeded the most. As shown in Figure 29, the ‘Absence of Interties’, ‘Household Socioeconomic Burden’, ‘Number of Water Sources’, ‘Total Net Annual Income’, and ‘Increasing Presence of Water Quality Trends Toward MCL’ are the five risk indicators that the majority of water systems were exceeding the minimum risk threshold for. Two of these risk indicators fall into the Accessibility category, and the other three are spread in each of the Water Quality, Affordability, and TMF Capacity categories.

[104] Systems that were automatically At-Risk for meeting the risk thresholds for “Number of Water Sources” and/or “Bottled or Hauled Water Reliance” were excluded from this analysis.

Figure 31: Risk Indicators Ranked by Number of Systems Exceeding Min. Risk Threshold



Based on the Risk Assessment methodology, individual risk indicators are assigned weights between one and three depending on how critical they are for a water system to meet the goals of the HR2W. To better understand which risk indicators are contributing the most towards a water system's total risk score, the average weighted scores for each risk indicator were calculated for At-Risk water systems. Table 29 shows in descending order the most influential risk indicators which contributed the most weighted points to the final risk scoring for all At-Risk systems.

Table 30: Risk Indicators Ranked by their Contribution to Total Risk Scores for At-Risk Water Systems

Category	Risk Indicator	Max Possible Weighted Risk Score	Avg. Weighted Score	Percent Contributing to Total Risk Score[105]
Accessibility	Number of Water Sources	3	1.72	15.6%
Water Quality	Percentage of Sources Exceeding an MCL	3	1.67	15.1%

[105] This column represents the proportion of each risk indicator's statewide average weighted score to the total risk score. The total risk score was calculated by summing up the weighted risk scores across all risk indicators for At-Risk systems and then averaging them. In this analysis 119 systems that are meeting the criteria for automatically At-Risk were excluded.

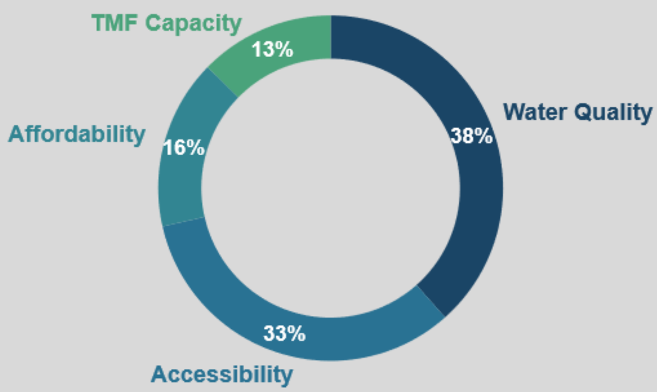
Category	Risk Indicator	Max Possible Weighted Risk Score	Avg. Weighted Score	Percent Contributing to Total Risk Score[105]
Affordability	Household Socioeconomic Burden	2	1.06	9.6%
Accessibility	Absence of Interties	1	0.91	8.2%
Affordability	Percent of Median Household Income	3	0.86	7.8%
Water Quality	Increasing Presence of Water Quality Trends Toward MCL	2	0.72	6.5%
Accessibility	Critically Overdrafted Groundwater Basin	2	0.71	6.4%
TMF Capacity	Total Net Annual Income	1	0.54	4.9%
TMF Capacity	Operating Ratio	1	0.45	4.1%
Water Quality	Past Presence on the HR2W List	2	0.44	4.0%
Accessibility	DWR – Drought & Water Shortage Risk Assessment Results	2	0.41	3.7%
Water Quality	Constituents of Emerging Concern	3	0.38	3.4%
TMF Capacity	Days Cash on Hand	1	0.34	3.0%
TMF Capacity	Monitoring & Reporting Violations	2	0.31	2.8%
Water Quality	History of *E. coli* Presence	3	0.19	1.8%
Affordability	Extreme Water Bill	1	0.14	1.2%
Accessibility	Source Capacity Violations	3	0.1	0.9%
TMF Capacity	Significant Deficiencies	3	0.09	0.8%
TMF Capacity	Operator Certification Violations	3	0.08	0.7%

Category	Risk Indicator	Max Possible Weighted Risk Score	Avg. Weighted Score	Percent Contributing to Total Risk Score[105]
Water Quality	Treatment Technique Violations	1	0.05	0.5%
Accessibility	Bottled Water or Hauled Water Reliance[106]	3	N/A	N/A

RISK INDICATOR CATEGORY RESULTS

The performance of At-Risk water systems across all individual risk indicators shows that the Water Quality category contributes the most weighted risk points to At-Risk scoring (38%), with Accessibility coming second (33%) and the Affordability (16%) and TMF Capacity (13%) categories contributing distant third and fourth highest shares of risk points.

Figure 32: Share of Each Risk Indicator Category in Calculating the Total Risk Score for Systems Meeting At-Risk Threshold (n=814)[107]



DEMOGRAPHIC ANALYSIS OF AT-RISK PUBLIC WATER SYSTEMS

Results for the 2023 Risk Assessment for public water systems can be combined with demographic data to better understand the populations most at-risk. However, there are several limitations to this demographic analysis. Demographic data is collected at the census block group or census tract level, and current census surveys do not indicate household drinking water source type. Therefore, the demographic information presented in the tables

[106] Water systems meeting the threshold for the 'Bottled Water or Hauled Water Reliance' risk indicator are automatically At-Risk regardless of the risk scores from other risk indicators, therefore this indicator is not considered in this analysis.
[107] This analysis includes 302 Failing systems that meet the At-Risk threshold in the Risk Assessment.

below may not represent the actual population served by public water systems. Any interpretation of these results should keep in mind the limitations of the analysis.

Demographic data (household size, linguistic isolation, poverty, median household income, and race/ethnicity) was taken from the 2021 American Community Survey. CalEnviroScreen 4.0 data is from OEHHA.[108] The CalEnviroScreen 4.0 data is displayed as percentiles, with higher percentiles indicating areas that are most affected by pollution and where people are especially vulnerable to the effects of pollution. The socioeconomic analysis was calculated using water service area boundaries, area-weighted census tract data where appropriate, and calculating weighted averages. This methodology means that there may be a bias towards demographic data from larger, rural tracts/block groups as these areas are often larger than smaller, urban tracts/block groups.

When compared with not at-risk water systems, Failing and At-Risk public water systems areas tend to have higher CalEnviroScreen scores, a higher percentage of households in poverty, a higher percentage of limited English-speaking households, a larger household size, non-white communities, and are equally likely to be in a DAC or SDAC area.

Table 31: Demographic Analysis for At-Risk and Failing Systems[109]

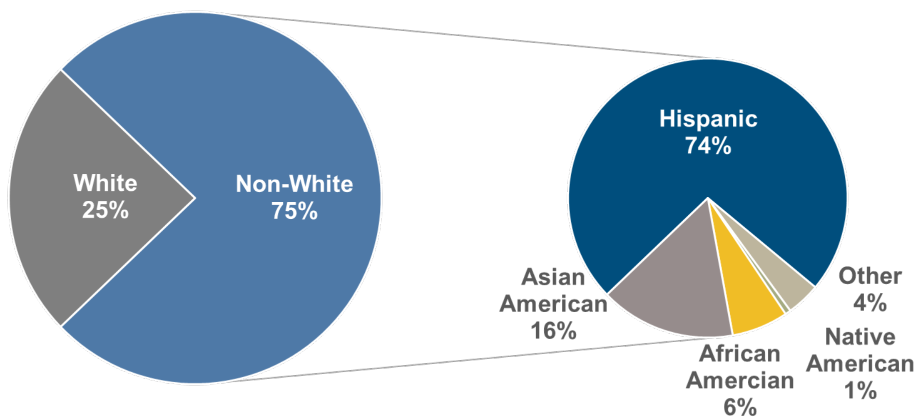
	Statewide (all areas)	Not At-Risk	Potentially At-Risk	At-Risk	Failing
Total Count of Systems	**3,053**	**1,707**	**453**	**512**	**381**
Average CalEnviroScreen 4.0 Percentile	42.7	36.1	47.6	52.2	53.4
Average CalEnviroScreen 4.0 Population Characteristics Percentile	49.1	38.5	49.1	52.1	51.7
Average CalEnviroScreen 4.0 Pollution Burden Percentile	45.4	37.7	45.4	50.7	53.6
Average percentage of households 2x below federal poverty	30.4%	25.8%	35%	37%	36.9%

108 OEHHA CalEnviroScreen
https://oehha.ca.gov/calenviroscreen

109 The three CaleEnviroscreen 4.0 data categories in this assessment utilize 2015-2019 American Community Survey (ACS) data. The following data categories in this assessment utilize updated 2016-2021 ACS data: Average percentage of households 2x below federal poverty, Average percentage of households with limited English speaking, Average household size, Percent of systems in DAC/SDAC areas, and Percent of non-white customers served.

	Statewide (all areas)	Not At-Risk	Potentially At-Risk	At-Risk	Failing
Average percentage of households with limited English speaking	6%	4.1%	6.3%	8.7%	9.6%
Average household size	2.8	2.7	2.8	2.8	3
Percent of systems in DAC/SDAC areas[110]	53.7% (1,639)	44.8% (765)	63.6% (288)	68.6% (351)	61.7% (235)
Percent of non-white customers served	57.8%	53.7%	67.5%	75.4%	69.7%

Figure 33: Distribution of At-Risk Public Water Systems by Majority Race/Ethnicity of Census Tract



LIMITATIONS OF THE RISK ASSESSMENT FOR PUBLIC WATER SYSTEMS

The Risk Assessment for public water systems is an important endeavor in assessing water system performance and risk. While the State Water Board has worked to advance the methodology since the first iteration of the Risk Assessment in 2021, the following limitations exist in the current methodology and approach:

Water Systems Not Assessed

Three types of systems have not been incorporated in the Risk Assessment. First, federally recognized tribal systems were originally envisioned to be included in the same risk

[110] DAC = "disadvantaged community" and represents areas with Median Household Income less than 80% of the California Median Household Income ($67,277).
SDAC = "severely disadvantaged communities" represents areas with Median Household Income less than 80% of the California Median Household Income ($50,458).

assessment as public water systems and attempts were made to gather data to this end, but ultimately tribal systems had to be excluded from the assessment due to missing data. Instead, State Water Board is working with U.S. EPA and Indian Health Service to merge and compare existing risk/need assessments for tribal water systems. Second, public water systems with greater than 30,000 service connections or more than 100,000 population served were not included, but these larger systems may be included in future iterations of the Risk Assessment. Finally, wholesalers have been excluded from the Risk Assessment. To evaluate the performance risk of wholesalers, the State Water Board may need to develop an alternative approach to assessing these systems than the methodology developed for other public water systems as there are not always direct correlations on risk indicators.

Data Quality

In 2021, the State Water Board expanded the electronical Annual Report (eAR) to require the submission of income data for the first time. Many water systems struggled to provide this information. Many water systems may have provided inaccurate data which may explain why three of the top five risk indicators with thresholds exceeded are the new financial risk indicators utilizing this data in the TMF Capacity category. The State Water Board has provided additional guidance for water systems completing the eAR to assist systems in providing accurate information. Updates to the eAR, including improved data validation checks and warning messages, will also improve data quality for future years.

Database and Data Collection Limitations

The State Water Board's primary violation, enforcement and regulatory tracking database, the Safe Drinking Water Information Systems (SDWIS), was designed for reporting compliance to the U.S. EPA for national tracking purposes. The database was not designed for the type of complex risk assessments being done in California or tailored to California's specific water quality regulations or drought-monitoring needs. SDWIS is limited in its ability to store technical, managerial and financial data and currently does not separate out other key system-level data components, such as boil water notices, how water system connections are utilized, water quality trends, etc. Several efforts to augment this data collection and management have been made by the State Water Board through project-specific efforts, such as the Modified Drinking Water Watch,[111] the eAR[112] and the creation of the SAFER Clearinghouse. The ideal solution would likely entail the creation of a comprehensive data management system to fully support the transparent and data-driven work required for this program.

RISK ASSESSMENT REFINEMENT OPPORTUNITIES

The Risk Assessment methodology will evolve over time to incorporate additional and better-quality data; evidence from targeted research to support existing and new risk indicators and thresholds; experience from implementing the SAFER Program; and further input from the

[111] Drinking Water Watch
https://sdwis.waterboards.ca.gov/PDWW/

[112] Electronic Annual Report (EAR) | California State Water Resources Control Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html

State Water Board and public. The following highlights are near-term opportunities for Risk Assessment refinement:

Outreach to Tribal Water Systems
Concerted outreach to Tribal water systems was conducted in 2021 by the State Water Board and the Department of Water Resources (DWR). These outreach efforts were centered on informing tribal government and their representatives about the purpose of the SAFER Program and informing them on the benefits of sharing information so that they may be included in future Risk Assessments. In the interim, SAFER Program staff will implement the SAFER Tribal Drinking Water Outreach Plan[113] and work with individual tribes, as requested by tribal governments or in response to drinking water needs identified through coordination with the U.S. EPA and DWR.

Mid-Sized Urban Disadvantaged Water Systems
Mid-sized urban disadvantaged water systems, like those in Los Angeles County, in some cases appear to be ranking lower on the At-Risk list than expected. This may be attributed to the fact that many of the risk indicators in the Water Quality category do not score issues related to secondary standards as high compared to primary standards. Regulations for compliance with secondary standards typically require sampling at the source, rather than the distribution system. Furthermore, many of these systems have interties and multiple sources, which means they do not score as many risk points in the Accessibility category. The limitations of the TMF Capacity category discussed above also contribute to the lower risk scores for some of these systems.

Expanded Data Collection Efforts
The State Water Board has already begun taking steps necessary to improve data coverage and accuracy for the Risk Assessment. Improvements to the eAR include new requirements for completing survey questions related to the Needs Assessment.[114] eAR functionality has been developed that will help auto-calculate certain datapoints like average customer charges for six hundred cubic feet (HCF). This helps reduce data errors.

The State Water Board will also begin developing new strategies to collect data related to drought resiliency, asset management and TMF Capacity for future iterations of the Needs Assessment. Recommendations on potential asset management and TMF Capacity risk indicators identified through the Risk Assessment methodology development process[115] will serve as a starting point for this effort.

Refinement of Risk Indicators and Thresholds
During the Risk Assessment methodology development process, three additional Affordability

[113] SAFER 2022 Tribal Outreach Plan
https://www.waterboards.ca.gov/safer/docs/2022/SAFER-Tribal-Outreach-Plan-ENG-03242022.pdf
[114] Electronic Annual Report (EAR) | California State Water Resources Control Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html
[115] October 7, 2020 White Paper:
Evaluation of Potential Indicators and Recommendations for Risk Assessment 2.0 for Public Water Systems
https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

risk indicators were recommended for inclusion in future iterations of the Risk Assessment:[116] 'Household Burden Indicator,' 'Poverty Prevalence Indicator,' and 'Housing Burden.'[117] The State Water Board has partnered with the Office of Environmental Health Hazard Assessment (OEHHA) to develop potential affordability indicators and will begin stakeholder engagement needed to develop the appropriate affordability thresholds necessary for inclusion in the Risk Assessment and Affordability Assessment.

Furthermore, as data on water system risk indicators and failures is tracked consistently over time going forward, future versions of the Risk Assessment will be able to more fully evaluate data-driven weighting and scoring approaches to characterizing water system risk. This may lead to dropping risk indicators from the assessment which demonstrate less relationship to risk than expected, and adding others which reflect new, or previously underestimated dimensions of risk.

The intent of the State Water Board going forward is to update the Risk Assessment annually, and in so doing, enhance the accuracy and inclusiveness of the assessment via an iterative, engaged process. Accordingly, future versions of the Risk Assessment will continue to incorporate new data and enhance existing data quality.

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[116] October 7, 2020 White Paper:
Evaluation of Potential Indicators and Recommendations for Risk Assessment 2.0 for Public Water Systems
https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

[117] *Household Burden Indicator*: This indicator measures the economic burden that relatively low-income households face in paying their water service costs by focusing on the percent of these costs to the 20th percentile income (i.e., the Lowest Quintile of Income (LQI) for the service area). This indicator is calculated by adding the average drinking water customer charges, dividing them by the 20th Percentile income in a community water system, and multiplying this by one hundred.
Poverty Prevalence Indicator: This indicator measures the percentage of population served by a community water system that lives at or below 200% the Federal Poverty Level. This measurement indicates the degree to which relative poverty is prevalent in the community.
Housing Burden: This indicator measures the percent of households in a water system's service area that are both low-income and severely burdened by housing costs (paying greater than 50% of their income for housing costs). This metric is intended to serve as an indicator of the affordability challenges low-income households face with respect to other non-discretionary expenses, which may impact their ability to pay for drinking water services.

RISK ASSESSMENT RESULTS FOR STATE SMALL WATER SYSTEMS & DOMESTIC WELLS

OVERVIEW

Figure 34: Categories of Risk

The Risk Assessment methodology developed for state small water systems and domestic wells is focused on identifying areas where groundwater is at high-risk of containing contaminants that exceed safe drinking water standards, is at high-risk of water shortage, and where there is high socioeconomic risk. This information is presented as an online dashboard.[118] Water quality risk data is from the State Water Board's Aquifer Risk Map,[119] water shortage risk data is from the Department of Water Resources Water Shortage Vulnerability Tool for Self-Supplied Communities,[120] and socioeconomic risk data was developed by the Office of Environmental Health Hazard Assessment. Previous work is available on

[118] State Small Water System and Domestic Well Risk Assessment Dashboard https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a

[119] Aquifer Risk Map Webtool https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=17825b2b791d4004b547d316af7ac5cb

[120] Drought and Water Shortage Risk for Self-Supplied Communities https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/DWRDroughtRiskExplorer-RuralCommunitesMarch2021/Dashboard?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

the State Water Board's Needs Assessment webpage.[121]

RISK CATEGORY DATA

The State Water Board has limited water quality, water shortage, and location data for state small water systems and domestic wells, as these systems are not regulated by the state nor are maximum contaminant levels directly applicable to domestic wells.[122] Due to the lack of data from actual state small water systems and domestic wells, it is difficult to precisely determine the count of state small water systems and domestic wells that are At-Risk. To learn more, refer to data collection efforts from Counties in the 2022 Retrospective section of this report.

Water Quality

The risk analysis in the Water Quality category uses proxy groundwater quality data to identify areas where shallow groundwater quality may exceed primary drinking water standards. *These proxy data do not assess the compliance with state or federal water quality standards.* As a result, the presence of a given state small water system or domestic well within an "at-risk" area does not signify that they are known to be accessing groundwater with contaminants above drinking water standards.

Water Shortage

The risk analysis in the Water Shortage category, conducted by DWR, includes a suite of risk indicators that indicate where state small water systems and domestic wells may experience water shortage issues. The risk indicators utilize modeled data and observed data to assess for water shortage risk. As a result, the presence of a given state small water system or domestic well within an "at-risk" area does not signify that the well has gone dry or is experiencing water shortage issues.

NEW: Socioeconomic Risk

The socioeconomic risk is partially based on census data, which does not differentiate between state small water system and domestic well reliant communities. Therefore, the socioeconomic risk of an area may not represent the socioeconomic risk of individual homes or communities.

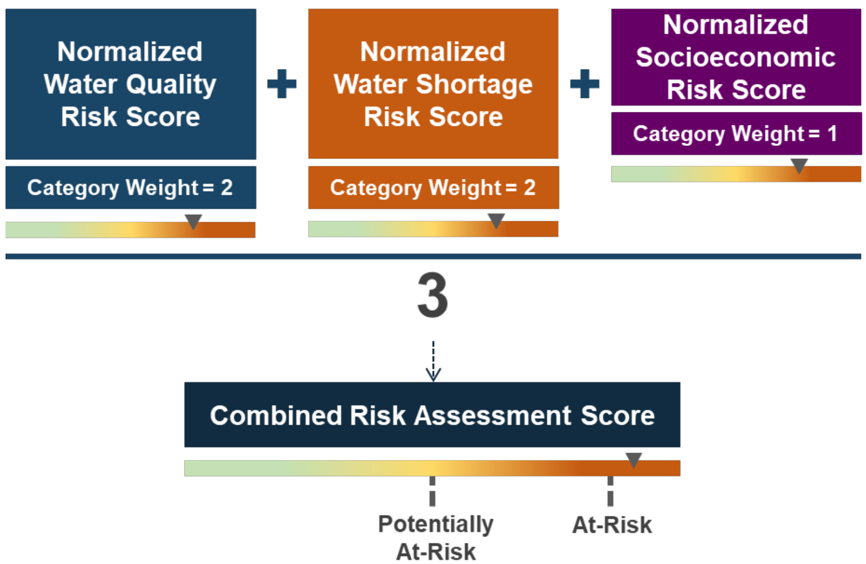
Physical monitoring and testing of state small water systems and individual domestic wells is needed to determine if those systems are unable to access safe drinking water. The State Water Board will continue to coordinate and support counties in their data collection, management, and sharing so that the Risk Assessment can improve its accuracy over time.

[121] Drinking Water Needs Assessment Page
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html
[122] State small water systems are typically required to conduct minimal monitoring. If water quality exceeds an MCL, corrective action is required only if specified by the Local Health Officer. State small water systems provide an annual notification to customers indicating the water is not monitored to the same extent as public water systems.

RISK ASSESSMENT METHODOLOGY

The three risk categories (water quality, water shortage, and socioeconomic risk) are combined following a similar methodology as the Risk Assessment for public water systems. Data from each category are normalized into four scores based on thresholds (Appendix B). The final combined risk score is calculated per square mile section. The score is calculated by multiplying the normalized category scores by the category weights, adding the weighted scores for all three categories, and dividing by the number of categories with data. The final risk score is binned into three groups: “At-risk,” “Potentially At-Risk,” and “Not At-Risk.” Any area that serves a state small water systems or a domestic well with a high score in two or more categories is designated “At-Risk” and any area with a high score in either the water quality or water shortage categories is designated “At-Risk” or “Potentially At-Risk.”

Figure 35: Risk Assessment Methodology



The risk designation per square mile section is assigned to all state small water systems and domestic wells within that section. Location data for state small water systems were provided to the State Water Board through county reporting required through SB 200. Location data for domestic wells were sourced from the Online System for Well Completion Records[123] (managed by DWR) and consist of “domestic” type well records, excluding those drilled prior to 1970 and only including “New/Production or Monitoring/NA” completion record types. Combined risk scores are calculated for all areas of the state, but the risk assessment is only intended for areas with a state small water system or domestic well record. The online webtool includes a filter that only shows the risk scores for areas of the state with at least one domestic well or state small water system, although the data for all areas is available to download.

[123] Department of Water Resources OSWCR database https://services.arcgis.com/aa38u6OgfNoCkTJ6/arcgis/rest/services/i07_WellCompletionReports_Exported_v2_gdb/FeatureServer

RISK ASSESSMENT RESULTS

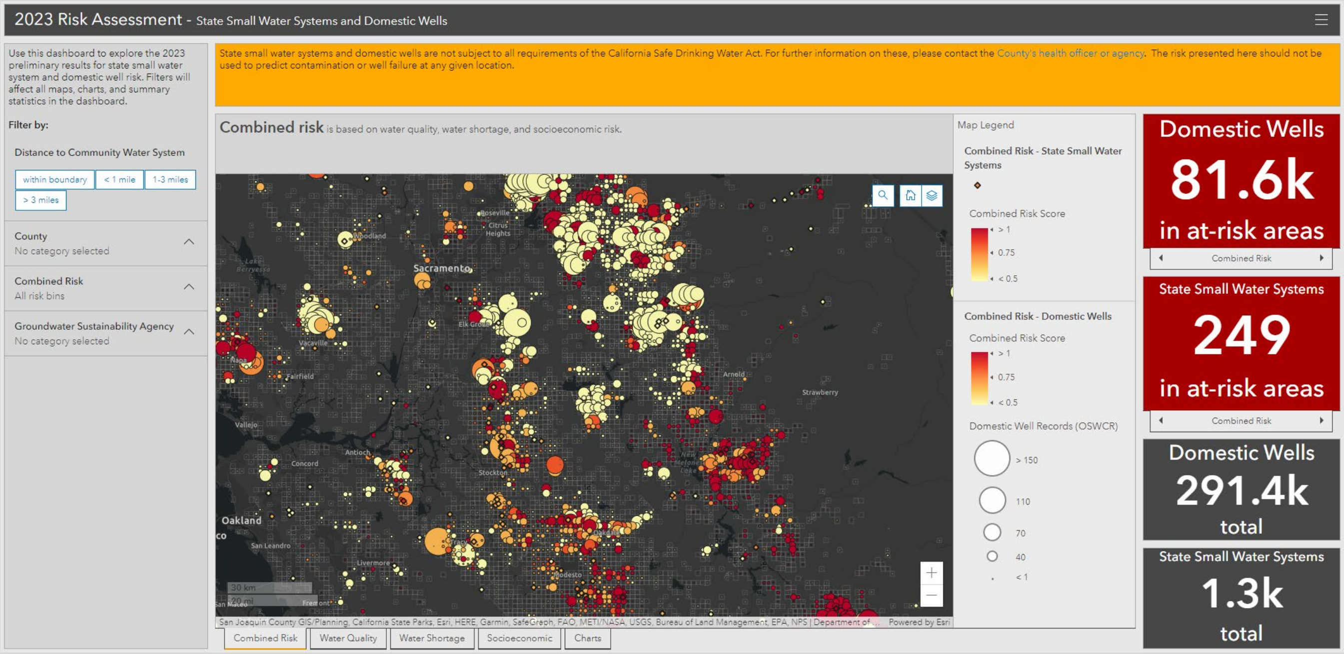
Table 31 shows the approximate counts of state small water systems and domestic wells statewide located in different risk areas based on data from the 2023 Risk Assessment.

Table 32: State Small Water System and Domestic Well Results (Statewide)

Systems	At-Risk	Potentially At-Risk	Not At-Risk
State Small Water Systems	245 (19%)	620 (48%)	432 (33%)
Domestic Wells	81,588 (28%)	103,986 (36%)	105,827 (36%)

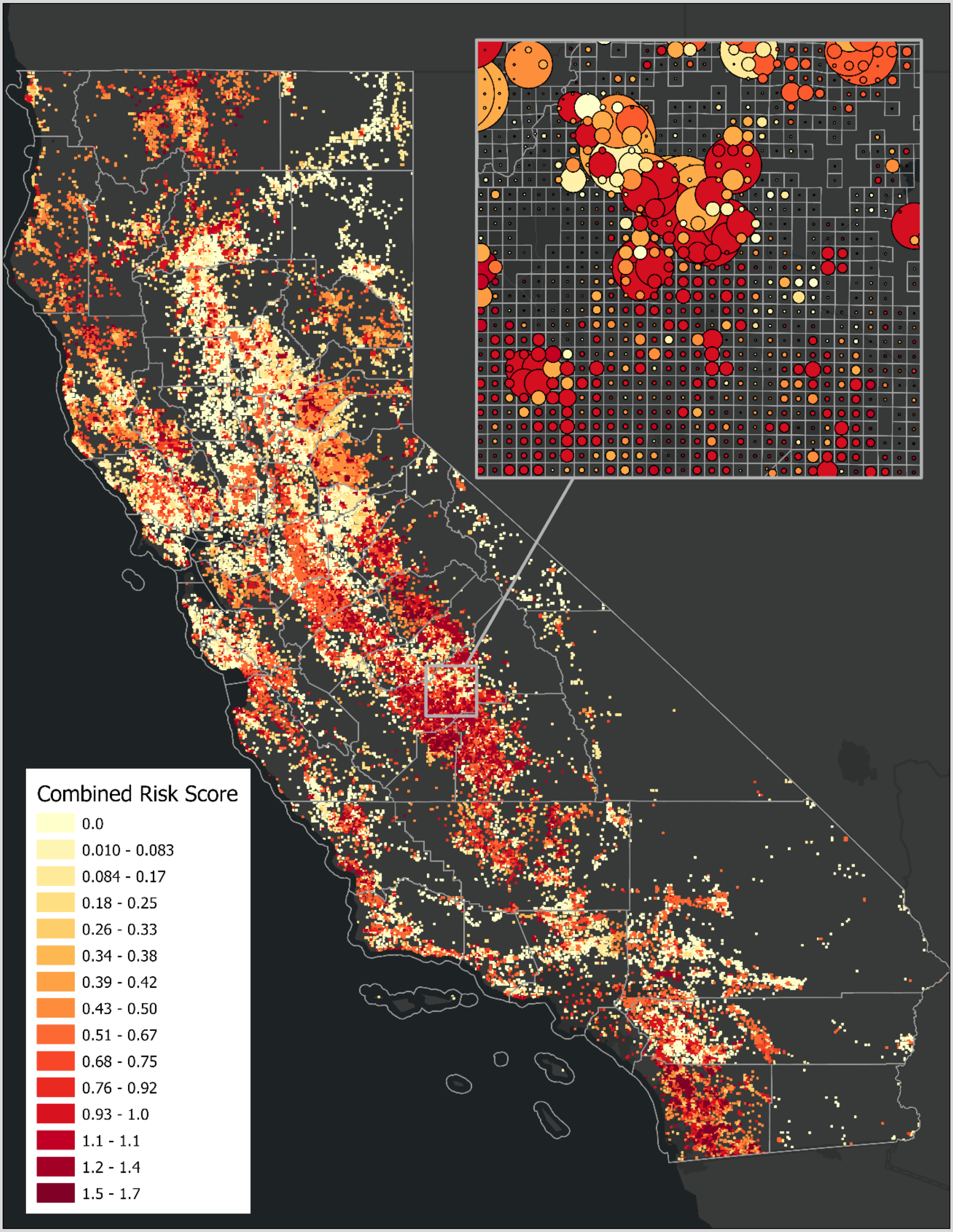
Figure 35 is a map that shows the combined risk for areas of the state with a state small water system or domestic well. To view this spatial data in more detail, and to see the state small water system and domestic well risk counts summarized by county please refer to the 2023 Risk Assessment – State Small Water System and Domestic Well Dashboard.[124]

Figure 36: Risk Assessment - State Small Water Systems and Domestic Well Dashboard



[124] State Small Water Systems & Domestic Wells Risk Assessment Dashboard https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a

Figure 37: Combined Risk for State Small Water Systems & Domestic Wells



COMBINED RISK ANALYSIS

Areas of highest combined risk are located in the Southern San Joaquin Valley, parts of the western Sierra Nevada foothills, and parts of San Diego County. The counties with the highest number of domestic wells in at-risk areas are Fresno, Nevada, San Diego, and Madera counties. The counties with the highest number of state small water systems in at-risk areas are Monterey, Tulare, Kern, and El Dorado counties.

Alluvial basins are less likely to contain at-risk domestic wells. For domestic wells in alluvial basins, 20% are at-risk while 36% of domestic wells outside of alluvial basins are at-risk. For state small water systems in alluvial basins, 14% are at-risk while 31% of state small water systems outside of alluvial basins are at-risk. This is likely due to the fact that although high water quality risk is associated with alluvial basins, both high water shortage risk and high socioeconomic risk are associated with areas outside alluvial basins.

Approximately 14,675 domestic wells (18% at-risk domestic wells) and 81 state small water systems (33% of at-risk state small water systems) are located within the boundary of a community water system. A further 26,579 domestic wells and 99 state small water systems are located within one mile of a community water system boundary.

Table 33: Distance of At-Risk Systems to Nearest Community Water System

Distance to Nearest Community Water System	At-Risk State Small Water Systems	At-Risk Domestic Wells
Within boundary	81 (33%)	14,675 (18%)[125]
< 1 mile	99 (40%)	26,579 (33%)
1 – 3 miles	39 (16%)	22,424 (27%)
> 3 miles	26 (11%)	17,910 (22%)

WATER QUALITY RISK ANALYSIS

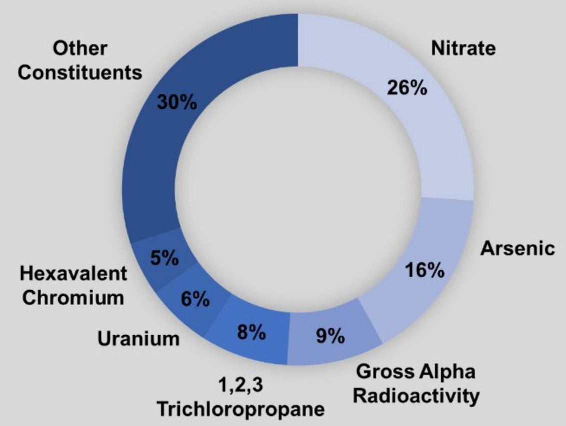
The Central Valley and the Salinas Valley contain the most areas at high water quality risk. The counties with the highest number of domestic wells in high water quality risk areas include Fresno, Sonoma, San Joaquin and Madera counties. The counties with the highest number of state small water systems in high water quality risk areas include Monterey, Kern, Riverside and Santa Clara counties.

Statewide, the top contaminants that contributed to higher risk designations in domestic wells and state small water systems are nitrate, arsenic, 1,2,3-trichloropropane, gross alpha, uranium, and hexavalent chromium. Figure 36 shows the proportion of domestic wells in high water quality risk areas where the contaminant may exceed drinking water standards. Note that multiple contaminants may exceed drinking water standards at a single location.

[125] Percentage represents the at-risk domestic wells that meet the distance criteria compared to the total number of at-risk domestic wells.

In comparison to water quality risk data from the previous year, the 2023 water quality risk results show that nitrate is contributing to a higher percentage of at-risk domestic wells than in 2022. This is likely due to nitrate water quality results from domestic wells collected during the 2022 calendar year under the Irrigated Lands Regulatory Program (ILRP). In 2022, over 600 ILRP domestic wells that had no water quality data prior to 2022 had nitrate results above the MCL.

Figure 38: Constituents Contributing to Shallow Water Quality Risk



WATER SHORTAGE RISK ANALYSIS

Areas of high-water shortage risk are concentrated in the Southern San Joaquin Valley, in the fractured rock areas of the western Sierra foothills, in parts of San Diego county and Northern California.

High water shortage risk areas are highly correlated with reported dry wells. Of the dry well reports[126] made to the Department of Water Resources within the past year, 85% are located within an area with high water shortage risk. 9% of reports are located within medium water shortage risk areas, and 6% of reports are located within low water shortage risk areas.

Nearly half of communities served by domestic wells with high water shortage risk are within the boundary of or within one mile of an existing community water system. Over two thirds of communities served by a state small water system with high water shortage risk are within the boundary of or within one mile or an existing community water system. Distance to existing community water systems is an important factor when considering water shortage risk because after a well has gone dry it can take a considerable amount of time for a long-term solution to be implemented.

[126] Households report well outages or issues to the Department of Water Resources
https://mydrywatersupply.water.ca.gov/report/

Table 34: High Water Shortage Risk Areas Distance to a Nearby Community Water System

Distance to Nearest Community Water System	State Small Water Systems with High Water Shortage Risk	Domestic Wells with High Water Shortage Risk
Within boundary	62 (24%)	17,006 (17%)
< 1 mile	125 (48%)	32,435 (32%)
1 – 3 miles	48 (18%)	29,383 (29%)
> 3 miles	26 (10%)	22,579 (22%)

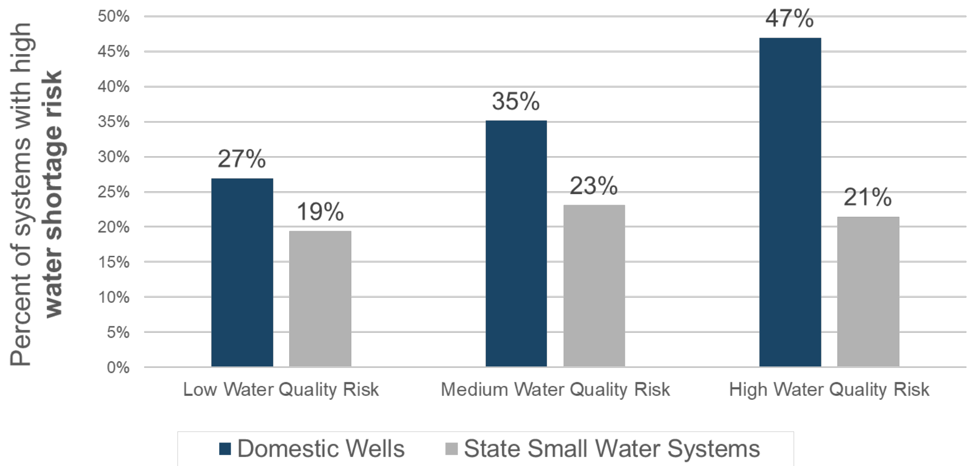
WATER QUALITY AND WATER SHORTAGE RISK ANALYSIS

There is some overlap between high water quality risk areas and high-water shortage risk areas, predominantly in the Southern San Joaquin Valley, in some upland (mountainous) areas of Madera and Fresno counties and in some upland areas of San Diego County. In other areas there is not as much overlap between high water quality risk and high-water shortage risk, with water shortage risk concentrated in upland, fractured rock areas and water quality risk concentrated in alluvial basins. Some examples of this separation between high water quality risk and high-water shortage risk areas are the Sacramento Valley, the Northern San Joaquin Valley, the Santa Rosa area and the Salinas Valley area.

In communities served by domestic wells there is however a positive correlation between increasing water quality risk and increased water shortage risk. Of domestic wells with low water quality risk only 27% have high water shortage risk. Of domestic wells with medium water quality risk, 35% have high water shortage risk, and of domestic wells with high water quality risk 47% also have high water shortage risk.

For communities served by state small water systems there is no correlation between high water quality risk and high-water shortage risk. For state small water systems with low water quality risk 19% have high water shortage risk, for state small water systems with medium water quality risk 23% have high water shortage risk, and for state small water systems with high water quality risk 21% have high water shortage risk.

Figure 39: Water Quality Risk Compared to Water Shortage Risk for Domestic Wells and State Small Water Systems



SOCIOECONOMIC RISK ANALYSIS

For socioeconomic scores assigned at the county level (testing type, testing impact, monitoring programs, administrative services, website quality, funding resources, replacement well cost and average number of wells per driller) higher average county scores do not always correlate with higher domestic well counts. The counties with the highest number of domestic wells (Fresno and Nevada counties) have extremely different county risk scores. Fresno county has one of the lowest county scores, while Nevada has among the highest. Some of the counties with the lowest number of domestic wells also have some of the highest county risk scores (Alameda, Humboldt, Contra Costa, Orange counties), while some counties with moderate numbers of domestic wells have very low county risk scores (San Joaquin, Tulare, San Bernardino).

The Central Valley does not have the highest overall socioeconomic risk scores, which could be because the county-level quality and administrative capacity indicator scores for the Central Valley are lower, indicating that many of these counties have more robust support for domestic wells than others. This lowers the overall socioeconomic risk scores in the Central Valley, even in areas with high census-level socioeconomic indicator scores. The areas with the highest socioeconomic risk scores are Nevada, Humboldt, San Diego, and Siskiyou counties.[127]

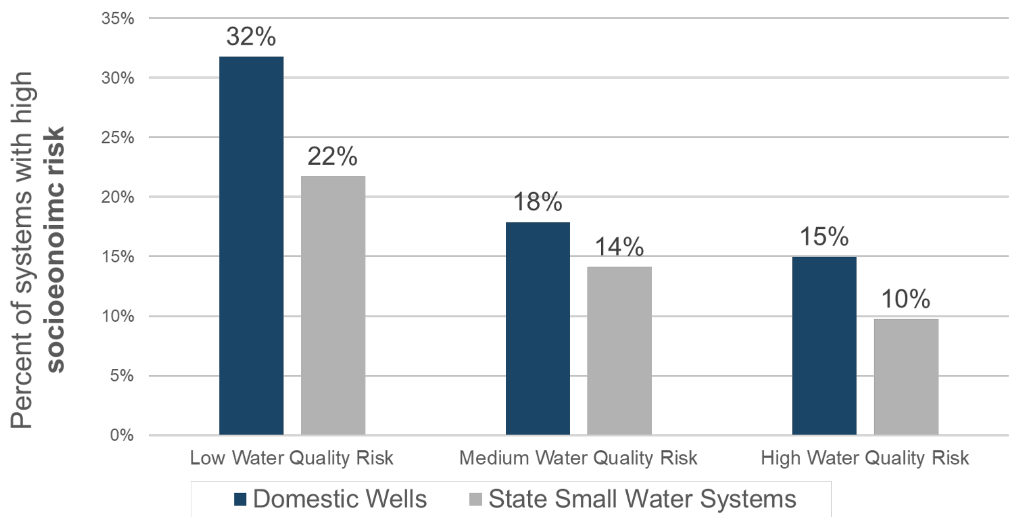
DAC/SDAC status does not appear to be associated with higher socioeconomic risk scores. The average socioeconomic risk score in DAC/SDAC areas is 0.7, compared with an average socioeconomic risk score in non-DAC/SDAC areas of 0.6. For areas with high socioeconomic risk, 36% are in DAC/SDAC areas and 64% are in non-DAC/SDAC areas. For areas with low socioeconomic risk, 27% of domestic wells are in DAC/SDAC areas and 73% are in non-DAC/SDAC areas.

[127] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

SOCIOECONOMIC AND WATER QUALITY RISK

Communities served by domestic wells and state small water systems with high water quality risk are less likely to have high socioeconomic risk as well. Of domestic wells with low water quality risk 32% have high socioeconomic risk, while of domestic wells with medium water quality risk 18% have high socioeconomic risk, and only 15% of high-water quality risk wells also have high socioeconomic risk (28% of domestic wells with unknown water quality risk have high socioeconomic risk). Of state small water systems with low water quality risk 22% have high socioeconomic risk, of state small water systems with medium water quality risk 14% have high socioeconomic risk, while only 10% of state small water systems with high water quality risk have high socioeconomic risk (26% of state small water systems with unknown water quality risk have high socioeconomic risk).

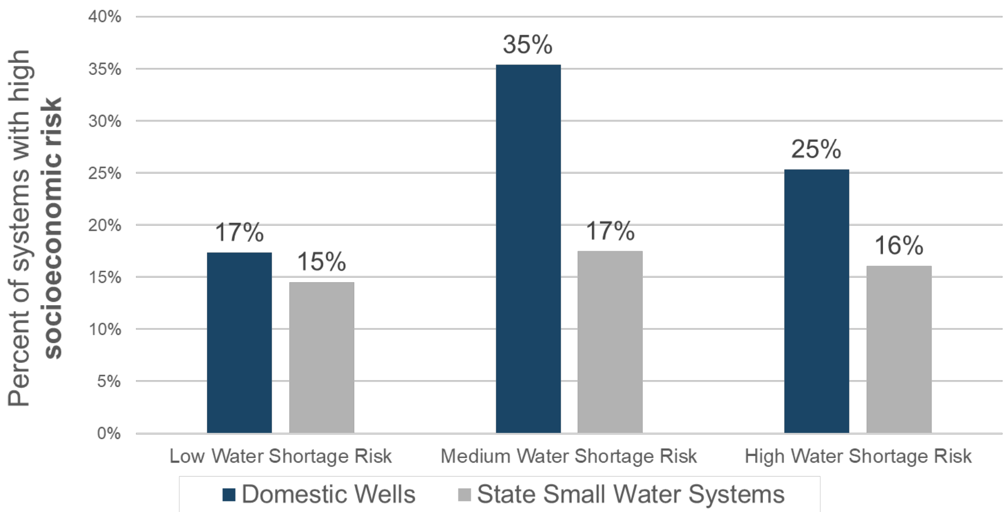
Figure 40: Water Quality Risk Compared to Socioeconomic Risk for Domestic Wells and State Small Water Systems



SOCIOECONOMIC AND WATER SHORTAGE RISK

For communities served by a domestic well or a state small water system there is no correlation between water shortage risk and socioeconomic risk. Of domestic wells with low water shortage risk 17% have high socioeconomic risk. Of domestic wells with medium water shortage risk 35% have high socioeconomic risk, and of domestic wells with high water shortage risk 25% have high socioeconomic risk. Of state small water systems with low water shortage risk 15% have high socioeconomic risk, of state small water systems with medium water shortage risk 17% have high socioeconomic risk, and for state small water systems with high water shortage risk 16% have high socioeconomic risk.

Figure 41: Water Shortage Risk Compared to Socioeconomic Risk for Domestic Wells and State Small Water Systems



DEMOGRAPHIC ANALYSIS OF AT-RISK STATE SMALL WATER SYSTEMS AND DOMESTIC WELL AREAS

Results for the 2023 Risk Assessment for state small water systems and domestic wells can be combined with demographic data to better understand the populations most at-risk for water shortage and water quality issues. However, there are several limitations to this demographic analysis. Demographic data is available at the census block group or census tract level, and current census surveys do not indicate household drinking water source type. Therefore, the demographic information presented in the tables below may not represent the population served by state small water systems or domestic wells. Any interpretation of these results should keep in mind the limitations of the analysis.

Demographic data (household size, linguistic isolation, poverty, median household income, and race/ethnicity) is from the 2021 American Community Survey. CalEnviroScreen 4.0 data is from OEHHA[128]. The CalEnviroScreen 4.0 data is displayed as percentiles, with higher percentiles indicating areas that are most affected by pollution and where people are especially vulnerable to the effects of pollution. The demographic analysis for state small water systems was calculated by assigning census data to state small water systems using the census area overlying the point location of the state small water system. The demographic analysis for domestic wells was calculated by assigning census data to square mile sections using the census area overlying the section centroid, and using a weighted average to determine the average demographic information per risk bin.

When compared with not at-risk state small water systems areas, at-risk state small water system areas tend to have slightly higher CalEnviroScreen 4.0 scores, a slightly higher

128 OEHHA CalEnviroScreen
https://oehha.ca.gov/calenviroscreen

percentage of households in poverty, a lower percentage of limited English-speaking households, a similar household size, and are more likely to be in a DAC or SDAC area. State small water systems that are potentially at-risk are the most likely to be in a majority non-white census area.

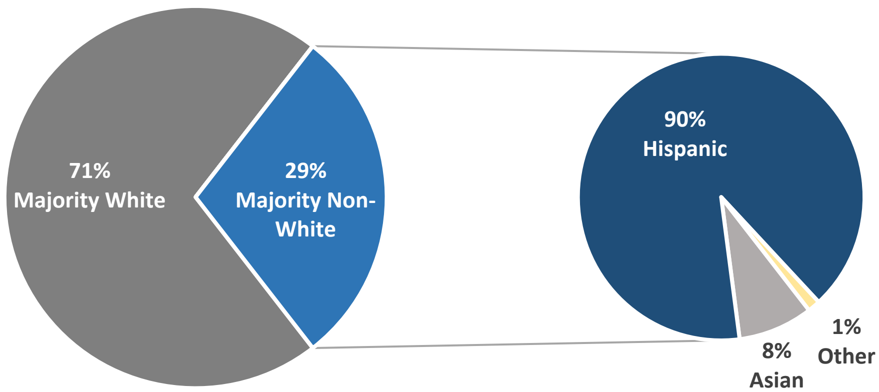
Table 35: Demographic Analysis for Areas with Combined At-Risk State Small Water Systems[129]

	Statewide (all areas)	Statewide (SSWS areas only)	Not At-Risk	Potentially At-Risk	At-Risk
Total Count of SSWS	**1,297**	**1,297**	**432**	**620**	**245**
Average CalEnviroScreen 4.0 Percentile	50.0	39.6	37.5	40.4	41.3
Average CalEnviroScreen 4.0 Population Characteristics Percentile	50.0	41.0	40.9	39.8	44.2
Average CalEnviroScreen 4.0 Pollution Burden Percentile	50.0	40.4	36.3	43.3	40.0
Average percentage of households 2x below federal poverty	28.2%	26.7%	26.3%	26.1%	29.3%
Average percentage of households with limited English speaking	8.6%	8.9%	7.1%	11.8%	4.8%
Average household size	2.9	2.8	2.7	3.0	2.7
Percent of SSWS in DAC/SDAC areas[130]	35.2% (457)	35.2% (457)	39.1% (169)	29.5% (183)	42.9% (105)
Percent of SSWS in majority non-white areas	42.7% (554)	42.7% (554)	30.3% (131)	56.8% (352)	29.0% (71)

[129] The three CalEnviroscreen 4.0 data categories in this assessment utilize 2015-2019 American Community Survey (ACS) data. The following data categories in this assessment utilize updated 2016-2021 ACS data: Average percentage of households 2x below federal poverty, Average percentage of households with limited English speaking, Average household size, Percent of systems in DAC/SDAC areas, and Percent of non-white customers served.

[130] DAC = “disadvantaged community” and represents areas with Median Household Income less than 80% of the California Median Household Income ($67,277).
SDAC = “severely disadvantaged communities” represents areas with Median Household Income less than 80% of the California Median Household Income ($50,458).

Figure 42: Distribution of At-Risk State Small Water Systems by Majority Race/Ethnicity of Census Tract



When compared with not at-risk domestic well areas, at-risk domestic well areas tend to have higher CalEnviroScreen scores, a higher percentage of household poverty, a higher percentage of households with limited English speaking, larger household size, are more likely to be in a DAC or SDAC area and are more likely to be in a majority non-white census area.

Table 36: Demographic Analysis for Areas with Combined At-Risk Domestic Wells[131, 132]

	Statewide (all areas)	Statewide (domestic well areas only)	Not At-Risk	Potentially At-Risk	At-Risk
Total Count of Domestic Wells	**291,401**	**291,401**	**105,827**	**103, 986**	**81,588**

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[131] CalEnviroScreen 4.0 data is available per census tract. Combined risk status for domestic wells is available per square mile section. To determine the CalEnviroScreen 4.0 percentile score average per combined risk category, each section was assigned the CalEnviroScreen 4.0 percentile score based on the tract that contains the centroid of the section. Some census tracts do not contain any section centroid and therefore do not contribute to the averages even if they overlap a section with a domestic well. The square mile sections are grouped by their combined risk status to determine the average score percentile using a weighted average approach. It is important to factor in the geographic relationship between tracts and sections. Without considering a weighting approach for averaging scores within each combined risk categories, scores of large census tracts would contribute more to the risk category average compared to small census tracts. For example, a tract with 600 sections contributes 600 of the same percentile scores while a tract with 20 sections only contributes 20 percentile scores. Instead, to reduce bias towards large rural areas, each section was assigned a weight of the inverse number of sections in the census tract. For example, a tract with 10 sections would be given a weight of 0.10. A one-way analysis of variance (ANOVA) showed a statistically significant difference in average scores between combined risk categories for CalEnviroScreen 4.0 percentile, Population Characteristics, Pollution Burden, Poverty, Average percentage of households with limited English speaking, and Household Size ($p<0.0001$).

[132] The three CalEnviroscreen 4.0 data categories in this assessment utilize 2015-2019 American Community Survey (ACS) data. The following data categories in this assessment utilize updated 2016-2021 ACS data:

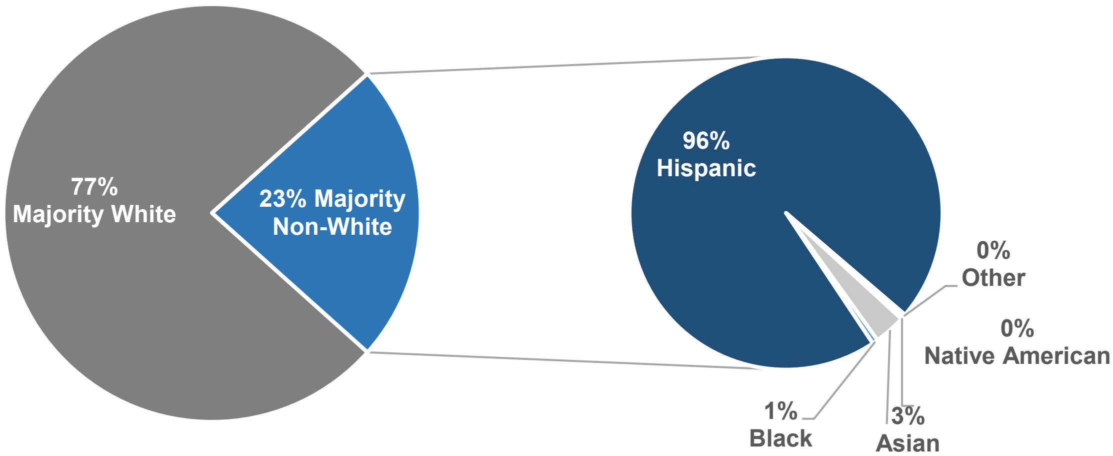
	Statewide (all areas)	Statewide (domestic well areas only)	Not At-Risk	Potentially At-Risk	At-Risk
Average CalEnviroScreen 4.0 Percentile	50.0	45.5	36.3	48.9	51.7
Average CalEnviroScreen 4.0 Population Characteristics Percentile	50.0	47.7	41.6	50.8	53.4
Average CalEnviroScreen 4.0 Pollution Burden Percentile	50.0	41.8	33.5	46.6	47.9
Average percentage of households 2x below federal poverty	28.2%	26.9%	23.9%	27.4%	31.4%
Average percentage of households with limited English speaking	8.6%	5.6%	4.1%	6.4%	6.8%
Average household size	2.9	2.9	2.8	3.0	3.0
Percent of domestic wells in DAC/SDAC areas[133]	32.5% (94,579)	32.5% (94,579)	30.1% (31,937)	28.8% (29,936)	40.1% (32,706)
Percent of domestic wells in majority non-white areas	19.8%	19.8%	14.2%	22.9%	23.2%

Average percentage of households 2x below federal poverty, Average percentage of households with limited English speaking, Average household size, Percent of systems in DAC/SDAC areas, and Percent of non-white customers served.

[133] DAC = “disadvantaged community” and represents areas with Median Household Income less than 80% of the California Median Household Income ($67,277).

SDAC = “severely disadvantaged communities” represents areas with Median Household Income less than 80% of the California Median Household Income ($50,458).

Figure 43: Distribution of At-Risk Domestic Wells by Majority Race/Ethnicity of Census Tract



LIMITATIONS OF THE RISK ASSESSMENT FOR STATE SMALL WATER SYSTEMS & DOMESTIC WELLS

The state small water system and domestic well risk ranking developed using this methodology is not intended to depict actual groundwater quality conditions at any given domestic supply well or small water system location. The purpose of this risk map analysis is to prioritize areas that may not meet primary drinking water standards or have water shortage risk to inform additional investigation and sampling efforts. The current lack of available state small water system and domestic well water quality data makes it impossible to characterize the actual water quality for any individual state small water system or domestic well without directly testing them. The analysis described here thus represents a good faith effort at using readily available data to estimate water quality and water shortage risk for state small water systems and domestic wells.

REFINEMENT OPPORTUNITIES

Provisions under SB 200 require counties to provide location and any available water quality data for state small water systems and domestic wells. The State Water Board is assisting counties in complying with these provisions and is developing a new database to collect and validate this data as it is submitted.[134] Future iterations of the Aquifer Risk Map and Risk Assessment for state small water systems and domestic wells will incorporate the locational and water quality data collected through this effort.

[134] State Small Water System and Domestic Well Water Quality Data
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/small_water_system_quality_data.html

COST ASSESSMENT UPDATE

OVERVIEW

In 2021, the State Water Board conducted a Cost Assessment to estimate the cost of implementing interim and long-term solutions for Failing systems, At-Risk public water systems, state small water systems, and domestic wells. Due to minor changes to the number of Failing and At-Risk systems in 2022, the State Water Board did not update the Cost Assessment estimates in the 2022 Needs Assessment. However, in September 2021 the Governor approved Senate Bill (SB) 552[135] which requires small water systems (15 – 2,999 connections) and schools to meet new drought infrastructure resiliency measures. In response to stakeholder feedback for better drought-related cost estimates and the need to support SB 552 planning, the State Water Board conducted a targeted Drought Infrastructure Cost Assessment for the 2022 Needs Assessment.

This 2023 Needs Assessment does not include an updated Cost Assessment. The State Water Board is currently updating the full Cost Assessment Model for Failing and At-Risk public water systems, state small water systems, and domestic wells for the 2024 Needs Assessment. This 2-year enhancement effort includes:

5. Updating how the Cost Assessment Model identifies and selects interim and long-term solutions for Failing and At-Risk systems.
6. Updating and enhancing the cost assumptions and formulas used in the Model to estimate costs – both capital and non-capital.
7. Improving the analysis of the Cost Assessment results.
8. Improving transparency by making the underlying data, formulas, etc. more accessible.

[135] Senate Bill No. 552, section 10609.62, Chapter 245
https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB552

The State Water Board began hosting public workshops in 2022 to start soliciting public feedback on the proposed enhancements to the Cost Assessment.[136] Additional workshops are planned for 2023.

SUMMARY OF PROPOSED CHANGES FOR 2024

The State Water Board is working on an updated, streamlined methodology for estimating potential modeled solution costs for Failing public water systems, At-Risk public water systems, state small water systems, and domestic wells. The proposed changes to the Cost Assessment Model include:

- Updating and/or validating all cost assumptions embedded in the model through an analysis of State Water Board funding projects, contractor, vender, and stakeholder outreach.
- Determine if physical consolidation is a viable model solution based on (1) physical location criteria and (2) total cost per service connection. Previously the Model would compare the total cost of physical consolidation to other long-term model solutions, like treatment by POU/POE, which are often much less expensive in the short-term. However, this led to an underestimation of cost due to the Model by over-selecting POU/POE, which are not often preferred long-term sustainable solutions.
- Utilize additional information about each water system or domestic well location to better identify potential modeled solutions. For example, systems that are failing for multiple monitoring and reporting violations will not have treatment modeled as a potential solution. The Risk Assessment for state small water systems and domestic wells now identifies locations at risk for water quality and/or drought (not available in the original Cost Assessment Model). The updated Model will better match potential solutions based on identified risk drivers.
- The sustainability and resiliency assessment will be removed from the Model to accommodate the new approach for matching potential model solutions to each system based on their challenges identified by the Failing criteria or Risk Assessment results.
- Use system and location-specific information to determine additional other essential infrastructure (OEI) needed, rather than relying on statewide assumptions applied proportionally to all water systems.
- OEI will be aligned with the Senate Bill 552 drought resiliency infrastructure requirements, utilizing updated cost assumptions reflecting current infrastructure market prices.

[136] August 8, 2022 Workshop: Proposed Changes for the Cost Assessment: White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/cost-assessment-white-paper.pdf; Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/2022-proposed-changes-to-cost-model-bt.pdf

PLANNED 2023 WORKSHOPS

The State Water Board will be hosting at least three public workshops in 2023 to solicit public and stakeholder feedback on the proposed enhancements to the Cost Assessment. These three workshops will cover the following:

(1) Physical consolidation GIS analysis and cost assumptions.
(2) Modeled treatment methodologies and cost assumptions.
(3) Complementary long-term solutions and emergency solutions cost assumptions.

AFFORDABILITY ASSESSMENT RESULTS

OVERVIEW

Ensuring drinking water is affordable is key to meeting California's Human Right to Water mandate.[137] The COVID-related economic crisis has served to further highlight the need to address affordability, both to ensure that households can afford the water that they drink as well as to support drinking water systems in maintaining enough financial viability to provide safe reliable drinking water.[138]

The purpose of the Affordability Assessment is to identify disadvantaged community water systems that have instituted customer charges that exceed the "Affordability Threshold" established by the State Water Board to provide drinking water that meets state and federal standards.[139] Legislation does not define what the Affordability Threshold should be. Nor is there specific guidance on the perspective in which the State Water Board should be assessing the Affordability Threshold.

WHY MEASURING AFFORDABILITY MATTERS

Drinking water affordability is a difficult challenge to measure. Different terms and metrics have been used to describe and measure affordability in the water sector for decades, and they have been used to influence important decisions. For instance, affordability metrics are used to determine which water systems are eligible for state and federal assistance. Water systems meeting certain affordability thresholds qualify for more grant vs. loan funding for infrastructure projects and are frequently prioritized for state and federal technical assistance as well.

Affordability metrics are often used by water systems when exploring possible rate changes. Systems serving communities with affordability challenges often struggle to raise their rates,

[137] State Water Board Resolution No. 2016-0010
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf
[138] Drinking Water COVID-19 Financial Impacts Survey | California State Water Resources Control Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/covid-19watersystemsurvey.html
[139] California Health and Safety Code, section 116769, subd. (a)(2)(B)

thus affecting their long-term financial capacity. Customers unable to pay for water services may then experience challenges in accessing a reliable source of safe drinking water.

Figure 44: Why Measuring Affordability Matters

State & Federal Gov.

- Funding eligibilities: Grant vs. Loan
- Prioritization for & access to technical assistance
- Fee waivers

Water Systems

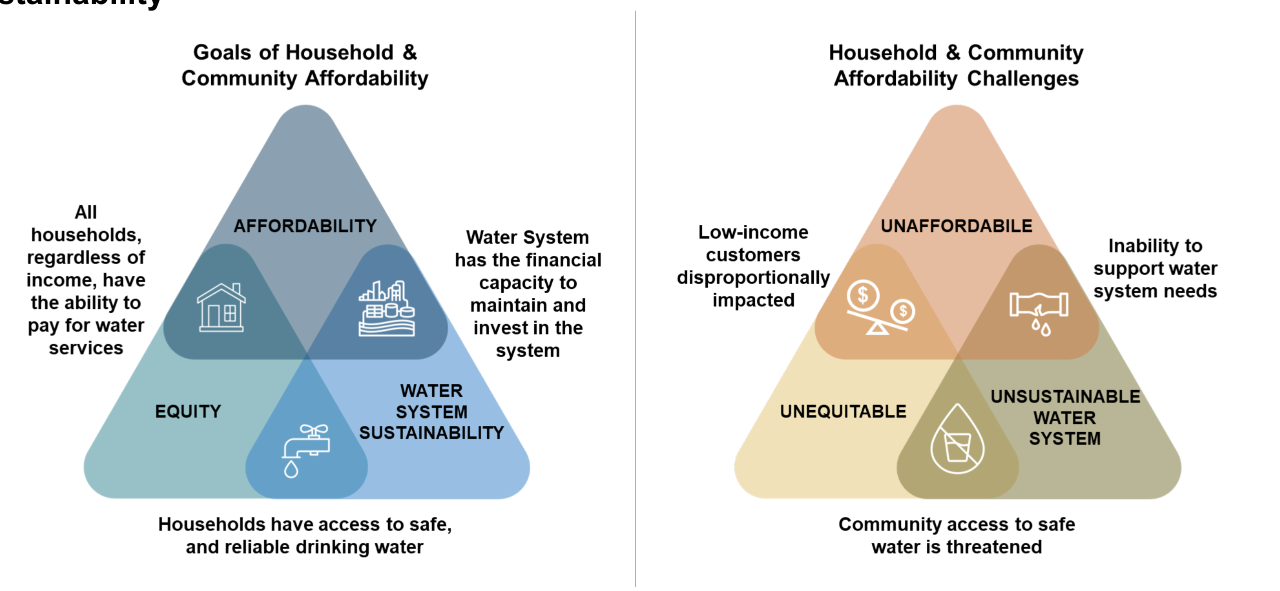
- Impacts rate-setting decisions
- Financial capacity of system
- Ability to pay for current and future needs

Customers

- Quality of life – percent of income spent on drinking water
- Access to safe drinking water

Affordability of drinking water services is an important challenge to assess because issues surrounding equity and water system sustainability overlap in numerous aspects of addressing affordability challenges and ensuring that all Californians have safe drinking water. Figure 43 illustrates this relationship and the potential consequences of inaction.

Figure 45: The Relationship Between Affordability, Equity and Water System Sustainability



DEFINING AFFORDABILITY

To better navigate the different metrics and approaches used to measure affordability, the State Water Board developed Figure 44 to illustrate the nexus of affordability definitions.

Figure 46: Nexus of Affordability Definitions

(1) Household Affordability: The ability of individual households to pay for an adequate supply of water. Metrics measuring household level affordability have been included in both the Affordability Assessment and Risk Assessment.

(2) Community Affordability: The ability of households within a community to pay for water services to financially support a resilient water system. Metrics measuring community level affordability are included in both the Affordability Assessment and Risk Assessment.

(3) & (4) Water System Financial Capacity: The ability of the water system to financially meet current and future operation and infrastructure needs to deliver safe drinking water. The financial capacity of water systems affects future rate impacts on households. The inability to provide adequate services may lead households served by the system to rely on expensive alternatives such as bottled water. Metrics measuring the financial capacity of water systems are included in the Risk Assessment only.

DRINKING WATER CUSTOMER CHARGES

Measuring affordability includes an analysis of the ability of households and communities to pay for current and future water service charges. Therefore, it is important to consider the average monthly customer charges for the same volume of water (6 hundred cubic feet [HCF]).

The State water Board began requiring the submission of average monthly residential customer charges for 6 HCF in the 2019 eAR. Figure 45 illustrates the trends in customer charges. It’s important to note, that many water systems struggled to submit customer charges data for 2020 reporting year, which may have contributed to the difference between average charges data from 2019 to 2020.

Table 36 summarizes 2021 average residential customer charges by system size. On average smaller community water systems charge more for the same volume of water compared to larger community water systems.

Figure 47: Average Monthly Residential Customer Charges for 6 HCF Over Time

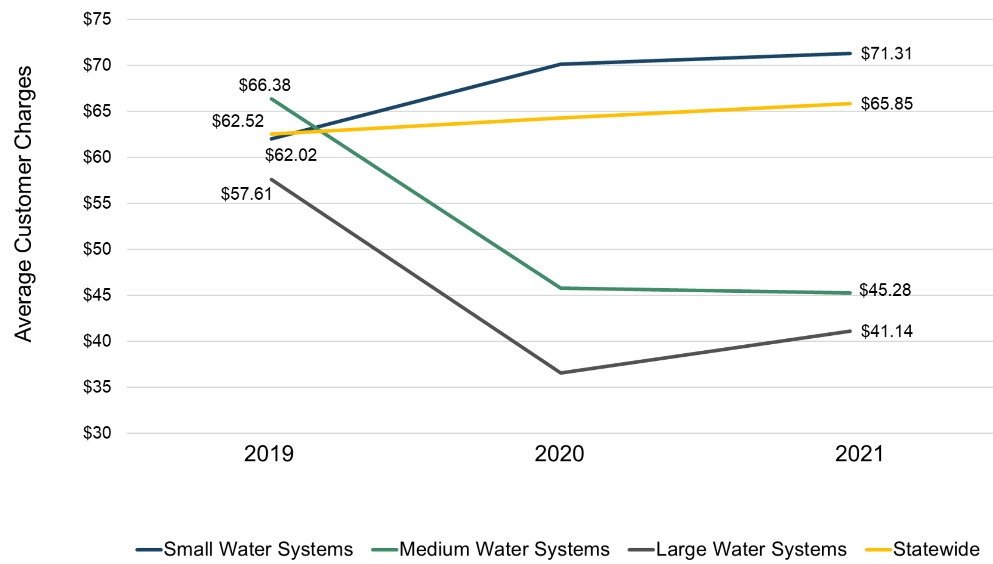


Table 37: 2021 Average Monthly Residential Customer Charges for 6 HCF by System Size

System Size	Total Systems	Average Customer Charges for 6 HCF
Large Community Water Systems[140]	91	$41.14
Medium Community Water Systems[141]	332	$45.28
Small Community Water Systems[142]	1,739	$71.31
STATEWIDE:	**2,162**	**$65.85**
Systems that Do Not Charge for Water or Missing Charge Data	*683*	

Table 37 and Table 38 summarize the 2021 average customer charges collected from water systems statewide in 2022. On average DAC/SDAC water systems charge residential customers $13 more a month for the delivery of 6 HCF. Furthermore, Failing ($73) and At-Risk

[140] Greater than 30,000 service connects or those that serve a population of 100,000 or more.
[141] 3,001 - 30,000 service connections or those that serve a population of less than 100,000.
[142] 3,000 service connections or less.

($86) water systems on average have higher customer charges for 6 HCF than Not At-Risk ($59) water systems.[143]

Table 38: 2021 Average Monthly Residential Customer Charges for 6 HCF by DAC/SDAC Status

Community Status	Total Systems	Average Customer Charges for 6 HCF
DAC/SDAC	1,027	$58.93
Non-DAC	1,130	$71.95
Missing DAC Status[144]	5	$105.73
STATEWIDE:	**2,162**	**$65.85**
Systems that Do Not Charge for Water or Missing Charge Data	*683*	

Table 39: 2021 Average Monthly Residential Customer Charges for 6 HCF by SAFER Status

SAFER Program Status[145]	Total Systems	Average Customer Charges for 6 HCF
Failing Systems	**236**	**$72.67**
Failing DAC/SDAC	143	$60.01
At-Risk Systems	**331**	**$86.48**
At-Risk DAC/SDAC	228	$77.84
Potentially At-Risk Systems	**283**	**$75.74**
Potentially At-Risk DAC/SDAC	161	$61.62
Not At-Risk System	**1,183**	**$58.97**
Not At-Risk System DAC/SDAC	460	$50.30
Not Assessed	**129**	**$43.98**
Not Assessed System DAC/SDAC	35	$45.30
STATEWIDE:	**2,162**	**$67.06**
Systems that Do Not Charge for Water or Missing Charge Data	*683*	

[143] Attachment D1: Affordability Assessment Data and Results https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023affordability.xlsx
[144] Missing DAC Status refers to the list of systems that were included in the affordability assessment but lacked data necessary to calculate their MHI to determine their DAC status.
[145] Water systems that are not DAC/SDAC or are missing DAC status designations are excluded from sub-categories within this table.

AFFORDABILITY ASSESSMENT METHODOLOGY

KEY 2023 AFFORDABILITY ASSESSMENT METHODOLOGY UPDATES

The State Water Board, in partnership with the Office of Environmental Health Hazard Assessment (OEHHA), hosted three public Affordability Workshops in 2022 to re-evaluate previously utilized affordability indicators, research new affordability indicators, and explore how to incorporate a new affordability indicator that measures disposable income limitations into the 2023 Needs Assessment and beyond.[146] These workshops also analyzed different approaches for determining DACs and establishing an "affordability threshold."

Remove Two Affordability Indicators

The State Water Board removed two affordability indicators from the Affordability Assessment: 'Percent of Residential Arrearages' and 'Residential Arrearage Burden.'

> **Arrearage**: Debt accrued for drinking water services for residential accounts that have not fully paid their drinking water bill balance 60 days after the bill payment due date.

The initial data used for these two risk indicators came from the State Water Board's 2021 Drinking Water Arrearage Payment Program.[147] Eligible community water system applicants were able to apply for a one-time payment to cover residential arrearages that accrued during the COVID-19 pandemic (March 4, 2020, through June 15, 2021). This dataset is not up-to-date and does not reflect current affordability challenges. Therefore, these two indictors were removed from the Assessment until updated data becomes available.

Add New Affordability Indicator: Household Socioeconomic Burden

The State Water Board and OEHHA developed a new affordability indicator, incorporating stakeholder feedback from the three Affordability Workshops, "Household Socioeconomic Burden," a composite indicator that is a combined measure of Housing Burden and Poverty Prevalence that measures the extent at which low-income customers may have affordability challenges now or in the future because their disposable income is constrained by high housing costs. This allows for the inclusion of water systems that do not charge customers directly for water in the assessment.[148] See Appendix D for more information.

WATER SYSTEMS ASSESSED

The Affordability Assessment is conducted annually for all community water systems. It is worth noting that, while there is some overlap, the systems included in the Affordability

[146] Workshop 1 (August 8, 2022); Presentation: https://bit.ly/3jsI4k8
Workshop 2 (September 20, 2022); Presentation: https://bit.ly/3juZwEI; White Paper: https://bit.ly/3HXrliS
Workshop 3 (November 1, 2022); Presentation: https://bit.ly/3CKoBIG; White Paper: https://bit.ly/3HVIsll
[147] California Water and Wastewater Arrearage Payment Program
https://www.waterboards.ca.gov/arrearage_payment_program/
[148] Since 2020, all affordability indicators have relied on the water systems charging for water. In 2022, nearly 40% of DAC water systems were excluded from the Assessment because they do not charge for water (i.e., mobile home parks that include their water bill in rental charge).

Assessment differ from the list of water systems analyzed in the Risk Assessment for public water systems. The Affordability Assessment includes all large and small community water systems (including above 30,000 service connections) and excludes non-transient, non-community water systems, like schools. The Risk Assessment, on the other hand, analyzed small and medium-size public water systems with less than 30,000 service connections or those that serve a population of less than 100,000 people and non-transient, non-community K-12 schools were included. Table 39 provides an overview of the systems included in the Affordability Assessment.

Table 40: Systems Included in the Affordability Assessment

SAFER Program Status	Risk Assessment	Affordability Assessment
Large Community Water Systems[149]	0	92
Medium Community Water Systems[150]	311	334
Small Community Water Systems[151]	2,384	2,419
Non-Community K-12 Schools	358	0
TOTAL:	**3,053**	**2,845**

AFFORDABILITY ASSESSMENT METHODOLOGY

The Affordability Assessment methodology has developed though a phased public process since January 2019. Public workshops have been hosted to solicit public feedback to help refine the Assessment over time. The Affordability Assessment methodology relies on two core elements which are utilized to identify water systems serving communities that may be experiencing drinking water affordability challenges:

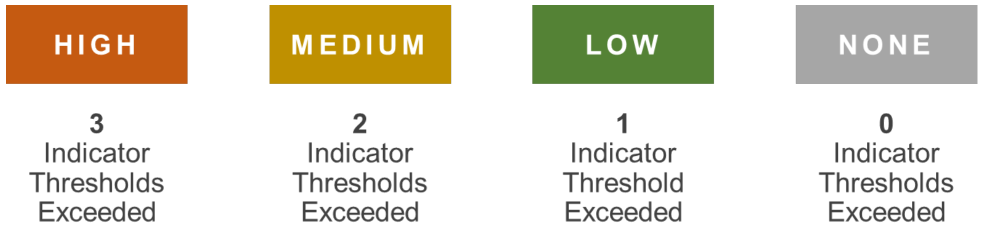
Affordability Indicators: quantifiable measurements of key data points that allow the State Water Board to assess drinking water affordability challenges.

Affordability Indicator Thresholds: the levels, points, or values associated with an individual affordability indicator that delineates when a water system's customers may be experiencing affordability challenges.

The Affordability Assessment identifies "High," "Medium," "Low" Affordability Burden communities. The designation is based on the number of Affordability Indicator thresholds met by each water system. The higher the count, the higher the Affordability Burden designation. See Appendix D for more information.

[149] Greater than 30,000 service connects or those that serve a population of 100,000 or more.
[150] 3,001 - 30,000 service connections or those that serve a population of less than 100,000.
[151] 3,000 service connections or less.

Figure 48: Illustration of the Affordability Assessment Methodology



AFFORDABILITY INDICATORS

In 2020, 23 Affordability indicators were identified and evaluated through public workshops for potential inclusion in both the Affordability Assessment and Risk Assessment.[152] Through these workshops, stakeholders identified a series of indicators that could be incorporated into the Assessment immediately and some that needed to be further developed and refined. Since 2020, the State Water Board and its partners have hosted workshops to further refine and update the Affordability indicators used in the Assessment as data becomes available or not available. Affordability indicators can be categorized based on the following attributes:

Household vs. Community Affordability Indicators

- **Household** affordability indicators measure the ability of individual households to pay for an adequate supply of water. Indicators measuring affordability at this scale often include a count or measurement of the number of customers within a service area of a water system that may be struggling now or in the future to pay for water services. *Currently, the Affordability Assessment has no household affordability indicators.*
- **Community** affordability indicators measure the ability of a water system's entire service area to pay for water services to financially support a resilient water system. Metrics measuring community level affordability often include data that spans all customers served by the water system.

Where there may be some households struggling to pay for water services, if the whole community is not struggling, then community level affordability may not be a concern. It is important to consider both household and community level affordability together.

Rates-Based vs. Non-Rates-Based Affordability Indicators

- **Rates-based** affordability indicators rely on data that is either directly or indirectly related to a water system directly charging for water. Rates-based indicators typically assess the proportion of a customer's income spent on water services or non-payment of water bills.
- **Non-rates-based** affordability indicators do not rely on a water system directly charging their customers for water services. These indicators may include income-based data or other data points that can assess ability to access drinking water services. These types

[152] Supplemental Appendix D.3. Potential Affordability Risk Indicator Evaluations.
https://www.waterboards.ca.gov/safer/docs/safer_supp_appxd3_101320.pdf

of indictors are important for measuring affordability challenges for customers who do not receive a water bill. Examples include mobile home park residents who pay for services in their rent.

Table 41: Affordability Indicators 2020 – 2023

Indicators	Household / Community	Rates-Based?	2021	2022	2023
Percent of Median Household Income (%MHI)	Community	Yes	✓	✓	✓
Extreme Water Bill	Community	Yes	✓	✓	✓
% Shut-Offs (Removed 2022)[153]	Household	Yes	✓		
Percentage of Residential Arrearages (Removed 2023)[154]	Household	Yes		✓	
Residential Arrearage Burden (Removed 2023)[155]	Community	Yes		✓	
NEW: Household Socioeconomic Burden	Community	No			✓

The following are brief descriptions of the affordability indicators utilized in the 2023 Affordability Assessment. Additional details on data sources, calculation methodologies, and thresholds are detailed in Appendix D.

% MHI: This indicator measures annual system-wide average residential customer charges for six Hundred Cubic Feet (HCF) per month relative to the annual Median Household Income (MHI) within a water system's service area. Six HCF indoor water usage per month is roughly equivalent to 50 gallons per person per day for a three-person household for 30 days.

Percent median household income (%MHI) is commonly used by state and federal regulatory agencies and by water industry stakeholders for assessing community-wide water charges affordability for decades. The State Water Board uses MHI to determine DAC status[156] and has for some time used the 1.5% MHI threshold in the Drinking Water State Revolving Fund (DWSRF) program as a metric for determining whether a small DAC will receive repayable (loan) or non-repayable (e.g., grant or non-repayable) funding.

Extreme Water Bill: This indicator measures drinking water customer charges that meet or exceed 150% and 200% of statewide average drinking water customer charges at the six HCF

[153] Data not collected.
[154] Data not collected.
[155] Data not collected.
[156] It is important to note that the estimated designation of community economic status is for the purposes of the Affordability Assessment only and will not be used by the State Water Board's Division of Financial Assistance (DFA) to make funding decisions. Further MHI analysis on a per system basis will be conducted by DFA when a system seeks State Water Board assistance.
[AB 401 Final Report](https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf)
https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf

level of consumption. The State Water Board's AB 401 report[157] recommended statewide low-income rate assistance program elements which utilize the two recommended tiered indicator thresholds of 150% and 200% of the state average drinking water bill for six HCF.

NEW: Household Socioeconomic Burden: The purpose of this risk indicator is to identify water systems that serve communities that have both high levels of poverty and high housing costs for low-income households. These communities may be struggling to pay their current water bill and may have a difficult time shouldering future customer charge increases when their limited disposable income is constrained by high housing costs. This indicator is a composite indicator of two data points: Poverty Prevalence and Housing Burden.

- **Poverty Prevalence** measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level.
- **Housing Burden Indicator** measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).

AFFORDABILITY ASSESSMENT RESULTS

AFFORDABILITY RESULTS BY COMMUNITY ECONOMIC STATUS

For the 2023 Affordability Assessment, State Water Board staff analyzed 2,845 community water systems, of which approximately 9 water systems lacked the data necessary to calculate any of the three affordability indicators.[158] Water systems that had partial data for some, but not all, of the affordability indicators were included in the analysis and are summarized in Table 41.

Overall, comparing the three indicators in cases where data was available, more community water systems exceed the affordability threshold for 'Household Socioeconomic Burden' (52%) than the affordability threshold for '%MHI' (17%). Of those that exceeded the affordability threshold for 'Household Socioeconomic Burden, 'most of them are DAC and SDAC systems (77%). Table 41 summarizes the number of water systems, by their community economic status, that exceeded the minimum affordability threshold for each indicator assessed.

Table 42: Total Number of Systems Meeting Affordability Threshold

Community Status	Total Systems	%MHI	Extreme Water Bill	Household Socioeconomic Burden
DAC/SDAC	1,483	368 (25%)	103 (7%)	1,138 (77%)
Non-DAC	1,347	118 (9%)	214 (16%)	334 (25%)

[157] AB 401 Final Report:
Recommendations for Implementation of a Statewide Low-Income Water Rate Assistance Program
https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf
[158] Attachment D1: Affordability Assessment Data and Results
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023affordability.xlsx

Community Status	Total Systems	%MHI	Extreme Water Bill	Household Socioeconomic Burden
Missing DAC Status[159]	15	0 (0%)	2 (13%)	8 (53%)
TOTAL:	**2,845**	**486 (17%)**	**319 (1%)**	**1,480 (52%)**
Missing Data[160]		*251 (9%)*	*248 (9%)*	*34 (1%)*
Not Applicable[161]		*669 (24%)*	*669 (24%)*	*0 (0%)*

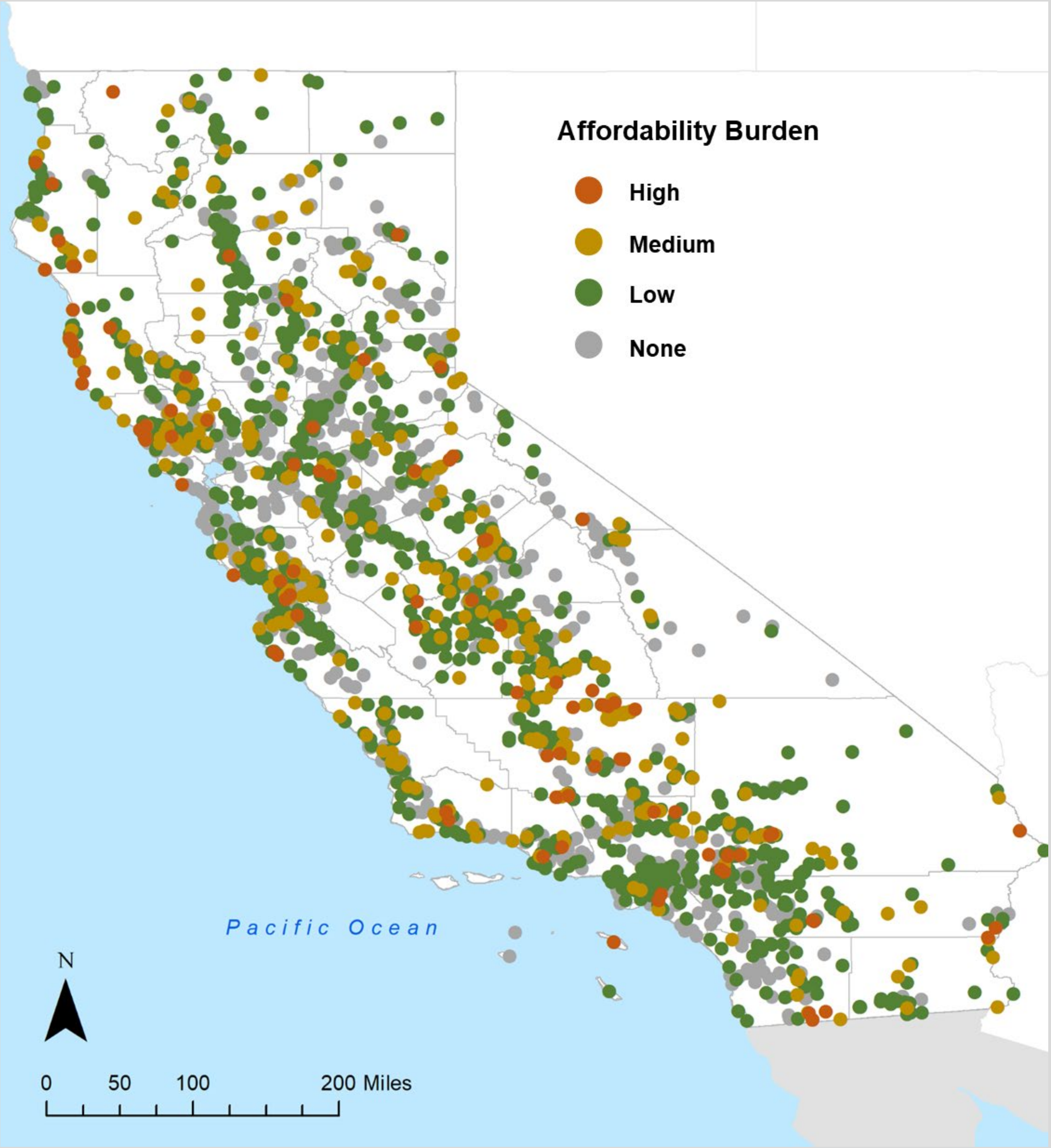
To assess which systems may be facing the greatest affordability burden, the State Water Board further analyzed how many water systems exceeded thresholds for multiple affordability indicators. Affordability burden is ranked from low (only one affordability indicator threshold exceeded), medium (two affordability indicator thresholds exceeded), or high (three affordability indicator thresholds exceeded) (Table 42). Of the 2,845 community water systems analyzed, most resulted in a low affordability burden (45%) followed by a medium affordability burden (12%) and a high affordability burden (3%). Overall, there is a higher proportion of DAC/SDAC systems that have a high or medium affordability burden compared to non-DAC and missing DAC status systems.

Table 43: Affordability Assessment Results

Community Status	Total Systems Assessed	High Affordability Burden[162]	Medium Affordability Burden[163]	Low Affordability Burden[164]	None
DAC/SDAC	1,483	75 (5%)	246 (17%)	889 (60%)	272 (18%)
Non-DAC	1,347	19 (1%)	107 (8%)	394 (29%)	828 (61%)
Missing DAC Status	15	0 (0%)	1 (7%)	8 (53%)	6 (40%)
TOTAL:	**2,845**	**94 (3%)**	**354 (12%)**	**1,291 (45%)**	**1,106 (39%)**

[159] Missing DAC Status refers to the list of systems that were included in the affordability assessment but lacked data necessary to calculate their MHI to determine their DAC status.
[160] Missing data: %MHI; lacked water rates data, lacked data to calculate MHI; Extreme Water Rates, lacked data on water rate charges, water rate was outside of $5-$500 range; Percent of Residential Arrearages/Residential Arrearage Burden, no arrearage survey data was submitted.
[161] Not applicable refers to systems who did not qualify to meet an indicator threshold: % MHI, systems who did not charge for water; Extreme Water Bill, systems that did not charge for water; % Residential Arrearages/ Residential Arrearage Burden, systems that did not charge for water, claimed no arrearages, or did not have residential arrearages.
[162] Community water system met the minimum threshold for 3 of the affordability indicators.
[163] Community water system met the minimum threshold for 2 of the affordability indicators.
[164] Community water system met the minimum threshold for 1 of the affordability indicators.

Figure 49: Affordability Assessment Results (n=2,845)



AFFORDABILITY RESULTS BY WATER SYSTEM SAFER PROGRAM STATUS

While SB 200 only mandates the identification of DAC/SDAC water systems that have customer charges that exceed affordability thresholds, the 2023 Affordability Assessment also identified the number of Failing and At-Risk public water systems exceeding affordability thresholds as well. Table 43 and the section below summarizes the number of Failing and At-Risk water systems, by their community economic status, that exceeded the minimum affordability threshold for each affordability indicator assessed.

According to the analysis, Failing and At-Risk systems exceeded the affordability thresholds for more affordability indicators when compared to Potentially At-Risk and Not At-Risk systems. The full results of this analysis, by affordability indicator, are detailed in Appendix D.

Table 44: Aggregated Affordability Assessment Results by Water System SAFER Program Status

SAFER Program Status[165]	Total Systems	%MHI	Extreme Water Bill	Household Socioeconomic Burden
Failing Systems	**323**	**83 (26%)**	**49 (15%)**	**203 (63%)**
DAC/SDAC	203	66 (33%)	16 (8%)	177 (87%)
At-Risk Systems	**468**	**155 (33%)**	**81 (17%)**	**330 (71%)**
DAC/SDAC	324	121 (37%)	41 (13%)	275 (85%)
Potentially At-Risk Systems	**408**	**92 (23%)**	**56 (14%)**	**268 (66%)**
DAC/SDAC	257	65 (25%)	19 (7%)	222 (86%)
Not At-Risk System	**1,485**	**151 (10%)**	**132 (9%)**	**611 (41%)**
DAC/SDAC	656	113 (17%)	27 (4%)	437 (67%)
Not Assessed	**161**	**4 (3%)**	**1 (1%)**	**68 (42%)**
DAC/SDAC	43	3 (7%)	0 (0%)	27 (63%)
TOTAL:	**2,845**	**485 (17%)**	**319 (11%)**	**1,480 (52%)**
Missing Data		*15 (1%)*	*248 (9%)*	*34 (1%)*
Not Applicable		*669 (24%)*	*669 (24%)*	*0 (0%)*

To assess which systems may be facing the greatest affordability burden, the State Water Board further analyzed how water systems, by SAFER status, exceeded thresholds for multiple affordability indicators. Affordability burden is ranked from low (only one affordability indicator threshold exceeded), medium, (two affordability indicator thresholds exceeded), or high (three affordability indicator thresholds exceeded). As summarized in Table 44, a relatively higher percentage of Failing and At-Risk water systems had higher affordability burden when compared to Potentially At-Risk and Not At-Risk water systems.

[165] Water systems that are not DAC/SDAC or are missing DAC status designations are excluded from sub-categories within this table.

Table 45: Affordability Assessment Results by SAFER Program Status

SAFER Program Status	Total Systems Assessed	High Affordability Burden[166]	Medium Affordability Burden[167]	Low Affordability Burden[168]	None
Failing Systems	**323**	**16 (5%)**	**67 (21%)**	**153 (47%)**	**87 (27%)**
DAC/SDAC	203	13 (6%)	50 (25%)	120 (59%)	20 (10%)
At-Risk Systems	**468**	**42 (9%)**	**107 (23%)**	**226 (48%)**	**93 (20%)**
DAC/SDAC	324	30 (9%)	85 (26%)	177 (55%)	32 (10%)
Potentially At-Risk Systems	**408**	**16 (4%)**	**70 (17%)**	**228 (56%)**	**94 (23%)**
DAC/SDAC	257	15 (6%)	45 (18%)	171 (67%)	26 (10%)
Not At-Risk System	**1,485**	**21 (1%)**	**107 (7%)**	**617 (42%)**	**740 (50%)**
DAC/SDAC	656	18 (3%)	64 (10%)	395 (60%)	179 (27%)
Not Assessed System	**161**	**0 (0%)**	**3 (2%)**	**67 (42%)**	**91 (57%)**
DAC/SDAC	43	0 (0%)	2 (5%)	26 (60%)	15 (35%)
TOTAL:	**2,845**	**95 (3%)**	**354 (12%)**	**1,291 (45%)**	**1,105 (39%)**

NEW WATER SYSTEM FINANCIAL CAPACITY & COMMUNITY AFFORDABILITY DASHBOARD

In 2022-2023, the State Water Board developed a new Water System Financial Capacity & Community Affordability Dashboard.[169] The purpose of this dashboard is to allow users to explore the relationships between water system financial capacity and affordability. The dashboard displays and auto-calculates averages of the financial capacity and affordability risk indicators for community water systems used in the Risk Assessment and Affordability Assessment. Users can filter the water systems and data displayed in the dashboard to better understand how water system characteristics, customer affordability challenges, and water system financial capacity are related. Learn more in Appendix G.

DEMOGRAPHIC ANALYSIS OF COMMUNITY WATER SYSTEMS

Results for the 2023 Affordability Assessment for community water systems can be combined with demographic data to better understand the populations most at-risk. However, there are several limitations to this demographic analysis. Demographic data is collected at the census block group or census tract level, and current census surveys do not indicate household

[166] Community water system met the affordability threshold for 3 affordability indicators.
[167] Community water system met the affordability threshold for 2 of the affordability indicators.
[168] Community water system met the affordability threshold for 1 of the affordability indicators.
[169] Water System Financial Capacity & Community Affordability Dashboard
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/afforddashboard.html

drinking water source type. Therefore, the demographic information presented in the tables below may not represent the actual population served by public water systems. Any interpretation of these results should keep in mind the limitations of the analysis.

Demographic data (household size, linguistic isolation, poverty, median household income, and race/ethnicity) was taken from the 2021 American Community Survey. CalEnviroScreen 4.0 data is from OEHHA.[170] The CalEnviroScreen 4.0 data is displayed as percentiles, with higher percentiles indicating areas that are most affected by pollution and where people are especially vulnerable to the effects of pollution. The socioeconomic analysis was calculated using water service area boundaries, area-weighted census tract data where appropriate, and calculating weighted averages. This methodology means that there may be a bias towards demographic data from larger, rural tracts/block groups as these areas are often larger than smaller, urban tracts/block groups.

When compared with Non-DAC/SDAC water systems, DAC/SDAC water system service areas tend to have higher CalEnviroScreen scores, a higher percentage of households in poverty, a higher percentage of limited English-speaking households, non-white communities. Systems with high affordability burden have higher CalEnviroScreen scores, percentages of households that are less than two times the federal poverty level, and greater linguistic isolation than medium and low affordability burden systems (Table 45).

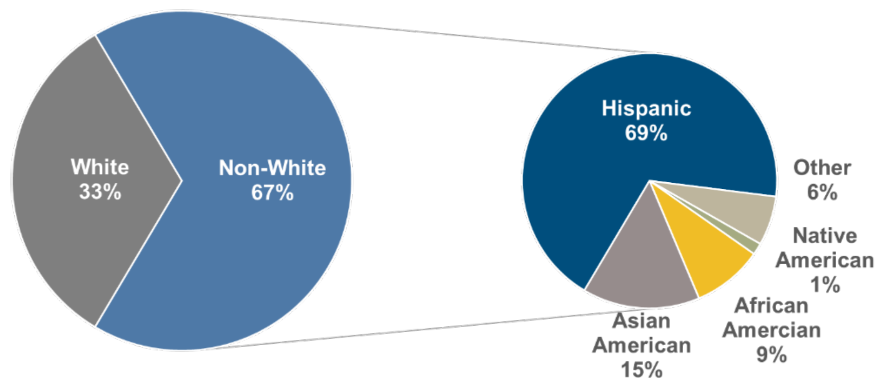
[170] OEHHA CalEnviroScreen
https://oehha.ca.gov/calenviroscreen

Table 46: Socioeconomic Analysis for Community Water Systems (CWSs)[171]

	Statewide (all CWS)	Non-DAC/SDAC CWSs	DAC/SDAC CWSs	No Afford. Burden CWSs	Low Afford. Burden CWSs	Medium Afford. Burden CWSs	High Afford. Burden CWSs
Total Count of Systems	**2,845**	**1,347**	**1,483**	**1,105**	**1,291**	**354**	**95**
Average CalEnviroScreen 4.0 Percentile	42.3	32.9	51	32.6	49.6	46	43.3
Average CalEnviroScreen 4.0 Population Characteristics Percentile	43.7	30.9	55.4	31.7	52.1	49.8	46.4
Average CalEnviroScreen 4.0 Pollution Burden Percentile	42.8	41.4	44.1	39.9	45.8	42	40.2
Average percentage of households 2x below federal poverty	30.2%	18.4%	40.4%	16.9%	38.1%	38.2%	41.4%
Average percentage of households with limited English speaking	6%	3.3%	8.2%	3%	8%	7.2%	6.3%
Average household size	2.8	2.8	2.7	2.7	2.8	2.7	2.7
Percent of non-white customers served	43.1%	38.7%	46.9%	36.2%	49.4%	41.6%	39.2%

[171] CalEnviroScreen 4.0 data is available per census tract. Combined risk status for domestic wells is available per square mile section. To determine the CalEnviroScreen 4.0 percentile score average per combined risk category, each section was assigned the CalEnviroScreen 4.0 percentile score based on the tract that contains the centroid of the section. Some census tracts do not contain any section centroid and therefore do not contribute to the averages even if they overlap a section with a domestic well. The square mile sections are grouped by their combined risk status to determine the average score percentile using a weighted average approach. It is important to factor in the geographic relationship between tracts and sections. Without considering a weighting approach for averaging scores within each combined risk categories, scores of large census tracts would contribute more to the risk category average compared to small census tracts. For example, a tract with 600 sections contributes 600 of the same percentile scores while a tract with 20 sections only contributes 20 percentile scores. Instead, to reduce bias towards large rural areas, each section was assigned a weight of the inverse number of sections in the census tract. For example, a tract with 10 sections would be given a weight of 0.10. A one-way analysis of variance (ANOVA) showed a statistically significant difference in average scores between combined risk categories for CalEnviroScreen 4.0 percentile, Population Characteristics, Pollution Burden, Poverty, Average percentage of households with limited English speaking, and Household Size ($p<0.0001$).

Figure 50: Distribution of High Affordability Burden Community Water Systems by Majority Race/Ethnicity Census Tract



AFFORDABILITY ASSESSMENT LIMITATIONS

The 2023 Affordability Assessment makes progress in identifying communities that may be struggling with water affordability challenges; however, the State Water Board has identified the following limitations that are worth noting:

Affordability Assessment Scope

As described above, there are multiple lenses through which to assess water "affordability." SB 200 does not define how the State Water Board should measure affordability. Nor does it specify if the "Affordability Threshold" is meant to assess household affordability, community affordability, and/or a water system's financial capacity. All three aspects of affordability are interrelated, but metrics or indicators that measure each can differ greatly. More engagement with the public, water systems, and stakeholders is needed to better define the scope of the Affordability Assessment and how its results will be utilized.

Affordability Indicator Data

The State Water Board acknowledges that there are some data coverage issues and data quality uncertainties for all the affordability indicators utilized in the Affordability Assessment. Customer charges, MHI, and/or residential arrearage data are not available for some water systems included in this assessment. Water system customer charge and residential arrearage data is self-reported and is difficult to verify its quality. Finally, water system boundaries, which are used to calculate MHI, may not be accurate. In some cases, they reflect a water system's jurisdiction boundary rather than their service area boundary.

An additional consideration that may be impacting the results of the Affordability Assessment is that water system customer charges may not reflect the full cost water systems face in order to meet current and future operations and infrastructure needs to deliver safe drinking water. For example, many small water systems lack asset management plans, capital improvement plans, and financial plans to assist them in setting customer charges appropriately. This may result in customer charges that are lower than what is needed to support resilient water systems. If more systems were to implement full-cost pricing of their customer charges, the Affordability Assessment results may be different.

Affordability Indicators

There has been criticism of %MHI by academics, water system associations, and the broader water sector mostly around its accuracy in measuring household affordability for those truly in need and the setting of arbitrary %MHI thresholds, limitations which the U.S. EPA has recently acknowledged. Furthermore, some affordability indicators may be more applicable to some governance types of systems than others. For instance, some of the feedback received on the affordability indicators from the Risk Assessment public engagement was that using rates-based indicators, like %MHI and Extreme Water Bill, does not capture the ways in which some systems' finance the full cost of service provision. Another point raised was that some individual water systems are connected to larger utility structures that help mitigate affordability challenges in ways that are not currently represented in the Affordability Assessment.

Currently, many other state agencies are developing and utilizing affordability indicators in similar complementary efforts. The selection of affordability indicators for the Needs Assessment fully considered affordability indicators used by the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Water Resources (DWR), and the California Public Utilities Commission (CPUC). However, many of the indicators selected for the Needs Assessment differ from those used by these other efforts. The use of different indicators, and corresponding thresholds, across state and federal agencies can lead to some confusion for water systems and communities. The State Water Board will continue to collaborate with other state agencies and work towards better alignment.

AFFORDABILITY ASSESSMENT REFINEMENT OPPORTUNITIES

The State Water Board will be conducting the Affordability Assessment on an annual basis as part of the Needs Assessment. To begin addressing the limitations highlighted above, the State Water Board will begin exploring new opportunities to refine the next iteration of the Affordability Assessment:

Improved Data Collection Efforts

The State Water Board has already begun taking necessary steps to improve data coverage and accuracy for the Affordability Assessment. Improvements to the 2020 reporting year eAR include new requirements for completing survey questions focused on customer charges and affordability.[172] eAR functionality has been developed that will help auto-calculate average customer charges for six HCF, which will help reduce data errors. Furthermore, the eAR will be able to better distinguish between water systems that do not charge for water compared to those that do. The 2021 eAR includes enhancements to customer charges validations to ensure better data quality.

Refinement of Affordability Indicators and Thresholds

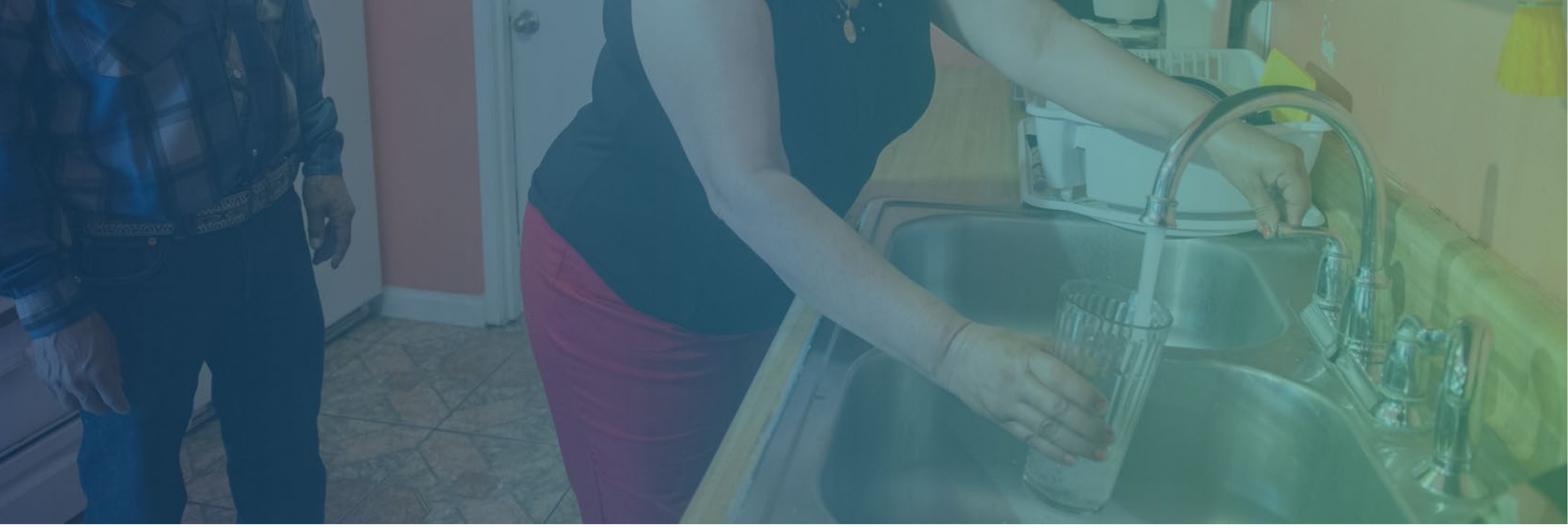
In 2022, the State Water Board hosted three public workshops to solicit feedback on current and future affordability indicators. Based on public feedback during these workshops, the State Water Board will begin developing a strategy to collect arrearage (customer debt), shut-off, and customer assistance program data from water systems to further enhance the data used

[172] Electronic Annual Report (EAR) | California State Water Resources Control Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html

in the Affordability Assessment. The State Water Board will conduct proper research and stakeholder engagement to develop new affordability indicators and the appropriate affordability thresholds necessary for inclusion in the Risk and Affordability Assessment.

Improved Aggregated Assessment

Further consideration will be given to how systems that have extremely low customer charges or have not raised their rates within a certain time period should be assessed for affordability and more broadly for risk. These systems may be more at-risk for falling out of water quality compliance or may be imposing affordability burdens on their customers through other means other than customer charges.



CONCLUSIONS

NEEDS ASSESSMENT OBSERVATIONS & FUTURE ITERATIONS

The State Water Board conducts the Needs Assessment annually to support the implementation of the SAFER Program. The results of the Needs Assessment will be used to prioritize public water systems, tribal water systems, state small water systems, and domestic wells for funding in each year's Safe and Affordable Drinking Water Fund Expenditure Plan; inform State Water Board technical assistance; and to develop strategies for implementing interim and long-term solutions. The State Water Board will also use the Needs Assessment results for targeted outreach on engagement and partnership activities.

The Needs Assessment methodology will be refined over time to incorporate additional and better-quality data; experience from implementation of the SAFER Program; and further input from the public and the SAFER Advisory Group. The following summarizes Needs Assessment refinement opportunities:

Trends Over Time

The 2023 Needs Assessment marks the third version of the report. As the implementation of the SAFER Program moves forward, there is a greater need for trends analysis of the Needs Assessment results. A current limiting factor is the methodological enhancements being made to the Needs Assessment components, especially within the first few years of the Program. Expansions to Failing criteria, changes to Risk Assessment data, etc. make it difficult to compare water system performance over time. To better track water system performance in the Needs Assessment over time, there will need to be a period where the methodology stays consistent for multiple years. Since the Risk Assessment and the other components of the Needs Assessment are still in their infancy, it may be a few years before this can be achieved.

Improved Data

The State Water Board has already begun taking necessary steps to improve data coverage and accuracy for the Needs Assessment. Improvements to the eAR include new requirements for public water systems in completing survey questions focused on drought and conservation, as well as the expanded financial capacity questions.[173] eAR functionality has been developed that will help improve data accuracy as well. Additionally, the State Water Board's Division of Financial Assistance has begun developing a strategy to capture more detailed funded project and technical assistance cost data.

The State Water Board is currently working on a comprehensive update of missing and unverified water system boundaries in the System Area Boundary Layer (SABL) to more accurately reflect water system area boundaries in a central database. Improvement of water system boundary data statewide will enhance the calculation of %MHI and other important data points for the Risk and Affordability Assessments, as well as increase the accuracy of the Cost Assessment's modeling of potential physical consolidation solutions.

The State Water Board continues to expand and enhance the SAFER Clearinghouse to better collect, aggregate, analyze, and track data associated with the SAFER Program and the Needs Assessment. In 2023 for example, the State Water Board launched a new Drought and Conservation Reporting module. This new reporting module is designed to reduce redundant data reporting from across multiple state agencies and programs, improve data quality, provide more flexibility in data reporting, and ensure greater access to this data.[174]

Expanded Outreach to Tribal Water Systems

Federally regulated California tribal water systems were originally envisioned to be included in both the Needs Assessment, and concerted outreach to Tribal water systems was conducted in 2021 by the State Water Board and the Department of Water Resources (DWR), but ultimately tribal systems were not included in the Needs Assessment for public water systems due to missing data. In the interim, SAFER Program staff will implement the SAFER Tribal Drinking Water Outreach Plan[175] and work with individual tribes, as requested by tribal governments or in response to drinking water needs identified through coordination with the U.S. EPA and DWR.

Alignment with other State Efforts

Multiple other California state agencies have recently begun assessing different aspects of drinking water systems' risks and performance with respect to the Failing list systems. These agencies include the Department of Water Resources (DWR), the Office of Environmental Health Hazard Assessment (OEHHA) and the California Public Utilities Commission (CPUC). The State Water Board continues to engage in discussions with staff from each of these agencies to try to avoid duplication of efforts and to ensure the most productive long-term statewide assessment of water system performance possible. Moving forward, the State Water

[173] Electronic Annual Report (EAR) | California State Water Resources Control Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html
[174] Drought and Conservation Reporting
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/clearinghouse_drought_conservation_reporting.html
[175] SAFER 2022 Tribal Outreach Plan (English)
https://www.waterboards.ca.gov/safer/docs/2022/SAFER-Tribal-Outreach-Plan-ENG-03242022.pdf
SAFER 2022 Tribal Outreach Plan (Spanish)
https://www.waterboards.ca.gov/safer/docs/2022/SAFER-Tribal-Outreach-Plan-ESP-03242022.pdf

Board will continue to pursue collaborative inter-agency opportunities to enhance the Needs Assessment.

The State Water Board is making the data from the Needs Assessment available to other state agencies and the public in an effort to encourage the utilization of its results into broader decision making. The State Water Board is partnering on the implementation of other statewide water program efforts that may impact drinking water, such as the Sustainable Groundwater Management Act (SGMA) and the Central Valley Salinity Alternatives for Long-Term Sustainability Initiative (CV-Salts). The State Water Board is seeking to ensure that core drinking water sustainability approaches, such as the importance of water partnerships and regionalization activities, are included in these discussions. For example, considerations of local solutions around new wells should include the results of the Risk Assessment, particularly affordability and TMF capacity needs when deliberating between installing new wells and consolidation.

Refinement of the Affordability Assessment

The State Water Board will begin developing a strategy to collect data needed for new affordability indicators as supported by stakeholders through three public workshops hosted in 2022. Stakeholders identified a need to collect and utilize arrearage (customer debt), shut-off, and customer assistance program data for future use in the Needs Assessment.

The State Water Board recognizes that additional public engagement and additional data analysis is needed to further refine the affordability indicators and thresholds utilized in the Affordability Assessment. The State Water Board will continue to collaborate with other state agencies and work towards better alignment amongst complimentary affordability efforts.

Further consideration will also be given to how systems that do not charge for water services or have extremely low customer charges should be assessed for affordability and more broadly for risk. These systems may be more at-risk for falling out of water quality compliance or may be imposing affordability burdens on their customers through other means other than customer charges.

Learning by Doing – SAFER Program Maturation

This is the third iteration of the Needs Assessment. While every effort was made to make it comprehensive, this assessment is designed to be an annual, iterative process and it is the State Water Board’s expectation that it will continue to improve over time. As the State Water Board’s SAFER Program matures, better tracking of systems that come on and off the Failing and At-Risk lists will occur within the State Water Board’s new SAFER Clearinghouse database. These improvements along with reflection and deeper investigation into areas where results did not fully reflect the breadth or depth of staff or community experiences (e.g., complexity of urban areas, asset management principals, and self-supplied homes using unfiltered surface water) will be incorporated into future efforts.

Continued Public Engagement

The State Water Board is committed to engaging the public and key stakeholder groups to solicit feedback and recommendations as it refines its Needs Assessment methodologies. The State Water Board will continue to host public workshops to provide opportunities for stakeholders to learn about and contribute to the refinement process. Stakeholders are encouraged to sign-up for the SAFER Program's email list-serve to receive notifications of when these public workshops are scheduled to occur.[176]

NEEDS ASSESSMENT NEXT STEPS

WATER SYSTEM REQUESTS FOR DATA UPDATES

The State Water Board is accepting inquiries related to underlying data change requests for the 2023 Needs Assessment. The data used for both Assessments are drawn from multiple sources and are detailed in Appendices below. Water systems are encouraged to reach out via the online webform below:

Water System Data Change Request Webform: https://forms.office.com/g/BdNjFNFZvJ

The State Water Board will be updating the Risk Assessment results in Attachment A1 as data changes occur.[177] Therefore, the list of water systems designated At-Risk and Potentially At-Risk in this Attachment will evolve from the aggregated assessment results summarized in this report over time.

2023-24 SAFE AND AFFORDABLE DRINKING WATER FUND EXPENDITURE PLAN

The results of the 2023 Needs Assessment will be utilized by the State Water Board and the SAFER Advisory Group[178] to inform the prioritization of funding and technical assistance within the Safe and Affordable Drinking Water Fund Expenditure Plan.[179] The SAFER Advisory Group is composed up to 20 appointed members that represent public water systems, technical assistance providers, local agencies, nongovernmental organizations, California Native American tribes, the public and residents served by community water systems in disadvantaged communities, state small water systems, and domestic wells.

The SAFER Advisory Group meets at least four times a year to provide many opportunities for public and community input. All meetings are widely publicized, open to the public, offer bilingual meeting materials, and language interpretation services. The State Water Board will also be hosting a workshop in August 2023 to inform the Fund Expenditure Plan.

[176] SAFER Program Email List-Serve (bottom of webpage)
https://www.waterboards.ca.gov/safer/
[177] Attachment A1: Risk Assessment Data and Results
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023risk.xlsx
[178] SAFER Advisory Group
https://www.waterboards.ca.gov/safer/advisory_group.html
[179] Safe and Affordable Drinking Water Fund
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/safer.html

APPENDIX A:
RISK ASSESSMENT METHODOLOGY FOR PUBLIC WATER SYSTEMS

INTRODUCTION

The purpose of the Risk Assessment for public water systems is to identify systems at-risk or potentially at-risk of failing to meet one or more key Human Right to Water goals: (1) providing safe drinking water; (2) accessible drinking water; (3) affordable drinking water; and/or (4) maintaining a sustainable and resilient water system. Data on performance and risk is most readily available for public water systems and thus the risk assessment methodology for public water systems allows for a multi-faceted examination across four risk indicator categories: Water Quality, Accessibility, Affordability; and TMF (technical, managerial, and financial) Capacity.

PUBLIC WATER SYSTEMS ASSESSED

The 2021 Risk Assessment for public water systems was conducted for community water systems with 3,300 service connections or less and all non-transient non-community water systems which serve K-12 schools. The 2022 Risk Assessment was expanded to include medium-sized community water systems. The expansion of the Risk Assessment to include larger community water systems allows the State Water Board to more thoroughly track the performance and capacity of community water systems, especially the larger water systems that are or have been on the Failing list.

The 2023 Risk Assessment excludes 68 wholesalers because they do not provide direct service to residential customers. Some water system types have also been excluded from certain risk categories or specific risk indicators See Table A1 for details.

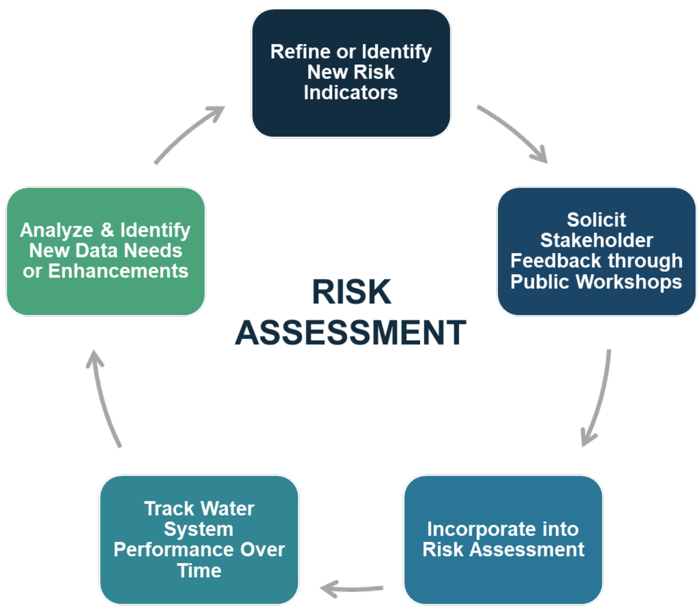
Table A1: Public Water Systems Analyzed in the 2023 Risk Assessment

Water System Type	Number	Water Quality	Accessibility	Affordability	TMF Capacity
Community Water Systems	2,695	Yes	Yes	Yes	Yes
K-12 Schools	359	Yes	Yes	No	Yes
TOTAL ANALYZED:	**3,054**				

RISK ASSESSMENT METHODOLOGY DEVELOPMENT PROCESS

The State Water Board, in partnership with UCLA, began developing the initial Risk Assessment in 2019. The State Water Board and UCLA hosted four public webinar workshops in 2020 to solicit feedback and recommendations on the development of the Risk Assessment. Approximately 683 individuals[180] participated in these workshops through either Zoom or CalEPA's live webcast. Since the initial launch of the Risk Assessment in 2021, the methodology has been refined following the development stages summarized in Figure A1. This effort was designed to encourage public and stakeholder participation, providing opportunities for feedback and recommendations throughout the methodology development process. Proposed Risk Assessment methodology updates are detailed in publicly available white papers, presented at public webinars, and public feedback is often incorporated into the final methodology and results. These materials are hosted on the Needs Assessment webpage.[181]

Figure A1: Phases of Risk Assessment Development



RISK ASSESSMENT METHODOLOGY

The Risk Assessment methodology relies on three core elements which are utilized to calculate an aggregated risk score for each public water system assessed:

Risk Indicators: quantifiable measurements of key data points that allow the State Water Board to assess the probability of a water system's failure to deliver safe drinking water or

[180] Individuals that participated in more than webinar workshop are double counted in this figure.
[181] State Water Board Needs Assessment Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html#affordability-assessment

other infrastructure and institutional failures. Risk indicators that measure water quality, accessibility, affordability, and TMF capacity are incorporated based on their criticality as it relates to a system's ability to remain in compliance with safe drinking water standards and their data availability and quality across the state.

Risk Indicator Thresholds: the levels, points, or values associated with an individual risk indicator that delineates when a water system is more at-risk of failing.

Scores & Weights: the application of a multiplying value or weight to each risk indicator and risk category, as certain risk indicators and categories may be deemed more critical than others and/or some may be out of the control of the water system. The application of weights to risk indicators and risk categories allows the State Water Board multiple ways to assess all risk indicators within each category together in a combined Risk Assessment score.

RISK INDICATORS

The Risk Assessment utilizes risk indicators to assess water system performance and risk. The following section provides a summary of how the indicators used in the Risk Assessment have evolved over time. Sections further below in this Appendix provide details on each individual risk indicator including definitions, required datapoints, and calculation methodologies.

INITIAL 2021 RISK INDICATORS

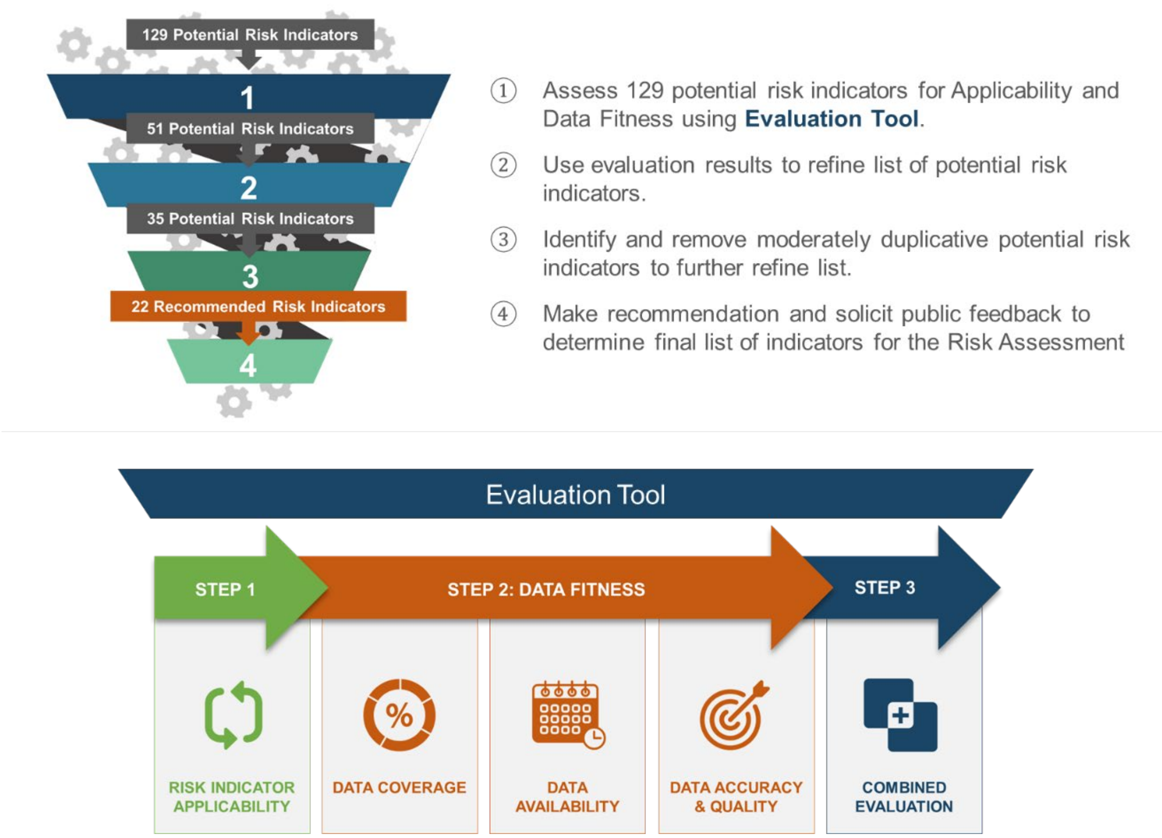
The State Water Board, in partnership with UCLA, began an effort in April 2020 to identify potential risk indicators to be considered for inclusion in the Risk Assessment for public water systems. The initial version of the draft Risk Assessment utilized 14 risk indicators.[182] In response to public feedback from its April 17, 2020, webinar workshop, the State Water Board and UCLA expanded the Risk Assessment scope to evaluate a much broader number of risk indicators. The State Water Board, UCLA, and the public identified 129 potential risk indicators, several from other complementary state agency efforts, to help predict the probability of a water system's failure to deliver safe drinking water. A concerted effort was made to identify potential risk indicators that measure water quality, accessibility, affordability, and TMF capacity based on their criticality as it relates to a system's ability to remain in compliance with safe drinking water standards. This effort included full consideration of risk indicators identified in efforts conducted by the Office of Environmental Health Hazard

[182] Identification of Risk Assessment 2.0 Indicators for Public Water Systems https://www.waterboards.ca.gov/drinking_water/programs/safer_drinking_water/docs/draft_white_paper_indicators_for_risk_assessment_07_15_2020_final.pdf

Assessment (OEHHA),[183] the Department of Water Resources (DWR),[184] and the California Public Utilities Commission.[185]

To facilitate the selection of the final indicators for the Risk Assessment, the State Water Board and UCLA conducted an extensive potential risk indicator evaluation process (Figure A2) with internal and external feedback to refine the list of 129 potential risk indicators to a recommend list of 22 risk indicators for the Risk Assessment. Learn more about the risk indicator identification, refinement, and selection process in the October 7, 2020, white paper *Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems.*[186]

Figure A2: Potential Risk Indicator Evaluation Process



[183] The Human Right to Water in California | OEHHA
https://oehha.ca.gov/water/report/human-right-water-california
[184] Countywide Drought and Water Shortage Contingency Plans | DWR
https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/County-Drought-Planning
[185] California Public Utilities Commission
https://www.cpuc.ca.gov/
[186] October 7, 2020 White Paper: Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems
https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

The 2020-21 potential risk indicator evaluation process yielded a recommended list of 19 risk indicators. Table A2 provides a summary of the risk indicators utilized in the 2021 Risk Assessment.

2022 NEW AND REMOVED RISK INDICATORS

To respond to stakeholder feedback, the State Water Board added eight new risk indicators and removed five risk indicators for the 2022 Risk Assessment. Additional information about what led to these changes are documented in the 2022 Needs Assessment.[187]

- New risk indicators included: 'Constituents of Emerging Concern,' 'Source Capacity Violations,' 'Bottled or Hauled Water Reliance,' 'Income,' 'Operating Ratio,' 'Days Cash on Hand,' 'Percent Residential Arrearages,' and 'Residential Arrearage Burden.'
- Removed risk indicators included: 'Maximum Duration of High Potential Exposure (HPE),' 'Water Source Types,' '% Shut-Offs,' 'Number of Service Connections,' and 'Extensive Treatment Installed.'

2023 ADDED AND REMOVED RISK INDICATORS

The State Water Board made minimal changes to the 2023 Risk Assessment indicators:

- Remove two affordability risk indicators: 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden.'
- Add one new affordability risk indicator: 'Household Socioeconomic Burden.'

Removed Risk Indicators

Recent actions have affected the available data for use in affordability indicators in the 2023 Needs Assessment. Arrearage data was collected one-time in the 2021 Drinking Water Arrearage Payment Program, which ended in June 2021. For these reasons, 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden' are not included in the 2023 Needs Assessment since updated data to support these metrics has not been collected. These indicators were advantageous to include in the Needs Assessment because they represent a direct measurement of households struggling to pay their water bills and may be incorporated into future iterations of the Needs Assessment if data becomes available.

Added Risk Indicator

The State Water Board, in partnership with the Office of Environmental Health Hazard Assessment (OEHHA), hosted three webinar workshops in 2022 to solicit stakeholder feedback on new and future affordability indicators for the Needs Assessment. The workshop white papers, presentations, and webinar recording are available on the Needs Assessment

[187] 2022 Needs Assessment
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

website.[188] The State Water Board has incorporated one new affordability risk indicator to the 2023 Risk Assessment, 'Household Socioeconomic Burden,' and identified potential new affordability indicators to include once data becomes available. Details on 'Household Socioeconomic Burden' calculation methodology, thresholds, scoring and weight can be found below in this Appendix.

Table A2: Risk Indicators Over Time

Indicators	Category	2021	2022	2023
History of *E. coli* Presence	**Water Quality**	✓	✓	✓
Increasing Presence of Water Quality Trends Toward MCL	**Water Quality**	✓	✓	✓
Treatment Technique Violations	**Water Quality**	✓	✓	✓
Past Presence on the Failing List	**Water Quality**	✓	✓	✓
Percentage of Sources Exceeding an MCL	**Water Quality**	✓	✓	✓
Maximum Duration of High Potential Exposure (HPE) (Removed 2022)	**Water Quality**	✓		
Constituents of Emerging Concern	**Water Quality**		✓	✓
Number of Sources	**Accessibility**	✓	✓	✓
Absence of Interties	**Accessibility**	✓	✓	✓
Water Source Types (Removed 2022)	**Accessibility**	✓		
DWR – Drought & Water Shortage Risk Assessment Results	**Accessibility**	✓	✓	✓
Critically Overdrafted Groundwater Basin	**Accessibility**	✓	✓	✓
Bottled or Hauled Water Reliance	**Accessibility**		✓	✓
Source Capacity Violations	**Accessibility**		✓	✓
Percent of Median Household Income (%MHI)	**Affordability**	✓	✓	✓
Extreme Water Bill	**Affordability**	✓	✓	✓
% Shut-Offs (Removed 2022)	**Affordability**	✓		
Residential Arrearage Burden (Removed 2023)	**Affordability**		✓	
Percentage of Residential Arrearages (Removed 2023)	**Affordability**		✓	
NEW: Household Socioeconomic Burden	**Affordability**			✓
Number of Service Connections (Removed 2022)	**TMF Capacity**	✓		
Operator Certification Violations	**TMF Capacity**	✓	✓	✓
Monitoring and Reporting Violations	**TMF Capacity**	✓	✓	✓
Significant Deficiencies	**TMF Capacity**	✓	✓	✓
Extensive Treatment Installed (Removed 2022)	**TMF Capacity**	✓		
Days Cash on Hand	**TMF Capacity**		✓	✓

[188] State Water Board Needs Assessment Source Capacity Violations Webpage https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html#affordability-assessment

Indicators	Category	2021	2022	2023
Operating Ratio	**TMF Capacity**		✓	✓
Net Annual Income	**TMF Capacity**		✓	✓

RISK INDICATOR THRESHOLDS, SCORES, & WEIGHTS

THRESHOLDS

To develop thresholds for the risk indicators in the Risk Assessment, the State Water Board reviewed multiple available types of evidence, looking both within California, across other state agencies nation-wide, and at the U.S. EPA's standards. Few exact risk indicator thresholds relating to water system failure were derived from sources beyond California legislative and regulatory definitions, given both the unique definition of water system failure employed in this assessment and the unique access to indicator data which this assessment enabled. However, similar indicators and associated thresholds to inform this process were also identified across other sources.

Based on the research conducted, most risk indicators did not have regulatorily defined thresholds. For binary risk indicators (*e.g.,* operator certification violations), the process of setting thresholds was straightforward because it is either present or absent. For other risk indicators with continuous or categorical data, thresholds were derived using cut points in the distribution of a given risk indicator, where Failing list systems started to cluster, as well as the professional opinion of external stakeholders, State Water Board staff, as well as an internal advisory group of District Engineers. Where possible, tiered thresholds were determined to capture more nuanced degrees of risk within indicators. Sections below provide more details about the rationale for the thresholds developed for each indicator.

Moving forward, the State Water Board will continue to refine the risk indicator thresholds as data availability improves and the SAFER Program matures. The process may include refining thresholds by analyzing historical data trends such as looking at the relationship between historical thresholds and the likelihood that systems came out of compliance.

SCORES

To enable the evaluation and comparison of risk indicators, a standardized score between 0 and 1 has been applied to each developed risk indicator threshold. This is important since many of the risk indicators are measured in different units and scales. The score normalizes the thresholds and allows the Risk Assessment to assess water system performance across all risk indicators. The scores assigned to the risk indicator thresholds were developed with the professional opinion of external stakeholders, State Water Board staff, as well as an internal advisory group of District Engineers (Table A3).

WEIGHTS

When evaluating the risk indicators, the Risk Assessment methodology can either apply the same “weight” to each risk indicator or apply different weights (see Figure A3). Public feedback during four public workshops indicated that the Risk Assessment should weigh some risk indicators higher than others because they may be more “critical” as they relate to a water system’s ability to stay in compliance. Weights between 1 and 3 were applied to individual risk indicators (Table A3), with a weight of 3 indicating the highest level of criticality). The individual risk indicator weights were developed with the professional opinion of external stakeholders, State Water Board staff, as well as an internal advisory group of District Engineers. In 2020, an analysis of how the application of risk indicator weights impacts the performance of Failing systems was shared with the public for feedback with white paper *Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems*[189] and a December 14, 2020 webinar,[190] which ultimately supported the final inclusion decision regarding individual risk indicator weights in the Risk Assessment.

[189] December 14, 2020 White Paper: Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems https://www.waterboards.ca.gov/safer/docs/draft_white_paper.pdf

[190] December 14, 2020 Webinar Presentationhttps://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/safer_risk_assessment_webinar_accessible.pdf
December 14, 2020 Webinar Recording
https://www.youtube.com/embed/6XDak8R5IDk?cc_load_policy=1&modestbranding=1&rel=0&autoplay=1

Table A3: Individual Risk Indicator Thresholds, Scores, and Weights

<table>
<tr><th>Risk Indicator</th><th>Thresholds</th><th colspan="2">Score</th><th>Weight</th><th>Max Score</th><th>Risk Level</th></tr>
<tr><td rowspan="2">History of E. coli Presence</td><td>Threshold 0 = No history of E. coli presence within the last three years.</td><td colspan="2">0</td><td>N/A</td><td>0</td><td>None</td></tr>
<tr><td>Threshold 1 = Yes history of E. coli presence (E. coli violation and/or Level 2 Assessment) within the last three years.</td><td colspan="2">1</td><td>3</td><td>3</td><td>High</td></tr>
<tr><td rowspan="4">Increasing Presence of Water Quality Trends Toward MCL</td><td>Threshold 0 = Less than 25% of sources are meeting one or more criteria listed below.</td><td colspan="2">0</td><td>N/A</td><td>0</td><td>None</td></tr>
<tr><td>Threshold 1 = Secondary Contaminants: 9-year average of running annual averages is at or greater than 80% of MCL <u>and</u> the running annual average has increased by 20% or more.</td><td>0.25 per source</td><td rowspan="3">If 25% or greater of sources are meeting any criteria, average the scores across all contaminated sources. ($0 \le n \le 1$)</td><td rowspan="3">2</td><td rowspan="3">2</td><td rowspan="2">Medium ($0 < n \le 0.5$)</td></tr>
<tr><td>Threshold 2 = Primary Non-Acute Contaminants: 9-year average of running annual averages is at or greater than 80% of MCL <u>and</u> the running annual average has increased by 5% or more.</td><td>0.5 per source</td></tr>
<tr><td>Threshold 3 = Acute Contaminants: If a source is meeting the following criteria:
• 9-year average (no running annual average) is at or greater than 80% of MCL; or
• Most recent 24-month average is at or greater than 80% of MCL; or
• Any one sample is over the MCL.</td><td>1 per source</td><td>High ($0.5 < n \le 1$)</td></tr>
</table>

<table>
<tr><th>Risk Indicator</th><th>Thresholds</th><th colspan="2">Score</th><th>Weight</th><th>Max Score</th><th>Risk Level</th></tr>
<tr><td rowspan="2">Treatment Technique Violations</td><td>Threshold 0 = 0 Treatment technique violations over the last three years.</td><td colspan="2">0</td><td>N/A</td><td>0</td><td>None</td></tr>
<tr><td>Threshold 1 = 1 or more Treatment technique violations over the last three years.</td><td colspan="2">1</td><td>1</td><td>1</td><td>High</td></tr>
<tr><td rowspan="3">Past Presence on the Failing List</td><td>Threshold 0 = 0 Failing list occurrence over the last three years.</td><td colspan="2">0</td><td>N/A</td><td>0</td><td>None</td></tr>
<tr><td>Threshold 1 = 1 Failing list occurrence over the last three years.</td><td colspan="2">0.5</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Threshold 2 = 2 or more Failing list occurrences over the last three years.</td><td colspan="2">1</td><td>2</td><td>2</td><td>High</td></tr>
<tr><td rowspan="2">Percentage of Sources Exceeding an MCL</td><td>Threshold 0 = less than 50% of sources exceed an MCL.</td><td colspan="2">0</td><td>N/A</td><td>0</td><td>None</td></tr>
<tr><td>Threshold 1 = 50% or greater of sources exceed an MCL.</td><td colspan="2">1</td><td>3</td><td>3</td><td>High</td></tr>
<tr><td rowspan="2">Constituents of Emerging Concern</td><td>Threshold 0 = Less than 25% of sources are meeting the criteria for Thresholds 1 and 2.</td><td colspan="2">0</td><td>N/A</td><td>0</td><td>None</td></tr>
<tr><td>Threshold 1 = If a source is meeting the following criteria:
• CrVI: 1 or more calculated RAA(s) over 5-year period are at or above 80% of the former MCL and below the former MCL (8 µg/L ≤ RAA < 10 µg/L); or
• PFAS: 2 or more samples over 5-year period are positive; this criterion applies to all 18 chemicals.</td><td>0.5 per source</td><td>If 25% or greater of sources are meeting any criteria, average the scores across all contaminated sources.
($0 \le n \le 1$)</td><td>3</td><td>3</td><td>Medium
($0 < n \le 0.5$)</td></tr>
</table>

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
	Threshold 2 = If a source is meeting the following criteria: • **CrVI: 1 or more** calculated RAA(s), over 5-year period, are at or above the former MCL (10 µg/L ≤ RAA); or • **PFAS: 2 or more** samples, over 5-year period, are at or above the notification level; this criterion only applies to 4 chemicals that have notification level; or • **1,4-Dioxane: 1 or more** calculated RAA(s), over 5-year period, are at or above the notification level (1 µg/L ≤ RAA).	1 per source			High (0.5 < n ≤ 1)
Number of Sources	**Threshold X** = **0** sources.	Automatically At-Risk	N/A	At-Risk	Very High
	Threshold 0 = **multiple** sources.	0	N/A	0	None
	Threshold 1 = **1** source only.	1	3	3	High
Absence of Interties	**Threshold 0** = **1 or more** interties.	0	N/A	0	None
	Threshold 1 = **0** interties.[191]	1	1	1	High
DWR – Drought & Water Shortage Risk	**Threshold 0** = **Below top 25%** of systems most at risk of drought and water shortage.	0	N/A	0	None
	Threshold 1 = **Between top 25% - 10.01%** of systems most at risk of drought and water shortage.	0.25	2	0.5	Medium

[191] All water systems with 10,000 service connections or greater, that have more than one source are excluded and risk scores of 0 are assigned. If a water system with 10,000 service connections or more has only one source and it is not an intertie, they receive a risk score of 1.

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
Assessment Results	**Threshold 2** = **Top 10%** of systems most at risk of drought and water shortage.	1	2	2	High

Critically Overdrafted Groundwater Basin	**Threshold 0** = **Less than 25%** of system's wells are located within a critically overdrafted basin.	0	N/A	0	None
	Threshold 1 = **25% or greater** of system's wells are located within a critically overdrafted basin.	1	2	2	High

Source Capacity Violations	**Threshold 0 = 0** source capacity violations or service connection moratoriums within the past 3 years.	0	N/A	0	None
	Threshold 1 = 1 or more source capacity violation or service connection moratorium within the past 3 years.	1	3	3	High

Bottled or Hauled Water Reliance	**Threshold 0 = 0** occurrences of bottled or hauled water reliance within the past 3 years.	0	N/A	0	None
	Threshold 1 = 1 or more occurrences of bottled or hauled water reliance within the past 3 years.	Automatically At-Risk	N/A	At-Risk	Very High

Percent of Median Household Income	**Threshold 0** = **Less than 1.49%**	0	N/A	0	None
	Threshold 1 = **1.5% - 2.49%**	0.75	3	2.25	Medium
	Threshold 2 = **2.5% or greater**	1	3	3	High

Extreme Water Bill	**Threshold 0** = **Below 149.99%** of the statewide average.	0	N/A	0	None

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
	Threshold 1 = **150% - 199.99%** of the statewide average.	0.5	1	0.5	Medium
	Threshold 2 = **200% or greater** of the statewide average.	1	1	1	High

Household Socio-economic Burden	**Threshold 0** = Combined score **0 – 0.125**	0	N/A	0	None
	Threshold 1 = Combined score **0.25 – 0.5**	0.5	2	1	Medium
	Threshold 2 = Combined score **0.625 – 1.0**	1	2	2	High

Operator Certification Violations	**Threshold 0** = **0** Operator Certification violations over the last three years.	0	N/A	0	None
	Threshold 1 = **1 or more** Operator Certification violations over the last three years.	1	3	3	High

Monitoring & Reporting Violations	**Threshold 0** = **1 or less** Monitoring & Reporting violations over the last three years.	0	N/A	0	None
	Threshold 1 = **2 or more** Monitoring & Reporting violations over the last three years.	1	2	2	High

Significant Deficiencies	**Threshold 0** = **0** Significant Deficiencies over the last three years.	0	N/A	0	None
	Threshold 1 = **1 or more** Significant Deficiencies over the last three years.	1	3	3	High

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
Operating Ratio	**Threshold 0** = **1 or greater**	0	N/A	0	None
	Threshold 1 = **Less than 1**	1	1	1	High

Total Annual Income	**Threshold 0** = **Greater than $0** total annual income.	0	N/A	0	None
	Threshold 1 = $0 total annual income.	0.5	1	0.5	Medium
	Threshold 2 = **Less than $0** total annual income.	1	1	1	High

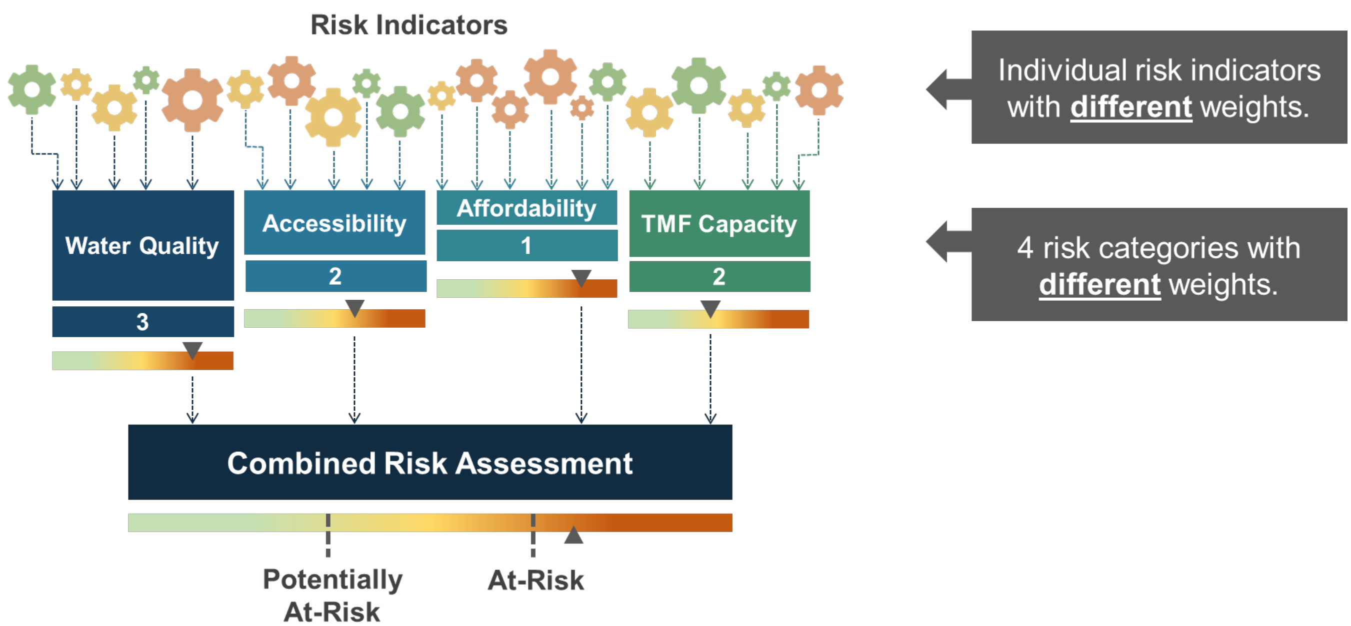
Days Cash on Hand	**Threshold 0** = **90 days or more** cash on hand.	0	N/A	0	None
	Threshold 1 = **30 days or greater** and **less than 90 days** cash on hand.	0.5	1	0.5	Medium
	Threshold 2 = **Less than 30 days** cash on hand.	1	1	1	High

RISK INDICATOR CATEGORY WEIGHTS

Public feedback during the initial Risk Assessment methodology development workshops indicated that the Risk Assessment should include risk indicator category weights. An analysis of how the application of risk indicator category weights impacts the performance of Failing: HR2W list systems was shared with the public for feedback with white paper *Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems*[192] and a December 14, 2021 webinar,[193] which ultimately supported the final inclusion category weights in the Risk Assessment.

Weights between 1 and 3 were applied to each risk indicator category, with a weight of 3 indicating the highest level of criticality (Figure A3). Risk indicator category weights were developed through stakeholder workshops and with the professional opinion of State Water Board staff, as well as an internal advisory group of District Engineers.

Figure A3: Aggregated Risk Assessment Methodology with Category Weights



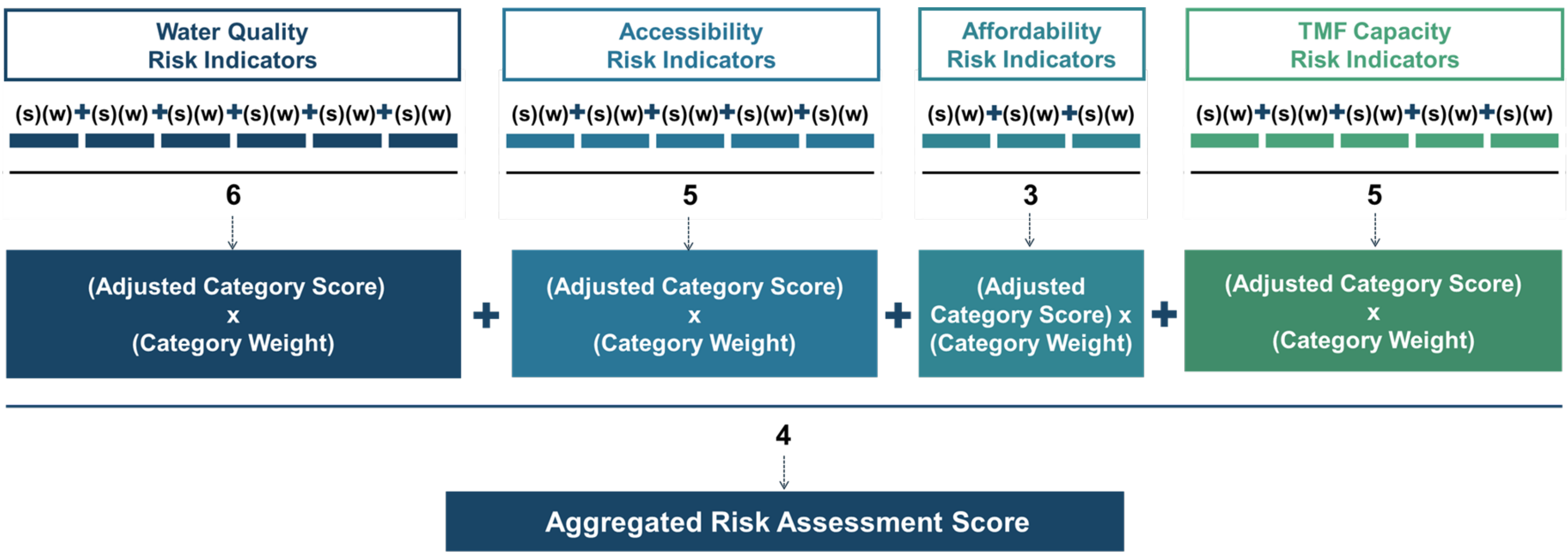
[192] December 14, 2020 White Paper:
[Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems](https://www.waterboards.ca.gov/safer/docs/draft_white_paper.pdf)
https://www.waterboards.ca.gov/safer/docs/draft_white_paper.pdf
[193] December 14, 2020 Webinar Presentation
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/safer_risk_assessment_webinar_accessible.pdf
December 14, 2020 Webinar Recording
https://www.youtube.com/embed/6XDak8R5IDk?cc_load_policy=1&modestbranding=1&rel=0&autoplay=1

AGGREGATED RISK ASSESSMENT CALCULATION METHODOLOGY

The assessment of individual risk indicators within each category and for the aggregated risk assessment relies on: (1) the amount of risk scores or points each system accrues per indicator, (2) the number of indicators that system is assessed for in each category, and (3) the weights applied to individual risk indicators and categories. Figure A4 provides an illustration of the aggregated Risk Assessment calculation method.

The aggregated Risk Assessment methodology takes the standardized score, between 0 and 1, for each risk indicator and applies a criticality weight to each indicator, between 1 and 3. Then a criticality weight is also applied to each risk indicator category (*e.g.,* Water Quality, Accessibility, *etc.*), between 1 and 3. The final score is an average of the weighted category scores.

Figure A4: Illustration of the Risk Assessment Calculation Methodology with Risk Indicator Scores (s) and Risk Indicator and Categories Weights (w)



ADJUSTING FOR MISSING DATA

It is important that the Risk Assessment methodology adapt for where data may be missing for certain water systems, either because a system failed to report necessary data or because the system may not have data to report. For example, some water systems do not charge for water. Therefore, those systems do not have the necessary data (*i.e.,* customer charges) for two of the three risk indicators in the Affordability category. On the other hand, a system may be missing data because the water system did not report the required data point to the State Water Board. The Risk Assessment methodology accommodates for these two scenarios differently.

Missing Data – Not Applicable
If a risk indicator is not application to a water system and data is unavailable for logical reasons, the water system will be assigned a risk score of 0 for the indicator. No other adjustments are made to the system's aggregated risk score.

Missing Data – Non-Reporting
A water system that is missing necessary data for a risk indicator will have the indictor weights within the risk category redistributed (Figure A5). This increases the calculated impact the other risk indicators have on the category's risk score. This approach allows the analysis to compare systems without complete data to systems with complete data. It also ensures water systems are not assigned lower aggregated risk scores for not reporting data.

Figure A5: Example of How the Aggregated Risk Assessment Adjusts for Missing Risk Indicator Data

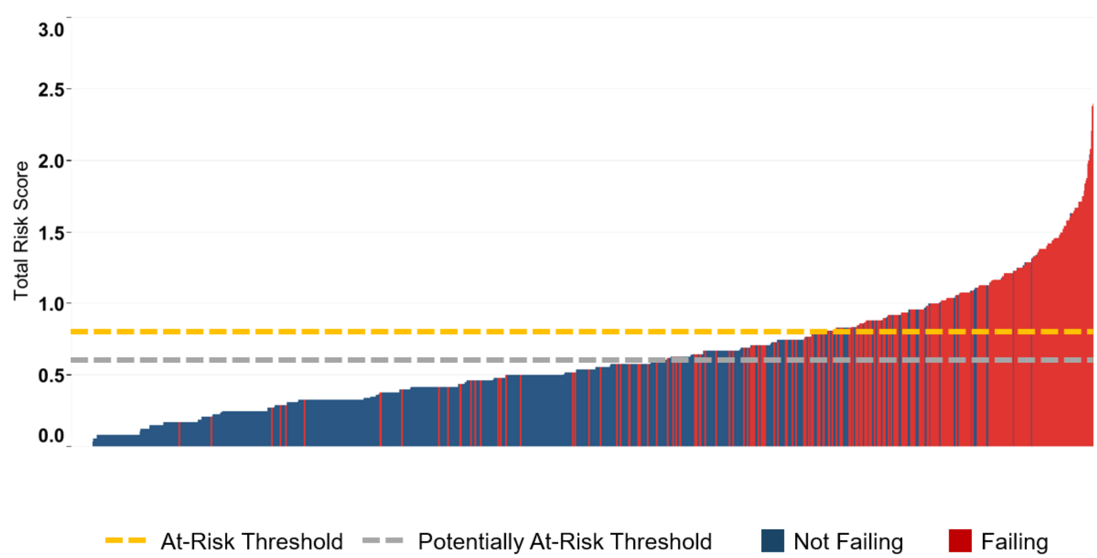
Historically, there have been water systems that were missing risk indicator data for a whole category, particularly the Affordability category. Many of these systems were unconventional community water systems in the sense that they had a stable population base, but no ratepayer base (for example, schools, prisons, parks). These systems, where identifiable, were excluded from the Affordability category of the Risk Assessment altogether and given a risk score of 0 for this category. The Risk Assessment redistributed the weights/score of a missing risk indicator category to the other categories when an entire category is excluded from the assessment, as illustrated in Figure A6. Currently, there are no occurrences where a system is missing risk indicator data for an entire category.

Figure A6: How the Aggregated Risk Assessment Adjusts for a Missing Risk Indicator Category

AGGREGATED RISK ASSESSMENT THRESHOLDS

The 2023 Risk Assessment thresholds are 0.8 for At-Risk water systems and 0.6 for Potentially At-Risk water systems. These thresholds remain unchanged from the 2022 Risk Assessment. The aggregated Risk Assessment thresholds were originally developed based on the distribution of Failing and non-Failing water systems.

Figure A7: Distribution of 2023 Total Risk Scores for Water Systems (n=3,053)



AGGREGATED RISK ASSESSMENT RESULTS ANALYSIS

The 2023 Risk Assessment was conducted for 3,053 public water systems. After removing the 381 Failing list systems, the Assessment results identified 512 (17%) At-Risk water systems, 453 (15%) Potentially At-Risk water systems, and 1,707 (56%) Not At-Risk water systems

(Figure 20). Of the 381 Failing water systems 302 (79%) meet the At-Risk threshold. If these systems come off the Failing list, they will be considered At-Risk systems.

Compared to the 2022 Risk Assessment results, the 2023 Assessment identifies 113 more At-Risk water systems and a statewide increase in total average risk scores from 0.56 to 0.61. The increase in the number of At-Risk water systems and total average statewide risk scores can be attributed to the following:

(1) 119 (4%) of At-Risk systems were automatically at-risk, regardless of their performance across all risk indicators because they have relied on bottled and/or hauled water to meet customer demand within the last three years or have 0 active sources. This is 30 more systems when compared to the 2022 Risk Assessment results, which had 89 (3%) of systems automatically At-Risk.
(2) The addition of the new affordability risk indicator 'Household Socioeconomic Burden' and removal of two affordability indicators resulted in an increase in risk scores accumulated for systems in the Affordability Category. The section below further explains how the impact of this change on the Risk Assessment results.

EXPLANATION OF THE CHANGES IN THE RISK ASSESSMENT RESULTS FROM 2022 TO 2023

The State Water Board has conducted an analysis to explain the increase in the number of At-Risk systems in the 2023 Risk Assessment results. A comparison of water system performance in each risk category was conducted between the 2022 and 2023 Assessments (Figure A8 and Table A4).

Figure A8: Changes in the Average Risk Score per Category

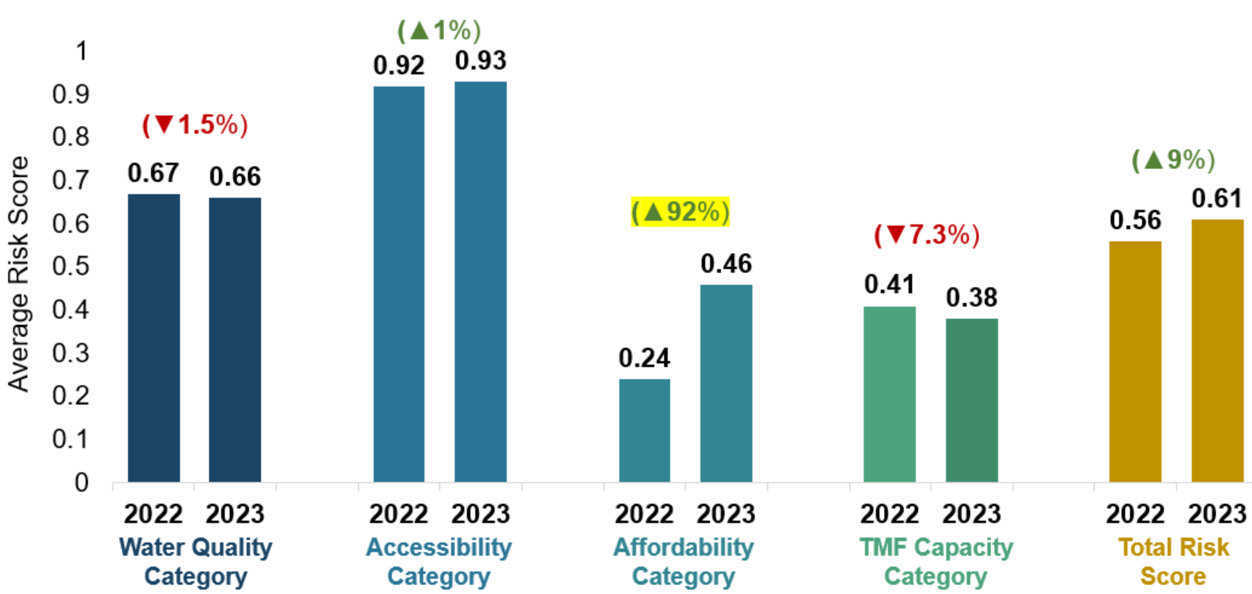


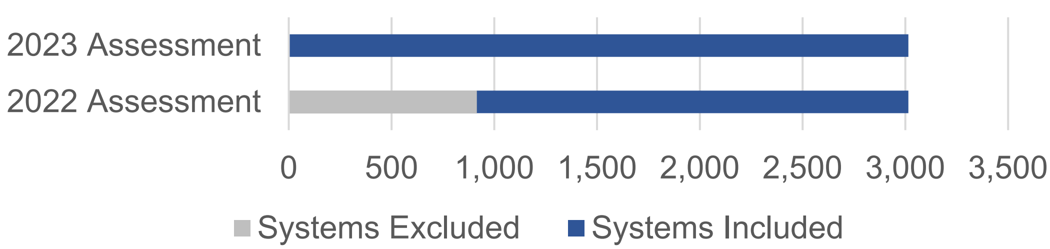
Table A4: 2022 and Final 2023 Risk Assessment Weighted Score Comparison[194]

Weighted Score Difference	Water Quality Category	Accessibility Category	Affordability Category	TMF Capacity Category	Total Score of Risk Assessment
# Systems **risk score unchanged**	2,264 (75%)	2,217 (73%)	910 (30%)	1,461 (48%)	**359 (12%)**
# Systems **risk score increased**	382 (13%)	419 (14%)	1,519 (50%)	716 (24%)	**1,648 (55%)**
# Systems **risk score decreased**	371 (12%)	381 (13%)	588 (19%)	840 (28%)	**1,010 (33%)**
Total	**3,017**	**3,017**	**3,017**	**3,017**	**3,017**

The analysis indicates the increase in the number of At-Risk water systems is a result of water system performance in the Affordability category of the Risk Assessment. In the 2023 results, 50% more water systems received higher risk scores in the Affordability category than they did in the 2022 Risk Assessment. This increase is driven by two factors:

1. In 2022, 947 water systems were excluded from the Affordability category of the Risk Assessment because they do not charge customers directly for water (Figure A9). All the Affordability risk indicators in 2022 were rate-based indicators. The inclusion of a non-rate-based affordability indicator "Household Socioeconomic Burden" meant these previously excluded systems are included in the analysis for this category in the 2023 Assessment, thus driving up the total average risk score in the preliminary results.

Figure A9: Number of Water Systems Included in the Affordability Risk Category

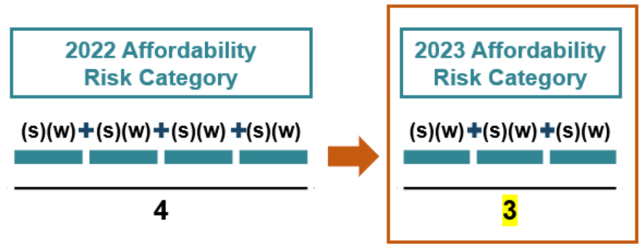


2. Due to the removal of two affordability risk indicators and the addition of one new indicator, the average scoring for the Affordability category is adjusted, where the denominator is

[194] This analysis excluded 19 water systems that were not included in ***both*** the 2022 and 2023 Risk Assessments.

decreasing from four to three (Figure A10). This results in a higher overall category risk score for systems accruing risk points for the affordability risk indicators.

Figure A10: Affordability Category Calculation Method Changes from 2022 to 2023



RISK INDICATOR DETAILS

IDENTIFICATION OF WATER SYSTEMS ASSESSED

The State Water Board conducts the Risk Assessment for a specific inventory of drinking water systems determined annually. In 2021, the State Water Board conducted a Risk Assessment for K-12 schools and community water systems with 3,300 service connections or less. In 2022, the inventory of systems included in the Assessment expanded to include systems with 30,000 service connections or less and less than 100,000 population served.

The following section summarizes the methodology employed to identify which water systems are included in the Risk Assessment using SDWIS data:

- Identify all active[195] water systems with a Federal Water System Type of "Community" and exclude systems with a primary service area of "Wholesaler." Does not exclude systems with multiple service areas and one of the non-primary service areas are designated as "Wholesaler." Some schools will be included in this category if they are designated as "Community" type.
- Identify all active water systems with a Federal Water System Type of "Non-Transient Non-Community" and with a primary service area of "School." Excluding schools that are not K-12 (i.e., colleges and pre-schools).
- Remove water systems that are larger than the determined service connection or population cutoffs for the Risk Assessment.

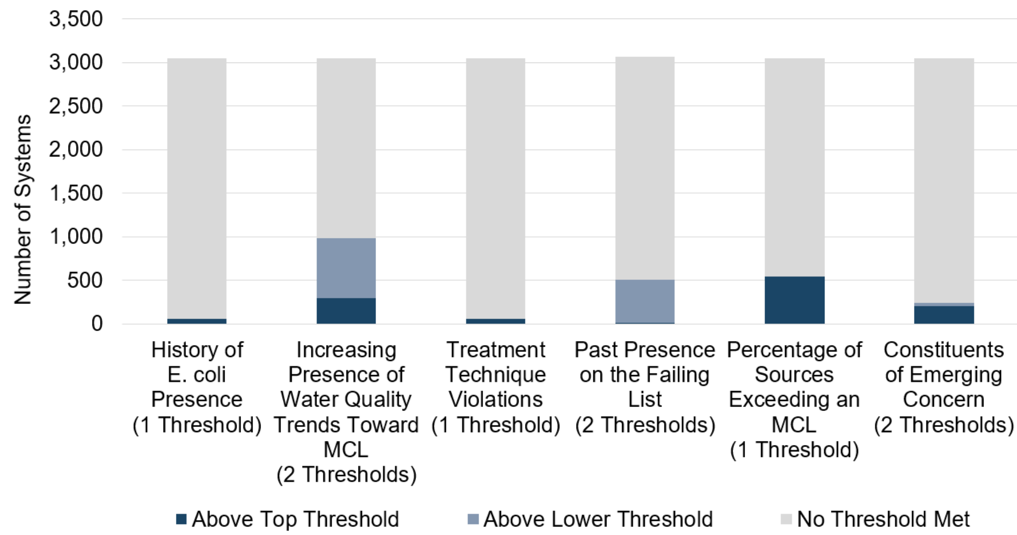
WATER QUALITY RISK INDICATORS

This section provides full details on each Water Quality risk indicator used in the Risk Assessment. Water Quality risk indicators measure current water quality and trends to identify

[195] "Active" means the water system was active at the time the data was pulled.

compliance with regulatory requirements, as well as frequency of exposure to drinking water contaminants. Figure A11 illustrates the number of water systems that exceeded the risk indicator thresholds within the Water Quality category. The range of potential thresholds for each risk indicator are summarized in the respective risk indicator label and detailed below.

Figure A11: Number of Systems Exceeding Thresholds for Each Water Quality Risk Indicator



HISTORY OF E. COLI PRESENCE

The presence of *E. coli* in drinking water suggests that the water supply may be contaminated with human or animal waste, and in turn, that other pathogens could be present. The presence of this contaminant could also suggest that water treatment is inadequate, interrupted, or intermittent. Water systems are required to conduct a Level 1 and/or a Level 2 Assessment if conditions indicate they might be vulnerable to bacteriological contamination.

A Level 1 Assessment is performed by a water system owner or operator when laboratory results indicate that bacteriological threats may exist, an assessment form must be filled and submitted to the state within 30 days. A Level 1 Assessment is triggered by any of the following conditions.[196]

- A public water system collecting fewer than 40 samples per month has two or more total coliform positive routine/repeat samples in the same month.
- A public water system collecting at least 40 samples per month has greater than 5.0 percent of the routine/repeat samples in the same month that are total coliform positive.

[196] Revised Total Coliform Rule
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/rtcr.html

- A public water system fails to take every required repeat sample after any single total coliform positive sample.

A Level 2 Assessment is performed by the state or state-approved entity, but the water system is responsible for ensuring the completion of the assessment regardless of the entity conducting it. The water system must notify the local regulating agency by the end of the business day to schedule a Level 2 assessment. A Level 2 Assessment is triggered by the following conditions:[197]

- A water system incurs an *E. coli* MCL violation.
- A water system has a second Level 1 Assessment within a rolling 12-month period.

Water systems must fix any sanitary defects within a required timeframe.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- *E. coli* violations – Analyte Code 3014: Safe Drinking Water Information System (SDWIS).
    - Query systems that only have *E. coli* related treatment technique and/or MCL violations. See list of violation codes below:

Table A5: Identified Violation Types Related to *E. coli*

Violation Number	Violation Type	Description
01*	**MCL, Single Sample**	MCL violation based on a single sample, or an organic analyte that is 10X the MCL.
1A	**MCL, *E. coli*, Positive *E. coli* (RTCR)**	*E. coli* MCL violation based on a single sample.
02*	**MCL, Numeric Average of Samples Taken**	A violation for an inorganic, organic, or radiological constituent where compliance is based on a running annual average or more monitoring period average.
T1*	**State Violation – Treatment Technique**	A violation where the water system failed to treat water using the treatment process the state has primacy to regulate (*i.e.,* treatment failed per the system's permit).

*These violations were inadvertently used to record an *E. coli* violation and therefore are being shown in this Table. Violation Number 1A is the code that should be used to record these violations.

- Level 2 Assessments

[197] Level 2 Assessment: A Quick Reference Guide
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/rtcr.html

- Violation Type Code (2B): SDWIS.
- Level 2 Assessment Activities Spreadsheet: Maintained by State Water Board's Data Support Unit (DSU).

Risk Indicator Calculation Methodology:

- Determine which systems have had *E. coli* violations within the last three years with a SOX (State Compliance Achieved) Enforcement Action.
- Determine which systems have had a Level 2 Assessment over the last three years.

Threshold Determination

The State Water Board has adopted a threshold for *E. coli* violations for the expanded Failing list criteria which relies on whether the water system has an open enforcement action for the violation.[198] For the Risk Assessment, a modified version of the expanded Failing list criteria threshold was developed for the "History of *E. coli* Presence" risk indicator. Systems that have had an *E. coli* violation or Level 2 Assessment within the last three years are considered more at risk than systems that have not.

Correlational and regression analysis between the risk indicator as defined with this threshold and water system failure to deliver safe drinking water as defined in the Failing list shows a statistically significant relationship.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "History of *E. Coli* Presence" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table A6 summarizes the thresholds, scores, and weight for this risk indicator.

Table A6: "History of *E. coli* Presence" Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**No** history of *E. coli* presence over the last three years.	0	N/A	0	None
1	**Yes**, history of *E. coli* presence (*E. coli* violation and/or Level 2 Assessment) over the last three years.	1	3	3	High

[198] Systems that meet the Failing list criteria will not be included in the Risk Assessment.

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

History of E.coli Presence: https://tabsoft.co/40baWOm

INCREASING PRESENCE OF WATER QUALITY TRENDS TOWARD MCL

This risk indicator identifies sources with an increasing presence of one or more regulated contaminants, especially those attributable to anthropogenic causes, that are detected at or greater than 80% of the MCL within the past nine years. Water systems with 25% of their sources or more experiencing upwards trends in contaminant concentrations are at-risk of exceeding regulatory water quality requirements and are therefore assigned risk points in the Risk Assessment.

Calculation Methodology

Important Note: *In 2022, the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2021 Needs Assessment to account for the inclusion of medium-size water systems that have many sources. Specifically, the analysis excluded systems from accruing risk points for this indicator if less than 25% of their active sources were meeting the risk criteria detailed below.*

In 2023, the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2022 Needs Assessment. The update adjusted the accounting of how impaired source thresholds are determined. Rather than assessing water quality source risk per contaminant group individually (acute, primary, and secondary), it is now done across all groups simultaneously. This improves the identification of water systems that are experiencing trends towards MCL in more than 25% of their sources regardless of contaminant group.

Required Risk Indicator Data Points & Sources:

- Dataset - SDWIS:
    - Data Point(s) - Water System Inventory
        - Active Source Water Facilities including[199]
            - Consecutive Connection (CC)
            - Infiltration Gallery (IG)
            - IN – Intake (IN)
            - Roof Catchment (RC)
            - Spring (SP)
            - WL Well (WL)
        - Active Water System Sampling Points for above Source Water Facilities[200]

[199] Source Water Facility Types not included in the list are excluded from analysis (ex. hauled water).
[200] Source Water Facility Types with no active sample points are excluded from analyses.

- Data point(s) - Water System Water Quality[201]
  - Water Quality Monitoring Sample Results and Dates for above sample points.
  - Water Quality Contaminants for Sample Results for above sample point.
  - List of eligible contaminants described below in Table A7, Table A8, and Table A9.

- Dataset – Water Quality Inquiry Replacement (WQIR):
  - Data point(s) for Contaminant Information:
    - Regulatory threshold information including:
      - Maximum Contaminant Levels (MCL)
      - Detection Limits for purposes of Reporting (DLR)
      - Notification Levels (NL)

Analyte names and codes for the contaminants of interest per contaminant category in SDWIS are listed in Table A7, Table A8, and Table A9.

Acute Contaminants[202] – Per the Tier 1 public notification rule[203]

Table A7: Acute Contaminants with a Primary MCL

Contaminant	SDWIS Analyte Code
Nitrate	1040
Nitrate-Nitrite	1038
Nitrite	1041
Perchlorate	1039
Chlorite	1009
Chlorine Dioxide	1008

Non-Acute Primary Contaminants

Table A8: Non-Acute Constituents that have a Primary MCL

Contaminant	SDWIS Analyte Code
Aluminum	1002
Antimony, Total	1074
Arsenic	1005
Asbestos	1094

[201] Water Quality Data that is flagged as False Positive (FP), Invalid (IV), or Questionable (QQ) is excluded from the analysis. Water Quality Data that was also outside of the desired time frame is excluded.
[202] CCR section 64400. Acute Risk. "Acute risk" means the potential for a contaminant or disinfectant residual to cause acute health effects, *i.e.,* death, damage or illness, as a result of a single period of exposure of a duration measured in seconds, minutes, hours, or days.
[203] CCR section 64463.1. Tier 1 Public Notice

Contaminant	SDWIS Analyte Code
Barium	1010
Beryllium	1075
Cadmium	1015
Chromium	1020
Cyanide	1024
Fluoride	1025
Mercury	1035
Nickel	1036
Selenium	1045
Thallium, Total	1085
Benzene	2990
Carbon Tetrachloride	2982
O-Dichlorobenzene	2968
P-Dichlorobenzene	2969
1,1-Dichloroethane	2978
1,2-Dichloroethane	2980
1,1-Dichloroethylene	2977
cis-1,2-Dichloroethylene	2380
trans-1,2-Dichloroethylene	2979
Dichloromethane	2964
1,2-Dichloropropane	2983
1,3-Dichloropropene	2413
Ethylbenzene	2992
Methyl-tert-butyl ether	2251
Chlorobenzene	2989
Styrene	2996
1,1,2,2-Tetrachloroethane	2988
Tetrachloroethylene	2987
Toluene	2991
1,2,4-Trichlorobenzene	2378
1,1,1-Trichloroethane	2981
1,1,2-Trichloroethane	2985
Trichloroethylene	2984
Trichlorofluoromethane	2218
Vinyl Chloride	2976
Xylenes, Total	2955
Lasso (Alachlor)	2051

Contaminant	SDWIS Analyte Code
Atrazine	2050
Bentazon	2625
Benzo(a)pyrene	2306
Carbofuran	2046
Chlordane	2959
2,4-D	2105
Dalapon	2031
1,2-dibromo-3-chloropropane	2931
Di(2-ethylhexyl)adipate	2035
Di(2-ethylhexyl)phthalate	2039
Dinoseb	2041
Diquat	2032
Endothall	2033
Endrin	2005
Ethylene Dibromide	2946
Glyphosate	2034
Heptachlor	2065
Heptachlor Epoxide	2067
Hexachlorobenzene	2274
Hexachlorocyclopentadiene	2042
BHC-GAMMA	2010
Methoxychlor	2015
Molinate	2626
Oxamyl	2036
Pentachlorophenol	2326
Picloram	2040
Total Polychlorinated Biphenyls (PCB)	2383
Simazine	2037
Thiobencarb (Bolero)	2727
Toxaphene	2020
1,2,3-Trichloropropane	2414
2,3,7,8-TCDD	2063
2,4,5-TP	2110
Combined Radium (–228 & –226)	4010
Gross Alpha particle Activity	4109
Combined Uranium	4006
Gross Beta particle activity	4100

Contaminant	SDWIS Analyte Code
38-Strontium-90	4174
Tritium	4102

Secondary Contaminants

Table A9: Constituents that have a Secondary MCL*

Contaminant	SDWIS Analyte Code
Aluminum	1002
Color	1905
Copper, Free	1022
Foaming Agent (Surfactants)	2905
Iron	1028
Manganese	1032
Methyl tert-butyl ether (MTBE)	2251
Odor	1920
Silver	1050
Thiobencarb (Bolero)	2727
Turbidity	0100
Turbidity, Field	C254
Zinc	1095

*Total Dissolved Solids, Specific Conductance, Chloride, and Sulfate are excluded.

Prepare Primary and Secondary Data:

Compliance for non-acute contaminants is typically based on calculations of the Running Annual Average (RAA) because they are focused on long-term health risks over time. Therefore, to assess the risk for potential failure of a maximum contaminant for non-acute primary and secondary contaminants calculations of the RAAs are needed.

Below is how the Running Annual Average is calculated for the purposes for the Needs Assessment:

- Step 1 - Calculate RAA for each sample point:
  - Define a search period that eligible sample results dates must occur in.
  - Calculate all quarters between the start and end date of the search period.
    - Example:
      - Start Date: 1/1/2012 - End Date: 1/1/2021
      - Number of Years = 9 Years = 36 Quarters
        - 2012-Quarter 1, 2012-Quarter 2, 2012-Quarter 3, 2012-Quarter 4, 2013-Quarter 1, etc.

    - For every sample result date, determine what quarter it falls in and assign that a sample result value. If there are multiple sample result dates per quarter, then those sample results will be averaged so that only one sample result value per quarter exists.

- Step 2 - RAA Periods are calculated by averaging four consecutive quarters of data.
    - Example: (2012-Quarter 2 + 2012-Quarter 3 + 2012-Quarter4 + 2013-Quarter 1)/4
    - Some water systems do not always have four quarters of data in every RAA period. Therefore, the number of quarters used in each RAA calculation is based on the data available during that RAA period. For example, if only three quarters of data are available during a particular RAA period, then only those three quarters will be used to calculate the RAA.
        - Example: (2012-1 + MISSING + 2012-3 + 2012-4)/3

Threshold Determination
The increasing presence of water quality trends toward an MCL violation, as defined here or a similar measure, has not been assessed in other previous studies as related to water system failure or employed by other regulatory agencies or stakeholders as a threshold of concern. The State Water Board's workgroup of District Engineers determined the draft tiered thresholds for this risk indicator based on their experience working with water systems throughout the state. These draft thresholds were shared with the public through workshops and white papers in 2020 and 2021 and ultimately incorporated into the Risk Assessment.

Contaminant Group Thresholds
The first step in this analysis involves analyzing historical water quality sample results (up to 9 years) for each system's active sources. Water quality data is analyzed by three contaminate groups: secondary contaminants, primary non-acute contaminants, and primary acute contaminates. The analysis utilizes the thresholds described in Table A10 to determine if any of the system's active sources may be experiencing declining water quality. For each source, the analysis identifies the highest threshold met if the source is meeting more than one contaminant group threshold.

Table A10Table A10: "Increasing Presence of Water Quality Trends Toward MCL" Contaminant Group Thresholds

Threshold Number	Threshold
1	**Secondary Contaminants**: 9-year average of running annual averages is at or greater than 80% of MCL and the running annual average has increased by 20% or more
2	**Primary Non-Acute Contaminants**: 9-year average of running annual averages is at or greater than 80% of MCL and the running annual average has increased by 5% or more.
3	**Acute Contaminants**: • 9-year average (no running annual average) is at or greater than 80% of MCL; or

Threshold Number	Threshold
	• Most recent 24-month average is at or greater than 80% of MCL; or • Any one sample over the MCL.

Percentage of Source Impairment Threshold
The analysis then determines if 25% or more of the water system's sources are meeting the contaminant group thresholds. If less than 25% of the system's sources are meeting the contaminant group thresholds, the water system will receive no (zero) risk points for this risk indicator. If 25% or more of the system's sources are exceeding any of the contaminant group thresholds, then it will receive risk points. Table A11 is an example of how this determination is made.

Table A11: Example of 25% or Greater Source Impairment Threshold Determination for a System with 6 Sources

Source	Threshold Exceedance	Contaminant Group	Impaired (Y/N)	Impaired Count
Well 01	9-year Average ≥ 80% MCL	Acute	Yes	1
Well 02	24-month Average ≥ 80% MCL	Acute	Yes	1
Well 03	24-month Average ≥ 80% MCL	Acute	Yes	1
Well 04	9-year Average ≥ 80% MCL	Secondary	Yes	1
Well 05	9-year Average ≥ 80% MCL	Non-Acute	Yes	1
Well 06	Below thresholds	N/A	No	0

Determining if the 25% threshold is met across the system's 6 active sources:
- # of impaired Source Water Facilities = 5
- Total Number of Source Water Facilities = 6
- (5/6) * 100 = 83.33%
- 83.33% > 25% = system will accrue risk points

Risk Indicator Scoring & Weighting
To determine the risk score for this indicator, each active source that is meeting one or more of the contaminant group thresholds will be assigned a risk score (Table A12). If a source is meeting more than one contaminant group threshold. See example in Table A13.

Table A12: "Increasing Presence of Water Quality Trends Toward MCL" Scores Per Source

Threshold Number	Contaminant Group	Score per Source
1	**Secondary Contaminants**	0.25
2	**Primary Non-Acute Contaminants**	0.5
3	**Acute Contaminants**	1

Table A13: Example of Selection of Max Score per Source

	Source #1	Source #2	Source #3	Source #4	Source #5	Source #6
Acute Risk Score	1.0	1.0	1.0	0	0	0
Non-Acute Risk Score	0.5	0.5	0.5	0.5	0	0
Secondary Risk Score	0	0	0.25	0.25	0.25	0
Max Score Per Source	**1**	**1**	**1**	**0.5**	**0.25**	**0**

After selecting the maximum score for each source, an average of all the non-zero risk scores is calculated. See example below:

$$\frac{1+1+1+0.5+0.25}{5} = \mathbf{0.75}$$

Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's internal stakeholder group, the weight of 2 is applied to the "Increasing Presence of Water Quality Trends Toward MCL" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table A14 summarizes the total risk score ranges and weights applied to this risk indicator.

Table A14: "Increasing Presence of Water Quality Trends Toward MCL" Total Risk Scores & Weights

Total Score Range	Weight	Max Risk Score	Risk Level
0	0	0	None
$0 < n \leq 0.5$	2	1	Medium
$0.5 < n \leq 1$	2	2	High

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Increasing Presence of Water Quality Trends Toward MCL: https://tabsoft.co/3JZd3Pv

TREATMENT TECHNIQUE VIOLATIONS

According to U.S. EPA and State Water Board regulations, systems must carry out specified treatment when there is no reliable or feasible method to measure the concentration of a contaminant to determine if there is a public health concern. A treatment technique is an enforceable procedure or level of technological performance, which public water systems must follow to ensure control of a contaminant. The treatment technique rules also list the best available technology for meeting the standard, and the compliance technologies available for small systems. Some examples of treatment technique rules are the following:

- Surface Water Treatment Rule[204] (disinfection and filtration)
- Ground Water Rule[205]
- Lead and Copper Rule (optimized corrosion control)
- Acrylamide and Epichlorohydrin Rules (purity of treatment chemicals)

This type of violation (which is distinct from more commonly known MCL or monitoring and reporting violations) is incurred when a water system does not follow required treatment techniques to reduce the risk from contaminants, *e.g.,* exceeding the maximum allowable turbidity or flow rate of a surface water treatment plant.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Treatment Technique violations: SDWIS

Table A15: Treatment Technique Violation Codes

Violation Type Code	SDWIS Violation Name
07	Treatment Techniques (Other)
12	Qualified Operator Failure
33	Failure to Submit Treatment Requirement Report
37	Treatment Tech. No Prior State Approval
40	Treatment Technique (FBRR)
41	Failure to Maintain Microbial Treatment
42	Failure to Provide Treatment
43	Single Turbidity Exceed (Enhanced SWTR)
44	Monthly Turbidity Exceed (Enhanced SWTR)
45	Failure to Address a Deficiency
46	Treatment Technique Precursor Removal

[204] Title 22 CCR, Division. 4, Chapter 17 Surface Water Treatment
https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I501543B0D4BA11DE8879F88E8B0DAAAE&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

[205] Title 22 CCR, Division 4, Chapter 15, Article 3.5 Groundwater Rule
https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I729BEDE0B98711E0B493EB23F8012672&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

Violation Type Code	SDWIS Violation Name
47	Treatment Technique Uncovered Reservoir
48	Failure to Address Contamination
57	OCCT/SOWT Recommendation
58	OCCT/SOWT Install Demonstration
59	WQP Level Non-Compliance
63	MPL Level Non-Compliance
64	Lead Service Line Replacement (LSLR)
65	Public Education
2A	Level 1 Assessment Treatment Technique
2B	Level 2 Assessment Treatment Technique
2C	Corrective Actions/Expedited Actions TT
2D	Start-up Procedures Treatment Technique
T1	State Violation-Treatment Technique

Risk Indicator Calculation Methodology:

- Determine which systems have had one or more Treatment Technique violations within the last three years using the Treatment Technique violation codes listed in Table A15 and excluding the following scenarios below:
    - Systems with an open Enforcement Action are excluded from the Risk Assessment because they meet the criteria for the expanded Failing list.
    - Systems that have had three or more Treatment Technique violations within the last three years are also excluded from the Risk Assessment because they meet the criteria for the Failing list.

Threshold Determination
The State Water Board has developed a threshold for Treatment Technique violations (in lieu of an MCL) for the expanded Failing list criteria that relies on: (1) whether the water system has an open enforcement action for the violation or (2) the system has had three or more Treatment Technique violations in the past three years.[206] For the Risk Assessment, a modified version of the expanded Failing list criteria threshold was developed for the "Treatment Technique Violations" risk indicator. Systems that have one or more treatment technique violations within the last three years are considered more at risk than systems that have not.

Correlational and regression analysis between the risk indicator as defined with this threshold and water system failure to deliver safe drinking water as defined in the Failing list shows a statistically significant relationship.

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk

[206] Systems that meet the HR2W list criteria will not be included in the Risk Assessment.

Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more “critical” as they relate to a water system’s ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board’s engineers, the maximum weight of 1 is applied to the “Treatment Technique Violations” risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 1. Table A16 summarizes the thresholds, scores, and weight for this risk indicator.

Table A16: “Treatment Technique Violations” Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** Treatment Technique violation over the last three years.	0	N/A	0	None
1	**1 or more** Treatment Technique violations over the last three years.	1	1	1	High

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Treatment Technique Violations: https://tabsoft.co/3mPTjEL

PAST PRESENCE ON THE FAILING LIST

This indicator reflects past presence on the Failing list within the last three years. The expanded Failing list includes systems that have an open enforcement action for a primary MCL violation, secondary MCL violation, *E. coli* violation, monitoring and reporting violation (15 months or more), a current treatment technique violation, and/or systems that have had three of more treatment technique violations in the past 3 years. A system is removed from the Failing list after they have come back into compliance and a return to compliance enforcement action has been issued and/or the system has less than three treatment technique violations or monitoring and reporting violations over the last three years.

Calculation Methodology
Required Risk Indicator Data Point & Source:

- Violation Data: SDWIS
- Enforcement Action Data: SDWIS

Refer to State Water Board's Failing water system website[207] for detailed criteria and methodology for the Failing list.

> ***Important Note***: In 2021, the State Water Board corrected the historical Failing list using a new and improved query methodology to analyze historical violation and enforcement data to better identify Failing list occurrence start and end dates.

Threshold Determination

Peer-reviewed studies suggest that past presence of drinking water quality violations is associated with subsequent present-day violations.[208] Therefore, tiered thresholds were developed, where more occurrences on the Failing list is associated with greater risk.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's District Engineers, the maximum weight of 2 is applied to the "Past Presence on the Failing List" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table A17 summarizes the thresholds, scores, and weight for this risk indicator.

Table A17: "Past Presence on the Failing List" Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Score	Risk Level
0	**0** Failing list occurrence over the last three years.	0	N/A	0	None
1	**1** Failing list occurrence over the last three years.	0.5	2	1	Medium
2	**2** or more Failing list occurrences over the last three years.	1	2	2	High

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

[207] Human Right to Water | California State Water Resources Control Board
https://www.waterboards.ca.gov/water_issues/programs/hr2w/

[208] See McDonald, Yolanda J., and Nicole E. Jones. "Drinking water violations and environmental justice in the United States, 2011–2015." *American journal of public health* 108.10 (2018): 1401-1407.

Past Presence on the Failing List: https://tabsoft.co/42mMjPX

PERCENTAGE OF SOURCES EXCEEDING AN MCL

This indicator reflects the percentage of sources that exceeded any primary drinking water MCL within the past three years. Water systems with impaired water sources make it more difficult to provide safe drinking water, particularly in the event of a drought or treatment failure.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Dataset - SDWIS:
  - Data Point(s) - Water System Inventory
    - Active Source Water Facilities including[209]
      - Consecutive Connection (CC)
      - Infiltration Gallery (IG)
      - IN – Intake (IN)
      - Roof Catchment (RC)
      - Spring (SP)
      - WL Well (WL)
    - Active Water System Sampling Points for above Source Water Facilities[210]
  - Data point(s) - Water System Water Quality[211]
    - Water Quality Monitoring Sample Results and Dates for above sample points.
    - Water Quality Contaminants for Sample Results for above sample points.
      - List of eligible contaminants described below in Table A18.
- Dataset – Water Quality Inquiry Replacement (WQIR):
  - Data point(s) for Contaminant Information:
    - Regulatory threshold information including:
      - Maximum Contaminant Levels (MCL)
      - Detection Limits for purposes of Reporting (DLR)
      - Notification Levels (NL)

Table A18: Analytes in WQIR Chemical Table

Analyte Name	SDWIS Analyte Code
1,1,1-Trichloroethane	2981
1,1,2,2-Tetrachloroethane	2988

[209] Source Water Facility Types not included in the list is excluded from analysis (ex. hauled water).
[210] Source Water Facility types with no active sample points is excluded from analyses.
[211] Water Quality Data that is flagged as False Positive (FP), Invalid (IV), or Questionable (QQ) is excluded from the analysis. Water Quality Data that was also outside of the desired time frame is excluded.

Analyte Name	SDWIS Analyte Code
Trichlorofluoromethane	2218
1,1,2-Trichloroethane	2985
1,1-Dichloroethane	2978
1,1-Dichloroethylene	2977
1,2,3-Trichloropropane	2414
1,2,4-Trichlorobenzene	2378
O-Dichlorobenzene	2968
1,2-Dichloroethane	2980
1,2-Dichloropropane	2983
1,3-Dichloropropene	2413
P-Dichlorobenzene	2969
2,3,7,8-TCDD	2063
2,4,5-TP	2110
2,4-D	2105
Lasso (Alachlor)	2051
Aluminum	1002
Antimony, Total	1074
Arsenic	1005
Asbestos	1094
Atrazine	2050
Barium	1010
Bentazon	2625
Benzene	2990
Benzo(a)pyrene	2306
Beryllium, Total	1075
Bromate	1011
Cadmium	1015
Carbofuran	2046
Carbon Tetrachloride	2982
Chlordane	2959
Chlorite	1009
Chromium (Total)	1020
CIS-1,2-Dichloroethylene	2380
CIS-1,3-Dichloropropene	2228
Combined Radium (-226 & -228)	4010
Cyanide	1024
Dalapon	2031
Di(2-Ethylhexyl) Phthalate	2039
1,2-Dibromo-3-Chloropropane	2931
Dichloromethane	2964
Dinoseb	2041
Diquat	2032
Endothall	2033

Analyte Name	SDWIS Analyte Code
Endrin	2005
Ethylbenzene	2992
Ethylene Dibromide	2946
Fluoride	1025
Glyphosate	2034
Gross Alpha Particle Activity	4109
Gross Beta Particle Activity	4100
Total Haloacetic Acids (HAA5)	2456
Heptachlor	2065
Heptachlor Epoxide	2067
Hexachlororobenzene	2274
Hexachlorocyclopentadiene	2042
BHC-Gamma	2010
Manganese, Dissolved	1034
Mercury	1035
Methoxychlor	2015
Methyl-tert-butyl ether	2251
Molinate	2626
Chlorobenzene	2989
Nickel	1036
Nitrate	1040
Nitrate-Nitrite	1038
Nitrite	1041
Oxamyl	2036
Pentachlorophenol	2326
Perchlorate	1039
Picloram	2040
Total Polychlorinated Biphenyls (PCB)	2383
Selenium	1045
Simazine	2037
38-Strontium-90	4174
Styrene	2996
Tetrachloroethylene	2987
Thallium, Total	1085
Thiobencarb (Bolero)	2727
Toluene	2991
Trihalomethanes (TTHM)	2950
Toxaphene	2020
Trans-1,2-Dichloroethylene	2979
Trans-1,3-Dicholropropene	2224
Tricholoroethylene	2984

Analyte Name	SDWIS Analyte Code
Trichlorofluoromethane	2218
Tritium	4102
Combined Uranium	4006
Vinyl Chloride	2976
Xylenes, Total	2955

Risk Indicator Calculation Methodology:

- Determine the number of impaired sources. Impaired sources with any sample results above their respective MCL for the chemicals listed above.
- Determine the total number of sources. Based on the source types listed above.
- Calculate the percentage of impaired sources by dividing the total number of sources with MCL exceedances by the total number of sources and then multiply that number by 100.

Threshold Determination

The percentage of sources exceeding an MCL, as defined here or a similar measure, has not been assessed in other previous studies as related to water system failure or employed by other regulatory agencies or stakeholders as a threshold of concern. However, this lack of precedent likely reflects that this indicator threshold is hard to obtain and analyze without significant expertise and experience with source water quality data and data processing capability. The State Water Board's workgroup of district engineers determined the draft tiered thresholds for this risk indicator based on their experience working with water systems throughout the state. These draft thresholds were shared with the public in 2020 and ultimately incorporated into the Risk Assessment.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Percentage of Sources Exceeding MCL" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table A19 summarizes the thresholds, scores, and weight for this risk indicator.

Table A19: "Percentage of Sources Exceeding MCL" Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**Less than 50%** of sources exceed an MCL.	0	N/A	0	None

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
1	**50% or greater** of sources exceed an MCL.	1	3	3	High

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Percentage of Sources Exceeding MCL: https://tabsoft.co/3LwX0JO

CONSTITUENTS OF EMERGING CONCERN

Constituents of emerging concern (CEC) are unregulated chemicals[212] that are potentially imposing adverse health effects and are likely present (i.e., known or anticipated to occur) at public water systems or in groundwater sources. The purpose of this risk indicator is to identify water systems that could potentially come out of compliance if certain constituents of emerging concern (CECs) were to be regulated by a primary and/or secondary maximum contaminant level (MCL).

While there are many CECs, the State Water Board is proposing a limited list of CECs for inclusion in the calculation of this risk indicator based on the likelihood that a MCL will be developed. This risk indicator would only assess water systems that have water quality sample results associated with hexavalent chromium (CrVI), 1,4-dioxane, and/or the 18 chemicals pertaining to per- and polyfluoroalkyl substances (PFAS) chemical group. The selection of these chemicals was influenced by monitoring data coverage and current regulatory priorities. More chemicals may be included in future iterations of the Risk Assessment.

> **Hexavalent chromium (CrVI)**: Chromium is a heavy metal that occurs throughout the environment. The trivalent form is a required nutrient and has very low toxicity. The hexavalent form, also commonly known as Chromium-6, is more toxic and has been known to cause cancer when inhaled. In recent scientific studies in laboratory animals, CrVI has also been linked to cancer when ingested. Much of the low level CrVI found in drinking water is naturally occurring, reflecting its presence in geological formations throughout the state. However, there are areas of contamination in California from historic industrial use, such as the manufacturing of textile dyes, wood preservation, leather tanning, and anti-corrosion coatings, where CrVI contaminated waste has migrated into the underlying groundwater.
>
> **1,4-Dioxane**: 1,4-dioxane has been used as a solvent and stabilizer for other solvents in a number of industrial and commercial applications. In 1988, 1,4-dioxane was added

[212] Chemicals that are not regulated by the National/State Primary & Secondary Drinking Water Regulations.

to the list of chemicals known to the state to cause cancer[213] and is also considered to pose a cancer risk by U.S. EPA. Over the past decade, 1,4-dioxane has been found in a number of wells, mostly in southern California. The drinking water notification level for 1,4-dioxane is 1 microgram per liter (µg/L). More information can be found at the State Water Board webpage.[214]

Per- and polyfluoroalkyl substances (PFAS): PFAS are a large group of synthetic fluorinated chemicals widely used in industrial processes and consumer products. These synthetic compounds are very persistent in the environment. People are exposed to these compounds through food, food packaging, textiles, electronics, personal hygiene products, consumer products, air, soils, and drinking water. PFAS contamination is typically localized and associated with an industrial facility that manufactured these chemicals or an airfield at which they were used. Studies indicate that continued exposure to low levels of PFAS may result in adverse health effects.

Calculation Methodology

Important Note: *In 2023 the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2022 Needs Assessment. The update adjusted the accounting of how impaired source thresholds are determined. Rather than assessing water quality source risk per* emerging contaminate *individually (*hexavalent chromium, 1,4-Dioxane, or PFAS*), it is now done across all contaminates simultaneously. This improves the identification of water systems that are experiencing trends towards MCL in more than 25% of their sources regardless of which contaminant is exceeding a threshold.*

Required Risk Indicator Data Points & Sources:

- Dataset - SDWIS:
    - Data Point(s) - Water System Inventory
        - Active Source Water Facilities Including[215]
            - Consecutive Connection (CC)
            - Infiltration Gallery (IG)
            - IN – Intake (IN)
            - Roof Catchment (RC)
            - Spring (SP)
            - WL Well (WL)
        - Active Water System Sampling Points for above Source Water Facilities[216]
    - Data Point(s) - Water System Water Quality[217]
        - Water Quality Monitoring Sample Results and Dates for above sample points.

---

[213] Office of Environmental Health Hazard Assessment - Proposition 65 (California Code of Regulations, Title 27, § 27001): https://oehha.ca.gov/proposition-65
[214] California State Water Resources Control Board - 1,4-Dioxane https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.html
[215] Source Water Facility Types not included in the list are excluded from analysis (e.g., hauled water).
[216] Source Water Facility Types with no active sample points are excluded from analyses.
[217] Water Quality Data that is flagged as False Positive (FP), Invalid (IV), or Questionable (QQ) is excluded from the analysis. Water Quality Data that was also outside of the desired time frame is excluded.

        - Water Quality Contaminants for Sample Results for above sample points.
        - List of eligible contaminants described below in Table A20.

- Dataset – Water Quality Inquiry Replacement (WQIR):
    - Data point(s) for Contaminant Information:
        - Regulatory thresholds information including:
            - Maximum Contaminant Levels (MCL)
            - Detection Limits for purposes of Reporting (DLR)
            - Notification Levels (NL)

Analyte names and codes for the contaminants of interest in SDWIS are listed in Table A20.

Table A20: Analyte Names and Codes for CrVI, 1,4-Dioxane & PFAS

Analyte Name	SDWIS Analyte Code
Hexavalent Chromium (CrVI)	1080
1,4-Dioxane	2049
Per- and polyfluoroalkyl substances (PFAS)	
Perfluorobutanesulfonic Acid (PFBS)	2801
Perfluoroheptanoic Acid (PFHpA)	2802
Perfluorohexane Sulfonic Acid (PFHxS)	2803
Perfluorononanoic Acid (PFNA)	2804
Perfluoroctane Sulfonic Acid (PFOS)	2805
Perfluoroctanoic Acid (PFOA)	2806
Perfluorodecanoic Acid (PFDA)	2807
Perfluorododecanoic Acid (PFDoA)	2808
Perfluorohexanoic Acid (PFHxA)	2809
Perfluorotetradecanoic Acid (PFTA)	2810
Perfluorotridecanoic Acid (PFTrDA)	2811
Perfluoroundecanoic Acid (PFUnA)	2812
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	2813
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	2814
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	2815
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	2816
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2817
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	2818

Risk Indicator Calculation Methodology:

Compliance for non-acute contaminants is typically based on calculations of the Running Annual Average (RAA) because they are focused on long-term health risks over time. Therefore, to assess risk for potential failure of a maximum contaminant for non-acute primary and secondary contaminants RAAs are needed.

Below is how the Running Annual Average is calculated for the purposes for the Needs Assessment:

Prepare CrVI Data:

- Step 1 - Calculate RAA for each sample point:
  - Define a search period that eligible sample results dates must occur in.
  - Calculate all quarters between the start and end date of the search period.
    - Example:
      - Start Date: 1/1/2012 - End Date: 1/1/2021
      - Number of Years = 9 Years = 36 Quarters
        - 2012-Quarter 1, 2012-Quarter 2, 2012-Quarter 3, 2012-Quarter 4, 2013-Quarter 1, etc.
  - For every sample result date, determine what quarter it falls in and assign that sample result value. If there are multiple sample result dates per quarter, then those sample results will be averaged so that only one sample result value per quarter exists.

- Step 2 - RAA Periods are calculated by averaging four consecutive quarters of data.
  - Example:(2012-Quarter 2 + 2012-Quarter 3 + 2012-Quarter 4 + 2013-Quarter 1)/4
  - Some water systems do not always have four quarters of data in every RAA period. Therefore, the number of quarters used in each RAA calculation is based on the data available during that RAA period. For example, if only three quarters of data are available during a particular RAA period, then only those three quarters will be used to calculate the RAA.
    - Example: (2012-1 + MISSING + 2012-3 + 2012-4)/3

Prepare PFAS Data:

- Define a search period that eligible sample results dates must occur in.
- Count the number of positive sample results (greater than detection limit) per PFAS chemical results during the search period for each water system.
- Count sample results above the Notification Level (NL) for chemicals that have an NL during the search period for each water system.
- Count the total number of positive sample results (greater than detection limit) over the search period for each water.

Table A21: PFAS Notification Levels

Analyte Name	Notification Level (NL)
PFOS	0.0065 µg/L
PFOA	0.0051 µg/L
PFBS	0.5 µg/L
PFHxS	3 ng/L

Prepare 1,4-Dioxane Data:

- Step 1 - Calculate RAA for each sample point:
    - Define a search period that eligible sample results dates must occur in.
    - Calculate all quarters between the start and end date of the search period.
        - Example:
            - Start Date: 1/1/2012 - End Date: 1/1/2021
            - Number of Years = 9 Years = 36 Quarters
                - 2012-Quarter 1, 2012-Quarter 2, 2012-Quarter 3, 2012-Quarter 4, 2013-Quarter 1, etc.
    - For every sample result date, determine what quarter it falls in and assign that sample result value. If there are multiple sample result dates per quarter, then those sample results will be averaged so that only one sample result value per quarter exists.

- Step 2 - RAA Periods are calculated by averaging four consecutive quarters of data.
    - Example:(2012-Quarter 2 + 2012-Quarter 3 + 2012-Quarter 4 + 2013-Quarter 1)/4
    - Some water systems do not always have four quarters of data in every RAA period. Therefore, the number of quarters used in each RAA calculation is based on the data available during that RAA period. For example, if only three quarters of data are available during a particular RAA period, then only those three quarters will be used to calculate the RAA.
        - Example: (2012-1 + MISSING + 2012-3 + 2012-4)/3

Threshold Determination

CrVI: On July 1, 2014, an MCL of 10 µg/L CrVI was approved by the Office of Administrative Law. On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the MCL on the basis that the state had not properly considered the economic feasibility of complying with the MCL. The State Water Board is currently working on the development of a new MCL for CrVI.[218] Until a new MCL is developed, the State Water Board is recommending using the previous MCL as part of a tiered

[218] Hexavalent Chromium Drinking Water MCL
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html

threshold for this risk indicator. Water systems with one or more RAA over a 5-year period are at or above 80% of the former MCL are considered medium risk and any RAA over a 5-year at or above the former MCL is considered high risk.

PFAS: Due to the ubiquitous nature of these contaminants, two positive samples are suggested as part of the tiered threshold to ensure that the water quality sample was not compromised. Since the risk related to each of the PFAS chemicals is not fully known, water quality is noted as a medium risk for any two positive samples of any PFAS contaminant. Three of the 18 PFAS chemicals have a notification level.[219] When two or more samples for these three PFAS chemicals are at or above their notification levels, they are considered to be at high risk for this indicator threshold.

1,4-Dioxane: The State Water Board is recommending a binary threshold for 1,4-Dioxane. The drinking water notification level for 1,4-dioxane is 1 microgram per liter (µg/L).[220] In January 2019, the State Water Board requested for the Office of Environmental Health Hazard Assessment (OEHHA) to establish a public health goal for 1,4-dioxane.[221] When one or more samples are detected at or above their notification level, they are considered to be at high risk for this indicator threshold.

Contaminants Thresholds

The first step in this analysis involves analyzing historical water quality sample results (up to 5 years) for each system's active sources. Currently, water quality data for this indicator is analyzed across three emerging contaminates: hexavalent chromium, PFAS, and 1,4-Dioxane. The analysis utilizes the thresholds described in Table A22 to determine if any of the system's active sources have elevated levels of these CECs. For each source, the analysis identifies the highest threshold met across all contaminants and if the source is meeting more than one threshold (example: a source that has met the threshold 1 for hexavalent chromium and threshold 3 for PFAS; the analysis will assign Threshold 3 to the source).

Table A22: "Constituents of Emerging Concern" Thresholds & Scores per Source

Threshold Number	Threshold
1	**CrVI: All** calculated RAA(s), over 5-year period, are below 80% of the former MCL (RAA < 8 µg/L); and **PFAS: Less than 2** samples, over 5-year period, are positive; and

[219] The State Water Board recognizes that more work is being done in this area and that the presence of any PFAS in drinking water may pose a public health risk. Notification levels are nonregulatory, health-based advisory levels established for contaminants in drinking water for which MCL have not been established. A notification level may be considered a candidate for the establishment of an MCL in the future, but it has not completed going through the regulatory standard setting process.

[220] 1,4-Dioxane
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.html

[221] Public Health Goals (PHGs) - OEHHA
https://oehha.ca.gov/water/public-health-goals-phgs

Threshold Number	Threshold
	1,4-Dioxane: 0 calculated RAA(s), over 5-year period, are at or above the notification level.
2	**CrVI: 1 or more** calculated RAA(s) over 5-year period are at or above 80% of the former MCL and below the former MCL (8 µg/L ≤ RAA < 10 µg/L); or **PFAS: 2 or more** samples over 5-year period are positive; this criterion applies to all 18 chemicals.
3	**CrVI: 1 or more** calculated RAA(s), over 5-year period, are at or above the former MCL (10 µg/L ≤ RAA); or **PFAS: 2 or more** samples, over 5-year period, are at or above the notification level; this criterion only applies to 3 chemicals that have notification level; or **1,4-Dioxane: 1 or more** calculated RAA(s), over 5-year period, are at or above the notification level (1 µg/L ≤ RAA).

Percentage of Source Impairment Threshold
The analysis then determines if 25% or more of the water system's sources are meeting the contaminant thresholds across all contaminants. If less than 25% of the system's sources are meeting the contaminant thresholds, the water system will receive no (zero) risk points for this risk indicator. If 25% or more of the system's sources are exceeding any of the contaminant thresholds across all contaminates, then it will receive risk points. Table A23 is an example of how this determination is made.

Table A23: Example of 25% or Greater Source Impairment Threshold Determination for a System with 5 Sources

Source	Threshold Exceedance	Contaminant	Impaired (Y/N)	Impaired Count
Well 01	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0
Well 02	5-year RAA > 80% MCL	CrVI	Yes	1
Well 03	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0
Well 04	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0
Well 05	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0

In this example, less than 25% of the system's active sources are meeting the thresholds summarized in Table A22. Therefore, this system would receive no (zero) risk points for this indicator. This occurs because of the following calculation:

- # of impaired Source Water Facilities = 1

- Total Number of Source Water Facilities = 5
- (1/5) * 100 = 20%

To meet the source impairment threshold, a water system must have 25% or more of its sources considered to be impaired.

Risk Indicator Scoring & Weighting

If a water system has more than 25% of its active sources meeting the thresholds in Table A22, the system's risk score for this indicator will be the average of the max risk score per source (Table A23). If a source is meeting more than one contaminant threshold (example: a source has met threshold 2 for hexavalent chromium and threshold 3 for 1,4-Dioxane; the analysis will assign Threshold 3 risk score to the source). See example in Table A24.

Table A23: "Constituents of Emerging Concern" Scores Per Source

Threshold Number	Contaminant Threshold	Score per Source
1	**CrVI: All** calculated RAA(s), over 5-year period, are below 80% of the former MCL (RAA < 8 µg/L); and **PFAS: Less than 2** samples, over 5-year period, are positive; and **1,4-Dioxane: 0** calculated RAA(s), over 5-year period, are at or above the notification level.	0
2	**CrVI:** 1 or more calculated RAA(s) over 5-year period are at or above 80% of the former MCL and below the former MCL (8 µg/L ≤ RAA < 10 µg/L); or **PFAS:** 2 or more samples over 5-year period are positive; this criterion applies to all 18 chemicals.	0.5
3	**CrVI:** 1 or more calculated RAA(s), over 5-year period, are at or above the former MCL (10 µg/L ≤ RAA); or **PFAS:** 2 or more samples, over 5-year period, are at or above the notification level; this criterion only applies to 4 chemicals that have notification level; or **1,4-**Dioxane: 1 or more calculated RAA(s), over 5-year period, are at or above the notification level (1 µg/L ≤ RAA).	1

Table A24: Example of Selection of Max Score Per Source

	Well 01	Well 02	Well 03	Well 04	Well 05
CrVI Risk Score	0.5	1	0.5	0	0
PFAS Risk Score	0.5	0.5	1	0.5	0
1,4-Dioxane Risk Score	1	1	1	0	0
Max Score per Source:	**1**	**1**	**1**	**0.5**	**0**

After selecting the maximum score for each source, an average of all the non-zero risk scores is calculated. See example below:

$$\frac{1 + 1 + 1 + 0.5}{4} = \mathbf{0.875}$$

Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Constituents of Emerging Concern" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 3. Table A25 summarizes the total risk score ranges and weights applied to this risk indicator.

Table A25: "Constituents of Emerging Concern" Total Risk Scores & Weights

Total Score Range	Weight	Max Risk Score	Risk Level
0	0	0	None
0 < n ≤ 0.5	3	1.5	Medium
0.5 < n ≤ 1	3	3	High

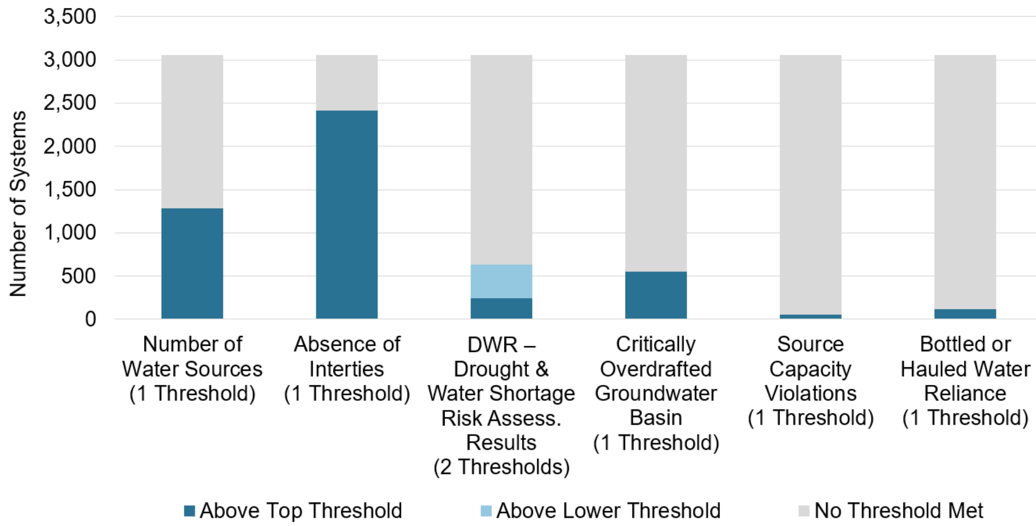
Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Constituents of Emerging Concern: https://tabsoft.co/3LwVSpy

ACCESSIBILITY RISK INDICATORS

This section provides full details on each Accessibility risk indicator used in the Risk Assessment. Accessibility risk indicators measure a system's ability to deliver safe, sufficient, and continuous drinking water to meet public health needs. Figure A12 illustrates the number of water systems that exceeded the risk indicator thresholds within the Accessibility category. The range of potential thresholds for each risk indicator are summarized in the respective risk indicator label and detailed below.

Figure A12: Number of Systems Exceeding Thresholds for Each Accessibility Risk Indicator



NUMBER OF SOURCES

Total number of available water sources including surface water, wells, and imported/purchased water.

Calculation Methodology

Required Risk Indicator Data Point & Source:

- Water Source Facility Type: SDWIS
    a. CC – Consecutive Connection
    b. IG – Infiltration Gallery
    c. IN – Intake
    d. RC – Roof Catchment
    e. SP – Spring
    f. WL – Well
    g. ST – Storage Tank

Risk Indicator Calculation Methodology:

- Prepare data
    a. Combine two SDWIS tables (the Water System table and Water System Facility table).

i. Apply filters to prepared data and get counts of the total number of Water System Facilities for each Water System.
   - Filters applied
      a. Active Water Systems Only
      b. Active Water System Facilities Only
      c. Water System Facilities with a facility type of CC, IG, IN, RC, SP, and WL

Threshold Determination

The threshold developed for the number of sources risk indicator mostly aligns with the thresholds used by DWR's Drought & Water Shortage Risk Assessment. Peer-reviewed studies also suggest that single source reliance is associated with water system failure.[222] Moreover, Section 64554(c) of the California Code of Regulations (CCR) requires new community water systems using only groundwater sources to have a minimum of two approved sources capable to meet the maximum day demand of the water system.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Number of Sources" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table A26 summarizes the thresholds, scores, and weight for this risk indicator.

Table A26: "Number of Sources" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
X	**0** source (automatically At-Risk).	N/A	N/A	N/A	Very High
0	**2 or more** sources.	0	N/A	0	None
1	**1** source.	1	3	3	High

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Number of Sources: https://tabsoft.co/3nfJn7E

[222] See Mullin, M. (2020). The effects of drinking water service fragmentation on drought-related water security. *Science, 368*(6488), 274-277.

ABSENCE OF INTERTIES

An intertie or interconnection is a connection between one or more water systems where systems can either supply or receive water from each other. The presence of interties is assumed to reduce the risk of a water outage by allowing water systems to switch sources and even governance structure support, if needed.

Calculation Methodology

Important Note: *In 2022 the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2021 Needs Assessment to account for the inclusion of medium-size water systems that have many sources.*

Required Risk Indicator Data Points & Source:

In SDWIS, this type of data is stored as a water system facility with a consecutive connection designation. Additionally, these types of water system facilities can be described in terms of their availability of use. According to internal SDWIS procedure documents, only the receiving facility should have a consecutive connection (CC) water system facility represented in SDWIS. The procedure document does not indicate whether emergency or seasonal CCs should be entered. The purpose of this metric is to capture the number of interties per water system entered in SDWIS, regardless of availability.

- Water source facility type and availability: SDWIS
    a. CC – Consecutive Connection
        i. Availability:
            - I – Interim
            - E – Emergency
            - O – Other
            - P – Permanent
            - S – Seasonal

Risk Indicator Calculation Methodology:

- Prepare data:
    - Combine two SDWIS tables (the Water System table and Water System Facility table).
- Apply filters to prepared data and get counts for each Water Source Type per Water System.
    - Filters applied:
        - Active Water Systems Only
        - Active Water System Facilities Only
        - Water System Facilities with a facility type of CC

Threshold Determination

Interties can be a critical lifeline for water systems, especially when faced with an emergency.

A water system is at a higher risk of failure if their sources were to become contaminated, dry, collapse, or be taken out of service (i.e., for maintenance etc.), without an intertie to a nearby system for back-up supply. The State Water Board has adopted a binary threshold for "Absence of Intertie." Water systems without an intertie are assigned risk scores and those with an intertie receive 0 risk score. The developed threshold aligns with DWR's Drought & Water Shortage Vulnerability Assessment.[223] All water systems with 10,000 service connections or greater, that have more than one source are excluded and risk scores of 0 are assigned. If a water system with 10,000 service connections or more has only one source and it is not an intertie, they receive a risk score of 1. Water systems with 10 or more water sources are also excluded and risk scores of 0 are assigned.

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 1 is applied to the "Absence of Interties" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 1. Table A27 summarizes the thresholds, scores, and weight for this risk indicator.

Table A27: "Absence of Interties" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**Systems with 10,000 service connections or greater; or with 10 or more water sources**	0	N/A	0	None
0	**1 or more** interties.	0	N/A	0	None
1	**0** interties.	1	1	1	High

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

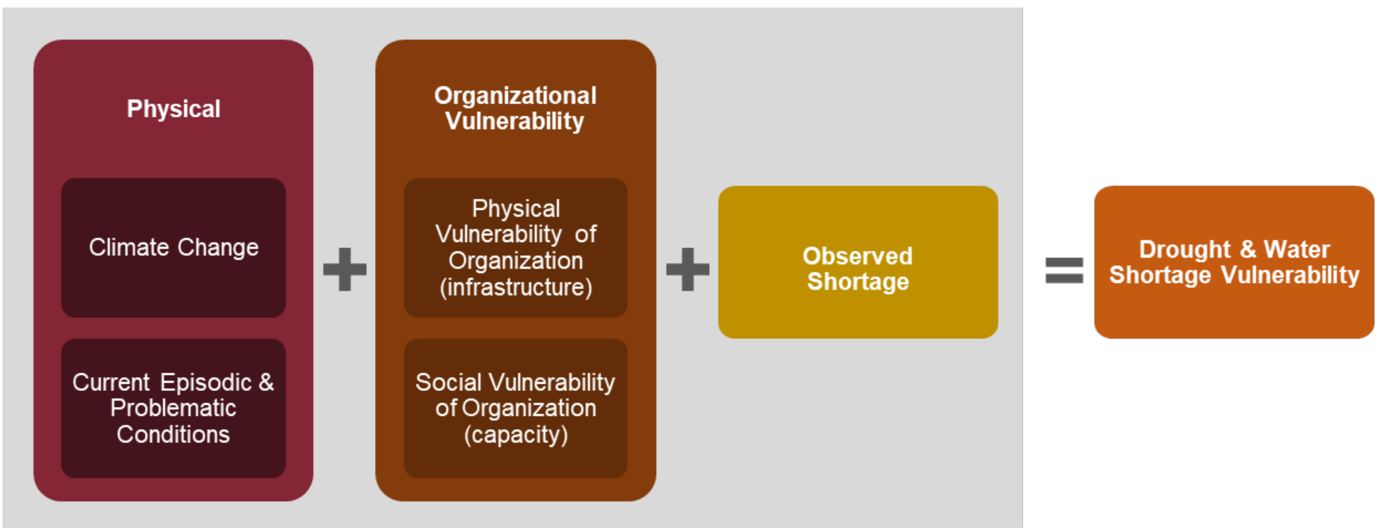
Absence of Interties: https://tabsoft.co/3Jqurv4

[223] Water Shortage Vulnerability Assessment of Small Water Systems: Update 2023
https://data.cnra.ca.gov/dataset/water-shortage-vulnerability-technical-methods

DWR – DROUGHT & WATER SHORTAGE RISK ASSESSMENT RESULTS

This indicator utilizes DWR's Drought and Water Shortage Risk Scoring Tool[224] results which identify small water suppliers and rural communities (defined as *Self-Supplied Communities* in the tool) that are potentially at-risk of drought and vulnerable to water shortages. For this tool, small water suppliers are considered publicly regulated systems with fewer than 3,000 service connections and using fewer than 3,000 acre-feet per year. Self-supplied communities are water systems with fewer than 15 service connections, which covers state small water systems (5 to 14 connections), local small water systems (2 to 4 connections), and domestic wells. This tool creates an aggregated, comparative risk score for each water system and community derived from a set of indicators that capture different dimensions of exposure to hazards, physical/social vulnerability, and observed supply shortages (29 indicators for small water suppliers and 29 indicators for self-supplied communities).

Figure A13: Grouping of Indicators (Components) Used to Estimate Water Shortage Vulnerability for Small Water Systems



Calculation Methodology

To improve the Water Shortage Vulnerability Assessment, in 2023 DWR updated the 2021 methodology to adjust the scoring to reflect existing knowledge, to align with policy-related research, and to accommodate newer data available. The full overview of changes is available online and summarized below in Table A28.[225]

[224] Drought and Water Shortage Risk Explorer Tool for Small Water Suppliers and Rural Communities
https://dwr.maps.arcgis.com/apps/MapSeries/index.html?appid=3353b370f7844f468ca16b8316fa3c7b
[225] Water Shortage Vulnerability Technical Methods
https://data.cnra.ca.gov/dataset/water-shortage-vulnerability-technical-methods

Table A28: Major Revisions Made to DWR's Water Shortage Vulnerability Assessment for Small Water Systems

Revision Description	2021 Version	2023 Version
Terminology Change: "Risk" changed to "vulnerability"	Referred to aggregated score as "drought risk"	Refers to aggregated scores as "water shortage vulnerability"
Vulnerability Scoring Weightings	Applied weightings by group of indicators	Apply weightings by indicator and by basin location
Vulnerability Scoring Null Values	Null values were accommodated in the aggregation equation by adjusting the denominator for their omission	By default, entries with missing data are treated as having a value of "0" (no vulnerability) for those indicators
Indicator added to account for estimate drought impacted systems	Not available	Incorporated
Indicator asses to account for multiple dry years	Not available	Calculated from PRISM data

For the *small water suppliers*, the 29 risk indicators utilized by DWR are weighted and aggregated similar to the approach used in the Risk Assessment. For scoring, the risk indicator variables are rescaled 0-1 numbers (1 is high and 0 is low) and combined with the other variables in their respective component. Individual indicator weights are applied to each variable and then the weighted component scores are aggregated.

Each group of variables is then combined with the other group scores for each component (Exposure, Vulnerability, and Observed Water Shortage). The final score for a water system is calculated with different weights depending on the system's source water composition ("Groundwater Only," "Surface Water Only," or "Both Groundwater and Surface Water"). Finally, the raw risk score from each component is summed and rescaled from 0 to 100 using a min-max scaling technique to calculate the final risk score.

The draft drought scoring for the small water suppliers and self-supplied communities can be found in the Drought and Water Shortage Risk Explorer Tool for Small Water Suppliers and Rural Communities.[226] Additional information is available on the DWR Water Shortage Vulnerability Scoring and Tool website.[227]

Threshold Determination

The State Water Board developed thresholds for this indicator (the top 10% and 25% of

[226] Drought and Water Shortage Risk Explorer Tool for Small Water Suppliers and Rural Communities https://dwr.maps.arcgis.com/apps/MapSeries/index.html?appid=3353b370f7844f468ca16b8316fa3c7b

[227] Water Shortage Vulnerability Scoring and Tool | DWR https://water.ca.gov/Programs/Water-Use-And-Efficiency/SB-552/SB-552-Tool

systems analyzed) based on the illustrative cutoff provided by DWR in its presentation of Drought & Water Shortage Vulnerability Assessment Results.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more “critical” as they relate to a water system’s ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board’s engineers, the maximum weight of 2 is applied to the “DWR Assessment Results” risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table A28 summarizes the thresholds, scores, and weight for this risk indicator.

Table A29: “DWR Assessment Results” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems not assessed by DWR**	0	N/A	0	None
0	**Below top 25%** of systems most at risk of drought and water shortage.	0	N/A	0	None
1	**Top 25%** of systems most at risk of drought and water shortage.	0.25	2	0.5	Low
2	**Top 10%** of systems most at risk of drought and water shortage.	1	2	2	High

* *DWR’s assessment includes community water systems with fewer than 3,000 service connections and less than 3,000 acre-ft in annual production. Water systems that do not have service area boundaries recorded in the California Drinking Water Systems Area Boundaries*[228] *were excluded.*

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

DWR Assessment Results: https://tabsoft.co/42kMN9g

[228] California Drinking Water System Area Boundaries https://gis.data.ca.gov/datasets/fbba842bf134497c9d611ad506ec48cc_0/explore?location=36.912748%2C-119.242341%2C6.67

CRITICALLY OVERDRAFTED GROUNDWATER BASIN

Water systems reliant on groundwater wells in basins considered to be in Critical Overdraft per DWR's Bulletin 118 may be at greater risk of meeting demand, especially during drought conditions. A basin is subject to critical conditions of overdraft when continuation of current water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts.

Calculation Methodology

Important Note: *In the 2022 Needs Assessment the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2021 Needs Assessment to account for the inclusion of medium-size water systems that have many sources.*

Required Risk Indicator Data Points & Sources:

- SGMA Basin Prioritization Statewide Summary Table:[229] DWR
- Water System Boundaries: State Water Board Service Area Boundary Layer (SABL)[230]
- Water Type Code: SDWIS
    - GW – Groundwater
    - SW – Surface Water
    - Both – GW and SW

Risk Indicator Methodology:

- Water System Boundaries – SABL – Water systems boundaries are overlaid with the critically overdrafted groundwater basins.
- Water System Source Water Identification – SDWIS – Water systems screened for source water (groundwater/surface water) to determine reliance on groundwater.

Threshold Determination

In the 2021 Risk Assessment, the State Water Board used 75% threshold of water system service area intersecting with a critically overdrafted groundwater basin. However, due to the data availability of water system well locations and source types, the thresholds for this risk indicator was updated in the 2022 Needs Assessment to reflect the percentage of a water system's groundwater sources within a critically overdrafted groundwater basin. A binary threshold is still utilized where a system that has at least 25% or more of its ground water sources within a critically overdrafted basin are assigned a risk score of 1 and those with less than 25% of their total sources within a critically overdrafted basin receiving a risk score of 0.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk

[229] SGMA Basin Prioritization Statewide Summary Table https://data.cnra.ca.gov/dataset/13ebd2d3-4e62-4fee-9342-d7c3ef3e0079/resource/6347629e-340d-4faf-ae7f-159efbfbcdc9/download/final-515-table.xlsx

[230] California Drinking Water System Boundaries https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 2 is applied to the "Critically Overdrafted Groundwater Basin" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table A29 summarizes the thresholds, scores, and weight for this risk indicator.

Table A30: "Critically Overdrafted Groundwater Basin" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**Systems with no groundwater sources**	0	N/A	0	None
0	**Less than 25%** of system's wells are located within a critically overdrafted basin.	0	N/A	0	None
1	**More than 25%** of system's wells are located within a critically overdrafted basin.	1	2	2	High

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Critically Overdrafted Groundwater Basin: https://tabsoft.co/3K0VH4T

SOURCE CAPACITY VIOLATIONS

The purpose of this risk indicator is to identify water systems that have violated source capacity standards as required in California Waterworks Standards[231] within the last three years. This violation criteria includes:

- Failure to maintain adequate source capacity (may include curtailment order and/or service connection moratorium).
- Failure to maintain adequate pressure leading to a water outage.
- Failure to complete a required source capacity planning study.

The State Water Board developed new source capacity violation codes in 2021 to better track and identify water systems failing to meet source capacity standards. Historically, the State Water Board has responded to source capacity violations with targeted citations, curtailment

[231] California Code of Regulations Title 22 Division 4 Chapter 16
https://bit.ly/40oNDjE

orders, and service connection moratoriums. Since the new source capacity violations only reflect recent actions, this risk indicator will also include water systems that have had active connection moratoriums within the last three years.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Service Connection Moratoriums: SDWIS
- Source Capacity Violations: Violation Type Code in SDWIS (Table A30): WW – Waterworks Standards

Table A31: Source Capacity Violation Analyte Codes

Violation Criteria	Analyte Code	Description
Failure to Maintain Adequate Source Capacity	C277 – CCR section 64554 – SRC CAPACITY	If a water system fails to have adequate source capacity pursuant to CCR section 64554[232]
Failure to Maintain Adequate Source Capacity	C278 – CCR section 64554 – SRC CAPACITY (CURTAILMENT)	If a water system fails to have adequate source capacity pursuant to CCR section 64554 AND a curtailment order has been issued (i.e., the failure is directly related to curtailments)
Failure to Maintain Adequate Pressure Leading to a Water Outage[233]	C279 – CCR section 64602 – WATER OUTAGE (DROUGHT)	If a water system fails to maintain the minimum required pressure of 20 pounds per square inch in its distribution system due to inadequate capacity caused by drought
Failure to Maintain Adequate Pressure Leading to a Water Outage[234]	C295 – CCR section 64602 – WATER OUTAGE	If a water system fails to maintain the minimum required pressure of 20 pounds per square inch in its distribution system due to inadequate capacity not caused by drought

[232] At all times, public water system's water source(s) shall have the capacity to meet the system's maximum day demand (MDD).

1. ≥ 1,000 service connections – source capacity, storage capacity, and/or emergency source connections must meet 4 hours of peak hourly demand (PHD)
2. < 1,000 service connections – storage capacity ≥ MDD

[233] This violation criterion is used for repeated, long-term water outages, consistent, repeated low-pressure event. This is not for routine main breaks or short-term outages.

[234] This violation criterion is used for repeated, long-term water outages, consistent, repeated low-pressure event. This is not for routine main breaks or short-term outages.

Violation Criteria	Analyte Code	Description
Failure to Complete A Source Capacity Planning Study	C280 – CCR section 64558 – SRC CAPACITY STUDY FAILURE	If a water system fails to complete a source capacity planning study required as part of an enforcement action

Risk Indicator Calculation Methodology:

- Source capacity violations - Identify systems that have had one or more source capacity violations within the past three years using the violation type code and analyte codes listed in Table A30.
- Service connection moratoriums (SCM) - Identify water systems that have had one or more SCM, based on referrals from State Water Board District staff, within the past three years.
    - Start Date & End Date
        - Historical SCM – have both the Start Date & End Date
        - Current (Active) SCM – have only Start Date

Threshold Determination

The State Water Board has developed a binary threshold for the Source Capacity Violations risk indicator. Any water systems that have not been able to meet source capacity water works standards within the last three years should receive risk points.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is suggested for the "Source Capacity Violations" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 3. Table A31 summarizes the thresholds, score, and weights for Source Capacity Violations.

Table A32: "Source Capacity Violations" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** source capacity violations within the past 3 years; and **0** service connection moratoriums within the past 3 years.	0	N/A	0	None
1	**1 or more** source capacity violations within the past 3 years; or **1 or more** service connection moratoriums within the past 3 years.	1	3	3	High

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Source Capacity Violations: https://tabsoft.co/3YYziJJ

BOTTLED OR HAULED WATER RELIANCE

The purpose of this risk indicator is to identify water systems that have had to supplement or replace their source of supply to meet customer demand with bottled water, and/or hauled water at any point within the past three years. A water system that is unable to meet the demand with their available sources due to water quality issues or source capacity challenges is at-risk of failing to provide water to the customers.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

To identify water systems that have had reliance on bottled water and/or hauled water at any point within the past 3 years, the following data points from multiple sources were used.

- Internal State Water Board Interim Solution Data Spreadsheet: Division of Financial Assistance (DFA)
  - Type of Assistance in “Regional Project” tab
    - Bottled Water
    - Hauled Water
  - Category in “All other funding” tab
    - Bottled Water
    - Hauled Water

- Water Source Facility: SDWIS
  - Water Source Facility Name – any facility names containing “Hauled”; or
  - Water Source Facility Type Code
    - NN – Non-Piped, Non-Purchased
    - NP – Non-Piped, Purchased

- Drought Tracking Spreadsheet: DDW
  - Drought Emergencies: Action
    - Bottled Water
    - Hauling Water

- Hauled Water and Severe Water Shortage Systems Tracking Spreadsheet: DDW
  - Actions In Progress – Hauled Water

- All Hazards Emergency Response Tracking Spreadsheet:[235] Water Boards Emergency Operations Center (WBEOC)/ DDW
    - Water System Actions - Water hauling
    - Comments - any description of the situation containing “Hauling”, “Hauler”, or “Hauled”

- Drought Projects Funding Commitments Data Spreadsheet:[236] Department of Water Resources (DWR)
    - Project Type - any project types containing “Bottled” and/or “Hauled”

Risk Indicator Calculation Methodology:

- Prepare DFA data – Identify water systems that have had one or more enrollments for receiving assistance of bottled water and/or hauled water. Some water systems may have multiple enrollments across different assistance types, funding sources and communities served.
- Prepare SDWIS data
    - Availability Codes reflect the availability for NN and NP facilities.
        - P – Permanent (the source is used all year round)
        - I – Interim (the source is used partly during the year)
        - E - Emergency (the source is used only during emergencies)
        - Other

Table A33: Preparation of SDWIS Hauled Water Data

Availability Code	Rely on hauled water only?	Include in the dataset?
P – Permanent	Yes	Include
P – Permanent	No	Include if system has been under hauled water reliance within the past 3 years.
I – Interim	Yes	Include
I – Interim	No	Include if system has been under hauled water reliance within the past 3 years.
E – Emergency	Yes or No	Include if system is listed in DFA Interim Solution Data*
Other	Yes or No	Include if system is listed in DFA Interim Solution Data*

[235] The DDW Public Water Systems All Hazards Emergency Response Tracking spreadsheet is designed to work on the Water Boards' Emergency Preparedness and Response Toolkit (EmPART)
[236] DWR’s funding commitments up to November 2022 was provided to the State Water Board. Any projects with a county applicant were excluded from the analysis because these projects are typically designed to support private domestic wells, not public water systems. After applying this filter there were four applicants that are public water systems. The State Water Board reached out to those systems to validate the data and determine if they have had bottled/hauled water reliance within the past 3-year.

** If a water system is not listed in DFA Interim Solution Data, data validation was performed by contacting the water system and/or regulating agency.*

- Prepare DDW Drought Tracking Data – Identify water systems that have had bottled/hauled water in response to water outage or shortage due to drought and cross-reference with DFA Interim Solution Data. Validate the data through water systems and/or regulating agencies for any systems that are not listed in DFA's data.

- Prepare DDW Hauled Water and Severe Water Shortage Systems Tracking Data – Identify water systems that have had hauled Water in response to water shortage and cross-reference with DFA Interim Solution Data. Validate the data through water systems and/or regulating agencies for any systems that are not listed in DFA's data.

- Prepare WBEOC/DDW All Hazards Emergency Response Tracking Data – Identify water systems that have had hauled water as an emergency response, or the description of their situation indicates potential use of hauled water. Cross-reference with DFA Interim Solution Data and validate the data through water systems and/or regulating agencies for any systems that are not listed in DFA's data.

- Prepare DWR Drought Projects Funding Commitments Data – Identify water systems that have applied for bottled water and/or hauled water funding and cross-reference with DFA Interim Solution Data. Validate the data through water systems and/or regulating agencies for any systems that are not listed in DFA's data.

- Combine two DFA spreadsheet tabs, SDWIS data, and other data validated through the water systems.

- Remove any duplicates of the water systems to identify unique systems.

Threshold Determination

The State Water Board analyzed how water systems performed for this risk indicator by 2021 SAFER status: Failing, At-Risk, Potentially At-Risk, and Not At-Risk. This analysis concluded that the majority of water systems that have relied on bottled water or hauled water over the last three years are either currently failing or at risk of failing (Table A33). Since there is a strong correlation between this risk indicator and failing, the State Water Board has developed a binary threshold of at least one or more occurrences.

Table A34: 2021 SAFER Status of Systems that Have Bottled Water or Hauled Water Reliance

TOTAL	Failing: HR2W List[237]	At-Risk	Potentially At-Risk	Not At-Risk
88	57 (65%)	18 (20%)	9 (10%)	4 (5%)

Risk Indicator Scoring & Weighting

[237] Failing list retrieved from the State Water Board SAFER Clearinghouse database on January 3, 2022

Due the strong correlation between this risk indicator and failing, the State Water Board has determined that any water systems that has relied on bottled or hauled water over the last three years to supplement their sources should **automatically be classified as At-Risk** if they are not currently on the Failing list.

Table A35: "Bottled or Hauled Water Reliance" Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** occurrences of bottled water or hauled water reliance within the last three years.	0	N/A	0	None
1	**1 or more** occurrences of bottled water or hauled water reliance within the last three years.	Automatically At-Risk	N/A	N/A	Very High

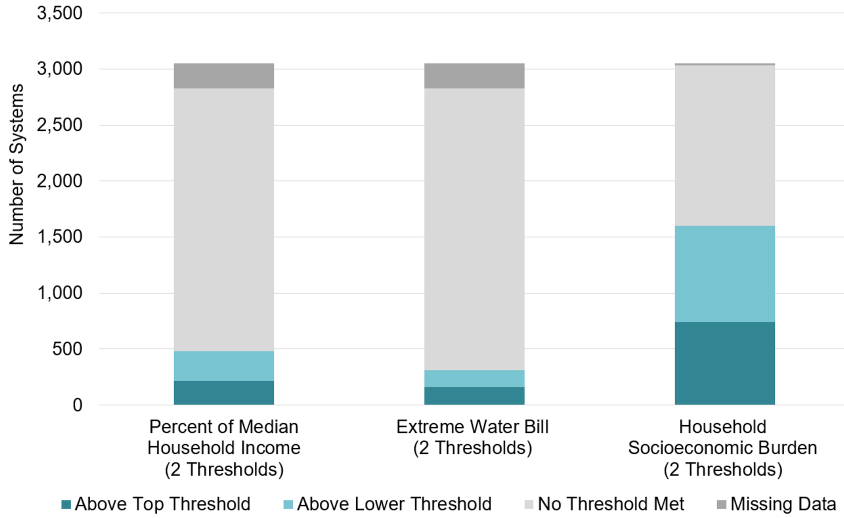
Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Bottled or Hauled Water Reliance: https://tabsoft.co/3TrGKM9

AFFORDABILITY RISK INDICATORS

This section provides full details on each Affordability risk indicator used in the Risk Assessment. Affordability risk indicators measure the capacity of households and the customer base as a whole to supply the revenue necessary for a water system to pay for necessary capital, operations, and maintenance expenses. Figure A13 illustrates the number of water systems that exceeded the risk indicator thresholds within the Affordability category. The range of potential thresholds for each risk indicator are summarized in the respective risk indicator label and detailed below.

Figure A14: Number of Systems Exceeding Thresholds for Each Affordability Risk Indicator



PERCENT OF MEDIAN HOUSEHOLD INCOME (%MHI)

This indicator measures the annual system-wide average residential water bill for six hundred cubic feet (HCF) per month relative to the annual Median Household Income (MHI) within a water system's service area.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Water system service area boundaries: SABL[238]
- Block group-Income in the Past 12 Months: 2021 5-year estimate U.S. Census Bureau's American Community Survey[199]
- Drinking Water Customer Charges: 2021 electronic Annual Report (eAR)
- Other Customer Charges: 2021 eAR

Average monthly drinking water customer charges are collected through the eAR. Historically this data has not been required for reporting leading to poor data coverage and accuracy issues. Extensive changes have been made to the 2020 electronic Annual Report making reporting customer charges mandatory with checks in place to improve the data quality. Due to the improvements made to the 2021 eAR this year we had a substantial decrease in customer charges reporting errors.

[238] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[199] 2021 American Community Survey 5 Year estimate Median Household Income
https://data.census.gov/table?t=Income+(Households,+Families,+Individuals)&y=2021&d=ACS+5-Year+Estimates+Detailed+Tables&tid=ACSDT5Y2021.B19013

Risk Indicator Calculation Methodology:
Median household income (MHI) is determined for a water system using American Community Survey data for household income. Community water system boundaries typically do not align with census boundaries where per capita income data is regularly collected. To assign an average median household income to a community water system, spatially weighted income data is aggregated by census block group within the water system service area.

The methodology for this indicator was based on the Division of Financial Assistance (DFA) MHI methodology. While the MHI calculation methodology for the Affordability Assessment generally aligns with DFA's MHI determination methodologies, there are slight differences. The differences are found in the calculation of MHI's for cities and census designated places, and in the application of the Margin of Error (MOE).

The DFA methodology dictates that when it is determined that a system boundary exactly matches city boundaries or closely matches a census designated place boundary, the MHI for the entire city or census designated place should be directly applied to the system rather than using areally-interpolated block group data. This likely leads to more accurate MHI estimation in these cases. However, this method was not used in the Needs Assessment given that a case-by-case determination of matching of cities and census designated places to system boundaries was not feasible for the entire state. The MHI for each water system is a population weighted MHI, using census block group area and population data. A population factor is generated based on the area of each census block group that falls within the water system boundary. The water system MHI is then calculated using population adjusted MHIs for each census block group that falls within the water system boundary using the formula below:

Equation A1: MHI Calculation

$$\sum \frac{(Block\ Group\ MHI) \times (Adjusted\ Block\ Group\ Population)}{(Total\ Adjusted\ Block\ Groups\ Population)}$$

MOE for MHI American Community Survey data is also included in the MHI calculation. A population adjusted MOE is found using the same methodology described for MHI. The lower range of the MOE will be applied to a community's estimated MHI up to a maximum MOE value of $7,500 for communities with more than 500 people and $15,000 for communities with 500 or fewer people. The MOE will be subtracted from the estimated MHI.

The DFA methodology uses a lower bound MHI by subtracting the block group MOE from the block group MHI, with limits based on community size prior to applying the population factor to MHI and MOE. The methodology applied in the Needs Assessment set margin of error limits and then applied them to population adjusted MHI figures, resulting in slightly different community water system MHI calculations than the DFA methodology.

As a result of these slight variations and the changing nature of household income, all funding related financial assessments must be completed by the DFA as their assessments are water system specific as opposed to the aggregated analysis done for the purposes of the Needs Assessment.

Average monthly drinking water customer charges are calculated using:

- Drinking water service costs are estimated at six HCF per month. This level of consumption is in line with statewide conservation goals of 55 gallons per capita per day, in an average 3-person household.
- When data becomes available, additional approximated customer charges (not collected through a customer's bill) will be added to this figure to calculate Total Drinking Water Customer Charges.

Equation A2: %MHI Calculation

$$\%\text{MHI} = \frac{\textit{Average Monthly Drinking Water Charges}\ (6\ \textit{HCF})}{\text{Water System Service Area MHI}}$$

Threshold Determination

%MHI is commonly used by state and federal regulatory agencies and by water industry stakeholders for assessing community-wide water charges affordability for decades. %MHI is utilized by the State Water Board (at 1.5% threshold) and the U.S. EPA (at 2.5% threshold) for assessing affordability. The State Water Board and DWR use %MHI to determine Disadvantaged Community (DAC) status, among other income-related metrics. DAC status is often used to inform funding eligibilities for different financial programs offered by the State and other agencies. OEHHA's Human Right to Water (HR2W) Tool also utilizes[239] the thresholds determined by the State Water Board for this indicator.[240] Other states, including North Carolina,[241] presently or have recently used 1.5% of MHI spent on water and sewer costs as a threshold for water system funding decisions.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the

[239] There has been criticism of this metric by academics, water system associations, and the broader water sector mostly around its accuracy in measuring household affordability for those truly in need and the setting of arbitrary %MHI thresholds, limitations which the U.S. EPA has recently acknowledged.

[240] Arkansas Natural Resources Commission (2020). Safe Drinking Water Fund Intended Use Plan SFY 2019 https://www.agriculture.arkansas.gov/wp-content/uploads/2020/05/0_-_2019_DWSRF_IUP_-_AMENDED_January_2019_01082019_1156hrs.pdf

[241] North Carolina Department of Environmental Quality. Joint Legislative Economic Development and Global Engagement Oversight Committee (March 17, 2016) https://www.ncleg.gov/DocumentSites/Committees/JLEDGEOC/2015-2016/Meeting%20Documents/3%20-%20March%2017,%202016/2%20%20DEQ_Kim%20Colson%20Water%20Infrastructure%20JLOC%20EDGE%2020160317.pdf

maximum weight of 3 is applied to the “Percent Median Household Income” risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table A35 summarizes the thresholds, scores, and weight for this risk indicator.

Table A36: “Percent Median Household Income” Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**System does not charge customers directly for water**	0	N/A	0	None
0	**Less than 1.5%**	0	N/A	0	None
1	**1.5% or greater**	0.75	3	2.25	Medium
2	**2.5% or greater**	1	3	3	High
*Missing**	**No data available due to non-reporting**	“--“	N/A	“--“	Unknown

**A water system may be missing necessary data for this indicator due to eAR non-reporting or because the data the system submitted is outside a reasonable range. For this indicator, monthly customer charges less than $5 or greater than $500 for 6 HCF were excluded. Refer to the section above on how the Risk Assessment accommodates for missing data in the calculation of a system’s aggregated risk score.*

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Percent Median Household Income: https://tabsoft.co/3Zc6sWt

EXTREME WATER BILL

This indicator measures drinking water customer charges that meet or exceed 150% of statewide average drinking water customer charges at the six hundred cubic feet (HCF) level of consumption.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Drinking Water Customer Charges: 2021 eAR
- Other Customer Charges: 2021 eAR

Risk Indicator Calculation Methodology:

Extreme Water Bill for a water system is determined using Average Monthly six HCF Drinking Water Customer Charges and Other Customer Charges divided by the State’s Monthly

Average Drinking Water Charges. The Risk Assessment is applied to water systems with less than 3,300 service connections; however, this methodology utilizes the statewide average customer charges to calculate extreme water bill, which includes systems with greater than 3,300 service connections. Due to data quality concerns, water systems that reported less than $5 or greater than $500 in monthly customer charges for six HCF were excluded from the analysis and the calculated statewide average.

Threshold Determination

The State Water Board's AB 401 report[242] recommended statewide low-income rate assistance program elements utilize the two recommended tiered indicator thresholds of 150% and 200% of the state average drinking water bill for six HCF.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 1 is applied to the "Extreme Water Bill" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 1. Table A36 summarizes the thresholds, scores, and weight for this risk indicator.

Table A37: "Extreme Water Bill" Thresholds, Weights & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**System does not charge customers directly for water**	0	N/A	0	None
0	**Below 150%** of the statewide average.	0	N/A	0	None
1	**Greater than 150%** of the statewide average.	0.5	1	0.5	Medium
2	**Greater than 200%** of the statewide average.	1	1	1	High
*Missing**	**No data available due to non-reporting**	"--"	N/A	"--"	Unknown

** A water system may be missing necessary data for this indicator due to non-reporting or because the data the system submitted is outside a reasonable range. For this indicator, monthly customer charges less than $5 or greater than $500 for 6 HCF were excluded. Refer to the section above on how the Risk Assessment accommodates for missing data in the calculation of a system's aggregated risk score.*

[242] AB 401 Final Report: https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Extreme Water Bill: https://tabsoft.co/3mXWURk

HOUSEHOLD SOCIOECONOMIC BURDEN

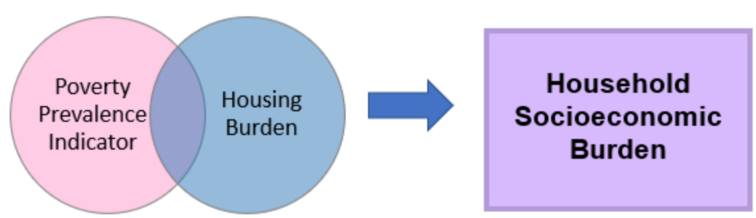
The purpose of this risk indicator is to identify water systems that serve communities that have both high levels of poverty and high housing costs for low-income households. These communities may be struggling to pay their current water bill and may have a difficult time shouldering future customer charge increases when their limited disposable income is constrained by high housing costs. This indicator is a composite indicator of two data points: Poverty Prevalence and Housing Burden.

- **Poverty Prevalence Indicator (PPI)** measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level.

- **Housing Burden Indicator** measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).

The combination of these two variables creates a more comprehensive picture of socioeconomic vulnerability while accounting for the varying levels of income and cost burdens throughout California.

Figure A15: PPI and Housing Burden Components Combined to Create Household Socioeconomic Burden Indicator



Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Poverty Prevalence Indicator: From the 2017-2021 American Community Survey (ACS),[243] a dataset containing the number of individuals above 200 percent of the federal poverty level (FPL) was downloaded by block groups for the state of California (25,607 in the state).
- Housing Burden Indicator data: From the 2015-2019 U.S. Department of Housing and Urban Development (HUD) Comprehensive Housing Affordability Strategy (CHAS),[244] a dataset containing cost burdens for households by HUD-adjusted median family income (HAMFI) category was downloaded by census tract for the state of California (8,057 in the state).

Risk Indicator Calculation Methodology:

Prepare Poverty Prevalence Indicator data: The number of individuals below 200 percent of the FPL was calculated by subtracting the reported estimate of individuals in poverty (2x FPL) by the total estimate. The number of individuals below 200% of the poverty level was divided by the total population for whom poverty status was determined.

Prepare Housing Burden Indicator data: CHAS— a special analysis of census data specific to housing— is only available at the census tract and other larger geographies. For each census tract, the data were analyzed to estimate the number of households with household incomes less than 80% of the county median and renter or homeowner costs that exceed 50% of household income. The percentage of the total households in each tract that are both low-income and housing-burdened was then calculated. Each census tract was associated with the block groups within it to maintain consistency with the PPI indicator, which is at the block group level.

PPI and Housing Burden at the block group level were area-weighted to CWS boundaries. These boundaries were downloaded from the System Area Boundary Layer (SABL).[245] Using the Intersect Tool in ArcPro, the area was determined for each portion of a water system boundary that intersected with a block group boundary. A weighted average, using area as the weight, was calculated for both PPI and Housing Burden for all water systems in the assessment.

The ACS and CHAS estimates come from a sample of the population and suppression criteria were assessed to flag estimates considered statistically unreliable.

[243] American Community Survey
https://data.census.gov/cedsci/
[244] HUD CHAS Data
https://www.huduser.gov/portal/datasets/cp.html
[245] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

Suppression Criteria for PPI

- Unlike the U.S. Census, ACS estimates come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.
- The SE was calculated for each block group using the formula for approximating the SE of proportions provided by the ACS.[246] When this approximation could not be used, the formula[247] for approximating the SE of ratios was used instead.
- The RSE is calculated by dividing a tract's SE by its estimate of the percentage of the population living below twice the federal poverty level and taking the absolute value of the result.
- Block group estimates that met either of the following criteria were considered reliable and included in the analysis:
    - RSE less than 50 (meaning the SE was less than half of the estimate); or
    - SE was less than the mean SE of all California block group estimates for poverty.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block groups with scores were included in the indicator.

Suppression Criteria for Housing Burden

- Like ACS estimates, CHAS data come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.
- The SE was calculated for each census tract using the formula for approximating the SE of proportions provided by the ACS.[248] When this approximation could not be used, the formula[249] for approximating the SE of ratios was used instead.
- The RSE was calculated by dividing a tract's SE by its estimate of the percentage of housing-burdened low-income households and taking the absolute value of the result.
- Census tract estimates that met either of the following criteria were considered reliable and included in the analysis:
    - RSE less than 50 (meaning the SE was less than half of the estimate); or
    - SE was less than the mean SE of all California census tract estimates for housing burdened low-income households.
- All census tract level Housing Burden scores were associated with the block groups within them.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block group with scores were included in the indicator.

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[246] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[247] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[248] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[249] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf

Component Thresholds

Poverty Prevalence (PPI): For PPI, various thresholds have been explored by other organizations and researchers including the use of 30%[250] or multiple categories such as less than 10%, 10% to 30%, 30% to 50%, and greater than 50%.[251] However, the most widely used PPI thresholds by organizations and researchers was first suggested by Raucher et al. in a report prepared for the American Water Works Association[252,253,254,255]. In the Raucher et al. report entitled 'Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector,' the following PPI thresholds are recommended: low risk less than 20%, medium risk between 20% to 35%, and high risk greater than 35%. The State Water Board and OEHHA evaluated these thresholds as it relates to California data and propose to use these thresholds for the PPI component of the Household Socioeconomic Burden indicator.

Table A38: PPI Component Threshold Scores

Component	Threshold	Score	Risk Level
PPI	**Threshold N/A =** Missing or not reliable PPI data	**N/A**	**Unknown**
	Threshold 0 = < 20%	**0**	**Low**
	Threshold 1 = 20% - 35%	**0.25**	**Medium**
	Threshold 2 = > 35%	**1**	**High**

Housing Burden: Based on a nationwide literature review, consistent thresholds for Housing Burden have not yet been established by other organizations or identified in the scientific literature. A report by the University of North Carolina on housing conditions in North Carolina identified census tracts in the top 20% of state as severely burdened.[256] Additionally, a recently published Master's Thesis about housing challenges in California identified census tracts in the

[250] Lauren Patterson (2021): Water Affordability
https://internetofwater.org/wp-content/uploads/2021/12/Blog010_WaterAffordability_Patterson.pdf
[251] David Mitchell, and Elizabeth Stryjewski (2020): Technical Memorandum on Water/Sewer Service Affordability Analysis
https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248
[252] Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector (2019)
https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813
[253] American Water Works Association: Measuring Water Affordability and the Financial Capability of Utilities
https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260
[254] Alliance for Water Efficiency (2020): An Assessment of Water Affordability and Conservation Potential in Detroit, Michigan
https://www.allianceforwaterefficiency.org/sites/www.allianceforwaterefficiency.org/files/highlight_documents/AWE_Water_Affordability_Detroit_Final_2020_0.pdf
[255] Duke University, Nicholas Institute: Exploring the Affordability of Water Services within and across Utilities
https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf
[256] William Rohe, Todd Owen, and Sarah Kerns; The University of North Carolina at Chapel Hill, Center for Urban and Regional Studies (2017): Extreme Housing Conditions in North Carolina
https://curs.unc.edu/wp-content/uploads/sites/400/2017/02/Extreme-Housing-Conditions-in-North-Carolina.pdf

top quartile of the state as being the "most impacted."[257] Lastly, one study showed that 16% of children in Los Angeles County live in severe housing-cost burdened households, but this was based on survey data.[258] Given the lack of peer-reviewed literature, consistency, and relevance among these limited examples, the census tracts were grouped into three categories (or tertiles), based on the overall distribution of 2019 housing burden data in the state to identify three levels of risk. The three categories were rounded to the nearest whole number.

Based on this statewide data, low risk corresponds with fewer than 14% of total households experiencing housing burden. Medium risk is between 14% and 21%, and high risk is greater than 21%, respectively. Using a matrix scoring approach, first each bin was assigned a score of 0 for "low vulnerability," 0.25 for "medium vulnerability" and 1 for "high vulnerability." The State Water Board will analyze water system arrearage, shut-off, and other affordability indicators over time to determine if the recommended Housing Burden thresholds should be adjusted in the future.

Table A39: Housing Burden Component Threshold Scores

Component	Threshold	Score	Risk Level
Housing Burden	**Threshold N/A =** Missing or not reliable Housing Burden data	**N/A**	**Unknown**
	Threshold 0 = <14%	**0**	**Low**
	Threshold 1 = 14% - 21%	**0.25**	**Medium**
	Threshold 2 = >21%	**1**	**High**

Threshold Determination

The two components of Household Socioeconomic Burden were combined using a matrix approach and following the same methodology as the Risk Assessment for state small water systems and domestic wells.[259] The normalized scores for PPI and Housing Burden components were added together and divided by the number of components (two). Below is the calculation used for each water system's Household Socioeconomic Burden score and Figure A15 shows how much each calculated score represents a degree of PPI and Housing Burden within the matrix.

[257] Lucresia Graham(2021): A Cartographic Exploration of Census Data on Select Housing Challenges Among California Residents
https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf
[258] Tabashir Z. Nobari, Shannon E. Whaley, Evelyn Blumenberg, Michael L. Prelip, and May C. Wanga (2018): Severe Housing-Cost Burden and Obesity Among Preschools-aged Low-Income Children in Lost Angeles County.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/
[259] 2022 Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Equation A3: Calculating Household Socioeconomic Burden Score

$$\textit{Household Socioeconomic Burden} = \frac{\textit{PPI Score} + \textit{Housing Burden Score}}{2}$$

Figure A16: Household Socioeconomic Burden Scores Within the Matrix Represents Varying Degrees of PPI and Housing Burden

Poverty (PPI)	**High Risk** ≥ 35%	Score = 1	*Missing*	0.5	0.625	1
	Med Risk 20% - 35%	Score = 0.25	*Missing*	0.125	0.25	0.625
	None < 20%	Score = 0	*Missing*	0	0.125	0.5
	Unknown	Score = *Missing*	*Missing*	*Missing*	*Missing*	*Missing*
			Score = *Missing*	Score = 0	Score = 0.25	Score = 1
			Unknown	**None** < 14%	**Med Risk** 14% - 21%	**High Risk** ≥ 21%
			Housing Burden			

These combined scores are converted into threshold risk designations, as shown in Table A39.

Table A40: Thresholds for Household Socioeconomic Burden

Threshold Number	Threshold	Risk Level
0	Combined score of **0 – 0.125**	**None**
1	Combined score of **0.25 – 0.5**	**Medium**
2	Combined score of **0.625 – 1.0**	**High**

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from an internal State Water Board, Division of Drinking Water workgroup, the weight of 2 is applied to the "Household Socioeconomic Burden" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table A40 summarizes the thresholds, score, and weights for Household Socioeconomic Burden.

Table A41: “Household Socioeconomic Burden” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**Combined score of 0 – 0.125**	0	N/A	0	None
1	**Combined score of 0.25 – 0.5**	0.5	2	1	Medium
2	**Combined score of 0.625 – 1.0**	1	2	2	High
*Missing**	**Missing PPI and/or Housing Burden data**	“--“	N/A	“--“	Unknown

*** American Community Survey and/or CHAS data may be missing for the water system’s service area.**

Explore Water System Risk Indicator Performance

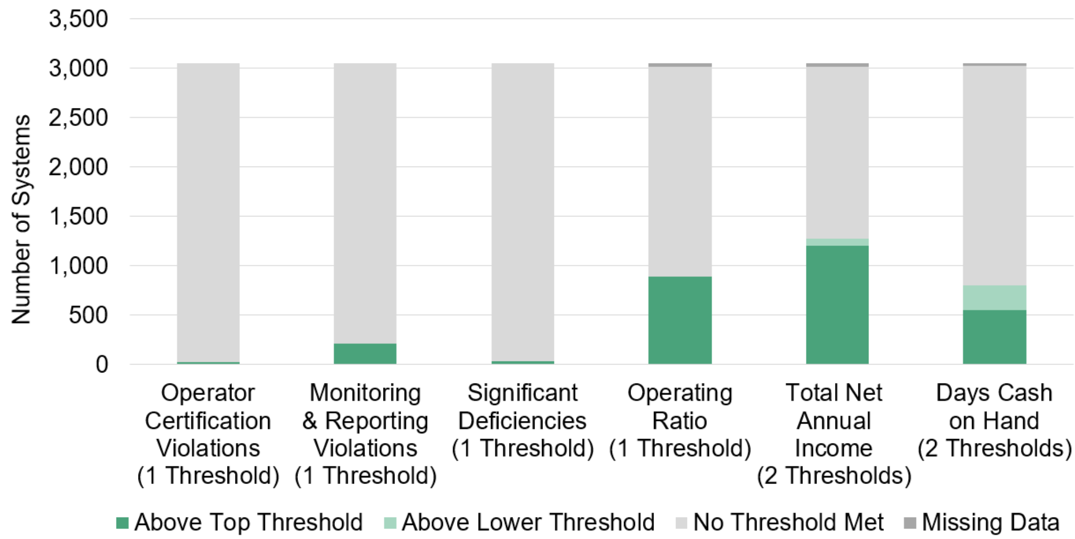
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Household Socioeconomic Burden: https://tabsoft.co/3n1SskA

TMF CAPACITY RISK INDICATORS

This section provides full details on each TMF Capacity risk indicator used in the Risk Assessment. TMF Capacity risk indicators measure a system’s technical, managerial and financial (TMF) capacity to plan for, achieve, and maintain long term compliance with drinking water standards, thereby ensuring the quality and adequacy of the water supply. Figure A16 illustrates the number of water systems that exceeded the risk indicator thresholds within the TMF Capacity category. The range of potential thresholds for each risk indicator are summarized in the respective risk indicator label and detailed below.

Figure A17: Number of Systems Exceeding Thresholds for Each TMF Capacity Risk Indicator



OPERATOR CERTIFICATION VIOLATIONS

Operator certification violations are issued to water systems that do not have an appropriately certified water treatment or distribution operator. A lack of adequately trained water treatment or distribution operators may be indicative of larger technical and managerial risks borne by the system. Research shows that poorly trained staff and managers working on water systems can result in avoidable waterborne disease outbreaks. Chief and shift operators must possess valid operator certificates pursuant to CCR sections 63765 and 63770.

Calculation Methodology

Required Risk Indicator Data Point & Source:

- Operator Certification Violations: SDWIS Violation Codes:
  - 12
  - OP

Risk Indicator Methodology:

- Determine which systems have had an Operator Certification Violation within the last three years.
  - Systems that are currently out of compliance or have returned to compliance are included.

Threshold Determination

Peer-reviewed studies suggest that the absence of a certified operator is associated with water system failure.[260] Moreover, operator certification violations are an established threshold for additional regulatory oversight by states, such as Illinois.[261] Therefore, a threshold of 1 or more operator certification violations over the last three years was determined.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Operator Certification Violations" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table A41 summarizes the thresholds, scores, and weight for this risk indicator.

Table A42: "Operator Certification Violations" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** Operator Certification violations over the last three years.	0	N/A	0	None
1	**1 or more** Operator Certification violations over the last three years.	1	3	3	High

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Operator Certification Violations: https://tabsoft.co/3lnVpeS

MONITORING & REPORTING VIOLATIONS

A water system is required to monitor and verify that the levels of contaminants present in the drinking water supplies do not exceed an MCL. A monitoring violation occurs when a water system fails to have its water tested as required within the legally prescribed time frame. A water system that fails to perform required monitoring for a group of chemicals (such as synthetic organic chemicals or volatile organic chemicals) would incur a monitoring violation for each of the individual chemicals within the group.

[260] See Oxenford, J. L., & Barrett, J. M. (2016). Understanding small water system violations and deficiencies. *Journal-American Water Works Association, 108*(3), 31-37.

[261] Office of the Illinois State Fire Marshal (2012.). "Notification of New NOV for Operator Certification Violations." Retrieved from: https://www2.illinois.gov/sites/sfm/SFMDocuments/Documents/NoticeRedTagOperators.pdf

A reporting violation occurs when a water system fails to report test results in a timely manner to the regulatory agency or fails to provide certification that mandated information was provided to the public, such as through the issuance of a public notice or the annual Consumer Confidence Report. A system may also receive a reporting violation for not submitting an Annual Report the State Water Board.

This indicator measures the total number of monitoring and reporting violations during a 3-year compliance cycle.

Calculation Methodology

Required Risk Indicator Data Point & Source:

- Monitoring and Reporting violations: SDWIS

Table A43: Monitoring & Reporting Violation Codes

Violation Type Code	SDWIS Violation Name
03	Monitoring, Regular
04	Monitoring, check, repeat, or confirmation
19	Failure to Conduct Assessment Monitoring
23	Monitoring, Routine Major (TCR)
24	Monitoring, Routine Minor (TCR)
25	Monitoring, Repeat Major (TCR)
26	Monitoring, Repeat Minor (TCR)
27	Monitoring, Routine (DBP)
29	Failure Submit Filter Profile/CPE Report
30	Monitoring, Routine (IDSE)
31	Monitoring of Treatment (SWTR-Unfilt/GWR)
32	Monitoring, Source Water (LT2)
34	Monitoring, Source Water (GWR)
35	Failure Submit IDSE/Subpart V Plan Rpt
36	Monitoring of Treatment (SWTR-Filter)
38	Monitoring, Turbidity (Enhanced SWTR)
39	Monitoring and Reporting (FBRR)
51	Initial Tap Sampling for Pb and CU
52	Follow-Up or Routine LCR Tap M/R
53	Water Quality Parameter M/R
56	Initial, Follow-Up, or Routine SOWT M/R
66	Lead Consumer Notification
3A	Routine Monitoring
3B	Additional Routine Monitoring

Violation Type Code	SDWIS Violation Name
3C	TC Samples (triggered by turbidity exceedance) Monitoring
3D	Monitoring, Lab Cert/Method Errors
4A	Assessment Forms Reporting
4B	Sample Result/Fail to Monitor Reporting
4C	Start-up Procedures Certification Form Reporting
4D	EC+ Notification Reporting
4E	*E. coli* MCL Reporting
4F	L1/L2 TT Vio or Correct Action Reporting
S1	State Violation-M&R (Major)
AR	Failure to Complete an Annual Report
RR	State Reporting Requirement Violation

Risk Indicator Methodology:

- Determine which systems have had Monitoring & Reporting violations over the last 3-year compliance period using the Monitoring & Reporting violation codes in Table A42. This excludes MCL and TT related Monitoring & Reporting violations described below that are included in the expanded Failing list criteria:
  - Systems that have three or more Monitoring and Reporting violations within the last three years where at least one violation has an Enforcement Action that has been open for 15 months or greater.

Threshold Determination
The State Water Board has developed a threshold for Monitoring & Reporting violations (related to an MCL or Treatment Technique) as criteria for the Failing list. The Failing list criteria threshold is three or more MCL/TT-related Monitoring & Reporting violations within the last three years where at least one violation has an open enforcement action greater than 15 months. For the Risk Assessment, the State Water Board developed a slightly modified version of the Failing list criteria threshold. Systems that have had two or more Monitoring & Reporting violations over the last three years are more at-risk.[262]

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 2 is applied to the "Monitoring and Reporting Violations" risk indicator.

[262] Systems that meet the Failing list criteria are not included in the Risk Assessment results.

Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table A43 summarizes the thresholds, scores, and weight for this risk indicator.

Table A44: “Monitoring and Reporting Violations” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**1 or less** Monitoring & Reporting violations over the last three years.	0	N/A	0	None
1	**2 or more** Monitoring & Reporting violations over the last three years.	1	2	2	High

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Monitoring and Reporting Violations: https://tabsoft.co/3Jum2XD

SIGNIFICANT DEFICIENCIES

Significant Deficiencies are identified by State Water Board staff or a Local Primacy Agency (LPA) during a Sanitary Survey and other water system inspections. Significant Deficiencies include, but are not limited to, defects in the design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that U.S. EPA determines to be causing or have the potential for causing the introduction of contamination into the water delivered to consumers. Significant Deficiencies can be identified for both groundwater and surface water systems, although the compliance deadlines and requirements differ depending on the applicable rule (Groundwater Rule vs. Long Term 2 Enhanced Surface Water Treatment [LT2] Rule).

State Water Board and LPA staff must enter these deficiencies into SDWIS and must follow-up on the addressing actions taken by the water system to correct the deficiencies. The State Water Board and LPA must provide written notification of a Significant Deficiency within 30 days and require the water system to respond within 30 days with a corrective action plan. Scheduled return to compliance dates should be noted in the plan and approved by the State Water Board or LPA. The water system must implement the appropriate corrective action within 120 days of notification or be in compliance with a State-approved plan for correcting the deficiency at the end of the same 120-day period. The State Water Board and LPAs must then confirm that the deficiency has been addressed within 30 days after the scheduled date of correction.

A water system can incur a violation for failing to respond to or correct a Significant Deficiency (Title 22 CCR § 64430 and 40 CFR § 141.404 (s) for systems subject to the Groundwater

Rule, or Title 22 CCR § 64650(f) and 40 CFR § 141.723 having for systems subject to LT2 Rule). The State Water Board and LPAs may take additional enforcement action as necessary to correct the deficiency.

Calculation Methodology

Required Risk Indicator Data Point & Source:

- Significant Deficiencies: Table in SDWIS with a SIG (Significant) severity designation.

Risk Indicator Calculation Methodology:

- Determine which systems have had a Significant Deficiency **within the last three years** using the visit date in SDWIS (date the State Water Board became aware of the Significant Deficiency).
    - Systems that are currently out of compliance or have returned to compliance are included.

Threshold Determination

As described above, the presence of Significant Deficiencies has already been defined as a threshold for State Water Board action. Moreover, peer-reviewed studies suggest that the presence of Significant Deficiencies is associated with water system failure.[263] Finally, similar measures of significant deficiencies are used as an established threshold of concern by states such as Alaska and Nevada,[264] Connecticut,[265] and New Mexico,[266] among others. Therefore, the threshold of one or more Significant Deficiencies within the last three years has been determined to be an appropriate threshold for risk.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Significant Deficiencies" risk indicator. Therefore, the

[263] See Oxenford, J. L., & Barrett, J. M. (2016). Understanding small water system violations and deficiencies. Journal-American Water Works Association, 108(3), 31-37.

[264] State Strategies to Assist Public Water Systems in Acquiring and Maintaining Technical, Managerial, and Financial Capacity." Retrieved from: https://books.google.com/books?id=MK64VtYz-SsC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

[265] Systems that meet the Failing list criteria will not be included in the Risk Assessment. McPhee, Eric (n.d.). "Significant Deficiencies." Connecticut Department of Public Health: Drinking Water Division. Retrieved from: https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/drinking_water/pdf/CTAWWAGWRTraining2009SigDefpdf.pdf?la=en

[266] New Mexico Environment Department: Drinking Water Bureau (2016). "Surface Water Rule and Interim Enhanced Surface Water Treatment Rule: Significant Deficiency Policy." Retrieved from: https://www.env.nm.gov/wp-content/uploads/sites/5/2018/11/RE_Surface-Water-Rule-Significant-Deficiency_Policy_020816.pdf

minimum risk score is 0 and the maximum risk score is 3. Table A44 summarizes the thresholds, scores, and weight for this risk indicator.

Table A45: "Significant Deficiencies" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** Significant Deficiencies over the last three years.	0	N/A	0	None
1	**1 or more** Significant Deficiencies over the last three years.	1	3	3	High

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Significant Deficiencies: https://tabsoft.co/42x7RJS

OPERATING RATIO

Operating Ratio is a measure of whether a water system's revenues are sufficient to cover the costs of operating the water system. Specifically, "Operating Ratio" is a ratio of the water system's annual revenues compared to annual operating expenses. To be self-supporting, a water system should have at least as much annual revenue as it has operating expenses, e.g., an operating ratio equal to or greater than 1.0. The operating ratio does not include planned investments in future years. Therefore, a water system should collect revenues greater than expenses to accommodate for future investments by building up their financial reserves.

Annual Revenue: includes total annual revenues generated from customer charges and fees (meter fees, base service charges, fixed charges, late fees, penalties, shutoff fees, reconnection fees, etc.); intergovernmental fund transfers (i.e., city or county tax revenues etc.); revenues generated through rent, land lease, or other revenue-generating activities.

Operations and Maintenance Expenses: expenses incurred during the system's normal operation during the reporting year. It may include salaries, benefits for employees, utility bills, system repair and maintenance, supplies (e.g., treatment chemicals), insurance, water purchased for resale, etc.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Electronic Annual Report, Total Annual Revenue – Section 8B1.8

- Total Annual Revenue for the Reporting Year = Residential Water Rate Revenue (B1.1) + Non-Residential Water Rate Revenue (B1.2) + Residential Fees and Charges Revenue (B1.3) + Non-Residential Fees and Charges Revenue (B1.4) + Interfund or Governmental Revenue (B1.5.2) – Interfund or Government Revenue Lost (B1.6) + Other Revenue (B1.7)
- Electronic Annual Report, Total Annual Operating Costs – Section 8B2.1

Risk Indicator Calculation Methodology:

Equation A4: Operating Ratio

$$\frac{Annual\ Revenue\ (\$)}{Annual\ Operating\ Expenses\ (\$)}$$

Threshold Determination

The threshold for this risk indicator was developed through an analysis of industry, academic, and state publications (Table A45). Feedback was also solicited from the Division of Drinking Water's internal stakeholder group. Many have suggested that a viable water system should have a current ratio of at least 1 or greater. An operating ratio of 1 is the lowest level for a self-supporting water system. A ratio below one means expenses are higher than revenues. If a water system has outstanding debt, an operating ratio above one is required. Usually, the higher the debt/equity ratio, the higher the operating ratio required.

Table A46: Industry Recommended Operating Ratio

Organization	Recommended Operating Ratio	Resources
Community Resource Group, Inc.	1	Small System Guide: Understanding Utility Financial Statements[267]
University of North Carolina Environmental Finance Center	≥ 1.2	California Small Water Systems Rates Dashboard[268]
Rural Community Assistance Partnership (RCAP)	≥ 1	Financial Management Guide[269]
University of Georgia	≥ 1.2	Evaluating Water System Financial Performance and Financing Options[270]

[267] See Small System Guide: Understanding Utility Financial Statements (2011). Community Resource Group, Inc. https://www.in.gov/iurc/files/small_system_guide_to_understanding_financial_statments.pdf
[268] See California Small Water Systems Rates Dashboard (2021). Environmental Finance Center at the University of North Carolina, Chapel Hill. https://dashboards.efc.sog.unc.edu/ca
[269] The Basics of Financial Management for Small-community Utilities
http://www.rcapsolutions.org/wp-content/uploads/2013/06/RCAP-Financial-Management-Guide.pdf
[270] See Jeffrey L. Jordan. Issue 3: Evaluating Water System Financial Performance and Financing Options. University of Georgia Department of Agricultural & Applied Economics.
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.195.4657&rep=rep1&type=pdf

Organization	Recommended Operating Ratio	Resources
Brookings	> 1	Appendix B: Investing in water: Comparing utility finances and economic concerns across U.S. cities[271]
Arizona Department of Environmental Quality	≥ 1	Capacity Development Application for a New Public Water System[272]
State of Florida Public Service Commission	≥ 1.25	Docket No. 20 180141-WS - Proposed adoption of Rule 25-30.4575, F.A.C., Operating Ratio Methodology[273]

Based on the industry standards summarized above, the State Water Board adopted a binary threshold for "Operating Ratio" as summarized in Table A46.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the minimum weight of 1 is suggested for the "Operating Ratio" risk indicator due to data quality concerns. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table A46 summarizes the thresholds, score, and weights for Operating Ratio.

Table A47: "Operating Ratio" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems serving military bases; non-transient non-community systems that are K-12 schools**	0	N/A	0	None
0	**1 or greater**	0	N/A	0	None
1	**Less than 1**	1	1	1	High
*Missing***	**No data available due to non-reporting**	"--"	N/A	"--"	Unknown

[271] See Joseph W. Kane (2016). Investing in water: Comparing utility finances and economic concerns across U.S. cities. Brookings. https://www.brookings.edu/research/investing-in-water-comparing-utility-finances-and-economic-concerns-across-u-s-cities/

[272] See Capacity Development Application for a New Public Water System. Arizona Department of Environmental Quality. https://legacy.azdeq.gov/environ/water/dw/download/appe.pdf

[273] See Office of the General Counsel (Harper), Division of Accounting and Finance (Galloway), Division of Economics (Guffey) (2018). Docket No. 20 180141-WS - Proposed adoption of Rule 25-30.4575, F.A.C., Operating Ratio Methodology. State of Florida Public Service Commission http://www.psc.state.fl.us/library/filings/2018/06300-2018/06300-2018.pdf

** Water systems serving military bases were excluded from the Risk Assessment's financial indicators. Non-transient non-community systems that are K-12 schools were excluded because they were not required to report the necessary data for this indicator.*

*** A water system may be missing necessary data for this indicator due to eAR non-reporting.*

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Operating Ratio: https://tabsoft.co/3JCl4Zk

TOTAL ANNUAL INCOME

The purpose of this risk indicator is to identify water systems whose total annual revenue is unable to cover their total annual expenses. A water system should generate enough revenue to cover all incurred expenses (including operational expenses) throughout the year. Total Net Annual Income of a water system should be a positive (+) value. If more money is spent than is brought in, then the water system will have to make adjustments in order to maintain operations. If the expenditures are outpacing revenue too quickly, then the water system may have to cut costs or decrease its level of service. Reserves or available cash savings allow for a financial cushion in times when expenses are greater than revenues.

A water system may generate enough revenue to cover their annual operating and maintenance costs (operating ratio = 1 or greater), but in some cases revenues may fall short in covering a water system's total annual expenses. These additional expenses that fall outside of general operating and maintenance costs typically include debt/loan repayments, new/upgraded infrastructure investments, unforeseen emergency costs, etc.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Electronic Annual Report, Total Annual Revenue - 8B1.8
- Electronic Annual Report, Total Annual Expenses - 8B2.5

Risk Indicator Calculation Methodology:

Equation A5: Total Annual Income

$$\textit{Total Annual Income} = \textit{Total Annual Revenue} - \textit{Total Annual Expenses}$$

Threshold Determination

Water systems may have emergencies they must respond to or a large capital investment that occurs within a year which may lead to negative total annual income. Based on industry standards and recommendations by State Water Board engineers, the tiered thresholds in Table A47 were developed for Total Annual Income.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the minimum weight of 1 is suggested for the "Total Annual Income" risk indicator due to data quality concerns. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table A47 summarizes the thresholds, score, and weights for Total Annual Income.

Table A48: "Total Annual Income" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems serving military bases; non-transient non-community systems that are K-12 schools**	0	N/A	0	None
0	**Greater than $0** total annual income	0	N/A	0	None
1	**$0** total annual income	0.5	1	0.5	Medium
2	**Less than $0** total annual income	1	1	1	High
*Missing***	**No data available due to nonreporting**	"--"	N/A	"--"	Unknown

** Water systems serving military bases were excluded from the Risk Assessment's financial indicators. Non-transient non-community systems that are K-12 schools were excluded because they were not required to report the necessary data for this indicator.*

*** A water system may be missing necessary data for this indicator due to eAR non-reporting.*

Explore Water System Risk Indicator Performance

The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Total Annual Income: https://tabsoft.co/3YXvyI8

DAYS CASH ON HAND

Days cash on hand is the estimated number of days a water system can cover its daily operations and maintenance costs, relying only on their current cash or liquid reserves, before running out of cash. This metric measures a system's financial capacity and is an estimate of how long a system can operate *without* new revenues or additional funding. It is a helpful measure of how long a system can operate if it has a sudden and dramatic reduction in operating income, perhaps from a large customer leaving or an environmental emergency (fire, drought restrictions, etc.).[274]

According to Moody's definition, "Cash is the most important resource utilities have to meet expenses, deal with emergencies, and survive temporary disruptions to cash flow without missing required payments."[275] Days cash on hand is a ratio that is calculated by dividing a water system's unrestricted cash by the system's estimated daily expenses. This calculation approach allows for the comparison of water systems of different sizes by accounting for differences in operational expenses (Table A48). The higher the number, the more days an organization can sustain its operations without any additional cash inflows.

Table A49: Comparison Example Between Large and Small Water System

Large Water System	Small Water System
$\frac{Unrestricted\ Cash: \$\mathbf{5,000,000}}{Average\ Daily\ Operation\ Expenses: \$\mathbf{100,000}}$	$\frac{Unrestricted\ Cash: \$\mathbf{20,000}}{Average\ Daily\ Operation\ Expenses: \$\mathbf{400}}$
Days Cash on Hand = **50 Days**	Days Cash on Hand = **50 Days**

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Electronic Annual Report, Section 8B.10

Risk Indicator Calculation Methodology:

- Risk indicator calculation formula (water system calculated and reported in the electronic Annual Report):
  - Calculate water system's **daily operating expenses**: [Annual Operating Expenses] / [365]
  - Calculate **days cash on hand**: [Total Unrestricted Cash] / [Daily Operating Expenses]

Equation A6: Days Cash on Hand

$$\frac{Unrestricted\ Cash\ (\$)}{Daily\ Operating\ Expenses\ (\$)}$$

Threshold Determination

The thresholds for the "Days Cash on Hand" risk indicator were developed by assessing peer-

[274] See Glenn Barnes (2015). Key Financial Indicators for Water and Wastewater Systems: Days of Cash on Hand. Environmental Finance Center at the University of North Carolina. https://efc.web.unc.edu/2015/06/24/days-cash-on-hand/

[275] See Edward Damutz, Leonard Jones, (2017). Moody's Utility Revenue Bond Rating Methodology. Moody's Investors Services. https://www.moodys.com/research/Moodys-updates-its-methodology-for-rating-US-municipal-utility-revenue--PR_373942

reviewed publications and soliciting feedback from the State Water Board's Division of Drinking Water internal stakeholder group. Table A49 and
Table A50 summarize recommendations made by industry groups and rating agencies for minimum days cash on hand.

Table A50: Industry Recommended Days Cash on Hand

Organization	Recommended Days Cash on Hand	Resources
University of North Carolina Environmental Finance Center	90+ days	California Small Water Systems Rates Dashboard[276]
Utility Financial Solutions, LLC	90+ days; Higher bond rating 200+ days	Managing Your Community's Stimulus Money[277]
International City/County Management Association (ICMA)	30 - 60 days	Capital Budgeting and Finance: A Guide for Local Governments[278]
Government Finance Officers Association	45+ days	Overview of GFOA's Best Practices in Budgeting[279]
American Water Works Association	270 - 365 days	Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector[280]

Table A51: Financial Scoring Criteria for Major Rating Agencies

Moody's[281]					
Aaa	Aa	A	Baa	Ba	B & Below
> 250 days	250 ≥ n > 150 days	250 ≥ n > 150 days	150 ≥ n > 35 days	35 ≥ n > 15 days	≤ 7 days

[276] See California Small Water Systems Rates Dashboard (2021). Environmental Finance Center at the University of North Carolina, Chapel Hill. https://dashboards.efc.sog.unc.edu/ca

[277] See Sally Duffy, P.E., Ian Robinson, Dawn Lund (2021). Managing Your Community's Stimulus Money. MI - AWWA, MWEA, and MRWA. https://cdn.ymaws.com/www.mi-water.org/resource/resmgr/docs/Managing_Stimulus_webinar_07.pdf

[278] See Robert L. (Bob) Bland, Michael R. Overton, (2019). A Budgeting Guide for Local Government, Fourth Edition. ICMA. https://icma.org/publications/budgeting-guide-local-government-fourth-edition

[279] See John Fishbein (2019). Overview of GFOA's Best Practices in Budgeting. Technical Services Center, Government Finance Officers Association (GFOA). https://nesgfoa.org/wp-content/uploads/2019/05/overview_of_gfoas_best_practices_in_budgeting_april_4_2019.pdf

[280] See R. Raucher, E. Rothstein, J. Mastracchio (2017): Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector. The American Water Works Association (AWWA).
https://www.awwa.org/Portals/0/AWWA/Government/DevelopingNewFrameworkForAffordabilityReport.pdf

[281] See Moody's Investors Service, US Municipal Utility Revenue Debt. October 19, 2017.
https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBM_1095545

S&P Global[282]					
1: Extremely Strong	2: Very Strong	3: Strong	4: Adequate	5: Vulnerable	6: Highly Vulnerable
> 150 days	150 ≥ n > 90 days	90 ≥ n > 60 days	60 ≥ n > 30 days	15 ≥ n > 30 days	≤ 15 days

Fitch[283] Liquidity Cushion		
Stronger	Neutral	Weaker
> 120 days	120 ≥ n > 90 days	< 90 days

Based on the industry standards summarized above, the State Water Board developed a tiered threshold for "Days Cash on Hand" as summarized in Table A51.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's Division of Drinking Water internal stakeholder group, the minimum weight of 1 is suggested for the "Days Cash on Hand" risk indicator. Table A51 summarizes the thresholds, score, and weights for Days Cash on Hand.

Table A52: "Days Cash on Hand" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems serving military bases; non-transient non-community systems that are K-12 schools**	0	N/A	0	None
0	**90 days or more** cash on hand.	0	N/A	0	None
1	**Less than 90 days** cash on hand.	0.5	1	0.5	Medium
2	**Less than 30 days** cash on hand.	1	1	1	High
*Missing***	**No data available due to non-reporting**	"--"	N/A	"--"	Unknown

** Water systems serving military bases were excluded from the Risk Assessment's financial indicators. Non-transient non-community systems that are K-12 schools were excluded because they were not required to report the necessary data for this indicator.*

[282] S&P Global, Criteria | Governments | U.S. Public Finance: U.S. Public Finance Waterworks, Sanitary Sewer, And Drainage Utility Systems: Rating Methodology and Assumptions. January 19, 2016; last update October 11, 2021; Accessed December 30, 2021 at https://disclosure.spglobal.com/ratings/en/regulatory/article/-/view/type/HTML/id/2735324

[283] Fitch Ratings, U.S. Water and Sewer Rating Criteria, March 18, 2021. https://www.fitchratings.com/research/us-public-finance/us-water-sewer-rating-criteria-18-03-2021

*** A water system may be missing necessary data for this indicator due to eAR non-reporting.*

Explore Water System Risk Indicator Performance
The distribution of how water systems have performed for this risk indicator is accessible using the hyperlink below. The results can be filtered by water system size (i.e., number of service connections).

Day Cash on Hand: https://tabsoft.co/3JpuOG3

APPENDIX B:
RISK ASSESSMENT METHODOLOGY FOR STATE SMALL WATER SYSTEMS & DOMESTIC WELLS

INTRODUCTION

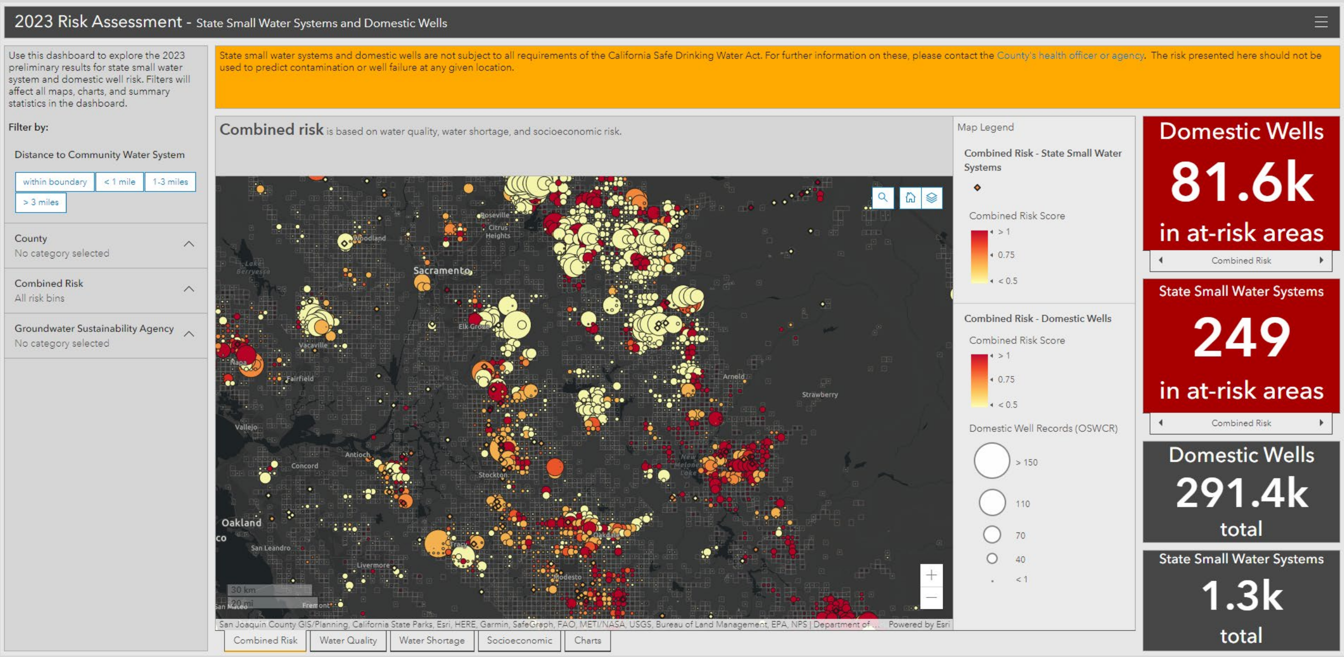
The 2021 Risk Assessment for state small water systems and domestic wells relied solely on modeled groundwater water quality risk to identify At-Risk communities. The 2021 Risk Assessment for *public water systems* used risk indicators beyond water quality, including accessibility, affordability, and technical, managerial, and financial capacity. In response to stakeholder feedback calling for a closer alignment of methodologies used for both Risk Assessments, the State Water Board worked in partnership with the Department of Water Resources (DWR) to develop a new combined Risk Assessment in 2022 with two risk categories; Water Quality which utilizes the State Water Board's Aquifer Risk Map[284] and Water Shortage which is based on analysis from DWR's Water Shortage Vulnerability Tool.[285] For the 2023 Risk Assessment, the State Water Board partnered with Office of Environmental Health Hazard Assessment (OEHHA) to develop a new Socioeconomic Risk category to include the Risk Assessment. This new category of risk aims to capture affordability, technical, and financial risk for communities served by state small water systems and domestic wells.

Figure B1: Risk Assessment Categories

[284] Aquifer Risk Map
https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=17825b2b791d4004b547d316af7ac5cb
[285] https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/County-Drought-Planning

As part of the 2023 Needs Assessment development, the State Water Board developed a new dashboard to display the results of the Risk Assessment for state small water systems and domestic wells. This dashboard is publicly available online and currently updated annually. Learn more about the Dashboard in Appendix F.

Figure B2: Risk Assessment – State Small Water System & Domestic Well Dashboard[286]



INTENDED USE OF THIS ANALYSIS

The risk rankings developed using this methodology are not intended to depict actual groundwater quality or quantity conditions at any given state small water system or domestic well location. The purpose of this risk map analysis is to prioritize areas that may not meet primary drinking water standards, may be at risk of water shortage, and/or may be experiencing affordability, technical, and financial risk to inform additional investigation and sampling efforts. The current lack of available state small water system and domestic well water quality data, water shortage data, and locational data makes it impossible to characterize the risk for individual state small water systems and domestic wells. The analysis described here thus represents a best effort at using the available data to estimate risk for state small water systems and domestic wells in a square mile section.

State small water systems and domestic wells are not subject to all requirements of the California Safe Drinking Water Act and are not regulated by the State Water Board. For further

[286] Risk Assessment Results for State Small Water Systems & Domestic Wells Dashboard https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a

information on local requirements for these systems, please contact the corresponding County's health officer or agency.

STATE SMALL WATER SYSTEMS & DOMESTIC WELLS ASSESSED

The 2023 combined Risk Assessment assessed 1,297 state small water systems and 291,401 known domestic wells. State small water system locations were provided to the State Water Board through county reporting required by SB 200. Domestic well locations were sourced from the Online System for Well Completion Records[287] (managed by DWR) and consist of "domestic" type well records, excluding those drilled prior to 1970 and only including" New" records.

RISK ASSESSMENT METHODOLOGY DEVELOPMENT PROCESS

The Risk Assessment methodology for state small water systems and domestic wells has been developed and refined through multiple stakeholder workshops since 2019:

2019 - 2021

The Aquifer Risk Map was developed from 2019-2020 with stakeholder feedback, including three public webinars held by the State Water Board over the course of 2020 to solicit feedback on the development of the aquifer risk map.[288] The Aquifer Risk Map work was influenced by previous work developing the Domestic Well Water Quality Tool, which provided an estimate of the number and location of domestic wells at-risk for water quality issues. Development of the Domestic Well Water Quality Tool involved a public workshop in 2019.[289]

2021 – 2022

For the 2022 Needs Assessment, a public webinar was held in October 2021 to solicit feedback on updates to the 2022 Aquifer Risk Map.[290] A public workshop was hosted on February 2, 2022 to present recommendations for a new Combined Risk Assessment

[287] The Department of Water Resources Online System for Well Completion Reports (OSWCR) https://data.ca.gov/dataset/well-completion-reports

[288] April 17, 2020 SAFER Webinar: Methods for Determining "At-Risk" Public Water Systems, Domestic Wells, and State Small Water Systems; Webinar Recording (P.M. session): https://www.youtube.com/embed/6W_HtzzPnF4?modestbranding=1&rel=0&autoplay=1
July 22, 2020 SAFER Risk Assessment Webinar; Webinar Recording (P.M. session): https://www.youtube.com/embed/jdYSbU8Gn_A?modestbranding=1&rel=0&autoplay=1; Presentation: https://www.waterboards.ca.gov/drinking_water/programs/safer_drinking_water/docs/safer_at_risk_webinar_2_pm_session_aquifer_risk_map.pdf
October 9, 2020 SAFER Aquifer Risk Map: At-Risk Domestic Wells and State Small Systems Public Webinar: Webinar Recording: https://www.youtube.com/watch?v=onX3kV8IdNw; Presentation: https://www.waterboards.ca.gov/safer/docs/safer_aquifer%20risk%20map_10092020.pdf

[289] January 18, 2019 Domestic Well Needs Assessment Workshop: Recording: https://www.youtube.com/watch?v=TnUBQfwPywk

[290] October 20, 2021 SAFER Aquifer Risk Map Proposed Updates; Summary of updates: https://gispublic.waterboards.ca.gov/portal/home/item.html?id=62b116bb7e824df098b871cbce73ce3b; Webinar Recording: https://www.waterboards.ca.gov/safer/docs/video/risk-aquifer-map-10-20-2021.mp4

for state small water systems and domestic wells using both the Aquifer Risk Map and the Department of Water Resource’s Water Shortage Vulnerability Assessment.[291]

2022 – 2023

For the 2023 Needs Assessment, the State Water Board partnered with OEHHA to develop a new category of the Risk Assessment for state small water systems and domestic wells that analyzed socioeconomic risk. Three workshops on measuring affordability were hosted in 2022 to develop a new proposed indicator, Household Socioeconomic Burden, that would be used to analyze affordability risk for public water systems and communities served by state small water systems and domestic wells. A workshop was hosted in February 2023 to provide an opportunity for stakeholders to recommend how this new affordability indicator and a suite of additional socioeconomic indicators could be combined into a new risk layer to be combine with water quality and water shortage risk to identify at-risk state small water systems and domestic well communities.[292]

RISK ASSESSMENT METHODOLOGY

OVERVIEW OF RISK CATEGORIES

The Risk Assessment for state small water systems and domestic wells utilizes three categories of data. These categories are calculated separately and analyzed together to identify At-Risk state small water systems and domestic wells. These categories align, but do not match, the categories used to identify At-Risk public water systems.

Water Quality Risk
Water quality risk is derived from the State Water Board’s Aquifer Risk Map. The Aquifer Risk Map uses available raw source groundwater quality data to identify areas where state small water systems and domestic wells may be accessing groundwater that does not meet primary drinking water standards (maximum contaminant level or MCL).

Water Shortage Risk
The water shortage physical vulnerability risk scores are from DWR’s “Water Shortage Vulnerability Assessment” scoring. DWR’s assessment utilizes a suite of physical vulnerability

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[291] February 2, 2022 Needs Assessment Workshop: Proposed Changes for the 2022 Needs Assessment: White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/needs-assessment-white-paper-draft.pdf; Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/proposed-changes-drinking-water-needs-assessment.pdf; Webinar Recording: https://www.youtube.com/embed/a-KJxB0YIl8?modestbranding=1&rel=0&autoplay=1

[292] February 3, 2023 Needs Assessment Workshop: Proposed Changes for the 2023 Needs Assessment: White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimneedsassessment.pdf; Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023/2023-Preliminary-Needs-Assessment-Results-Webinar-Presentation.pdf

factors to assess drought and water shortage risk for square mile sections, including exposure to hazard, climate change, physical vulnerability, and record of outages.

Socioeconomic Risk
Socioeconomic risk is derived from two core datasets. The first contains county-level water quality and administrative services and the second is U.S. Census data. These datasets were compiled by the State Water Board and OEHHA to (1) assess a counties' overall administrative, technical, and managerial capacity to assist communities served by state small water systems and domestic wells and (2) assess the ability of communities served by these systems to access and pay for water at a neighborhood level, especially when faced with a well experiencing water quality or water shortage issues.

RISK INDICATORS

The Risk Assessment for state small water systems and domestic wells analyzes a diverse set of risk indicators across the three categories: Water Quality, Water Shortage, and Socioeconomic. Table B1 provides a summary of the risk indicators used in the assessment. Details on how these indicators are calculated and incorporated into the Assessment are detailed in subsequent sections in this Appendix.

Table B1: Risk Indicators for State Small Water Systems & Domestic Wells

Category	2023 Risk Indicators
Water Quality	Modeled Groundwater Water Quality at or Above MCL (Aquifer Risk Map)
Water Shortage	Temperature Shift
	Saline Intrusion Projected
	Projected Wildfire
	Current Year's Precipitation
	Consecutive Dry Years
	Geology - Fractured Rock Area
	Subsidence
	Basin Salt
	Overdrafted Basin
	Chronic Declining Water Levels
	Surrounding Land Use - Presence & Amount of Irrigated Agriculture
	Wildfire as Present Threat to Water Shortage
	Dry Domestic Well Susceptibility in Basins
	Domestic Well Density in Fractured Rock Areas
	Reported Household Outages on Domestic Well

Category	2023 Risk Indicators
Socioeconomic	Water Quality Testing Requirements for Domestic Wells
	Water Quality Testing Type Required for Domestic Wells
	Water Quality Test Results Impacts on Permitting for Domestic Wells
	Does the County Have a Water Quality Monitoring Program?
	County Administrative Services
	County Website Quality
	County Funding Resources Available to Domestic Well Owners
	Replacement Well Permit Cost
	Average Number of Wells Drilled Per Unique Driller in the Past Two Years
	Household Socioeconomic Burden
	Linguistic Isolation
	Unemployment
	Transportation Limitations

MAPPING RISK DATA

There is minimal data *directly* from state small water systems or domestic wells publicly available. Therefore, the Risk Assessment uses publicly available statewide datasets and develops risk scores spatially at a square mile section. The risk status for each area is applied to all state small water systems and domestic well locations within that square mile section. The total number of systems and wells within each risk area are summarized to determine the count of systems At-Risk.

THRESHOLDS

To develop thresholds for the risk indicators in the Risk Assessment, the State Water Board, DWR, and OEHHA reviewed multiple available types of evidence, looking both within California, across other state agencies nation-wide, and at the U.S. EPA's standards. Few exact risk indicator thresholds relating to state small water system and/or domestic well risk were derived from sources beyond California legislative and regulatory definitions, given both the unique definition of risk employed in this assessment and the unique access to indicator data which this assessment enabled. However, similar indicators and associated thresholds were also identified across other sources and are documented in the individual indicator details provided in the following sections in this Appendix.

Moving forward, the State Water Board will continue to refine the risk indicator thresholds as data availability improves and the SAFER Program matures. The process may include refining thresholds by analyzing historical data trends such as looking at the relationship between historical thresholds and the likelihood of state small water systems and domestic wells failing.

SCORES

To enable the evaluation and comparison of risk indicators, a standardized score between 0 and 1 has been applied to each developed risk indicator threshold. This is important since many of the risk indicators are measured in different units and scales. The score normalizes the thresholds and allows the Risk Assessment to assess risk across all risk indicators. The scores assigned to the risk indicator thresholds were developed with the professional opinion of external stakeholders, State Water Board staff, DWR staff, and OEHHA staff.

WEIGHTS

When evaluating the risk indicators, the Risk Assessment methodology can either apply the same "weight" to each risk indicator or apply different weights. Public feedback during four public workshops indicated that the Risk Assessment should weigh some risk indicators higher than others because they may be more "critical" as they relate to risk. Weights between 1 and 3 were applied to individual risk indicators (with a weight of 3 indicating the highest level of criticality). The individual risk indicator weights were developed with the professional opinion of external stakeholders, State Water Board staff, DWR staff, and OEHHA staff.

RISK CATEGORY WEIGHTS

Public feedback during the initial Risk Assessment methodology development workshops indicated that the Risk Assessment should include risk category weights. Weights of 1 and 2 were applied to each risk category, with a weight of 2 indicating the highest level of criticality.

Table B2: Category Weights

Category	Category Weight
Water Quality Risk	2
Water Shortage Risk	2
Socioeconomic Risk	1

Table B3: Category Risk Thresholds for Communities Served by State Small Water Systems and Domestic Wells

Category	Threshold	Score	Weight	Max Score	Risk Level
Water Quality Risk	Contaminants less than 80% of MCL	0	2	0	Low
	Contaminants between 80% - 100% of MCL	0.25	2	0.5	Medium
	Contaminants above MCL	1	2	2	High
	No data available	N/A	N/A	N/A	N/A
Water Shortage Risk	Score below 60th percentile (< 0.452) of areas with a state small	0	2	0	Low

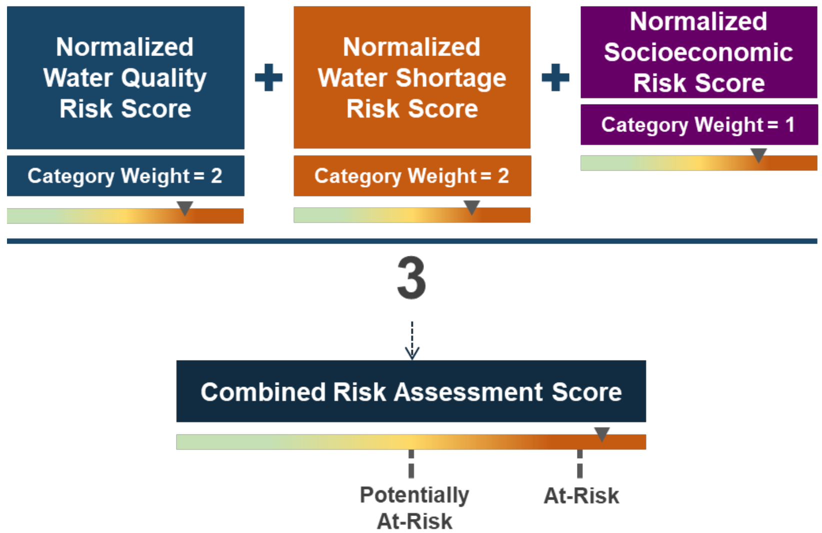
Category	Threshold	Score	Weight	Max Score	Risk Level
	water systems and/or domestic well				
	Score in in 60-80th percentile (0.452-0.534) of areas with a state small water systems and/or domestic well	0.25	2	0.5	Medium
	Score above 80th percentile (>0.534) of areas with a state small water systems and/or domestic well	1	2	2	High
	No data available	N/A	N/A	N/A	N/A
Socioeconomic Risk	Score below 60th percentile (< 0.667) of areas with a state small water systems and/or domestic well	0	1	0	Low
	Score in 60-80th percentile (0.667-0.885) of areas with a state small water systems and/or domestic well	0.25	1	0.25	Medium
	Score above 80th percentile (>0.885) of areas with a state small water systems and/or domestic well	1	1	1	High
	No data available	N/A	N/A	N/A	N/A

COMBINED RISK ASSESSMENT CALCULATION METHODOLOGY

The final combined risk score per public land survey system (PLSS) section is determined by multiplying the normalized category score by the category weight, adding the weighted scores for all three categories, and dividing by the number of categories with data. The final risk score is binned into three groups: “At-risk” (score >= 1), “Potentially At-Risk” (score >= 0.5), and “Not At-Risk” (score < 0.5). These numeric cutoffs mean that any area with a high score in two or more categories is always “At-risk” and any area with a high score in either the water quality or water shortage categories is always “Potentially At-Risk” or “At-Risk.”

To calculate the state small water system and domestic well statewide results, the total number of system and well records in each combined risk designation bin are summed.

Equation 1: Combined Risk Score Calculation Method



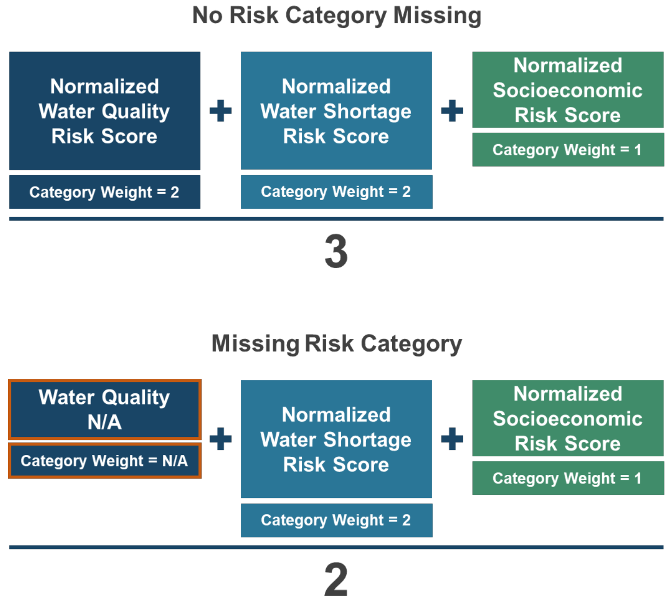
ADJUSTING FOR MISSING DATA

It is important that the Risk Assessment methodology adapts for where data may be missing for certain locations where state small water systems and domestic wells may be located. The methodology used to adjust for missing data replicates the approach taken in the Risk Assessment for public water systems. For the Socioeconomic Risk category, the methodology omits any value for a missing risk indicator and re-distributes the weights/scores to risk indicators within the same category which did have valid values (Figure B3). It is important to note that this approach is not used by DWR in their Water Shortage category.

Figure B3: Example of How the Assessment Adjusts for Missing Risk Indicator Data

For some locations, modeled groundwater quality data is from the Water Quality category. The methodology used to adjust for missing category data mirrors the approach taken in the Risk Assessment for public water systems. The Risk Assessment redistributes the weights/score of a missing risk category to the other categories when an entire category is excluded from the assessment, as illustrated in Figure B4.

Figure B4: How the Aggregated Risk Assessment Adjusts for a Missing Risk Indicator Category



AGGREGATED RISK ASSESSMENT THRESHOLDS

The final combined risk score per PLSS section is determined by multiplying the normalized category score by the category weight, adding the weighted scores for all three categories, and dividing by the number of categories with data. The final risk score is binned into three groups: "At-Risk," "Potentially At-Risk," and "Not At-Risk." These numeric cutoffs mean that any area with a high score in two or more categories is always "At-Risk" and any area with a high score in either the water quality or water shortage categories is always "Potentially At-Risk" or "At-Risk."

Table B4: Aggregated Risk Assessment Thresholds

Risk Level	Score
At-Risk	≥ 1
Potentially At-Risk	1 < n ≥ 0.5
Not At-Risk	< 0.5

RISK CATEGORY & INDICATOR DETAILS

WATER QUALITY RISK (AQUIFER RISK MAP)

A complete description of the 2023 Aquifer Risk Map methodology is available online.[293] The Aquifer Risk Map uses previously collected water quality results from various datasets, including the Division of Drinking Water, the US Geological Survey-Groundwater Ambient Monitoring and Assessment programs' Priority Basin and Domestic Well Projects, the USGS-National Water Information System dataset, the Department of Water Resources, local groundwater monitoring projects, the Irrigated Lands Regulatory Program, and monitoring/clean-up sites. These water quality results are depth-filtered to only focus on data from groundwater depths accessed by domestic wells and state small water systems. Data from all chemical constituents with a Maximum Contaminant Level (MCL) are assessed, and several additional chemical constituents including hexavalent chromium, copper, lead, and N-Nitrosodimethylamine (NDMA) are included in the analysis as well (refer to Table B1 for chemical constituent codes and comparison concentrations). Water quality results were converted to an MCL Index[294] to allow comparison between chemical constituents. The 20-year average concentration and highest recent (within 5 years) results are calculated for each square mile (PLSS) section where data is available. The average and highest recent results are compared to the MCL to determine the risk status of the square mile section. The R script used to download, process, and filter the water quality data is available on GitHub.[295]

Table B5: Chemical Constituent Codes and Maximum Contaminant Values for Aquifer Risk Map Chemical Constituents

Chemical Abbreviation (Web Tool)	Chemical Name	Units	Comparison Concentration Value	Comparison Concentration Type
24D	2,4-Dichlorophenoxyacetic acid (2,4 D)	µg/L	70	MCL
AL	Aluminum	µg/L	1000	MCL
ALACL	Alachlor	µg/L	2	MCL
ALPHA	Gross Alpha radioactivity	pCi/L	15	MCL
AS	Arsenic	µg/L	10	MCL
ATRAZINE	Atrazine	µg/L	1	MCL
BA	Barium	mg/L	1	MCL
BDCME	Bromodichloromethane (THM)	µg/L	80	MCL

[293] Methodology for 2023 Aquifer Risk Map
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=a00ee2ed17464141900131c46e126c45
[294] The MCL index consists of the finding divided by the MCL, with a special consideration for non-detect results with a reporting limit above the MCL.
[295] Methodology script (GitHub)
https://github.com/EmilyHoulihan/Aquifer_Risk_Map

Chemical Abbreviation (Web Tool)	Chemical Name	Units	Comparison Concentration Value	Comparison Concentration Type
BE	Beryllium	µg/L	4	MCL
BETA	Gross beta	pCi/L	50	MCL
BHCGAMMA	Lindane (Gamma-BHC)	µg/L	0.2	MCL
BIS2EHP	Di(2-ethylhexyl) phthalate (DEHP)	µg/L	4	MCL
BRO3	Bromate	µg/L	10	MCL
BTZ	Bentazon	µg/L	18	MCL
BZ	Benzene	µg/L	1	MCL
BZAP	Benzo(a)pyrene	µg/L	0.2	MCL
BZME	Toluene	µg/L	150	MCL
CD	Cadmium	µg/L	5	MCL
CHLORDANE	Chlordane	µg/L	0.1	MCL
CHLORITE	Chlorite	mg/L	1	MCL
CLBZ	Chlorobenzene	µg/L	70	MCL
CN	Cyanide (CN)	µg/L	150	MCL
CR	Chromium	µg/L	50	MCL
CR6	Chromium, Hexavalent (Cr6)	µg/L	10	Temporary comparison level*
CRBFN	Carbofuran	µg/L	18	MCL
CTCL	Carbon Tetrachloride	µg/L	0.5	MCL
CU	Copper	mg/L	1.3	Action Level
DALAPON	Dalapon	µg/L	200	MCL
DBCME	Dibromochloromethane (THM)	µg/L	80	MCL
DBCP	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	0.2	MCL
DCA11	1,1-Dichloroethane (1,1 DCA)	µg/L	5	MCL
DCA12	1,2 Dichloroethane (1,2 DCA)	µg/L	0.5	MCL
DCBZ12	1,2 Dichlorobenzene (1,2-DCB)	µg/L	600	MCL
DCBZ14	1,4-Dichlorobenzene (p-DCB)	µg/L	5	MCL

Chemical Abbreviation (Web Tool)	Chemical Name	Units	Comparison Concentration Value	Comparison Concentration Type
DCE11	1,1 Dichloroethylene (1,1 DCE)	µg/L	6	MCL
DCE12C	cis-1,2 Dichloroethylene	µg/L	6	MCL
DCE12T	trans-1,2, Dichloroethylene	µg/L	10	MCL
DCMA	Dichloromethane (Methylene Chloride)	µg/L	5	MCL
DCP13	1,3 Dichloropropene	µg/L	0.5	MCL
DCPA12	1,2 Dichloropropane (1,2 DCP)	µg/L	5	MCL
DINOSEB	Dinoseb	µg/L	7	MCL
DIQUAT	Diquat	µg/L	20	MCL
DOA	Di(2-ethylhexyl) adipate	mg/L	0.4	MCL
EBZ	Ethylbenzene	µg/L	300	MCL
EDB	1,2 Dibromoethane (EDB)	µg/L	0.05	MCL
ENDOTHAL	Endothall	µg/L	100	MCL
ENDRIN	Endrin	µg/L	2	MCL
F	Fluoride	mg/L	2	MCL
FC11	Trichlorofluoromethane (Freon 11)	µg/L	150	MCL
FC113	1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	mg/L	1.2	MCL
GLYP	Glyphosate (Round-up)	µg/L	700	MCL
H-3	Tritium	pCi/L	20000	MCL
HCCP	Hexachlorocyclopentadiene	µg/L	50	MCL
HCLBZ	Hexachlorobenzene (HCB)	µg/L	1	MCL
HEPTACHLOR	Heptachlor	µg/L	0.01	MCL
HEPT-EPOX	Heptachlor Epoxide	µg/L	0.01	MCL
HG	Mercury	µg/L	2	MCL
MOLINATE	Molinate	µg/L	20	MCL
MTBE	MTBE (Methyl-tert-butyl ether)	µg/L	13	MCL
MTXYCL	Methoxychlor	µg/L	30	MCL
NI	Nickel	µg/L	100	MCL
NNSM	N-Nitrosodimethylamine (NDMA)	µg/L	0.01	NL

Chemical Abbreviation (Web Tool)	Chemical Name	Units	Comparison Concentration Value	Comparison Concentration Type
NO2	Nitrite as N	mg/L	1	MCL
NO3N	Nitrate as N	mg/L	10	MCL
OXAMYL	Oxamyl	µg/L	50	MCL
PB	Lead	µg/L	15	Action Level
PCA	1,1,2,2 Tetrachloroethane (PCA)	µg/L	1	MCL
PCATE	Perchlorate	µg/L	6	MCL
PCB1016	Polychlorinated Biphenyls (PCBs)	µg/L	0.5	MCL
PCE	Tetrachloroethene (PCE)	µg/L	5	MCL
PCP	Pentachlorophenol (PCP)	µg/L	1	MCL
PICLORAM	Picloram	mg/L	0.5	MCL
RA-226/RA-228	Radium 226 and Radium 228	pCi/L	5	MCL
SB	Antimony	µg/L	6	MCL
SE	Selenium	µg/L	50	MCL
SILVEX	2,4,5-TP (Silvex)	µg/L	50	MCL
SIMAZINE	Simazine	µg/L	4	MCL
SR-90	Strontium 90	pCi/L	8	MCL
STY	Styrene	µg/L	100	MCL
TBME	Bromoform (THM)	µg/L	80	MCL
TCA111	1,1,1-Trichloroethane	µg/L	200	MCL
TCA112	1,1,2-Trichloroethane	µg/L	5	MCL
TCB124	1,2,4- Trichlorobenzene (1,2,4 TCB)	µg/L	5	MCL
TCDD2378**	2,3,7,8-Tetrachlorodibenzodioxin (Dioxin)	µg/L	3.00E-05	MCL
TCE	Trichloroethene (TCE)	µg/L	5	MCL
TCLME	Chloroform (THM)	µg/L	80	MCL
TCPR123	1,2,3-Trichloropropane (1,2,3 TCP)	µg/L	0.005	MCL
THIOBENCARB	Thiobencarb	µg/L	70	MCL
THM	Total Trihalomethanes	µg/L	80	MCL
TL	Thallium	µg/L	2	MCL

Chemical Abbreviation (Web Tool)	Chemical Name	Units	Comparison Concentration Value	Comparison Concentration Type
TOXAP	Toxaphene	µg/L	3	MCL
U	Uranium	pCi/L	20	MCL
VC	Vinyl Chloride	µg/L	0.5	MCL
XYLENES	Xylenes (total)	µg/L	1750	MCL

*Since there is currently no MCL for Hexavalent Chromium (CrVI), a temporary comparison value was used to remain consistent with the risk assessment for public water systems.
**No data for 2,3,7,8-Tetrachlorodibenzodioxin (Dioxin) was available for this analysis, because there are no samples from wells that met our depth and time criteria.

DEPTH FILTER

Most available groundwater quality data is sourced from public (municipal) supply wells. This is a result of California's requirement for monitoring and reporting of groundwater from wells that are part of a public water system that supplies water to 15 or more service connections. In contrast, domestic wells (any system that serves less than 5 connections) and state small water systems (5 – 14 connections) are not regulated by the state and therefore lack comprehensive data.

For many regions, municipal supply wells access a deeper portion of the groundwater resource when compared with domestic wells. This deeper groundwater is typically less affected by contaminants introduced at the ground surface than shallower groundwater. As a result, use of data from municipal wells would likely result in a systematically low bias for an estimate of the shallower groundwater typically accessed by domestic wells.

Accordingly, staff developed a method to filter data that more likely represents shallower groundwater accessed by domestic wells, as summarized below.

Since well depth varies throughout the state, a domestic depth zone was defined numerically for each groundwater unit[296] based on Total Completed Depth statistics from the Online System of Well Completion Reports (OSWCR) database. Based on well depth data in the OSCWR database, a well depth interval per groundwater unit was determined for wells classified as domestic and for wells classified as public (Figure B5). These well depth statistics were then compared to assess whether domestic and public well depth intervals overlap, which indicates that they access the same groundwater source. For groundwater units where the depth interval for public and domestic wells overlapped (or the public interval was

[296] This project uses Groundwater Units as areas of analysis. Groundwater Units consist of groundwater basins as defined by DWR Bulletin 118 (https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/B118-Interim-Update-2016.pdf), and the connecting upland areas associated with each of these basins as delineated by the USGS (https://www.sciencedirect.com/science/article/pii/S2214581814000305?via%3Dihub). Use of Groundwater Units results in coverage of the entire state. Averaging of well depths and groundwater quality within a Groundwater Unit was considered reasonable based on the assumed relative consistency of hydrogeologic conditions within each Unit.

shallower) water quality data from public wells was included in the analysis. For groundwater units where the depth interval for public wells was deeper than the depth interval for domestic wells, water quality data from public wells was screened out of the analysis. For details on the maximum domestic well depth and the comparison of public and domestic wells for each groundwater unit, see Attachment B1.[297]

Figure B5 illustrates the numeric depth filter which is based on the average of section maximum/minimum well depths per Groundwater Unit. Wells with a known depth that fall within the "domestic well depth interval" are included in the analysis. Wells with a known depth that fall outside the "domestic well depth interval" are screened out of the analysis. For wells without a known depth - if the "public bottom" depth of a Groundwater Unit is shallower or within 10% of the "domestic bottom" depth, then wells classified as public are included in the analysis. If the "public bottom" depth of a Groundwater Unit is more than 10% deeper than the "domestic bottom" depth, then wells classified as public are screened out of the analysis.

[297] Attachment B1 lists the depth filter output for each groundwater unit in California. The table shows the ID, name, maximum domestic depth (in feet) and whether that groundwater unit has domestic and public wells at similar depths. The numeric value in the third column indicates the domestic depth maximum cutoff – only wells with shallower depths are used to estimate domestic/state small water quality. A "no" in the final column indicates that domestic and public wells are accessing different groundwater depths, and public wells are not used to estimate domestic/state small water quality when well depth is unknown. A "yes" in the final column indicates that domestic and public wells are accessing similar groundwater depths, and public wells are used to estimated domestic/state small water quality when well depth is unknown.
Attachment B1: Groundwater Depth by Unit
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023gwdepthbyunit.xlsx

Figure B5: Numeric Depth Filter

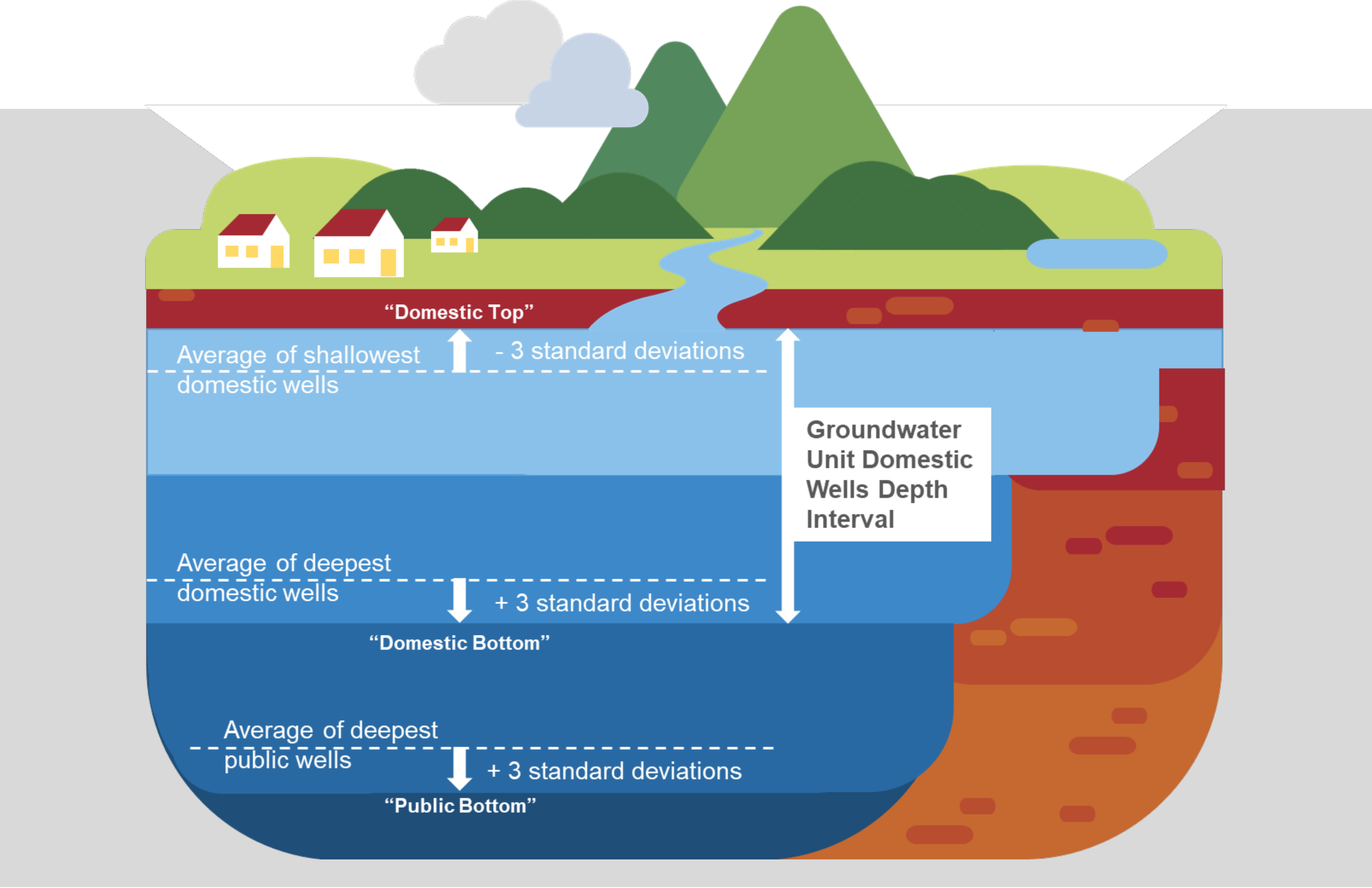
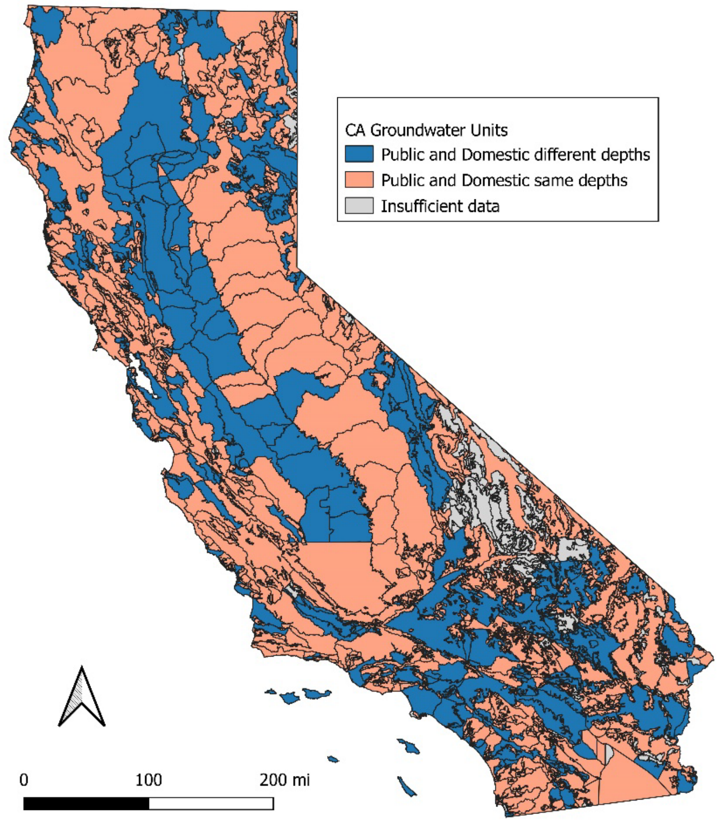


Figure B6 illustrates the depth filter by well type (for wells with unknown depth) in California. This map shows basins where domestic wells and public wells may be accessing similar groundwater depths (pink) and basins where domestic wells and public wells are accessing different groundwater depths (blue). For the basins shown in pink, public wells were used as a proxy for domestic depth water quality.

Figure B6: Depth by Well Type



Most wells with water quality data do not have well construction data (indicating the depth of well or screen interval). Wells with depth data were filtered based on their numeric well construction; wells without numeric construction data were filtered by well type.

Wells with Known Numeric Depths

Staff used OSWCR Total Completed Depth section summary statistics to determine a "Domestic Bottom" and "Domestic Top" depth for each Groundwater Unit. The domestic well depth zone was defined as the range between "Domestic Bottom" depth[298] and "Domestic Top" depth[299]. For Group 1 wells, if the given depth of the well fell between the "Domestic Top" depth and the "Domestic Bottom" depth, water quality data from that well was included in the analysis.

[298] Domestic Bottom = average of section maximum domestic well depths (from OSWCR) plus 3 standard deviations of section maximum well depths for each groundwater unit.
[299] Domestic Top = average of section minimum domestic well depths (from OSWCR) minus 3 standard deviations of section minimum well depths for groundwater unit.

Wells with Unknown Numeric Depths

Staff used OSWCR well depth information to compare “Domestic Bottom” depth (defined above) to “Public Bottom” depth[300] (defined below). If the “Public Bottom” depth for a given Groundwater Unit was shallower than the “Domestic Bottom” depth, or within 10% of “Domestic Bottom” depth (shallower or deeper), then it was considered reasonable to include data from public wells into the analysis for that Groundwater Unit. If the “Public Bottom” depth for a given Groundwater Unit was more than 10% deeper than the “Domestic Bottom” depth, water quality data from public wells was screened out of the analysis for that Groundwater Unit.

DE-CLUSTERING

Available water quality results were spatially and temporally de-clustered to square mile sections to account for differences in data sampling density within each section over space and time. This was conducted to prevent certain areas with a high density of wells and frequent sampling to achieve a disproportionate weighting to the overall risk characterization of an area. To expand the coverage of the water quality risk map, averaged, de-clustered data from sections that contain a well(s) that provide water quality data are projected onto neighboring sections that do not include a well providing water quality data.

Water quality data is assessed using two metrics - the long-term (20 year) average and all recent results (within 5 years). The temporal and spatial de-clustering methodology for each metric is outlined below.

Long-Term Average

- Water quality results from each well for each chemical constituent are averaged per year (for the past 20 years).
- The results are averaged per well.
- The results are averaged for each square mile section.

Recent Results

- All recent (within the past 5 years) results in a section are categorized as “under” (less than 80 percent of MCL), “close” (80 percent – 100 percent of MCL), or “over” (greater than MCL) for each constituent.
- The count of recent results in each category (under, close, over) are summarized per square mile section.

The average and recent result count from adjacent sections is used to calculate results for neighboring square mile sections that do not contain a well with water quality data. If neighboring sections have multiple adjacent source sections with water quality data, the adjacent results are averaged.

[300] Public Bottom = average of section maximum public well depths (from OSWCR) plus 3 standard deviations of section maximum well depths for groundwater units.

NORMALIZING WATER QUALITY RISK DATA

In summary, the Aquifer Risk Map uses available raw source groundwater quality data to estimate the water quality risk to state small water systems and domestic wells. For the combined Risk Assessment for state small water systems and domestic wells, the 2023 Aquifer Risk Map data is normalized into four risk bins summarized in Table B6.

Table B6: Normalizing Aquifer Risk Map Results

Aquifer Risk Map Result	Normalized Risk Score	Risk Level
No nearby water quality data available for any contaminants.	N/A	Unknown Risk
20-year average and all recent results for all measured contaminants are below 80% of the MCL.	0	Low Risk
20-year average or highest recent result for one or more contaminants is between 80% - 100% of the MCL.	0.25	Medium Risk
20-year average or highest recent result for one or more contaminants is above the MCL.	1	High Risk

Since the water quality risk estimates are limited to areas within ~2 miles of a well with water quality data, much of the state is assigned the "unknown risk". However, the majority of state small water systems and domestic well locations do have water quality data available nearby (90% of state small water systems and 80% of known domestic wells).

2023 WATER QUALITY RISK RESULTS

Table B7: 2023 Water Quality Risk Results

Water Quality Risk	High Risk	Medium Risk	Low Risk	Unknown Risk
State Small Water Systems	699 (54%)	78 (6%)	387 (30%)	133 (10%)
Domestic Wells	99,814 (34%)	15,869 (5%)	117,028 (40%)	58,690 (20%)

WATER SHORTAGE RISK (DWR WATER SHORTAGE VULNERABILITY TOOL)

The water shortage risk scores are from the DWR's Water Shortage Vulnerability Tool for state small water systems and domestic wells. The complete methodology for this analysis is available online.[301] In summary, the DWR assessment utilizes a suite of risk factors to assess water shortage risk for at the public land survey system (PLSS) square mile sections, including

[301] Water Shortage Vulnerability Scoring and Tool | DWR
https://water.ca.gov/Programs/Water-Use-And-Efficiency/SB-552/SB-552-Tool

exposure to hazard, climate change, physical vulnerability, socioeconomic vulnerability, and record of outages.

To improve the Water Shortage Vulnerability Map, in 2023 DWR updated the 2021 methodology to adjust the scoring to reflect existing knowledge, to align with policy-related research, and to accommodate newer data available. The full overview of changes is available online and summarized below in Table B8.[302]

Table B8: Major Revisions Made to DWR's Water Shortage Vulnerability Assessment for State Small Water Systems & Domestic Wells

Revision Description	2021 Version	2022 Version
Terminology Change: Risk changed to vulnerability	Referred to aggregated score as “drought risk”	Refers to aggregated scores as “water shortage vulnerability”
Present physical vulnerability and social vulnerability separately	Physical vulnerability and social vulnerability were aggregated as a sing score	Aggregate scores of physical and social vulnerability are represented as separate indices
Spatial units, increase resolution	All indicators applied to Census Block Groups for spatial analysis	All indicators of physical vulnerability presented and combined at one square mile grid for whole state (PLSS)
Vulnerability Scores (physical)	Applied weighting by component	Apply weights by indicator and by basin location
Re-created tool	Tableau with minimal access to data besides aggregate score	ArcGIS Web App Tool, improved access to all individual maps and customizable user interface designed to support county planning

For the combined Risk Assessment for state small water systems and domestic wells, the DWR water shortage risk scores were normalized into four risk bins summarized in Table B9.

Table B9: Normalizing DWR Water Shortage Vulnerability Results

DWR Drought Assessment Result	Normalized Risk Score	Risk Level
No drought and water shortage risk scores are available for this area.	N/A	Unknown Risk

[302] Technical Methods for the Drought and Water Shortage Vulnerability Assessment Update 2023: California’s Domestic Wells and State Small Water Systems
https://data.cnra.ca.gov/dataset/water-shortage-vulnerability-technical-methods/resource/fe040d6a-ed1b-4f0f-9ad9-50aada68ba03?inner_span=True

DWR Drought Assessment Result	Normalized Risk Score	Risk Level
Below top 40% of areas with a state small water systems and/or domestic well.	0	Low Risk
Top 40% of areas with a state small water systems and/or domestic well.	0.25	Medium Risk
Top 20% of areas with a state small water systems and/or domestic well.	1	High Risk

2023 WATER SHORTAGE RISK RESULTS

Table B10: Water Shortage Risk Results

Water Shortage Risk	High Risk	Medium Risk	Low Risk	Unknown Risk
State Small Water Systems	261 (20%)	183 (14%)	853 (66%)	0 (0%)
Domestic Wells	101,393 (35%)	69,245 (24%)	120,763 (41%)	0 (0%)

SOCIOECONOMIC RISK

Historically, the Needs Assessment has not included affordability indicators in the Risk Assessment for state small water systems and domestic well communities. Based on stakeholder feedback, the State Water Board and OEHHA explored potential affordability and broader socioeconomic indicators in 2021-22, applicable to state small water systems and domestic wells, for inclusion in the Needs Assessment.

Thirteen indicators were identified to develop a new Socioeconomic Risk map for the 2023 Risk Assessment for state small water systems and domestic wells. The suite includes seven county level measures capturing water quality testing practices and administrative services or resources available to domestic well owners. Well costs are captured through two indicators measured at the county level. Finally, four socioeconomic indicators were developed at the Census Tract and Block Group level using demographic information included in the 2019 and 2021 5-Year American Communities Survey.

Figure B7: Socioeconomic Risk Indicators

County Data			
County Water Quality Testing for Domestic Wells	**County Level Services for Domestic Wells**	**Well Costs**	**Economic Characteristics**
Testing Requirements	Administrative Services	Replacement Well Permit Cost	Household Socioeconomic Burden
Testing Type	Website Quality	Average Number of Wells Drilled Per Unique Driller in the Past Two Years	Linguistic Isolation
Testing Impacts on Permitting	Funding Resources Available to Domestic Well Owners		Unemployment
Water Quality Monitoring			Transportation Limitations

County Data Collection Effort

During the Fall and Winter of 2022, OEHHA and the State Water Board reviewed county-specific information about domestic wells for all 58 California counties to develop the dataset needed for the county-based risk indicators.[303] This effort included:

1. Evaluation of publicly available information related to domestic wells on each county's website, including attachments and links.
2. Review of domestic well ordinances, fee schedules, and drought assistance programs.
3. In cases where information was unavailable online, counties were contacted via phone.

These indicators are used in the Risk Assessment to capture risk associated with resource availability and County managerial capacity to support communities served by state small water systems and domestic wells.

How the Socioeconomic Risk Category is Calculated

To calculate the Socioeconomic Risk Category results, indicator scores for the thirteen Socioeconomic Risk indicators were multiplied by their weight at the geographic scale associated with each indicator (county, census tract, or census block group). As the geographic scales vary across the indicators, the risk scores were spatially associated with square mile sections. At the section scale, individual risk scores were summed and then divided by the number of indicators with data (max of thirteen).

COUNTY WATER QUALITY TESTING FOR DOMESTIC WELLS

State and federal law do not require water quality testing for domestic wells, neither before nor during operation. However, many California counties have water quality testing requirements for domestic wells. These requirements and programs were evaluated to assess risk for communities served by domestic wells. Counties with fewer domestic well water quality requirements/programs receive a higher score for each risk indicator, illustrating that well owners may be at greater risk when there are fewer regulatory requirements or programs designed to ensure domestic well owners are informed of potential water quality concerns.

[303] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

Four indicators were considered for this category: Water Quality Testing Requirements, Testing Type Required, Test Impacts/Corrective Actions, and County Sampling/Monitoring programs. Each of these indicators are described below.

Water Quality Testing Requirements for Domestic Wells

This indicator reflects whether a County requires any level of water quality testing for new domestic wells during the permitting process. It has three thresholds: Testing required, testing recommended but not required, and testing neither recommended nor required.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board's website.[304]

Threshold Determination

Testing Required (Threshold 0): Counties were classified as having testing required when some level of water quality testing is mandated when drilling a new well. Often, testing requirements are specified in a county ordinance, but they may also be highlighted on a website or other documents. In some counties, water quality tests are only required when a well is drilled in addition to a building or plumbing permit issuance. For example, a test would be required if the well is drilled in tandem with the construction of a new primary or accessory dwelling unit, but not necessarily if it is drilled in isolation. For this analysis, these counties were not classified as having "required testing," because testing would not be mandatory for replacement wells.[305] This threshold is associated with the lowest level of risk.

Testing is Recommended but not Required (Threshold 1): Counties that advise well owners to test their wells, but do not mandate a water quality test as a part of the permitting process are included in this threshold. For example, Fresno County recommends and supports testing but notes that "private wells are not required to meet any water quality standards."[306] This threshold is considered medium risk.

No testing required or recommended (Threshold 2): Some counties neither require nor recommend water quality testing. These counties may have ordinances that give permission for staff to request samples, but testing is not explicitly recommended or required in the ordinance or other supporting documents. These counties were classified as "no testing recommended or required." Additionally, counties where testing was only recommended through a generic well owner's guide were included in this

[304] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx
[305] This was observed in Butte County.
[306] Fresno County Well Permitting Program
https://www.co.fresno.ca.us/departments/public-health/environmental-health/water-surveillance-program/water-well-permitting-program

category. These counties were classified as having “No testing required," indicating the highest risk level.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 3 was suggested for the “Water Quality Testing Requirements for Domestic Wells” risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 3. Table B11 summarizes the thresholds, score, and weights for “Water Quality Testing Requirements for Domestic Wells.”

Table B11: “Water Quality Testing Requirements for Domestic Wells” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location	N/A	N/A	*Missing*	Unknown
0	Required water quality testing	0	N/A	0	None
1	Recommended testing, but not required	0.5	3	1.5	Medium
2	No testing required or recommended	1	3	3	High

Water Quality Testing Type Required for Domestic Wells

The purpose of this risk indicator is to assess the extent to which water quality testing is performed or recommended. It captures which contaminants counties either require or recommend be tested for (e.g., coliform, nitrate, arsenic).

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board’s website.[307]

Threshold Determination

Bacteria + Other (Threshold 0): This threshold applies to counties that recommend/require testing for bacteria and at least one non-bacteria test.

[307] County Risk Indicator Analysis https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

The number of contaminants tested varies widely by county; some counties require an extensive panel for all chemicals listed in Title 22,[308] while others may only require one or two non-bacteria tests. For example, Santa Clara County requires that wells are tested for bacteria and all Title 22 inorganics, while Yolo County only mandates bacteria and nitrate. Some counties did not list the specific chemicals that should be considered, instead indicating that "chemical and bacteriological" tests are necessary.[309] All these counties have been classified in this lowest threshold based on available information.

Bacteria Only (Threshold 1): Some counties only require or recommend bacteriological testing and do not recommend other contaminants should be tested for.

This indicator was based on county water quality testing requirements for new domestic wells. If the county "recommends" testing of additional contaminates they were still assigned this threshold since water quality testing of additional contaminants is recommended and not required. There are currently six counties that currently require bacteriological testing as a part of the permitting process but encourage additional testing too. These counties were categorized as "bacteria only" to reflect the permitting requirements. This threshold is associated with a medium level of risk.

Not applicable, no testing required, or tests are unspecified (Threshold 2): Counties that neither recommend nor require testing were categorized as "Not Applicable." Additionally, counties that may recommend/require testing but provided no additional information about the necessary tests were placed in this threshold. For example, Sacramento County only states that "appropriate analyses should be made based upon the intended uses of the water."[310] Because there was no specific information about the nature of the testing, Sacramento County was classified as "Not Applicable." This threshold is associated with the highest level of risk for this indicator.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 1 was suggested for the "Water Quality Testing Type Required for Domestic Wells." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table B12 summarizes the thresholds, score, and weights for "Water Quality Testing Type Required for Domestic Wells."

Table B12: "Water Quality Testing Type Required for Domestic Wells" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location	N/A	N/A	*Missing*	Unknown

[308] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Lawbook.html
[309] Merced County.
[310] Sacramento County Municipal Code 6.28.030.8.b

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	Bacterial + Other	0	N/A	0	None
1	Bacterial Only	0.5	1	0.5	Medium
2	Not applicable, no testing required, or tests are unspecified	1	1	1	High

Water Quality Test Results Impacts on Permitting for Domestic Wells

While several counties require water quality testing as part of the domestic well permitting process, not all counties require corrective actions if the water quality does not meet health standards. This risk indicator captures whether corrective actions are required if water quality does not meet health standards.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board's website.[311]

Threshold Determination

Corrective Actions Required (Threshold 0): This threshold applies to counties that require corrective actions, such as re-chlorination or installation of treatment systems, in the event of a failed water quality test. Counties in this threshold also typically require resampling of the well to verify that the water is safe to drink after corrective actions are taken. This threshold represents the lowest risk for this indicator.

Unknown (Threshold 1): Some counties do not specify if a failed water quality test would require corrective actions or if the tests are for owner information only. Therefore, these counties are considered low risk.

Testing is for Owner Information Only (Threshold 2): Some counties do not require any corrective actions in the event of a failed water quality test. Water quality testing is solely meant to inform domestic well owners about their drinking water safety. All counties that recommend, but do not require, water quality testing were included in this threshold and are considered medium risk.

Not Applicable (Threshold 3). Counties that do not require or recommend testing were classified in this threshold. This is the highest risk for this indicator.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and

[311] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 2 was suggested for the “Water Quality Test Results Impacts on Permitting for Domestic Wells.” Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table B13 summarizes the thresholds, score, and weights for “Water Quality Test Results Impacts on Permitting for Domestic Wells.”

Table B13: “Water Quality Test Results Impacts on Permitting for Domestic Wells” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Yes, failure requires corrective actions.	0	N/A	0	None
1	Unknown, it’s unclear if the failed test will result in corrective actions prior to permit finalization.	0.25	2	0.5	Low
2	No, testing is for owner information only.	0.5	2	1	Medium
3	Not applicable, no testing required.	1	2	2	High

Does the County Have a Water Quality Monitoring Program?

Many counties have programs to conduct voluntary domestic well water quality sampling and monitoring by county staff or through third-party partnerships. These programs not only help inform domestic well owners of their water quality, they also create a valuable dataset that could be used by counties and other stakeholders to make more informed decisions for future well permitting and groundwater management. This risk indicator captures whether a county has a program to sample domestic well water quality for contamination.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board’s website.[312]

Threshold Determination

County Run or Funded Program (Threshold 0): Counties that have a program or staff that will sample or test domestic wells fall in this threshold. These programs may vary in scope, with some counties taking samples for every new well, while other counties may

[312] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

only conduct the sampling upon request. This is considered the lowest risk threshold for this indicator.

Program Operated Through Non-County Providers (Threshold 1): Some counties partner with third party organizations (e.g., Self-Help Enterprises, Central Coast Testing Program) to offer well-sampling services. These counties are considered in this threshold.

Additionally, counties that assist in facilitating testing or transporting samples, but do not directly conduct sampling or testing, are included in this threshold. For example, Mendocino County has a sample drop-off point, and the county facilitates the transport of sample bottles to the regional laboratory. This allows residents to sample the water themselves, then deliver these samples to the regional laboratory easily and affordably.

This threshold represents medium risk for this indicator. Counties that only publish lists of local water quality testing laboratories or companies were not considered in this threshold.

No Program (Threshold 2): Counties that do not have a water quality testing program or partnerships with external organizations are considered in this threshold. These counties may reference local laboratories or sampling services on their website. This is considered the highest risk for this indicator.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 2 was suggested for the “Does the County Have a Water Quality Monitoring Program?” Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table B14 summarizes the thresholds, score, and weights for “Does the County Have a Water Quality Monitoring Program?”

Table B14: “Does the County Have a Water Quality Monitoring Program?” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Yes, county either operates of funds a program.	0	N/A	0	None
1	Yes, program is operated through a non-county provider.	0.5	2	2	Medium
2	No program either operated by the county or non-county provider.	1	2	2	High

COUNTY LEVEL SERVICES

Aside from water quality, another important aspect of risk to domestic well users is the availability of administrative resources to domestic well users when a well runs dry or becomes contaminated. County staff, resource information, and funding programs are all services needed to support state small water systems and domestic wells when preparing for or responding to challenges.

County Administrative Services

This risk indicator reflects whether counties have specific programs or advertised administrative capacity to assist domestic well owners. The scope of these services varies widely between counties, so a broad interpretation of these services was used during the evaluation of this indicator.

Examples of administrative services include:

- Advertised staff assistance or consultation for dry wells
- Advertised staff assistance for interpreting water quality reports/tests
- Water delivery for owners of dry wells
- Water storage installation for owners of dry wells
- Custom web maps used to expedite well drilling applications
- Water refilling stations
- Training and equipment loans for well level monitoring

Water quality sampling was not considered an administrative service, as this is captured in separate risk indicators.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board's website.[313]

Threshold Determination

County Provided Admin Services (Threshold 0). This threshold indicates that county staff are directly involved with providing at least one administrative service as listed above. Counties in this threshold may also partner with external agencies to provide other services but provide at least one service in-house. This is the lowest risk threshold for this indicator.

External agency/group admin services (Threshold 1). Counties in this threshold do not provide any of the administrative services listed above, instead they link or partner with external agencies with assistance programs for well owners. For example, many counties in the San Joaquin Valley partner with Self-Help Enterprises, which has

[313] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

numerous programs available for well-owners, including well consultation and water storage installation. This threshold is considered medium risk.

No admin services provided or linked (Threshold 2). Counties in this threshold do not provide or advertise any administrative services for domestic well owners. This threshold is considered high risk.

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 2 was suggested for the "County Administrative Services." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table B15 summarizes the thresholds, score, and weights for "County Administrative Services."

Table B15: "County Administrative Services" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Administrative services are provided by the county.	0	N/A	0	None
1	Services provided by a non-county provider.	0.5	2	2	Medium
2	No administrative services provided or referenced on county website.	1	2	2	High

County Website Quality

This risk indicator is intended to capture the general quality of information available, and ease of access, for well owners and drillers on the county's website.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board's website.[314]

[314] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

Threshold Determination

Substantial information about quality, resources, and services (Threshold 0). Counties in this threshold typically had extensive information about the well-permitting process, county programs, advice for maintaining a well etc. on their websites. Most counties in the state (38) were in this threshold, which represents the lowest risk.

Some information about quality, resources, or services (Threshold 1). Counties in this threshold had some information pertinent to well owners on their websites. However, the information is limited in scope, may be outdated, and/or would likely leave a well owner or driller with remaining questions. 10 counties were in this threshold, which represents medium risk.

Little or no information about quality, resources, or services (Threshold 2). Counties with no or very limited information on their websites were placed in this threshold. These counties may not have a webpage dedicated to domestic well owners or have minimal relevant information. This threshold represents the highest risk.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 1 was suggested for the "County Website Quality." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table B16 summarizes the thresholds, score, and weights for "County Website Quality."

Table B16: "County Website Quality" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Substantial information about water quality, available resources, and/or services provided.	0	N/A	0	None
1	Some information about water quality, available resources, and/or services provided.	0.5	1	0.5	Medium
2	Little or no information about water quality, available resources, and/or services provided.	1	1	1	High

County Funding Resources Available to Domestic Well Owners

The purpose of this risk indicator is to assess available county financial resources available to domestic well owners experiencing water quality and/or quantity challenges. Most public-financial resources are provided or administered by state or federal agencies; however, a limited number of counties have their own funding and/or assistance programs for domestic well owners.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board's website.[315]

Threshold Determination

Funding resources are provided by the county (Threshold 0). This threshold includes counties with their own funding programs. These counties may also provide links to external resources. Only four counties had their own dedicated funding programs. This threshold represents the lowest risk. Examples include:

- Funding for installation of temporary water tanks, water hauling, piping and electrical improvements (Yolo County)
- Housing rehabilitation funds may be used for dry wells (Fresno County)
- Funding for well deepening and/or pump repairs (Shasta County)
- Zero interest loans for well repairs (Humboldt County)

External funding resources are provided (Threshold 1). This threshold includes counties that provide links to other sources of funding administered by other public agencies. This threshold is considered medium risk.

Examples of external funding sources include:

- U.S. Department of Agriculture Loans
- Rural Community Assistance Corporation
- Community Development Block Grant Funds
- State Water Quality Control Board

No funding linked or provided (Threshold 2). This threshold includes counties that did not provide any information about available funding programs on their website. This is considered the highest risk threshold.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 1 was suggested for the "County Funding Resources Available to Domestic Well Owners." Therefore, the minimum risk score for this indicator is 0

[315] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

and the maximum risk score is 1. Table B17 summarizes the thresholds, score, and weights for “County Funding Resources Available to Domestic Well Owners.”

Table B17: “County Funding Resources Available to Domestic Well Owners” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	County funding resources available.	0	N/A	0	None
1	County provides information on funding available from non-county sources.	0.5	1	0.5	Medium
2	No funding resources available or information provided.	1	1	1	High

WELL COSTS CATEGORY

Maintaining, deepening, and/or replacing wells can be a cost burden for those who are dependent on them. This category of risk indicators attempts to assess the relative cost risk associated with dependency on state small water systems and domestic wells. The State Water Board and OEHHA suggest additional data collection to enhance this category of risk indicators over time. This is especially critical with rising costs and inflation.

Replacement Well Permit Cost

This risk indicator measures the cost to obtain permits for a replacement well in each county. This indicator does not include the cost of drilling the well, which varies by factors such as the drilling company, necessary well depth, and local basin conditions. Most counties increase fees at the beginning of the fiscal year (July 1); thus, the indicator is representative of the 2021-2022 fiscal year.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- County outreach and public information review conducted in 2022. This dataset is published on the State Water Board’s website.[316]
- Information on domestic well permits and associated fees were collected by calling county well permitting agencies and speaking on the phone with environmental health specialists, department directors, and permit fee specialists in late 2021 and early 2022. The county representative was asked the cost of permitting if a homeowner wanted to

[316] County Risk Indicator Analysis
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimcountydata.xlsx

build a replacement well, deepen an existing well, or build a second well. The first scenario, building a replacement well, was identified as the most common solution for when an existing well goes dry and is used here for this indicator of replacement well permit cost.

Threshold Determination
Percentiles were calculated for each county, where the county with the highest replacement well permit costs received a percentile of 100. The thresholds for this indicator were set in the same manner as other risk indicators in the Risk Assessment for public water systems where comparative ranking across the state occurs (see DWR Drought and Water Shortage Risk), where the top 20% of counties or counties above the 80th percentile, where assigned the highest threshold 2. Counties in the middle 60th to 80th percentile were assigned a medium threshold 1, and counties in the bottom 40th (percentiles below 60) were assigned a threshold of 0 (no risk).

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 2 was suggested for the "Replacement Well Permit Cost." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table B18 summarizes the thresholds, score, and weights for "Replacement Well Permit Cost."

Table B18: "Replacement Well Permit Cost" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Percentile less than 60.	0	N/A	0	None
1	60 to less than the 80 percentile.	0.5	2	2	Medium
2	Percentile 80 to 100 (top 20% of counties).	1	2	2	High

Average Number of Wells Drilled Per Unique Driller in the Past Two Years

The purpose of this risk indicator is to approximate the cost associated with wait-time and increased demand for well drillers. A higher number of wells drilled per active well driller in a county may also be associated with areas experiencing high demand and increased costs associated with drilling a well.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- OWSCR (Online System of Well Completion Reports).[317]
- The data was filtered by well type (domestic, public, and other) and the unique driller ID number. Other well types include industrial, irrigation, and monitoring. Data on the number of active unique drillers in each county between 2020-2022 and the number of domestic wells drilled between 2020-2022 in each county were identified. This indicator was calculated by dividing the number of domestic wells drilled by the number of active unique drillers per county. This ensures that counties with lower demand will not receive lower scores simply because they have fewer active drillers.

Threshold Determination
Percentiles were calculated for each county, where the county with the highest average number of domestic wells per driller (Nevada County with an average new domestic well per driller of 80) received a percentile of 100 and the county with the lowest average number of domestic wells per driller (Orange County with an average domestic well per driller of 1) received the lowest percentile. The thresholds for this indicator were set in the same manner as other risk indicators in the Risk Assessment for public water systems where comparative ranking across the state occurs (see DWR Drought and Water Shortage Risk), where the top 20% of counties or counties above the 80th percentile, where assigned the highest threshold 2. Counties in the middle 60th to 80th percentile were assigned a medium threshold 1, and counties in the bottom 40th (percentiles below 60) were assigned a threshold of 0 (no risk).

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 2 was suggested for the "Average Number of Wells Drilled Per Unique Driller in the Past Two Years." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table B19 summarizes the thresholds, score, and weights for "Average Number of Wells Drilled Per Unique Driller in the Past Two Years."

Table B19: "Average Number of Wells Drilled Per Unique Driller in the Past Two Years" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Percentile less than 60.	0	N/A	0	None
1	60 to less than the 80 percentile.	0.5	2	2	Medium
2	Percentile 80 to 100 (top 20% of counties).	1	2	2	High

[317] OWSCR Well Completion Report Well
data.ca.gov/dataset/well-completion-reports

Table B20: Well Cost Category Indicator Data

County	Replacement Well Permit Cost	Number of Domestic Wells Drilled	Unique Drillers	Average Domestic Wells per Driller
Alameda	$794	24	5	4.80
Alpine	$512	11	1	11.00
Amador	$450	106	5	21.20
Butte	$593	253	14	18.07
Calaveras	$935	117	8	14.63
Colusa	$532	29	4	7.25
Contra Costa	$1,383	72	10	7.20
Del Norte	$150	41	2	20.50
El Dorado	$771	344	5	68.80
Fresno	$1,287	946	27	35.04
Glenn	$575	145	9	16.11
Humboldt	$522	95	5	19.00
Imperial	$3,776	N/A	N/A	N/A
Inyo	$512	8	4	2.00
Kern	$2,320	205	22	9.32
Kings	$550	174	13	13.38
Lake	$422	41	9	4.56
Lassen	$339	28	5	5.60
Los Angeles	$3,209	71	13	5.46
Madera	$1,065	520	21	24.76
Marin	$2,846	22	6	3.67
Mariposa	$248	190	5	38.00
Mendocino	$772	303	12	25.25
Merced	$894	268	13	20.62
Modoc	$90	8	3	2.67
Mono	$648	24	2	12.00
Monterey	$4,344	61	11	5.55
Napa	$546	131	10	13.10
Nevada	$1,086	480	6	80.00
Orange	$738	3	3	1.00
Placer	$1,450	371	10	37.10
Plumas	$514	87	7	12.43
Riverside	$719	437	12	36.42

County	Replacement Well Permit Cost	Number of Domestic Wells Drilled	Unique Drillers	Average Domestic Wells per Driller
Sacramento	$1,086	99	14	7.07
San Benito	$1,348	57	9	6.33
San Bernardino	$906	576	21	27.43
San Diego	$970	68	8	8.50
San Francisco	N/A	N/A	N/A	N/A
San Joaquin	$966	269	12	22.42
San Luis Obispo	$1,196	299	11	27.18
San Mateo	$5,939	9	2	4.50
Santa Barbara	$1,482	23	10	2.30
Santa Clara	$3,034	90	7	12.86
Santa Cruz	$2,441	96	6	16.00
Shasta	$650	264	8	33.00
Sierra	$747	11	3	3.67
Siskiyou	$545	205	8	25.63
Solano	$184	34	11	3.09
Sonoma	$987	647	10	64.70
Stanislaus	$615	312	10	31.20
Sutter	$1,062	27	8	3.38
Tehama	$241	267	11	24.27
Trinity	$240	175	4	43.75
Tulare	$447	508	33	15.39
Tuolumne	$1,298	107	3	35.67
Ventura	$1,535	15	6	2.50
Yolo	$1,322	47	11	4.27
Yuba	$857	184	7	26.29

SOCIOECONOMIC BURDEN CATEGORY

Four indicators representing socioeconomic burden were included in this risk layer to estimate additional factors that affect a state small water system and domestic well community's ability to afford and acquire water. OEHHA and the State Water Board evaluated existing Census measures of socioeconomic vulnerability to identify relevant indicators. The new affordability indicator for public water systems called 'Household Socioeconomic Burden', which is a combination of poverty and housing-burdened low-income households, is proposed here with the same reasons outlined in the November 2022 white paper.[318] OEHHA and the State Water Board also evaluated other measures of socioeconomic vulnerability including the 14 measures included in the Center for Disease Control's Social Vulnerability Index[319] as well as the five socioeconomic factors included in CalEnviroScreen.[320] Linguistic isolation, unemployment, and transportation limitations (households without a vehicle) are also proposed as indicators here as they may reflect the ability to pay for water at a neighborhood level.

Household Socioeconomic Burden

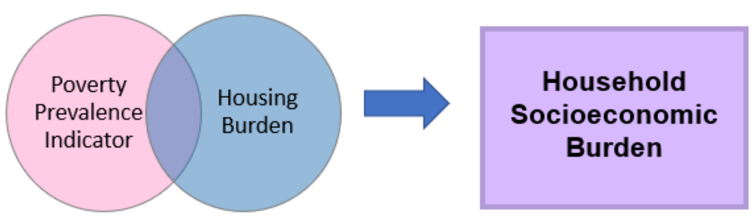
The purpose of this risk indicator is to identify communities that have both high levels of poverty and high housing costs for low-income households. These communities may be struggling to pay for access to safe drinking water and may have a difficult time shouldering future drinking water costs when their limited disposable income is constrained by high housing costs. This indicator is a composite indicator of two data points: Poverty Prevalence and Housing Burden.

- **Poverty Prevalence Indicator (PPI)** measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level.

- **Housing Burden Indicator** measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).

The combination of these two variables creates a more comprehensive picture of socioeconomic vulnerability while accounting for the varying levels of income and cost burdens throughout California.

Figure A18: PPI and Housing Burden Components Combined to Create Household Socioeconomic Burden Indicator



[318] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/affordability-whitepaper-workshop3-nov2022.pdf
[319] https://www.atsdr.cdc.gov/placeandhealth/svi/index.html
[320] https://oehha.ca.gov/calenviroscreen/population-indicators

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Poverty Prevalence Indicator: From the 2017-2021 American Community Survey (ACS),[321] a dataset containing the number of individuals above 200 percent of the federal poverty level (FPL) was downloaded by block groups for the state of California (25,607 in the state).
- Housing Burden Indicator data: From the 2015-2019 U.S. Department of Housing and Urban Development (HUD) Comprehensive Housing Affordability Strategy (CHAS),[322] a dataset containing cost burdens for households by HUD-adjusted median family income (HAMFI) category was downloaded by census tract for the state of California (8,057 in the state).

Risk Indicator Calculation Methodology:

Prepare Poverty Prevalence Indicator data: The number of individuals below 200 percent of the FPL was calculated by subtracting the reported estimate of individuals in poverty (2x FPL) by the total estimate. The number of individuals below 200% of the poverty level was divided by the total population for whom poverty status was determined.

Prepare Housing Burden Indicator data: CHAS— a special analysis of census data specific to housing— is only available at the census tract and other larger geographies. For each census tract, the data were analyzed to estimate the number of households with household incomes less than 80% of the county median and renter or homeowner costs that exceed 50% of household income. The percentage of the total households in each tract that are both low-income and housing-burdened was then calculated. Each census tract was associated with the block groups within it to maintain consistency with the PPI indicator, which is at the block group level.

Each PLSS section was associated with a PPI and Housing Burden score based on the block group or tract that the centroid of the PLSS section fell within.

The ACS and CHAS estimates come from a sample of the population and suppression criteria were assessed to flag estimates considered statistically unreliable.

Suppression Criteria for PPI

- Unlike the U.S. Census, ACS estimates come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.

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[321] American Community Survey
https://data.census.gov/cedsci/

[322] HUD CHAS Data
https://www.huduser.gov/portal/datasets/cp.html

- The SE was calculated for each block group using the formula for approximating the SE of proportions provided by the ACS.[323] When this approximation could not be used, the formula[324] for approximating the SE of ratios was used instead.
- The RSE is calculated by dividing a tract's SE by its estimate of the percentage of the population living below twice the federal poverty level and taking the absolute value of the result.
- Block group estimates that met either of the following criteria were considered reliable and included in the analysis:
    - RSE less than 50 (meaning the SE was less than half of the estimate); or
    - SE was less than the mean SE of all California block group estimates for poverty.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block groups with scores were included in the indicator.

Suppression Criteria for Housing Burden

- Like ACS estimates, CHAS data come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.
- The SE was calculated for each census tract using the formula for approximating the SE of proportions provided by the ACS.[325] When this approximation could not be used, the formula[326] for approximating the SE of ratios was used instead.
- The RSE was calculated by dividing a tract's SE by its estimate of the percentage of housing-burdened low-income households and taking the absolute value of the result.
- Census tract estimates that met either of the following criteria were considered reliable and included in the analysis:
    - RSE less than 50 (meaning the SE was less than half of the estimate); or
    - SE was less than the mean SE of all California census tract estimates for housing burdened low-income households.
- All census tract level Housing Burden scores were associated with the block groups within them.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block group with scores were included in the indicator.

Component Thresholds

Poverty Prevalence (PPI): For PPI, various thresholds have been explored by other organizations and researchers including the use of 30%[327] or multiple categories such as less

[323] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[324] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[325] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[326] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[327] Lauren Patterson (2021): Water Affordability
https://internetofwater.org/wp-content/uploads/2021/12/Blog010_WaterAffordability_Patterson.pdf

than 10%, 10% to 30%, 30% to 50%, and greater than 50%.[328] However, the most widely used PPI thresholds by organizations and researchers was first suggested by Raucher et al. in a report prepared for the American Water Works Association[329,330,331,332]. In the Raucher et al. report entitled 'Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector,' the following PPI thresholds are recommended: low risk less than 20%, medium risk between 20% to 35%, and high risk greater than 35%. The State Water Board and OEHHA evaluated these thresholds as it relates to California data and propose to use these thresholds for the PPI component of the Household Socioeconomic Burden indicator.

Table A53: PPI Component Threshold Scores

Component	Threshold	Score	Risk Level
PPI	**Threshold N/A =** Missing or not reliable PPI data	**N/A**	**Unknown**
	Threshold 0 = < 20%	**0**	**Low**
	Threshold 1 = 20% - 35%	**0.25**	**Medium**
	Threshold 2 = > 35%	**1**	**High**

Housing Burden: Based on a nationwide literature review, consistent thresholds for Housing Burden have not yet been established by other organizations or identified in the scientific literature. A report by the University of North Carolina on housing conditions in North Carolina identified census tracts in the top 20% of state as severely burdened.[333] Additionally, a recently published Master's Thesis about housing challenges in California identified census tracts in the top quartile of the state as being the "most impacted."[334] Lastly, one study showed that 16% of children in Los Angeles County live in severe housing-cost burdened households, but this was

[328] David Mitchell, and Elizabeth Stryjewski (2020): Technical Memorandum on Water/Sewer Service Affordability Analysis
https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248

[329] Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector (2019)
https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813

[330] American Water Works Association: Measuring Water Affordability and the Financial Capability of Utilities
https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260

[331] Alliance for Water Efficiency (2020): An Assessment of Water Affordability and Conservation Potential in Detroit, Michigan
https://www.allianceforwaterefficiency.org/sites/www.allianceforwaterefficiency.org/files/highlight_documents/AWE_Water_Affordability_Detroit_Final_2020_0.pdf

[332] Duke University, Nicholas Institute: Exploring the Affordability of Water Services within and across Utilities
https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf

[333] William Rohe, Todd Owen, and Sarah Kerns; The University of North Carolina at Chapel Hill, Center for Urban and Regional Studies (2017): Extreme Housing Conditions in North Carolina
https://curs.unc.edu/wp-content/uploads/sites/400/2017/02/Extreme-Housing-Conditions-in-North-Carolina.pdf

[334] Lucresia Graham(2021): A Cartographic Exploration of Census Data on Select Housing Challenges Among California Residents
https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf

based on survey data.[335] Given the lack of peer-reviewed literature, consistency and relevance among these limited examples, the census tracts were grouped into three categories (or tertiles), based on the overall distribution of 2019 housing burden data in the state to identify three levels of risk. The three categories were rounded to the nearest whole number.

Based on this statewide data, low risk corresponds with fewer than 14% of total households experiencing housing burden. Medium risk is between 14% and 21%, and high risk is greater than 21%, respectively. Using a matrix scoring approach, first each bin was assigned a score of 0 for "low vulnerability," 0.25 for "medium vulnerability" and 1 for "high vulnerability."

The State Water Board will analyze water system arrearage, shut-off, and other affordability indicators over time to determine if the recommended Housing Burden thresholds should be adjusted in the future.

Table A54: Housing Burden Component Threshold Scores

Component	Threshold	Score	Risk Level
Housing Burden	**Threshold N/A =** Missing or not reliable Housing Burden data	N/A	Unknown
	Threshold 0 = <14%	0	Low
	Threshold 1 = 14% - 21%	0.25	Medium
	Threshold 2 = >21%	1	High

Threshold Determination

The two components of Household Socioeconomic Burden were combined using a matrix approach and following the same methodology as the Risk Assessment for state small water systems and domestic wells.[336] The normalized scores for PPI and Housing Burden components were added together and divided by the number of components (two). Below is the calculation used for each water system's Household Socioeconomic Burden score and Figure B8 shows how much each calculated score represents a degree of PPI and Housing Burden within the matrix.

Equation B1: Calculating Household Socioeconomic Burden Score

$$\textit{Household Socioeconomic Burden} = \frac{PPI\ Score + Housing\ Burden\ Score}{2}$$

[335] Tabashir Z. Nobari, Shannon E. Whaley, Evelyn Blumenberg, Michael L. Prelip, and May C. Wanga (2018): Severe Housing-Cost Burden and Obesity Among Preschools-aged Low-Income Children in Lost Angeles County.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/
[336] 2022 Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Figure B8: Household Socioeconomic Burden Scores Within the Matrix Represents Varying Degrees of PPI and Housing Burden

Poverty (PPI)	**High Risk** ≥ 35%	Score = 1	*Missing*	0.5	0.625	1
	Med Risk 20% - 35%	Score = 0.25	*Missing*	0.125	0.25	0.625
	None < 20%	Score = 0	*Missing*	0	0.125	0.5
	Unknown	Score = *Missing*	*Missing*	*Missing*	*Missing*	*Missing*
			Score = *Missing*	Score = 0	Score = 0.25	Score = 1
			Unknown	**None** < 14%	**Med Risk** 14% - 21%	**High Risk** ≥ 21%
			Housing Burden			

These combined scores are converted into threshold risk designations, as shown in Table B21.

Table B21: Thresholds for Household Socioeconomic Burden

Threshold Number	Threshold	Risk Level
0	Combined score of **0 – 0.125**	None
1	Combined score of **0.25 – 0.5**	Medium
2	Combined score of **0.625 – 1.0**	High

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from an internal State Water Board, Division of Drinking Water workgroup, the weight of 2 is applied to the “Household Socioeconomic Burden” risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table B22 summarizes the thresholds, score, and weights for Household Socioeconomic Burden.

Table B22: “Household Socioeconomic Burden” Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**Combined score of 0 – 0.125**	0	N/A	0	None
1	**Combined score of 0.25 – 0.5**	0.5	2	1	Medium

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
2	**Combined score of 0.625 – 1.0**	1	2	2	High
*Missing**	**Missing PPI and/or Housing Burden data**	"--"	N/A	"--"	Unknown

** American Community Survey and/or CHAS data may be missing for area PLSS.*

Linguistic Isolation

Linguistic isolation measures limited English-speaking where no one over the age of 14 speaks English at least "very well," as defined by the U.S. Census. Linguistically isolated households may face barriers to obtaining technical and financial assistance for their wells or state small water systems.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- American Community Survey, 2017-2021.
- This number of households classified as limited English-speaking was downloaded by block groups for the state of California. Percentiles were calculated at the block group scale.
- To summarize by PLSS sections, the centroid of each PLSS section was associated with the percentile and threshold of the census block group it fell into.

Threshold Determination

The thresholds for this indicator were set in the same manner as other risk indicators in the Risk Assessment for public water systems where comparative ranking across the state occurs (see DWR Drought and Water Shortage Risk). The top 20% of census block groups (above the 80th percentile), were assigned the highest threshold 2. Block groups in the middle 60th to 80th percentile were assigned a medium threshold 1, and block groups in the bottom 40th (percentiles below 60) were assigned a threshold of 0 (no risk).

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 1 was suggested for the "Linguistic Isolation" risk indicator due to data quality concerns. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table B23 summarizes the thresholds, score, and weights for "Linguistic Isolation."

Table B23: "Linguistic Isolation" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	Percentile less than 60.	0	N/A	0	None
1	60 to less than the 80th percentile.	0.5	1	0.5	Medium
2	Percentile 80 to 100 (top 20% of block groups).	1	1	1	High

Unemployment

Unemployment measures the percentage of the population over the age of 16 that is unemployed and eligible for the labor force. Communities with higher levels of unemployment may face difficulties paying for well repairs, replacements, or alternatives.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- American Community Survey, 2017-2021.
- This number of unemployed individuals was downloaded by block groups for the state of California. Percentiles were calculated at the block group scale.
- To summarize by PLSS sections, the centroid of each PLSS section was associated with the percentile and threshold of the census block group it fell into.

Threshold Determination

The thresholds for this indicator were set in the same manner as other risk indicators in the Risk Assessment for public water systems where comparative ranking across the state occurs (see DWR Drought and Water Shortage Risk). The top 20% of census block groups (above the 80th percentile), were assigned the highest threshold 2. Block groups in the middle 60th to 80th percentile were assigned a medium threshold 1, and block groups in the bottom 40th (percentiles below 60) were assigned a threshold of 0 (no risk).

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 1 was suggested for the "Unemployment." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table B24 summarizes the thresholds, score, and weights for "Unemployment."

Table B24: "Unemployment" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown
0	Percentile less than 60.	0	N/A	0	None

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
1	60 to less than the 80^{th} percentile.	0.5	1	0.5	Medium
2	Percentile 80 to 100 (top 20% of block groups).	1	1	1	High

Transportation Limitations

Transportation limitations are measured by the percent of households without a vehicle. Communities with domestic wells and state small water systems typically have lower walkability and public transportation access, so vehicles are important for accessing employment, education, recreation, and healthcare. Households without vehicles may have limited mobility, impacting their ability to get water from alternative sources in the event that their state small water system or domestic well is experiencing problems.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- American Community Survey, 2017-2021.
- This number of unemployed individuals was downloaded by block groups for the state of California. Percentiles were calculated at the block group scale.
- To summarize by PLSS sections, the centroid of each PLSS section was associated with the percentile and threshold of the census block group it fell into.

Threshold Determination

The thresholds for this indicator were set in the same manner as other risk indicators in the Risk Assessment for public water systems where comparative ranking across the state occurs (see DWR Drought and Water Shortage Risk). The top 20% of census block groups (above the 80^{th} percentile), were assigned the highest threshold 2. Block groups in the middle 60^{th} to 80^{th} percentile were assigned a medium threshold 1, and block groups in the bottom 40^{th} (percentiles below 60) were assigned a threshold of 0 (no risk).

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on internal deliberations and stakeholder feedback, the minimum weight of 1 was suggested for the "Transportation Limitations." Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table B25 summarizes the thresholds, score, and weights for "Transportation Limitations."

Table B25: "Transportation Limitations" Thresholds, Weights, & Scores

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Data missing for location.	N/A	N/A	*Missing*	Unknown

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	Percentile less than 60.	0	N/A	0	None
1	60 to less than the 80^{th} percentile.	0.5	1	0.5	Medium
2	Percentile 80 to 100 (top 20% of block groups).	1	1	1	High

2023 SOCIOECONOMIC RISK RESULTS

Table B26: Socioeconomic Risk Results

Socioeconomic Risk	High Risk	Medium Risk	Low Risk	Unknown Risk
State Small Water Systems	198 (16%)	269 (22%)	830 (63%)	0 (0%)
Domestic Wells	71,156 (24%)	53,734 (18%)	166,511 (57%)	0 (0%)

To calculate the Socioeconomic Risk results shown in Table B26, first the risk scores for the thirteen individual Socioeconomic Risk indicators with various underlying spatial scales (county, census tract, or census block group) were associated with square mile sections. Per section, an overall Socioeconomic Risk score was calculated by averaging the thirteen risk scores. Grouped results in Table B26 for areas with a domestic well or state small water system was calculated by grouping the section level Socioeconomic Risk Component score by their 2023 Needs Assessment Combined Risk category and calculating averages or counts for each risk bin. For square mile sections that overlapped more than one census tract/block group, the data from the maximum overlapping tract/block group was used. For the domestic well analysis, only square miles sections with at least one domestic well record were used to calculate the averages. For the state small water system analysis, only square mile sections with at least one state small water system location were used to calculate the averages. The number of domestic well records or state small water systems was not used to weight the socioeconomic data, meaning that this analysis is just of *areas* with domestic wells or state small water systems, not a socioeconomic analysis for these systems specifically. This methodology also means that socioeconomic data was area-weighted, because final numbers were calculated by assigning data to square mile sections and then calculating averages. Also, note that several socioeconomic data points used in this analysis (poverty, MHI, and limited English-speaking households or linguistic isolation) were also used as risk factors in the Water Shortage Vulnerability Tool, which was used to calculate the combined risk score.

APPENDIX C: UPDATES ON THE COST ASSESSMENT

INTRODUCTION

The State Water Board is currently updating the full Cost Assessment Model for Failing and At-Risk public water systems, state small water systems, and domestic wells for the 2024 Needs Assessment.

The State Water Board is proposing an updated, streamlined methodology for estimating potential modeled solution costs for Failing public water systems, At-Risk public water systems, state small water systems and domestic wells. The proposed changes to the Cost Assessment Model include:

- Updating and/or validating all cost assumptions embedded in the model through an analysis of State Water Board funding projects and conducting contractor, vender, and stakeholder outreach.
- Determining if physical consolidation is a viable model solution based on (1) physical location criteria and (2) total project cost estimates. Previously the Model would compare the total cost of physical consolidation to other long-term model solutions, like treatment by POU/POE, which are often much less expensive in the short-term. However, this led to an underestimation of cost due to the Model by over-selecting POU/POE, which are not often preferred long-term sustainable solutions.
- Utilizing additional information about each water system or domestic well location to better identify potential modeled solutions. For example, systems that are failing for multiple monitoring and reporting violations will not have treatment modeled as a potential solution. The Risk Assessment for state small water systems and domestic wells now identifies locations at risk for water quality and/or drought (not available in the original Cost Assessment Model). The updated Model will better match potential solutions based on identified risk drivers.
- Removing the sustainability and resiliency assessment from the Model to accommodate the new approach for matching potential model solutions to each system based on their challenges as identified by the Failing criteria or Risk Assessment results.
- Using system and location-specific information to determine additional other essential infrastructure (OEI) needed, rather than relying on statewide assumptions applied proportionally to all water systems.
- Aligning OEI with the Senate Bill 552 drought resiliency infrastructure requirements, utilizing updated cost assumptions reflecting current infrastructure market prices.

COST ASSESSMENT WORKSHOPS

The State Water Board began hosting public workshops in 2022 to start soliciting public feedback on the proposed enhancements to the Cost Assessment.[337] Three additional workshops are planned for 2023 and they will cover the following topics:

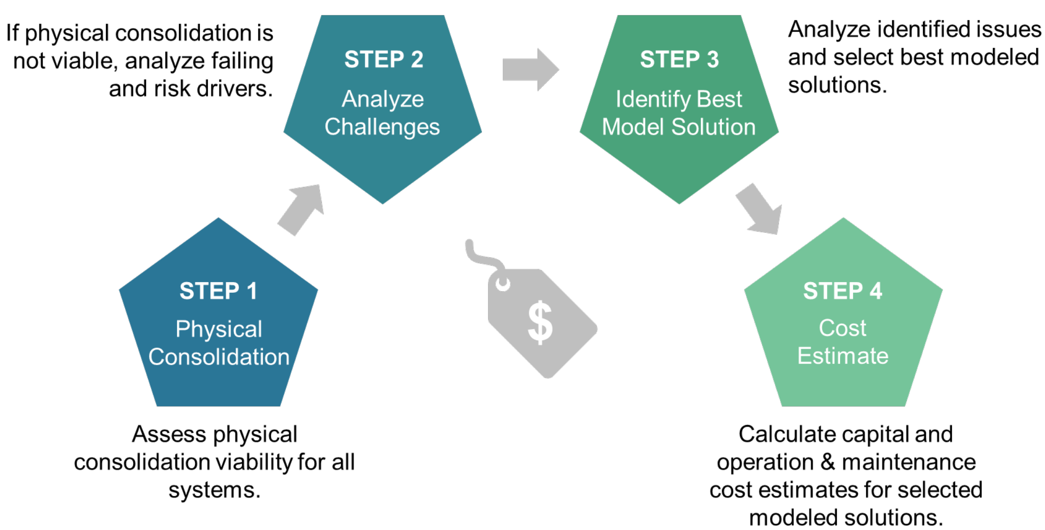
(1) Physical consolidation GIS analysis and cost assumptions.
(2) Modeled treatment methodologies and cost assumptions.
(3) Complementary long-term solutions and emergency solutions cost assumptions.

Subscribe to the SAFER mailing list to be notified of future workshops: https://www.waterboards.ca.gov/resources/email_subscriptions/swrcb_subscribe.html

OVERVIEW OF PROPOSED ENHANCEMENTS TO THE COST MODEL

In response to stakeholder feedback after the release of the 2021 Cost Assessment and 2022 Drought Infrastructure Cost Assessment, the State Water Board is proposing an updated, streamlined Cost Assessment Model for estimating potential modeled solution costs for Failing public water systems, At-Risk public water systems, At-Risk state small water systems and domestic wells. The proposed updated methodology first explores physical consolidation as a potential modeled solution and if the model suggests it may not be viable, other modeled solutions will be examined and matched to the system's identified challenges, (Figure C1) below describes the proposed Cost Assessment Model flow process.

Figure C1: Proposed Updated Cost Assessment Model Process



337 August 8, 2022 Workshop: Proposed Changes for the Cost Assessment: White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/cost-assessment-white-paper.pdf; Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/2022-proposed-changes-to-cost-model-bt.pdf

Table C1: Key Differences Between the Original and Proposed Updated Cost Assessment Model Components

	2021 Cost Assessment	Proposed Cost Assessment
Systems Included	• Failing systems • At-Risk public water systems • At-Risk state small water systems and domestic wells	No Change
Long-Term Cost Estimates	• Physical consolidation • Treatment • POU/POE • Technical Assistance • Other Essential Infrastructure (OEI): storage tanks, new wells, well replacement, upgraded electrical, backup power, distribution replacement, additional meters, etc.	• Physical consolidation • Treatment • POU/POE • Technical Assistance • *Added*: Administrator • *Added*: Bottled Water • Other Essential Infrastructure (OEI): monitor static well levels (*added*), backup electrical supply, back-up source (new well or intertie), meter all service connections, storage tanks, upgraded electrical, and distribution replacement • New well[338]
Interim Cost Estimate[339]	• POU/POE • Bottled Water	No Change
20-Year Operations & Maintenance Costs	Included	No Change
Sustainability and Resiliency Assessment	Included	*Excluded*
Cost Formulas, Multipliers, and Estimates		*Updated*
Model Decision Criteria		*Updated*

[338] For state small water systems and domestic wells.
[339] Interim solutions are for public water systems only. No interim solutions are considered for state small water systems and domestic wells since long term solutions are nearly the same.

APPENDIX D:
AFFORDABILITY ASSESSMENT METHODOLOGY

INTRODUCTION

The purpose of the Affordability Assessment is to identify disadvantaged community (DAC) and severely disadvantages community (SDAC) water systems, that have instituted customer charges that exceed the “Affordability Threshold” established by the State Water Board in order to provide drinking water that meets state and federal standards.[340]

WATER SYSTEMS ASSESSED

The Affordability Assessment is conducted annually for all California community water systems. It is worth noting that, while there is some overlap, the systems included in the Affordability Assessment differ from the list of water systems analyzed in the Risk Assessment for public water systems. The Affordability Assessment includes large and small community water systems but excludes non-transient, non-community water systems, like schools. The Risk Assessment, on the other hand, analyzed smaller public water systems with less than 30,000 service connections or that served a population of less than 100,000 people and non-transient non-community K-12 schools were included. Both assessments exclude all community water system wholesalers, transient water systems, state small water systems and domestic wells. Table D1 provides an overview of the systems included in the Affordability Assessment.

Table D1: Systems Included in the Affordability Assessment

SAFER Program Status	Risk Assessment	Affordability Assessment
Failing Systems	381	323
At-Risk Systems	512	468
Potentially At-Risk	453	408
Not At-Risk	1,707	1,485
Not Assessed	N/A	161
TOTAL:	**3,053**	**2,845**

[340] California Health and Safety Code, section 116769, subd. (a)(2)(B)

The difference in the number of Failing systems and At-Risk systems between the Risk Assessment and Affordability Assessment in Table D1 can be attributed to the exclusion of non-transient, non-community K-12 schools in the Affordability Assessment.

AFFORDABILITY ASSESSMENT METHODOLOGY DEVELOPMENT PROCESS

The State Water Board, in partnership with UCLA, began developing the initial Affordability Assessment in 2019. The State Water Board and UCLA hosted four public webinar workshops in 2020 to solicit feedback and recommendations on the development of the Affordability Assessment. Approximately 683 individuals[341] participated in these workshops through either Zoom or CalEPA's live webcast. Since the initial launch of the Affordability Assessment in 2021, the methodology has been refined through additional public workshops. The State Water Board encourages public and stakeholder participation in the Affordability Assessment refinement process and strives to provide opportunities for feedback and recommendations. Proposed Affordability Assessment methodology updates are detailed in publicly available white papers, presented at public webinars, and public feedback is often incorporated into the final methodology and results. These materials are hosted on the Needs Assessment webpage.[342]

In 2022, the State Water Board partnered with the Office of Environmental Health Hazard Assessment (OEHHA) to host three public Affordability Workshops to re-evaluate previously utilized affordability indicators, research new affordability indicators, and explore how to incorporate a new affordability indicator that measures disposable income limitations into the 2023 Needs Assessment and beyond.[343] These workshops also analyzed different approaches for determining DACs and establishing an "affordability threshold."

AFFORDABILITY ASSESSMENT METHODOLOGY

SB 200 calls for the identification of "any community water system that serves a disadvantaged community that must charge fees that exceed the affordability threshold established by the board in order to supply, treat, and distribute potable water that complies with federal and state drinking water standards."[344] Based on the legislative requirements, the Affordability Assessment is conducted following a two-step process summarized below:

STEP 1: Identify DAC water systems that have instituted customer charges.

[341] Individuals that participated in more than webinar workshop are double counted in this figure.
[342] State Water Board Needs Assessment Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html#affordability-assessment
[343] Workshop 1 (August 8, 2022); Presentation: https://bit.ly/3jsI4k8
Workshop 2 (September 20, 2022); Presentation: https://bit.ly/3juZwEI; White Paper: https://bit.ly/3HXrliS
Workshop 3 (November 1, 2022); Presentation: https://bit.ly/3CKoBlG; White Paper: https://bit.ly/3HVIsll
[344] California Health and Safety Code section 116769 (2) (B).

STEP 2: Of these DAC water systems, the State Water Board must identify those that exceed an "Affordability Threshold" in order to provide drinking water that meets State and Federal standards.

STEP 1: DAC & SDAC DETERMINATION

SB 200 requires the identification of DAC and SDAC systems that meet the Affordability Threshold. For the purposes of the Affordability Assessment, the State Water Board determined DAC and SDAC economic status for water systems using available data.

> **Disadvantaged Community** or DAC means the entire service area of a community water system, or a community therein, in which the MHI is less than 80% of the statewide annual MHI level.
>
> **Severely Disadvantaged Community** or SDAC means the entire service area of a community water system in which the MHI is less than 60% of the statewide MHI.

The State Water Board used the methodology detailed below to estimate MHI. **It is important to note that the estimated designation of community economic status is for the purposes of the Affordability Assessment only and will not be used by the State Water Board's Division of Financial Assistance (DFA) to make funding decisions.** Further MHI analysis on a per system basis will be conducted by DFA when a system seeks State Water Board assistance.

Table D2: Water System Community Economic Status for the Affordability Assessment

Community Economic Status	Total Systems	Failing Systems	At-Risk Systems
DAC	542	45	96
SDAC	941	158	228
Non-DAC	1,347	119	138
Missing DAC Status	15	1	6
TOTAL:	**2,845**	**323**	**468**

STEP 2: CONDUCT AFFORDABILITY ASSESSMENT

OVERVIEW OF AFFORDABILITY ASSESSMENT METHODOLOGY

The Affordability Assessment methodology relies on two core elements which are utilized to identify water systems serving communities that may be experiencing drinking water affordability challenges affordability indicators and thresholds. The methodology employed by the current Affordability Assessment utilizes the same affordability indicators and minimum thresholds used in the Risk Assessment.

Affordability Indicators: quantifiable measurements of key data points that allow the State Water Board to assess drinking water affordability challenges.

Affordability Indicator Thresholds: the levels, points, or values associated with an individual affordability indicator that delineates when a water system's customers may be experiencing affordability challenges.

The Affordability Assessment identifies "High," "Medium," "Low" Affordability Burden communities. The designation is based on the number of Affordability Indicator thresholds met by each water system. The higher the count, the higher the Affordability Burden designation. See Appendix D for more information.

AFFORDABILITY INDICATORS

Since 2020, the State Water Board and its partners have hosted workshops to feather refine and update the Affordability indicators used in the Risk and Affordability Assessments as data becomes available or is no longer available. Affordability indicators can be categorized based on the following attributes:

Household vs. Community Affordability Indicators

- **Household** affordability indicators measure the ability of individual households to pay for an adequate supply of water. Indicators measuring affordability at this scale often include a count or measurement of the number of customers within a service area of a water system that may be struggling now or in the future to pay for water services. *Currently, the Affordability Assessment has no household affordability indicators.*
- **Community** affordability indicators measure the ability of a water system's entire service area to pay for water services to financially support a resilient water system. Metrics measuring community level affordability often include data that spans all customers served by the water system.

Where there may be some households struggling to pay for water services, if the whole community is not struggling, then community level affordability may not be a concern. It is important to consider both household and community level affordability together.

Rates-Based vs. Non-Rates-Based Affordability Indicators

- **Rates-based** affordability indicators rely on data that is either directly or indirectly related to a water system directly charging for water. Rates-based indicators typically assess the proportion of a customer's income spent on water services or non-payment of water bills.
- **Non-rates-based** affordability indicators do not rely on a water system directly charging their customers for water services. These indicators may include income-based data or other data points that can assess ability to access drinking water services. These types of indictors are important for measuring affordability challenges for customers who don't receive a water bill. Examples include mobile home park residents who pay for services in their rent.

2021 Affordability Indicators

In 2020, the State Water Board conducted an Affordability Assessment for community water systems, which analyzed one affordability indicator, water charges as a percent of median household income (%MHI), for the FY 2020-21 Safe and Affordable Drinking Water Fund Expenditure Plan.[345] From April through October 2020, the State Water Board and UCLA conducted extensive research and public engagement to identify potential affordability indicators for the Needs Assessment.[346] This effort identified 23 potential affordability indicators (white paper, Table 10).[347] In 2021, the State Water Board selected two new affordability indicators from the list of 23 to incorporate into the 2021 Risk Assessment and 2021 Affordability Assessment. These two indicators were: 'Extreme Water Bill' and '% Shut-offs.'

2022 Added and Removed Affordability Indicators

In 2020, Governor Newsom issued an Executive Order that prohibited water shut-offs beginning March 4, 2020, through December 31, 2021.[348] Therefore, data for '% Shut-offs' was unavailable for the majority of 2020 and was not collected from water systems in the 2020 Electronic Annual Report (EAR). Thus, the State Water Board removed this affordability indicator from the 2022 Needs Assessment.

The State Water Board has replaced '% Shut-offs' with two new affordability indicators: 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden.' These indicators were used to identify water systems that have a community that is experiencing household affordability challenges and are a direct measure of household drinking water affordability.

2023 Added and Removed Affordability Indicators

Remove Two Affordability Indicators

The State Water Board removed two affordability indicators from the Affordability Assessment: 'Percent of Residential Arrearages' and 'Residential Arrearage Burden.'

[345] The Fund Expenditure Plan used an affordability threshold of 1.5% MHI to identify DAC water systems that may have customer charges that are unaffordable: FY 2020-21 Fund Expenditure Plan https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/docs/sadwfep_2020_07_07.pdf

[346] The identification of additional affordability indicators was undertaken in conjunction with the identification of possible affordability risk indicators for the Risk Assessment. A full list of potential affordability indicators considered can be found in the white paper *Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems:* October 7, 2020 White Paper: Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

[347] October 7, 2020 White Paper: Evaluation of Potential Indicators and Recommendations for Risk Assessment 2.0 for Public Water Systems https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

[348] Governor Newsom Executive Order https://www.gov.ca.gov/2020/04/02/governor-newsom-issues-executive-order-protecting-homes-small-businesses-from-water-shutoffs/

Arrearage: Debt accrued for drinking water services for residential accounts that have not fully paid their drinking water bill balance 60 days after the bill payment due date.

The initial data used for these two risk indicators came from the State Water Board's 2021 Drinking Water Arrearage Payment Program.[349] Eligible community water system applicants were able to apply for a one-time payment to cover residential arrearages that accrued during the COVID-19 pandemic (March 4, 2020, through June 15, 2021). This dataset is not up-to-date and does not reflect current affordability challenges. Therefore, these two indictors were removed from the Assessment until updated data becomes available.

Add New Affordability Indicator: Household Socioeconomic Burden
The State Water Board and OEHHA developed a new affordability indicator, incorporating stakeholder feedback from the three Affordability Workshops, 'Household Socioeconomic Burden,' a composite indicator that is a combined measure of Housing Burden and Poverty Prevalence that measures the extent at which low-income customers may have affordability challenges now or in the future because their disposable income is constrained by high housing costs. This allows for the inclusion of water systems that do not charge customers directly for water in the assessment.[350]

Table D3: Affordability Indicators Over Time

Indicators	Household / Community	Rates-Based?	2021	2022	2023
Percent of Median Household Income (%MHI)	Community	Yes	✓	✓	✓
Extreme Water Bill	Community	Yes	✓	✓	✓
% Shut-Offs (Removed 2022)[351]	Household	Yes	✓		
Percentage of Residential Arrearages (Removed 2023)[352]	Household	Yes		✓	
Residential Arrearage Burden (Removed 2023)[353]	Community	Yes		✓	
NEW: Household Socioeconomic Burden	Community	No			✓

AFFORDABILITY INDICATOR THRESHOLDS

To develop thresholds for the affordability indicators in the Affordability Assessment and Risk Assessment, the State Water Board reviewed multiple available types of evidence, looking

[349] California Water and Wastewater Arrearage Payment Program
https://www.waterboards.ca.gov/arrearage_payment_program/
[350] Since 2020, all affordability indicators have relied on the water systems charging for water. In 2022, nearly 40% of DAC water systems were excluded from the Assessment because they do not charge for water (i.e., mobile home parks that include their water bill in rental charge).
[351] Data not collected.
[352] Data not collected.
[353] Data not collected.

both within California, across other state agencies nation-wide, and at the U.S. EPA's standards. Sections below provide more details about the rationale for the thresholds developed for each indicator. The minimum thresholds developed for the affordability indicators in the Risk Assessment are the same thresholds used in the Affordability Assessment.

Moving forward, the State Water Board will continue to refine the affordability indicator thresholds as data availability improves and the SAFER Program matures. The process may include refining thresholds by analyzing historical data trends such as looking at the relationship between historical thresholds and debt and shut-off data once it becomes available.

Table D4: Affordability Indicator Thresholds

Indicators	Affordability Threshold
Percent of Median Household Income (%MHI)	1.5% MHI or greater
Extreme Water Bill	Greater than 150% of the statewide average.
Household Socioeconomic Burden	Combined Poverty Prevalence and Housing Burden score of 0.25 – 1

AGGREGATED AFFORDABILITY ASSESSMENT & THRESHOLD BURDENS

The Affordability Assessment utilizes the count of affordability thresholds met across all three affordability indicators. The current approach does not include scoring or weighting of the individual affordability indicators, like they are in the Risk Assessment, they are all assessed equally in Affordability Assessment analysis.

Table 47: Current Aggregated Affordability Assessment Thresholds

Current Affordability Assessment Thresholds	Total Affordability Burden
0 Affordability Indicator Thresholds Exceeded	None
1 Affordability Indicator Thresholds Exceeded	Low
2 Affordability Indicator Thresholds Exceeded	Medium
3 Affordability Indicator Thresholds Exceeded	High

AFFORDABILITY INDICATOR DETAILS

PERCENT OF MEDIAN HOUSEHOLD INCOME (%MHI)

This indicator measures the annual system-wide average residential water bill for six hundred cubic feet (HCF) per month relative to the annual Median Household Income (MHI) within a water system's service area.

Calculation Methodology

Required Data Points & Sources:

- Water system service area boundaries: SABL[354]
- Block group-Income in the Past 12 Months: 2021 U.S. Census Bureau's American Community Survey[309]
- Drinking Water Customer Charges: 2021 electronic Annual Report (eAR)
- Other Customer Charges: 2021 eAR

Average monthly drinking water customer charges are collected through the eAR. Historically this data has not been required for reporting leading to poor data coverage and accuracy issues. Extensive changes have been made to the 2021 electronic Annual Report making reporting customer charges mandatory with checks in place to improve the data quality.

Calculation Methodology:

Median household income (MHI) is determined for a water system using American Community Survey data for household income. Community water system boundaries typically do not align with census boundaries where per capita income data is regularly collected. To assign an average median household income to a community water system spatially weighted income data is aggregated by census block group within the water system service area.

The methodology for this indicator was based on the Division of Financial Assistance (DFA) MHI methodology. While the MHI calculation methodology for the Affordability Assessment generally aligns with DFA's MHI determination methodologies, there are slight differences. The differences found in the calculation of MHI's for cities and census designated places and in the application of the Margin of Error (MOE).

The DFA methodology dictates that when it is determined that a system boundary exactly matches city boundaries or closely matches a census designated place boundary, the MHI for the entire city or census designated place should be directly applied to the system rather than using areally-interpolated block group data. This likely leads to more accurate MHI estimation in these cases. However, this method was not used in the Needs Assessment given that a case-by-case determination of matching of cities and census designated places to system

[354] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[309] 2021 American Community Survey 5 Year estimate Median Household Income
https://data.census.gov/table?t=Income+(Households,+Families,+Individuals)&y=2021&d=ACS+5-Year+Estimates+Detailed+Tables&tid=ACSDT5Y2021.B19013

boundaries was not feasible for the entire state. The MHI for each water system is a population weighted MHI, using census block group area and population data. A population factor is generated based on the area of each census block group that falls within the water system boundary. The water system MHI is then calculated using population adjusted MHIs for each census block group that falls within the water system boundary using the formula below:

Equation D1: MHI Calculation

$$\sum \frac{(Block\ Group\ MHI) \times (Adjusted\ Block\ Group\ Population)}{(Total\ Adjusted\ Block\ Groups\ Population)}$$

MOE for MHI American Community Survey data is also included in the MHI calculation. A service area adjusted MOE is found using the same methodology described for MHI. The lower range of the MOE will be applied to a community's estimated MHI up to a maximum MOE value of $7,500 for communities with more than 500 people and $15,000 for communities with 500 or fewer people. The MOE will be subtracted from the estimated MHI.

The DFA methodology uses a lower bound MHI by subtracting the block group MOE from the block group MHI, with limits based on community size prior to applying the population factor to MHI and MOE. The methodology applied in the Needs Assessment set margin of error limits and then applied them to population adjusted MHI figures, resulting in slightly different community water system MHI calculations than the DFA methodology.

As a result of these slight variations and the changing nature of household income, all funding related financial assessments must be completed by the DFA as their assessments are water system specific as opposed to the aggregated analysis done for the purposes of the Needs Assessment.

Average monthly drinking water customer charges are calculated using:

- Drinking water service costs estimated at six HCF Feet per month. This level of consumption is in line with statewide conservation goals of 55 gallons per capita per day, in an average 3-person household.
- When data becomes available, additional approximated customer charges (not collected through a customer's bill) will be added to this figure to calculate Total Drinking Water Customer Charges.

Equation D2: %MHI Calculation
%MHI = [Average Monthly Drinking Water Changes] / [MHI]

Threshold Determination
%MHI is commonly used by state and federal regulatory agencies and by water industry stakeholders for assessing community-wide water charges affordability for decades. %MHI is utilized by the State Water Board (at 1.5% threshold) and the U.S. EPA (at 2.5% threshold) for assessing affordability. The State Water Board and DWR use %MHI to determine Disadvantaged Community (DAC) status, among other income-related metrics. DAC status is

often used to inform funding eligibilities for different financial programs offered by the State and other agencies. OEHHA's Human Right to Water (HR2W) Tool also utilizes[355] the thresholds determined by the State Water Board for this indicator.[356] Other states, including North Carolina,[357] presently or have recently used 1.5% of MHI spent on water and sewer costs as a threshold for water system funding decisions. For purposes of the Affordability Assessment, the threshold used is 1.5%.

Table D5: %MHI Affordability Thresholds

Threshold Number	Threshold	Affordability Burden
0	**Below 1.5%** MHI	**No**
1	**1.5% MHI or greater**	**Yes**

Indicator Analysis

State Water Board staff analyzed 2,845 community water systems, of which approximately 251 systems lacked the data necessary to calculate %MHI. Overall, 486 (19%) of water systems exceeded the 1.5% MHI affordability threshold. Of those, 368 systems were identified that serve DAC/SDACs. Table D6 and Table D7 summarize the full results of this indicator analysis. The full results from the affordability threshold calculations are included in Attachment D1.[358]

Table D6: %MHI Assessment Results by Community Status

Community Status	Total Systems	Missing	N/A	Threshold Not Met	Threshold Met
DAC/SDAC	1,483	134 (9%)	446 (30%)	981 (66%)	368 (25%)
Non-DAC	1,347	112 (8%)	213 (16%)	1,117 (83%)	118 (9%)
TOTAL:	**2,845**	**246 (9%)**	**659 (23%)**	**2,098 (74%)**	**486 (17%)**
Missing DAC Status	*15*				

[355] There has been criticism of this metric by academics, water system associations, and the broader water sector mostly around its accuracy in measuring household affordability for those truly in need and the setting of arbitrary %MHI thresholds, limitations which the U.S. EPA has recently acknowledged.
[356] Arkansas Natural Resources Commission (2020). Safe Drinking Water Fund Intended Use Plan SFY 2019: https://www.agriculture.arkansas.gov/wp-content/uploads/2020/05/0_-_2019_DWSRF_IUP_-_AMENDED_January_2019_01082019_1156hrs.pdf
[357] North Carolina Department of Environmental Quality, Joint Legislative Economic Development and Global Engagement Oversight Committee (March 17, 2016) https://www.ncleg.gov/DocumentSites/Committees/JLEDGEOC/2015-2016/Meeting%20Documents/3%20-%20March%2017,%202016/2%20%20DEQ_Kim%20Colson%20Water%20Infrastructure%20JLOC%20EDGE%2020160317.pdf
[358] Attachment D1: Affordability Assessment Data and Results https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023affordability.xlsx

Table D7: %MHI Assessment Results by Water System SAFER Program Status

SAFER Program Status	Total Systems	Missing	N/A	Threshold Not Met	Threshold Met
Failing Systems	**323**	**26 (8%)**	**84 (26%)**	**214 (66%)**	**83 (26%)**
DAC/SDAC	203	16	59	121	66
At-Risk Systems	**468**	**52 (11%)**	**135 (29%)**	**261 (56%)**	**155 (33%)**
DAC/SDAC	324	44	94	159	121
Potentially At-Risk Systems	**408**	**39 (10%)**	**124 (30%)**	**277 (68%)**	**92 (23%)**
DAC/SDAC	257	25	95	167	65
Not Failing or At-Risk System	**1,485**	**106 (7%)**	**294 (20%)**	**1,227 (83%)**	**152 (10%)**
DAC/SDAC	656	38	190	505	113
TOTAL:	**2,845**	**223 (8%)**	**637 (22%)**	**1,979 (70%)**	**482 (17%)**
Missing SAFER Status:	*161*				

EXTREME WATER BILL

This indicator measures drinking water customer charges that meet or exceed 150% of statewide average drinking water customer charges at the six hundred cubic feet (HCF) level of consumption.

Calculation Methodology

Required Data Points & Sources:

- Drinking Water Customer Charges: 2021 eAR
- Other Customer Charges: 2021 eAR

Calculation Methodology:

Extreme Water Bill for a water system is determined using Average Monthly six HCF Drinking Water Customer Charges and Other Customer Charges divided by the State's Monthly Average Drinking Water Charges. Due to data quality concerns, water systems that reported less than $5 or greater than $500 in monthly customer charges for six HCF were excluded from the analysis and the calculated statewide average.

Threshold Determination

The State Water Board's AB 401 report[359] recommended statewide low-income rate assistance

[359] AB 401 Final Report:
Recommendations for Implementation of a Statewide Low-Income Water Rate Assistance Program
https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf

program elements utilize a minimum affordability indicator threshold of 150% of the state average drinking water bill for six HCF.

Table D8: Extreme Water Bill Affordability Thresholds

Threshold Number	Threshold	Affordability Burden
0	**Below 150%** of the statewide average.	**No**
1	**Greater than 150%** of the statewide average.	**Yes**

Indicator Analysis

State Water Board staff analyzed 2,845 community water systems, of which approximately 248 water systems lacked the data necessary to estimate water rates. Overall, 317 (12%) of systems exceeded the 150% extreme water bill affordability threshold. Of those that exceeded the extreme water bill affordability threshold, 103 systems serve DAC/SDACs. Table D9 and Table D10 summarize the full results of this indicator analysis. The tables of the full results from the affordability threshold calculations are included in Attachment D1.[360]

Table D9: Extreme Water Bill Assessment Results by Community Status

Community Status	Total Systems	Missing	N/A	Threshold Not Met	Threshold Met
DAC/SDAC	1,483	124 (8%)	0 (0%)	800 (54%)	103 (7%)
Non-DAC	1,347	108 (8%)	0 (0%)	808 (60%)	214 (16%)
TOTAL:	**2,845**	**232 (8%)**	**0 (0%)**	**1,608 (57%)**	**317 (11%)**
Missing DAC Status	*15*				

Table D10: Extreme Water Bill Assessment Results by Water System SAFER Program Status

SAFER Program Status	Total Systems	N/A	Missing	Threshold Not Met	Threshold Met
Failing Systems	**323**	**0 (0%)**	**23 (7%)**	**164 (51%)**	**49 (15%)**
DAC/SDAC	203	0	15	112	16
At-Risk Systems	**468**	**0 (0%)**	**50 (11%)**	**200 (43%)**	**81 (17%)**
DAC/SDAC	324	0	42	145	41
Potentially At-Risk Systems	**408**	**0 (0%)**	**37 (9%)**	**190 (47%)**	**56 (14%)**
DAC/SDAC	257	0	24	118	19

[360] Attachment D1: Affordability Assessment Results and Data
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023affordability.xlsx

SAFER Program Status	Total Systems	N/A	Missing	Threshold Not Met	Threshold Met
Not Failing or At-Risk System	**1,485**	**0 (0%)**	**96 (6%)**	**955 (64%)**	**132 (9%)**
DAC/SDAC	656	0	32	401	27
TOTAL:	**2,845**	**0 (0%)**	**206 (7%)**	**1,509 (53%)**	**318 (11%)**
Missing SAFER Status:	*161*				

HOUSEHOLD SOCIOECONOMIC BURDEN

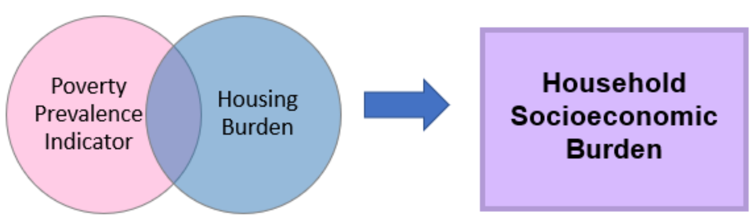
The purpose of this indicator is to identify water systems that serve communities that have both high levels of poverty and high housing costs for low-income households. These communities may be struggling to pay their current water bill and may have a difficult time shouldering future customer charge increases when their limited disposable income is constrained by high housing costs. This indicator is a composite indicator of two data points: Poverty Prevalence and Housing Burden.

- **Poverty Prevalence Indicator (PPI)** measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level.

- **Housing Burden Indicator** measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).

The combination of these two variables creates a more comprehensive picture of socioeconomic vulnerability while accounting for the varying levels of income and cost burdens throughout California.

Figure D1: PPI and Housing Burden Components Combined to Create Household Socioeconomic Burden Indicator



Calculation Methodology

Required Data Points & Sources:

- Poverty Prevalence Indicator: From the 2017-2021 American Community Survey (ACS),[361] a dataset containing the number of individuals above 200 percent of the federal poverty level (FPL) was downloaded by block groups for the state of California (25,607 in the state).
- Housing Burden Indicator data: From the 2015-2019 U.S. Department of Housing and Urban Development (HUD) Comprehensive Housing Affordability Strategy (CHAS),[362] a dataset containing cost burdens for households by HUD-adjusted median family income (HAMFI) category was downloaded by census tract for the state of California (8,057 in the state).

Calculation Methodology:

Prepare Poverty Prevalence Indicator data: The number of individuals below 200 percent of the FPL was calculated by subtracting the reported estimate of individuals in poverty (2x FPL) by the total estimate. The number of individuals below 200% of the poverty level was divided by the total population for whom poverty status was determined.

Prepare Housing Burden Indicator data: CHAS— a special analysis of census data specific to housing— is only available at the census tract and other larger geographies. For each census tract, the data were analyzed to estimate the number of households with household incomes less than 80% of the county median and renter or homeowner costs that exceed 50% of household income. The percentage of the total households in each tract that are both low-income and housing-burdened was then calculated. Each census tract was associated with the block groups within it to maintain consistency with the PPI indicator, which is at the block group level.

PPI and Housing Burden at the block group level were area-weighted to CWS boundaries. These boundaries were downloaded from the System Area Boundary Layer (SABL).[363] using the Intersect Tool in ArcPro, the area was determined for each portion of a water system boundary that intersected with a block group boundary. A weighted average, using area as the weight, was calculated for both PPI and Housing Burden for all water systems in the assessment.

The ACS and CHAS estimates come from a sample of the population and suppression criteria were assessed to flag estimates considered statistically unreliable.

[361] American Community Survey
https://data.census.gov/cedsci/
[362] HUD CHAS Data
https://www.huduser.gov/portal/datasets/cp.html
[363] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

Suppression Criteria for PPI

- Unlike the U.S. Census, ACS estimates come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.
- The SE was calculated for each block group using the formula for approximating the SE of proportions provided by the ACS.[364] When this approximation could not be used, the formula[365] for approximating the SE of ratios was used instead.
- The RSE is calculated by dividing a tract's SE by its estimate of the percentage of the population living below twice the federal poverty level and taking the absolute value of the result.
- Block group estimates that met either of the following criteria were considered reliable and included in the analysis:
  - RSE less than 50 (meaning the SE was less than half of the estimate); or
  - SE was less than the mean SE of all California block group estimates for poverty.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block group with scores were included in the indicator.

Suppression Criteria for Housing Burden

- Like ACS estimates, CHAS data come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.
- The SE was calculated for each census tract using the formula for approximating the SE of proportions provided by the ACS.[366] When this approximation could not be used, the formula[367] for approximating the SE of ratios was used instead.
- The RSE was calculated by dividing a tract's SE by its estimate of the percentage of housing-burdened low-income households and taking the absolute value of the result.
- Census tract estimates that met either of the following criteria were considered reliable and included in the analysis:
  - RSE less than 50 (meaning the SE was less than half of the estimate); or
  - SE was less than the mean SE of all California census tract estimates for housing burdened low-income households.
- All census tract level Housing Burden scores were associated with the block groups within them.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block group with scores were included in the indicator. Block groups that met the inclusion

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[364] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[365] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[366] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[367] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf

criteria were sorted and assigned percentiles based on their position in the distribution.

Component Thresholds

Poverty Prevalence (PPI): For PPI, various thresholds have been explored by other organizations and researchers including the use of 30%[368] or multiple categories such as less than 10%, 10% to 30%, 30% to 50%, and greater than 50%.[369] However, the most widely used PPI thresholds by organizations and researchers was first suggested by Raucher et al. in a report prepared for the American Water Works Association[370,371,372,373]. In the Raucher et al. report entitled 'Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector,' the following PPI thresholds are recommended: low risk less than 20%, medium risk between 20% to 35%, and high risk greater than 35%. The State Water Board and OEHHA evaluated these thresholds as it relates to California data and propose to use these thresholds for the PPI component of the Household Socioeconomic Burden indicator.

Table D11: PPI Component Threshold Scores

Component	Threshold	Score
PPI	**Threshold N/A =** Missing or not reliable PPI data	**N/A**
	Threshold 0 = < 20%	**0**
	Threshold 1 = 20% - 35%	**0.25**
	Threshold 2 = > 35%	**1**

Housing Burden: Based on a nationwide literature review, consistent thresholds for Housing Burden have not yet been established by other organizations or identified in the scientific literature. A report by the University of North Carolina on housing conditions in North Carolina

[368] Lauren Patterson (2021): Water Affordability https://internetofwater.org/wp-content/uploads/2021/12/Blog010_WaterAffordability_Patterson.pdf
[369] David Mitchell, and Elizabeth Stryjewski (2020): Technical Memorandum on Water/Sewer Service Affordability Analysis https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248
[370] Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector (2019) https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813
[371] American Water Works Association: Measuring Water Affordability and the Financial Capability of Utilities https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260
[372] Alliance for Water Efficiency (2020): An Assessment of Water Affordability and Conservation Potential in Detroit, Michigan https://www.allianceforwaterefficiency.org/sites/www.allianceforwaterefficiency.org/files/highlight_documents/AWE_Water_Affordability_Detroit_Final_2020_0.pdf
[373] Duke University, Nicholas Institute: Exploring the Affordability of Water Services within and across Utilities https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf

identified census tracts in the top 20% of state as severely burdened.[374] Additionally, a recently published Master's Thesis about housing challenges in California identified census tracts in the top quartile of the state as being the "most impacted."[375] Lastly, one study showed that 16% of children in Los Angeles County live in severe housing-cost burdened households, but this was based on survey data.[376] Given the lack of peer-reviewed literature, consistency and relevance among these limited examples, the census tracts were grouped into three categories (or tertiles), based on the overall distribution of 2019 housing burden data in the state to identify three levels of risk. The three categories were rounded to the nearest whole number.

Based on this statewide data, low risk corresponds with fewer than 14% of total households experiencing housing burden. Medium risk is between 14% and 21%, and high risk is greater than 21%, respectively. Using a matrix scoring approach, first each bin was assigned a score of 0 for "low vulnerability," 0.25 for "medium vulnerability" and 1 for "high vulnerability." The State Water Board will analyze water system arrearage, shut-off, and other affordability indicators over time to determine if the recommended Housing Burden thresholds should be adjusted in the future.

Table D12: Housing Burden Component Threshold Scores

Component	Threshold	Score
Housing Burden	**Threshold N/A =** Missing or not reliable Housing Burden data	**N/A**
	Threshold 0 = <14%	**0**
	Threshold 1 = 14% - 21%	**0.25**
	Threshold 2 = >21%	**1**

Threshold Determination

The two components of Household Socioeconomic Burden were combined using a matrix approach and following the same methodology as the Risk Assessment for state small water systems and domestic wells.[377] The normalized scores for PPI and Housing Burden components were added together and divided by the number of components (two). Below is the calculation used for each water system's Household Socioeconomic Burden score and Figure D2 shows how much each calculated score represents a degree of PPI and Housing Burden within the matrix.

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374 William Rohe, Todd Owen, and Sarah Kerns; The University of North Carolina at Chapel Hill, Center for Urban and Regional Studies (2017): Extreme Housing Conditions in North Carolina
https://curs.unc.edu/wp-content/uploads/sites/400/2017/02/Extreme-Housing-Conditions-in-North-Carolina.pdf

375 Lucresia Graham(2021): A Cartographic Exploration of Census Data on Select Housing Challenges Among California Residents
https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf

376 Tabashir Z. Nobari, Shannon E. Whaley, Evelyn Blumenberg, Michael L. Prelip, and May C. Wanga (2018): Severe Housing-Cost Burden and Obesity Among Preschools-aged Low-Income Children in Lost Angeles County.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/

377 2022 Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Equation D3: Calculating Household Socioeconomic Burden Score

$$\textbf{\textit{Household Socioeconomic Burden}} = \frac{PPI\ Score + Housing\ Burden\ Score}{2}$$

Figure D2: Household Socioeconomic Burden Scores Within the Matrix Represents Varying Degrees of PPI and Housing Burden

Poverty (PPI)	**High Risk** ≥ 35%	Score = 1	*Missing*	0.5	0.625	1
	Med Risk 20% - 35%	Score = 0.25	*Missing*	0.125	0.25	0.625
	None < 20%	Score = 0	*Missing*	0	0.125	0.5
	Unknown	Score = *Missing*	*Missing*	*Missing*	*Missing*	*Missing*
			Score = *Missing*	Score = 0	Score = 0.25	Score = 1
			Unknown	**None** < 14%	**Med Risk** 14% - 21%	**High Risk** ≥ 21%
			Housing Burden			

These combined scores are converted into threshold Affordability Burden designations, as shown in Table D13.

Table D13: Thresholds for Household Socioeconomic Burden

Threshold Number	Threshold	Affordability Burden
0	Combined score of **0 – 0.125**	**No**
1	Combined score of **0.25 – 1**	**Yes**

Indicator Analysis

State Water Board staff analyzed 2,845 community water systems, of which approximately 34 water systems lacked necessary data. Of the 2,811 water systems with sufficient data, 1,812 (64%) systems exceeded the Household Socioeconomic Burden affordability threshold. Of those that exceeded the threshold, 1,138 are DAC/SDAC systems. Table D14 and Table D15 summarize the full results of this indicator analysis. The tables of the full results from the affordability threshold calculations are included in Attachment D1.[378]

[378] Attachment D1: Affordability Assessment Data and Results
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023affordability.xlsx

Table D14: Household Socioeconomic Burden Assessment Results by Community Status

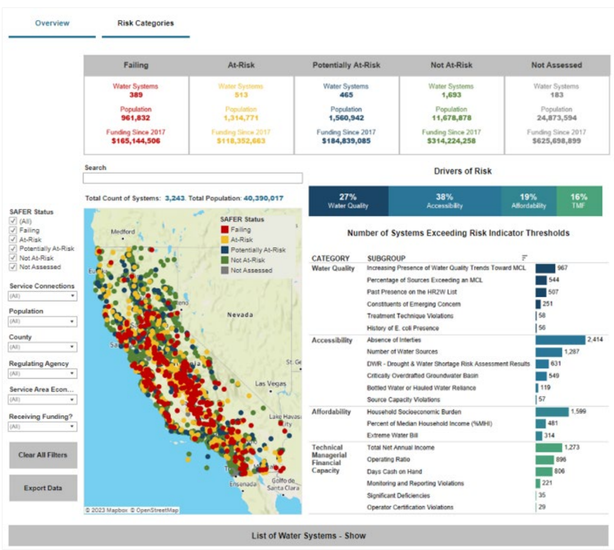
Community Status	Total Systems	Missing	N/A	Threshold Not Met	Threshold Met
DAC/SDAC	1,483	13 (1%)	0 (0%)	333 (22%)	1,138 (77%)
Non-DAC	1,347	19 (1%)	0 (0%)	994 (74%)	674 (50%)
TOTAL:	**2,845**	**32 (1%)**	**0 (0%)**	**1,327 (47%)**	**1,812 (64%)**
***Missing* DAC Status**	*15*				

Table D15: Household Socioeconomic Burden Results by Water System SAFER Program Status

SAFER Program Status	Total Systems	Missing	N/A	Threshold Not Met	Threshold Met
Failing Systems	**323**	**2 (1%)**	**0 (0%)**	**118 (37%)**	**203 (63%)**
DAC/SDAC	203	1	0	25	177
At-Risk Systems	**468**	**1 (1%)**	**0 (0%)**	**137 (29%)**	**330 (71%)**
DAC/SDAC	324	0	0	49	275
Potentially At-Risk Systems	**408**	**2 (1%)**	**0 (0%)**	**138 (34%)**	**268 (66%)**
DAC/SDAC	257	0	0	35	222
Not Failing or At-Risk System	**1,485**	**5 (1%)**	**0 (0%)**	**869 (59%)**	**611 (41%)**
DAC/SDAC	656	2	0	217	437
TOTAL:	**2,845**	**10 (1%)**	**0 (0%)**	**1,262 (44%)**	**1,412 (50%)**
Missing SAFER Status:	*161*				

APPENDIX E:
SAFER DASHBOARD

INTRODUCTION



In 2022, the State Water Board released the web-based SAFER Dashboard. The SAFER Dashboard displays the current list of Failing water systems and the results of the Risk Assessment for public water systems. This is a core component of the State Water Board's annual Drinking Water Needs Assessment. Learn more about the Risk Assessment for public water systems in Appendix A.

The Dashboard displays risk drivers for public water systems. The Dashboard includes source data from the State Water Board, the Department of Water Resources, and the Office of Environmental Health Hazard Assessment. The Dashboard is used by internal staff and members of the public to identify and explore Failing and At-Risk public water systems and how they perform in the following risk categories: water quality, accessibility, affordability, and TMF (technical, managerial, and financial) capacity. The Dashboard displays summary statistics of the number of Failing and At-risk public water systems in different risk categories and shows users the locations of these systems. Users can apply filters to view regional or system-level statistics.

NAVIGATING THE DASHBOARD

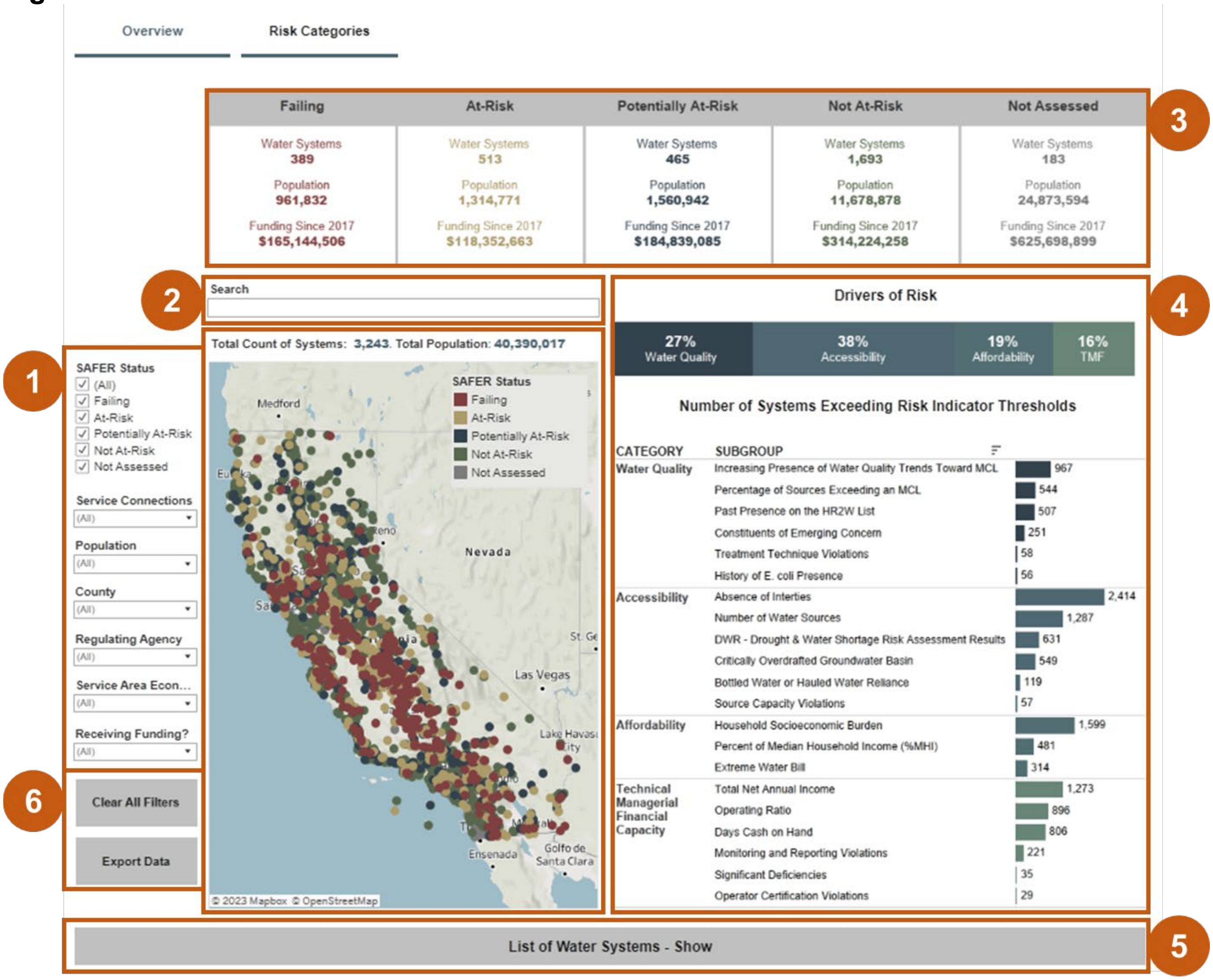
The SAFER Dashboard can be viewed in the State Water Board's website at the URL below:

https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/saferdashboard.html

STATEWIDE OR REGIONAL VIEW

By default, the SAFER Dashboard displays the full statewide dataset of Failing water systems and the results of the Risk Assessment. Figure E1 and the sections below provide an overview of the information and functionality currently available in the statewide view.

Figure E1: Statewide View SAFER Dashboard



1. FILTER OPTIONS

Users can filter the SAFER Dashboard to change the data summaries displayed. Users can select multiple filters at a time using the drop-down menu options on the left side of the Dashboard. Table E1 summarizes the filter options currently available.

Table E1: Filter Options in the SAFER Dashboard

Filter Option	About
SAFER Status[379]	Whether a water system is Failing, At-Risk or Potentially At-Risk of failing, Not At-Risk of failing, or Not Assessed.

[379] Failing criteria is summarized in the Drinking Water Needs Assessment and detailed online at the link below. The criteria used to determine At-Risk, Potentially At-Risk, and Not At-Risk water systems is detailed in Appendix A of the annual Drinking Water Needs Assessment report.
Failing Criteria: https://www.waterboards.ca.gov/water_issues/programs/hr2w/docs/hr2w_expanded_criteria.pdf

Filter Option	About
Service Connections	The total number of service connections served by the water system.
Population	The total estimated population served by the water system.
County	The primary County where the water system is physically located.
Regulating Agency	The State Water Board District Office or Local Primacy Agency that is responsible for regulatory oversight of the system.
Service Area Economic Status	The disadvantage community statis of the water system, determined with U.S. Census median household income (MHI) data. “Disadvantaged community” or “DAC” means the entire service area of a community water system, or a community therein, in which the MHI is less than 80% of the statewide annual MHI level.[380] “Severely disadvantaged community” or “SDAC” means the entire service area of a community water system in which the MHI is less than 60% of the statewide MHI.[381]
Receiving Funding?	Indicates if the water system has received technical assistance, planning and/or construction funding from the State Water Board since 2017. This information is provided by the State Water Board’s Division of Financial Assistance.

2. MAP DISPLAY & SEARCH OPTIONS

Users can use the search box to look-up a water system. Users can enter either a water system’s name or a Public Water System ID (PWSID) number to search the list of active community water systems and schools.

Note: To clear the search box and re-set the map, the user must select the entered text, delete it, and hit enter with your keyboard within the search box.

The map will display the systems that meet the filtered criteria (1) or the water system the user has looked-up using the search box. The color of the point location represents the current SAFER Status of the water system. Above the map is a summary of the total number of systems meeting the filter criteria and the total population served by those water systems.

[380] Health & Saf. Code, § 116275, subd. (aa).
[381] Water Code § 13476, subd. (j)).

3. ABOUT THE SAFER SYSTEMS

The top of the SAFER Dashboard contains a breakdown summary of information regarding the systems that fall into the SAFER Status categories: Failing, At-Risk, Potentially At-Risk, Not At-Risk, and Not Assessed. As filters are applied to the Dashboard, the displayed numbers will automatically update to reflect the systems meeting both the SAFER Status criteria and the applied Dashboard filter criteria.

Table E2: SAFER Systems Data Summary

Summary Data by SAFER Status	About
Water Systems	Total count of water systems meeting the criteria for each SAFER Status.
Population	Total population served of the water systems meeting the criteria for each SAFER Status.
Funding Since 2017	Total amount of technical assistance, planning and construction funding provided by the State Water Board since 2017. This information is provided by the State Water Board's Division of Financial Assistance.

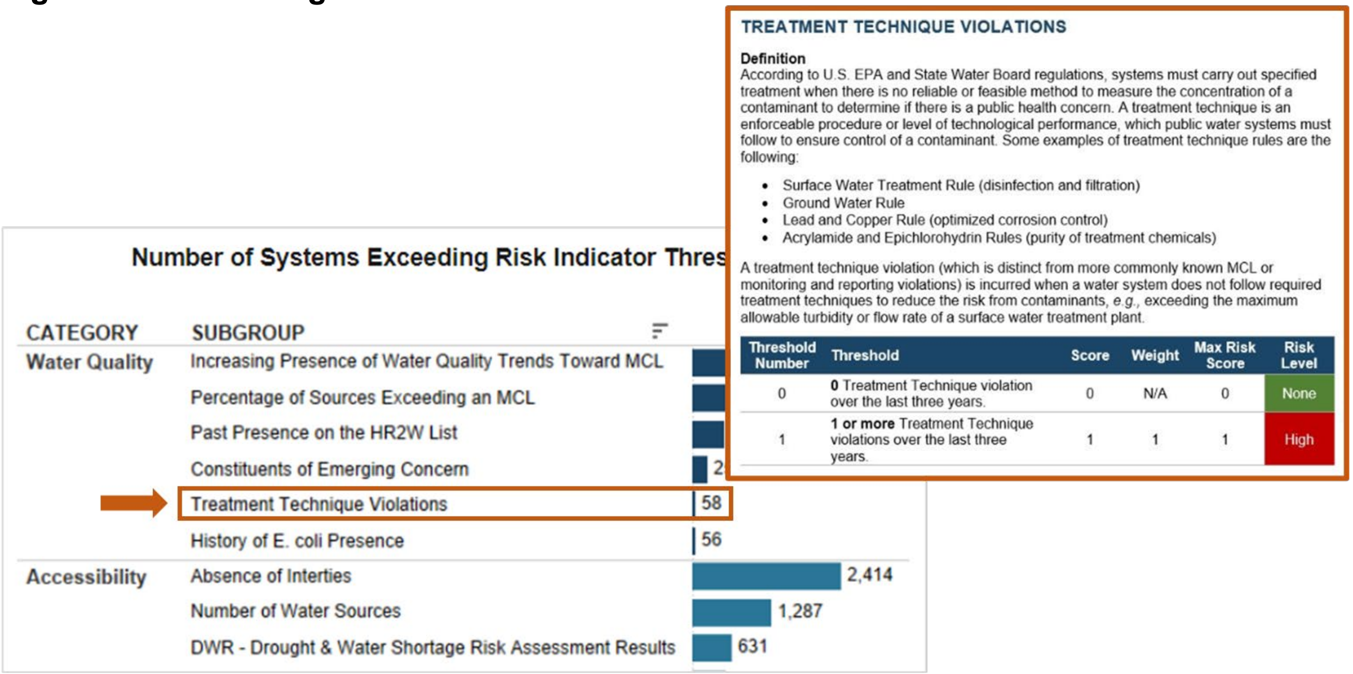
4. DRIVERS OF RISK & RISK INDICATOR PERFORMANCE

The right-side of the SAFER Dashboard displays the summary of water system performance in the Risk Assessment. The 'Drivers of Risk' chart indicates which risk categories the water systems displayed in the Dashboard accrued the most risk points in. The chart and the percentages will update automatically when filters are applied and/or is the user searches for a particular water system.

The 'Number of Systems Exceeding Risk Indicator Thresholds' bar chart displays the total number of water systems that meet the lowest risk criteria for each displayed risk indicator. The chart will update automatically when filters are applied and/or is the user searches for a particular water system.

Learn More: Users can click on a risk indicator title to open a new web-browser tab with the risk indicator definition and risk threshold criteria (Figure E2).

Figure E2: Accessing Risk Indicator Definitions



5. LIST OF WATER SYSTEMS

Selecting the ‘List of Water Systems’ button at the bottom of the SAFER Dashboard will Show and Hide the list of water systems that are meeting the applied filter criteria (1) or search box fields (2).

6. CLEAR FILTERS & EXPORT DATA BUTTONS

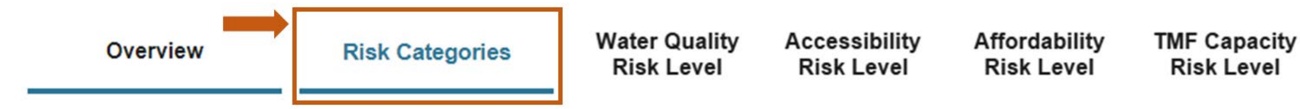
Selecting the ‘Clear All Filters’ button will de-select and re-set the filter options on the left side of the Dashboard (1). *Note*: This button will NOT clear the search box fields (2). To clear the search box, the user must select the entered text, delete it, and hit enter with your keyboard within the search box.

The ‘Export Data’ button will open a pop-up window with options for how to download the data displayed in the Dashboard. *Note*: This feature in the Dashboard is known to have issues. Users are encouraged to use the links above the Dashboard to access the data in a more user-friendly format.

STATEWIDE OR REGIONAL VIEW - RISK CATEGORIES

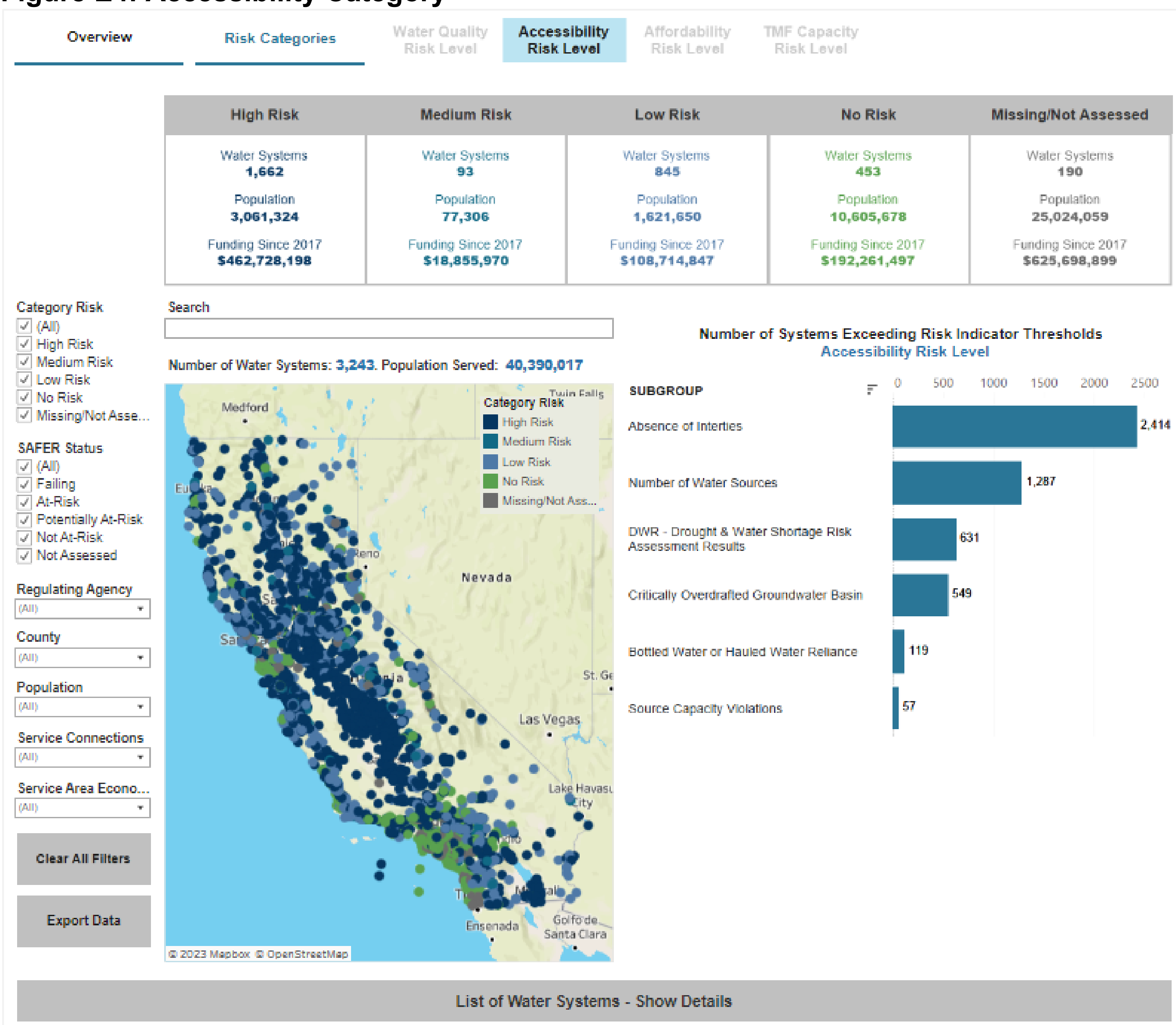
The SAFER Dashboard statewide and regional view can be narrowed down to each risk category by clicking on ‘Risk Categories’ button at the top of the Dashboard: Water Quality; Accessibility; Affordability; and TMF (technical, managerial, and financial) Capacity (Figure E3).

Figure E3: Risk Categories



Users can select their desired Risk Category and the SAFER Dashboard will automatically refresh to display the statewide view of how water systems have performed within that category. The filter options, search box, and display features function the same as they do on the Overview view. The only NEW feature is the ability to view and filter by a system's performance in the risk category (to left filter option).

Figure E4: Accessibility Category



INDIVIDUAL WATER SYSTEM VIEW

The SAFER Dashboard also displays detailed information about individual water systems. To navigate to the individual water system view, users should click on the corresponding dot-location in the map (Figure E5).

Figure E5: Individual Water System View

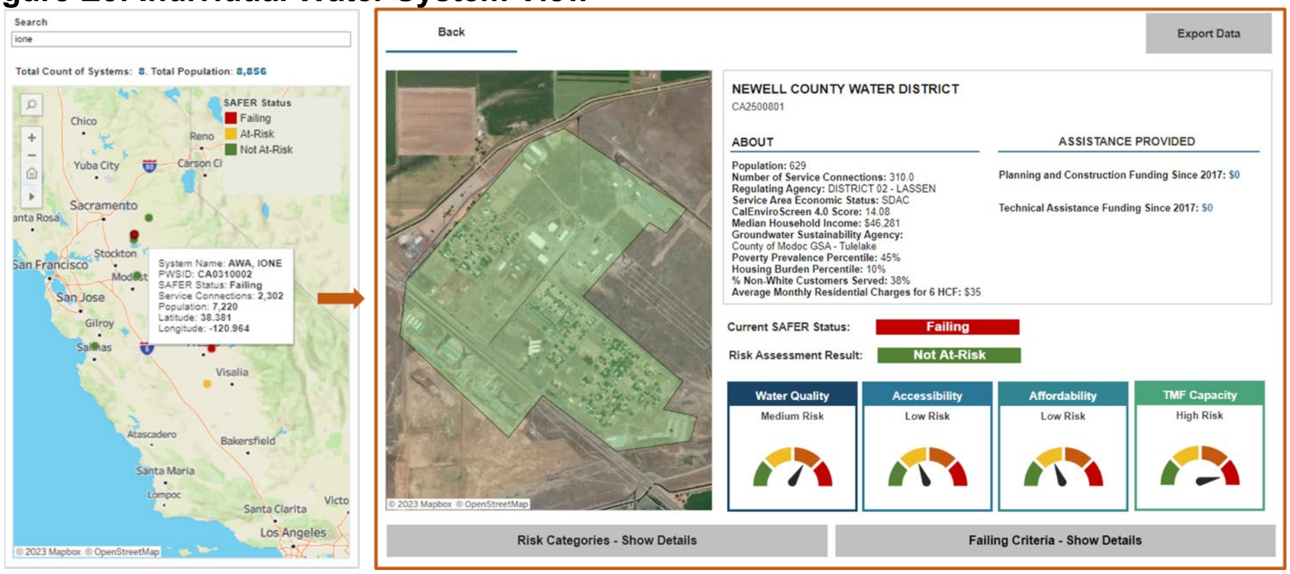
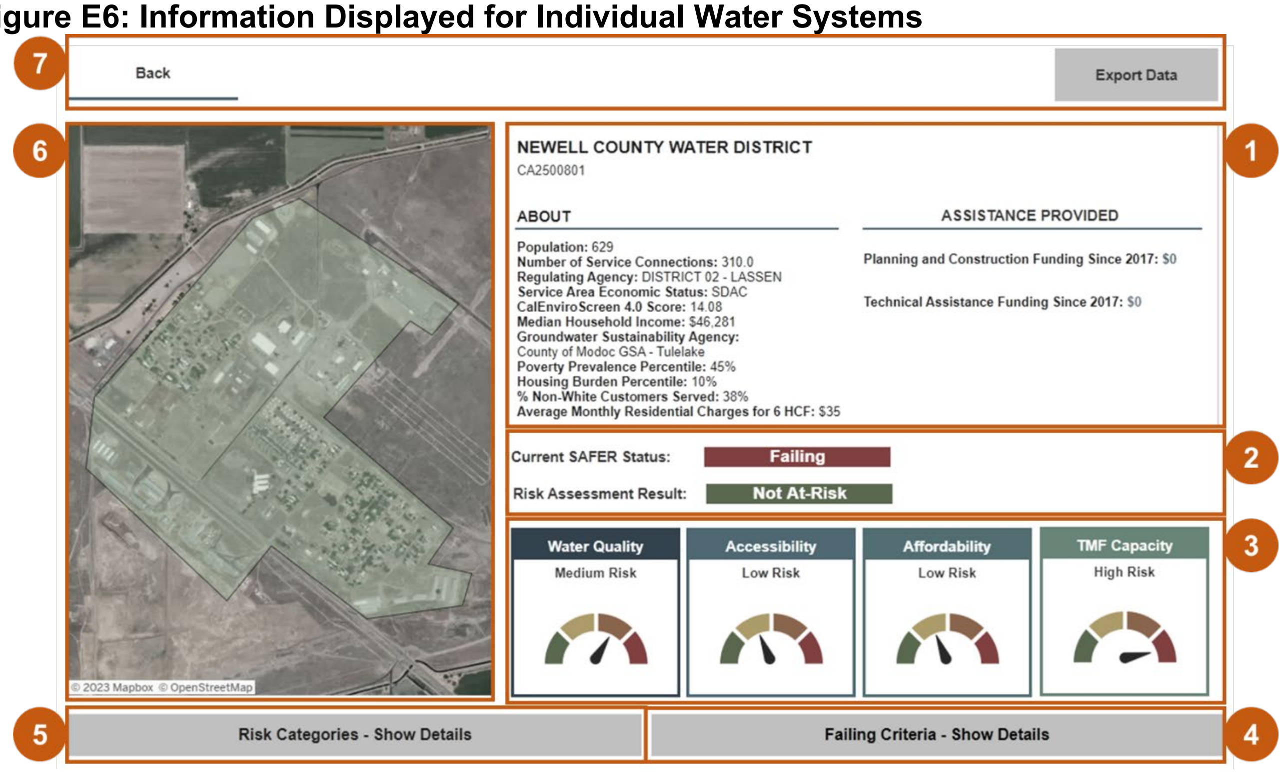


Figure E6 and the sections below provide an overview of the information and functionality currently available in the individual water system view.

Figure E6: Information Displayed for Individual Water Systems



1. WATER SYSTEM DETAILS

The profile page for individual water systems displays information about the system's location, size, demographics, State Water Board assistance received etc.

Table E3: Water System Details

Water System Information	About
Water System Name	The water system's name
Public Water System ID (PWSID = CA#######)	The unique identifier assigned by the State Water Board to individual water systems. The PWSID is used for the state and federal data and information tracking purposes.
Population	The total number of service connections served by the water system.
Number of Service Connections	The total estimated population served by the water system.
Regulating Agency	The State Water Board District Office or Local Primacy Agency that is responsible for regulatory oversight of the system.
Service Area Economic Status	The disadvantage community statis of the water system, determined with U.S. Census median household income (MHI) data. "Disadvantaged community" or "DAC" means the entire service area of a community water system, or a community therein, in which the MHI is less than 80% of the statewide annual MHI level.[382] "Severely disadvantaged community" or "SDAC" means the entire service area of a community water system in which the MHI is less than 60% of the statewide MHI.[383]
CalEnviroScreen 4.0 Score	CalEnviroScreen is a screening methodology that can be used to help identify California communities that are disproportionately burdened by multiple sources of pollution. Scores range from 0 to 100, with 100 representing high pollution burden and 0 low pollution burden.
Median Household Income	Median household income (MHI) is determined for a water system using American Community Survey data for household income. Community water system boundaries typically do not align with census boundaries where per capita income data is regularly collected. To assign an average median household income to a community water system spatially weighted income data is aggregated by

[382] Health & Saf. Code, § 116275, subd. (aa).
[383] Water Code § 13476, subd. (j)).

Water System Information	About
	census block group within the water system service area. Learn more in Appendix E of the annual Needs Assessment report.
Groundwater Sustainability Agency	The Groundwater Sustainability Agency the water system's location is associated with.
Poverty Prevalence Percentile	Measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level.
Housing Burden Percentile	Measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).
% Non-White Customers Served	The estimated percentage of population served by the water system that is non-white. U.S. Census and water system service area boundaries are used to calculate this value.
Average Monthly Residential Charges for 6 Hundred Cubic Feet (HCF)	The most common residential drinking water charges for 6 hundred cubic feet (HCF) of water per month. This data is collected annually from water systems.
Planning and Construction Funding Since 2017	Indicates the estimated total amount of State Water Board grant and/or loan planning and/or construction funding the water system has received since 2017. Planning and construction funding is allocated to water systems directly. This information is provided by the State Water Board's Division of Financial Assistance.
Technical Assistance Funding Since 2017	Indicates the estimated total amount of State Water Board technical assistance funding that the water system has benefitted from since 2017. Technical assistance funding is allocated to designated technical assistance providers that work directing with a water system. This information is provided by the State Water Board's Division of Financial Assistance.

2. FAILING AND AT-RISK STATUS

The individual water system profile page displays the current SAFER Status of the water systems and how the system is performing in the Risk Assessment. The SAFER Status can be one of four options as defined in Table E4.

The water system's Risk Assessment performance is based on the most current Risk Assessment methodology and data available. See Appendix A of the annual Needs Assessment report to learn more about the current methodology and the section below on the refresh rate of the Risk Assessment results. If a water system is system's SAFER Status is currently Failing, the Risk Assessment result will indicate what the systems SAFER Status will be once it comes off the Failing list.

Table E4: SAFER and Risk Assessment Status

Status	About
Failing	Failing water systems are those that are meeting current Failing criteria as defined by the State Water Board.[384]
At-Risk	Water system's At-Risk of failing. Systems are designated At-Risk based on their performance across multiple risk indicators in the Risk Assessment as defined in the Drinking Water Needs Assessment.[385]
Potentially At-Risk	Water system's Potentially At-Risk of failing. Systems are designated Potentially At-Risk based on their performance across multiple risk indicators in the Risk Assessment as defined in the Drinking Water Needs Assessment.
Not At-Risk	Water system's Not At-Risk of failing. Systems are designated Not At-Risk based on their performance across multiple risk indicators in the Risk Assessment as defined in the Drinking Water Needs Assessment.
Not Assessed	Water systems that are currently not Failing and not included in the Risk Assessment analysis.[386]

3. RISK ASSESSMENT CATEGORY RISK

The Risk Category dials display how water systems are performing within each category of the Risk Assessment. Sections below detail the methodology used to determine category High, Medium, Low, or No Risk.

4. FAILING CRITERIA MET

Users can click on the 'Failing Criteria' Hide and Reveal button at the bottom of the SAFER Dashboard to display information about a system's Failing SAFER Status if the system is currently Failing Figure E7.

[384] Failing criteria is summarized in the Drinking Water Needs Assessment and detailed online at the link below. Failing Criteria: https://www.waterboards.ca.gov/water_issues/programs/hr2w/docs/hr2w_expanded_criteria.pdf
[385] The criteria used to determine At-Risk, Potentially At-Risk, and Not At-Risk water systems is detailed in Appendix A of the annual Drinking Water Needs Assessment report.
[386] Large community water system with greater than 30,000 service connection or more than 100,000 population served are not included in the Risk Assessment and will not have a Risk Assessment result.

Figure E7: Failing Details

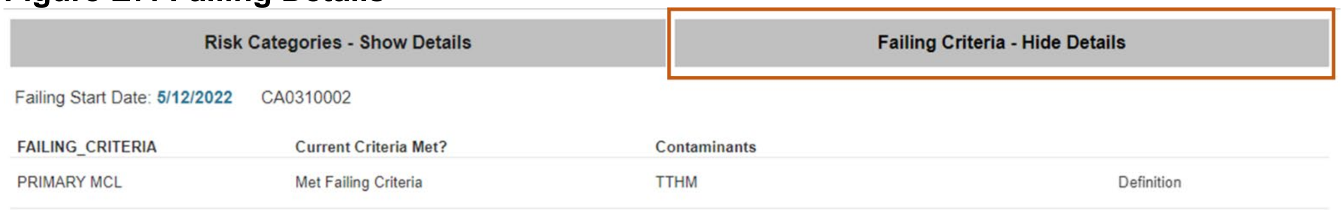
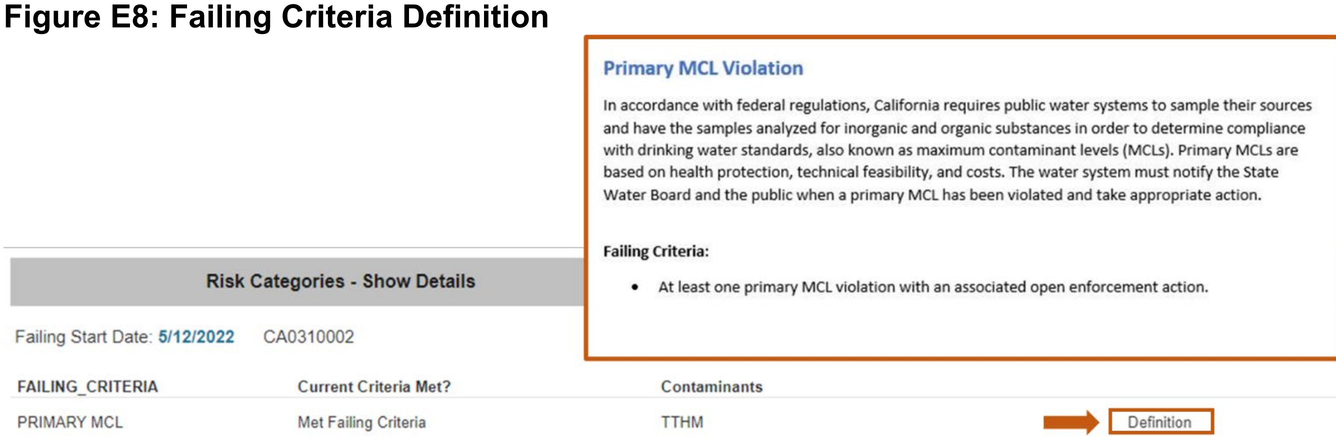


Table E 5: Failing Details

Displayed Information	About
Failing Start Date	The data the water system began meeting the Failing criteria and was added to the Failing list. If a system id Failing because they are meeting multiple Failing criteria, the Start date will represent the oldest criteria met.
Failing Criteria	The Failing criteria the water system is meeting as defined by the State Water Board.[387] A system can be on the Failing list for more than one criterion met.
Contaminants	The contaminants associated with the Failing criteria met. A water system can have multiple contaminates associated with a Failing criteria met.
Definition	Clicking on the word “Definition” will open a new web-browser tab with the definition and details for the associated Failing criteria (Figure E8).

Figure E8: Failing Criteria Definition



[387] Failing criteria is summarized in the Drinking Water Needs Assessment and detailed online at the link below. Failing Criteria: https://www.waterboards.ca.gov/water_issues/programs/hr2w/docs/hr2w_expanded_criteria.pdf

5. RISK INDICATOR PERFORMANCE

Users can click on the ‘Risk Categories’ Hide and Reveal button at the bottom of the SAFER Dashboard to display information on how the water system has performed for all the Risk Assessment indicators (Figure E9).

Figure E9: Risk Categories

Risk Categories - Hide Details	Failing Criteria - Show Details

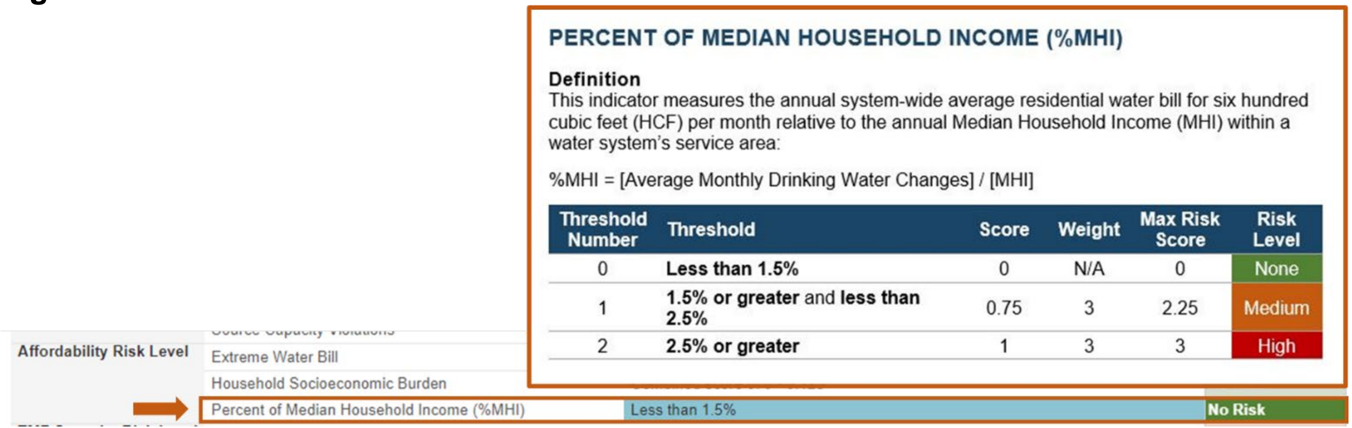
RISK CATEGORY	SUBGROUP	Threshold Met	
Water Quality Risk Level	Constituents of Emerging Concern	Less than 25% sources meeting the criteria	No Risk
	History of E. coli Presence	No history of E. coli presence over the last 3 years	No Risk
	Increasing Presence of Water Quality Trends Toward MCL	Less than 25% sources meeting the criteria	No Risk
	Past Presence on the HR2W List	1 HR2W list occurrence over the last 3 years	Medium Risk
	Percentage of Sources Exceeding an MCL	Less than 50% sources exceed an MCL	No Risk
	Treatment Technique Violations	No violation over the last three years	No Risk
Accessibility Risk Level	Absence of Interties	No intertie	High Risk
	Bottled Water or Hauled Water Reliance	No occurrences of bottled/hauled water reliance within the last 3 years	No Risk
	Critically Overdrafted Groundwater Basin	No sources within a Critically Overdrafted Basin	No Risk
	DWR - Drought & Water Shortage Risk Assessment Results	Below top 25%	No Risk
	Number of Water Sources	1 source	High Risk
	Source Capacity Violations	No source capacity violations; and no Service Connection Moratoriums within the pa	No Risk
Affordability Risk Level	Extreme Water Bill	Below 150% of statewide average	No Risk
	Household Socioeconomic Burden	Combined score of 0 - 0.125	No Risk
	Percent of Median Household Income (%MHI)	Less than 1.5%	No Risk
TMF Capacity Risk Level	Days Cash on Hand	Less than 90 days cash on hand	Medium Risk
	Monitoring and Reporting Violations	Less than 2 violations	No Risk
	Operating Ratio	1 or greater	No Risk
	Operator Certification Violations	No Operator Certification violations over the last three years	No Risk
	Significant Deficiencies	No Significant Deficiencies over the last three years	No Risk
	Total Net Annual Income	Greater than $0	No Risk

Table E6: Risk Category Details

Displayed Information	About
Risk Category	The category of indicators in the Risk Assessment. Categories include: Water Quality, Accessibility, Affordability, and TMF (technical, managerial, and financial) Capacity
Subgroup	This is the individual risk indicator within the category. Click on the name to learn more (Figure E10).
Threshold Met	How the water system performed for each individual risk indicator. Each threshold corresponds to a risk level which is based on a calculation of risk points. Click on the name of the risk indicator to learn more (Figure E10).
Associated Risk Level	The level of risk associated with the threshold met for each individual risk indicator. Click on the name to learn more (Figure E10).

Learn More: Users can click on a risk indicator title to open a new web-browser tab with the risk indicator definition and risk threshold criteria (Figure E10).

Figure E10: Risk Indicator Definition


PERCENT OF MEDIAN HOUSEHOLD INCOME (%MHI)

Definition
This indicator measures the annual system-wide average residential water bill for six hundred cubic feet (HCF) per month relative to the annual Median Household Income (MHI) within a water system's service area:

%MHI = [Average Monthly Drinking Water Changes] / [MHI]

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**Less than 1.5%**	0	N/A	0	None
1	**1.5% or greater** and **less than 2.5%**	0.75	3	2.25	Medium
2	**2.5% or greater**	1	3	3	High

6. WATER SYSTEM LOCATION

The individual water system profile page will display the water system's service area boundary. If the State Water Board does not have the water system's service area boundary, it will display an estimated point location on the map. This data is from the State Water Board's System Area Boundary Layer (SABL) dataset.[388]

7. BACK AND EXPORT BUTTONS

The 'Back' button at the top of the SAFER Dashboard will navigate the user back to the Statewide View of the SAFER Dashboard. The 'Export Data' button will open a pop-up window with options for how to download the data displayed in the Dashboard. *Note*: This feature in the Dashboard is known to have issues. Users are encouraged to use the links above the Dashboard to access the data in a more user-friendly format.

DATA REFRESH RATE

The SAFER Dashboard displays data from many different sources that is collected and analyzed at different frequencies. The sections below provide a summary of the data refresh rate.

FAILING WATER SYSTEMS

The Failing list of water systems is updated **daily** in the SAFER Dashboard before noon. The Failing list of water systems is generated by reviewing all new and historical violation and enforcement data for active community water systems and non-community schools and identifying which systems are currently meeting the Failing criteria.[389] Systems that are meeting the criteria are listed as Failing in the Dashboard, those that are not Failing will have their

[388] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[389] Failing Criteria
https://www.waterboards.ca.gov/water_issues/programs/hr2w/docs/hr2w_expanded_criteria.pdf

results from the Risk Assessment displayed: At-Risk, Potentially At-Risk, Not At-Risk, or Not Assessed.

RISK ASSESSMENT RESULTS

The Risk Assessment results and corresponding performance for individual risk indicators are updated in the SAFER Dashboard on a **quarterly** basis. Important to note that some risk indicators are dependent on data that is not collected or updated more than once a year. For example, 'Days Cash in Hand,' is dependent on water system reporting through the electronic Annual Report (eAR). This indicator will stay constant throughout the year unless a data change request is made or when new eAR data becomes available. Other risk indicators, like 'Percentage of Sources Exceeding an MCL,' have new data submitted to the State Water Board on a monthly basis. These indicators will be updated quarterly and may impact a water system's aggregated performance in the Risk Assessment.

CATEGORY RISK DETERMINATION

The SAFER Dashboard displays in multiple locations the Risk Category performance for water systems. **This performance designation is for the SAFER Dashboard only and does not have a direct role determining the Risk Assessment results for water systems.** The purpose of the Category Risk level determination is to allow SAFER Dashboard users to assess relative risk per category. Table E7 details the normalized risk score ranges used to determine Category Risk levels. The thresholds used for the risk levels were determined based on an analysis of how systems were performing in the category and comparing category scores to Failing and At-Risk water system performance within the category. Refer to Appendix A of the annual Drinking Water Needs Assessment to learn more about how risk points are accrued within each Category.

Table E7: Risk Scores per Category and Risk Levels

Risk Category	High Risk	Medium Risk	Low Risk	No Risk
Water Quality	$0.6 \leq n$	$0.45 \leq n < 0.6$	$0 < n < 0.45$	0
Accessibility	$0.64 \leq n$	$0.49 \leq n < 0.64$	$0 < n < 0.49$	0
Affordability	$0.8 \leq n$	$0.65 \leq n < 0.8$	$0 < n < 0.65$	0
TMF Capacity	$0.64 \leq n$	$0.49 \leq n < 0.64$	$0 < n < 0.49$	0

ACCESSING THE DATA

A hyperlink for a user-friendly excel spreadsheet is accessible at the top of the Dashboard screen. It contains a snapshot in time of the Risk Assessment results and the Failing list.

APPENDIX F:
STATE SMALL WATER SYSTEM & DOMESTIC WELL RISK ASSESSMENT DASHBOARD

INTRODUCTION

In 2023, the State Water Board released a new web-based dashboard displaying the results of the Risk Assessment for state small water systems and domestic wells. This is a core component of the State Water Board's annual Drinking Water Needs Assessment. Learn more about the Risk Assessment for state small water systems and domestic wells in Appendix B.

The dashboard displays risk drivers for communities served by state small water systems and domestic wells. The dashboard includes source data from the State Water Board, the Department of Water Resources, and the Office of Environmental Health Hazard Assessment. The dashboard is used by internal staff and members of the public to explore areas where state small water systems and domestic wells may encounter water quality risk, water shortage risk, socioeconomic risk, or risk from multiple categories. The dashboard displays summary statistics of the number of state small water systems and domestic wells in different risk categories and shows users the locations of these at-risk systems.

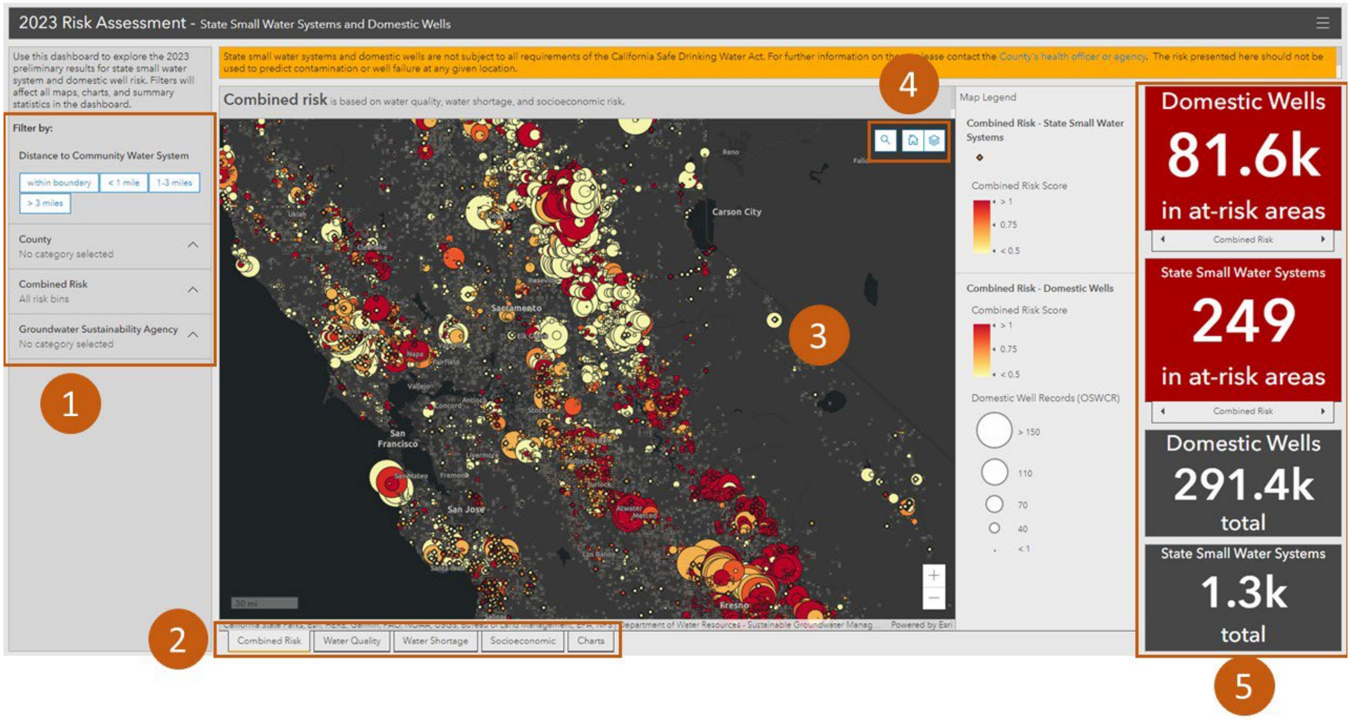
NAVIGATING THE DASHBOARD

The default dashboard view includes a central map window, a filtering menu on the left, and summary statistic indicators on the right. All areas of the dashboard except the filtering menu can be resized by the user. Links to other relevant pages are available in the top right corner of the dashboard.

The map window displays the risk results for state small water systems and domestic wells. The color ramp indicates the risk level, with at-risk areas in red, potentially at-risk areas in orange, and not at-risk areas in light yellow. At most zoom levels, state small water system locations are represented by a diamond shape and the number of domestic wells per square mile section is represented by the circle size, with larger circles indicating more domestic wells in that section. When the map is zoomed out to view all of California, the state small water systems and domestic well view is replaced with square mile section polygons. The map legend is available on the right-hand side of the map window.

The risk level for areas without a state small water systems or domestic well is not displayed on the dashboard, but that data is available in the underlying GIS data.

Figure F1: Default Dashboard View



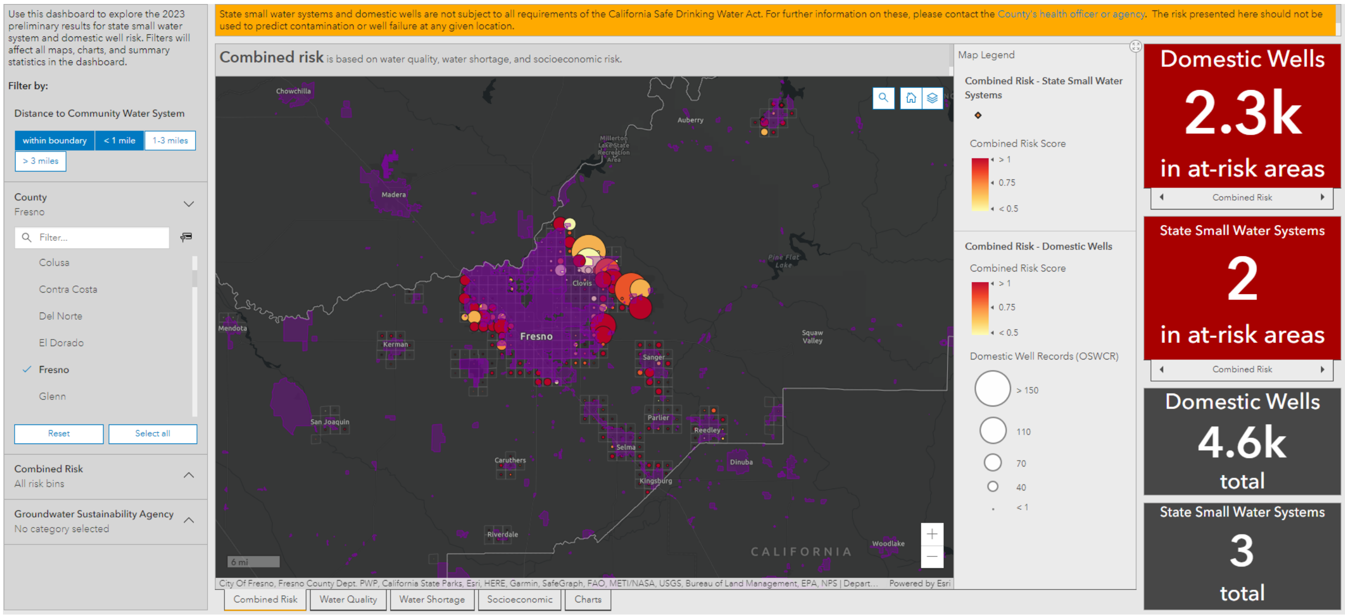
1. FILTER OPTIONS

The map display and summary statistics can be filtered by four different parameters. These parameters stack and selecting them automatically updates the map view and summary statistics.

Figure F1: Filter Options

Filter Option	About
Distance to Community Water System	The approximate distance (in miles) from a state small water system or centroid of a domestic well cluster to the nearest community water system service boundary.
County	The county that the domestic well cluster or state small water system is located in.
Combined Risk	The combined risk status of the domestic well cluster or state small water system (at-risk: ≥ 1; potentially at-risk: ≥ 0.5; not at-risk: < 0.5).
Groundwater Sustainability Agency	The groundwater sustainability agency that the domestic well cluster or state small water system is located in. If a square mile section (domestic well cluster area) is located in multiple GSA’s the section is assigned to the GSA that contains the centroid of that section.

Figure F2: Filtering Options Example (Distance to Community Water System and County)



2. MAP TABS

There are four map tabs and one chart tab available at the bottom of the map window. Clicking on the tabs allows the user to view risk information associated with the three categories (water quality, water shortage, and socioeconomic risk) as well as the overall combined risk. The chart tab shows the combined risk information in a bar graph format with totals by county and allows users to hover over the chart to view the exact numbers combined risk numbers by county.

Figure F3: Water Quality Risk Tab

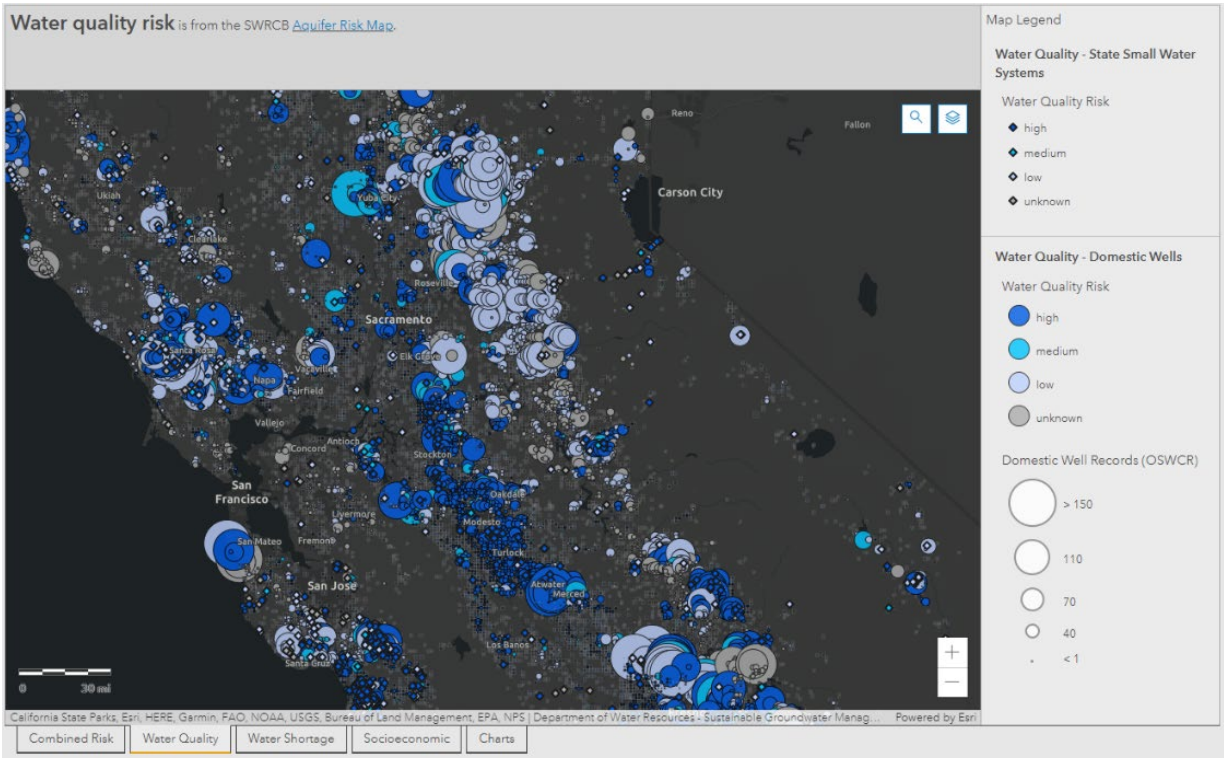
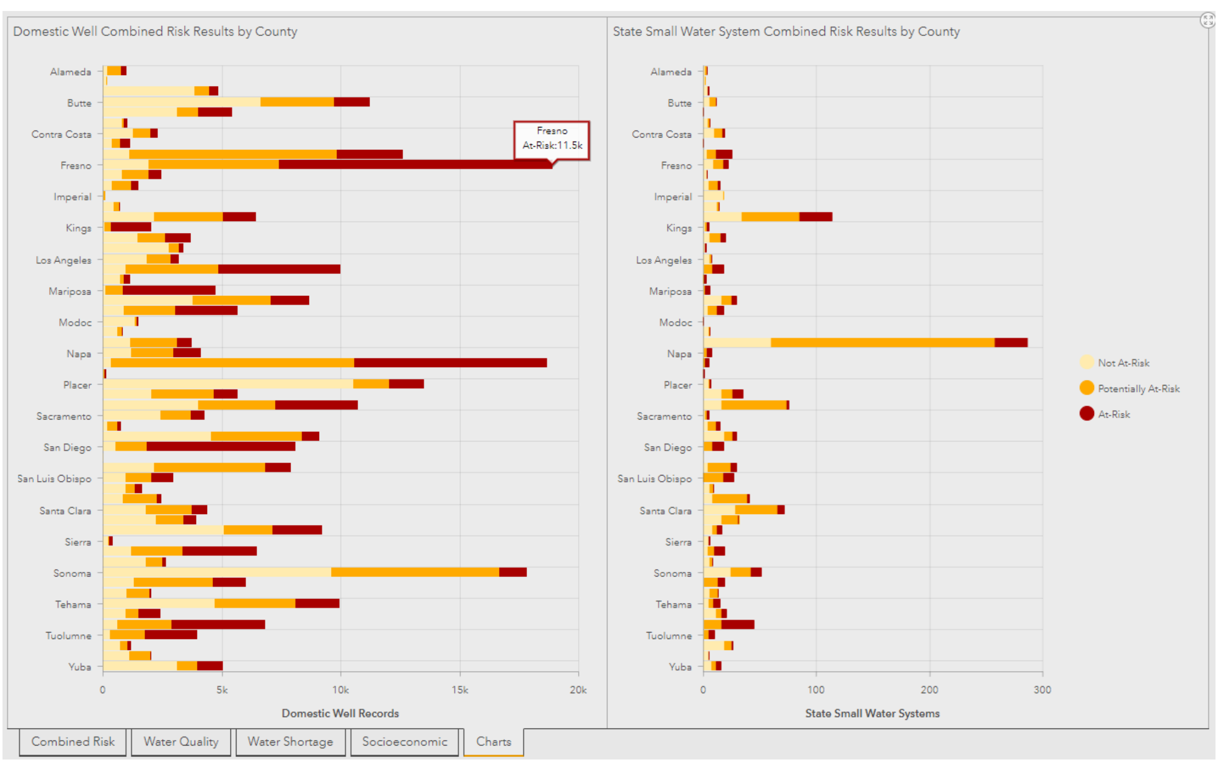


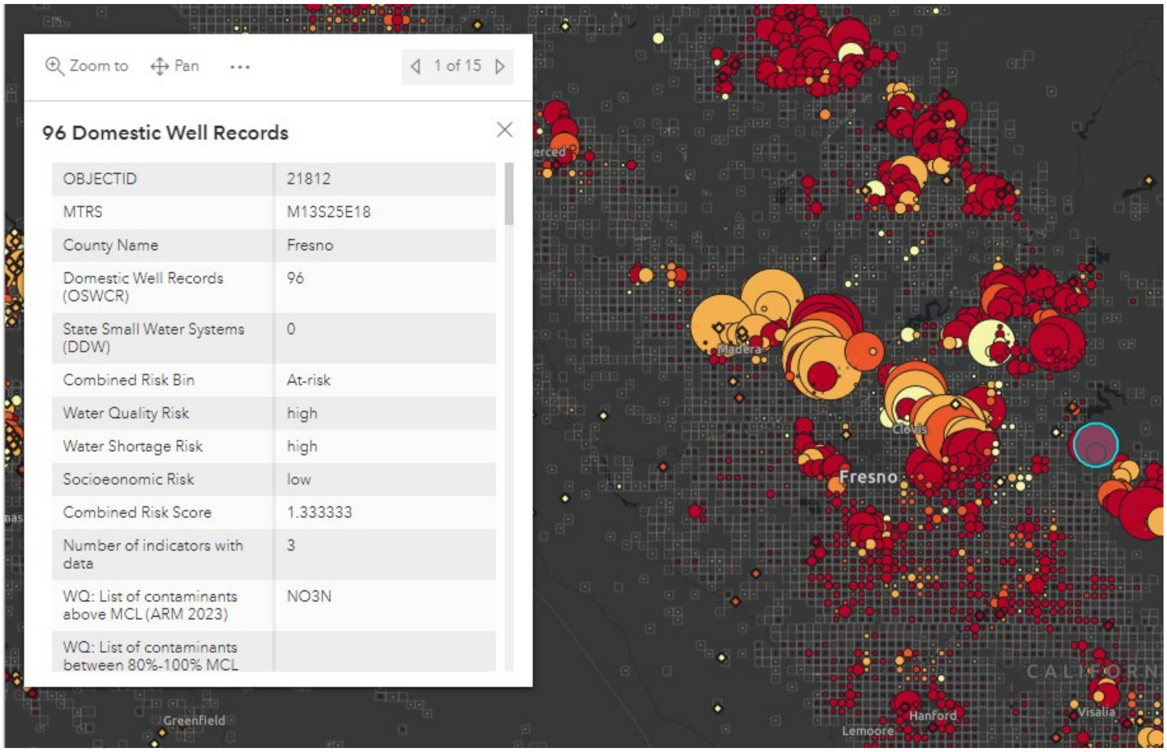
Figure F4: Chart Tab



3. MAP WINDOW

This screen allows users to zoom, scroll, and click on individual domestic well clusters or state small water systems to view all attributes of the area or system.

Figure F5: Domestic Well Cluster Details



4. SEARCH AND LAYER OPTIONS

The search bar can be used to look up a specific address or a state small water system name. The home icon can be used to reset the map to the default extent. The layer icon can be used to toggle map layers on and off. If a map layer is greyed out, it means that the layer cannot display at the current zoom level.

Some layers that users may find helpful but are not turned on by default include the Public Water System Boundaries Layer, the DWR Dry Household Wells layer (available in the Water Shortage category tab), legislative boundaries (available in the Combined Risk tab), and CalEnviroScreen 4.0 scores (available in the Combined Risk tab).

Figure F6: Layer Options

5. SUMMARY STATISTICS

There are four summary statistic indicators displayed on the right-hand side of the dashboard. These indicators are automatically updated when any filtering criteria is applied. The indicators are not affected by the map zoom or by clicking on an individual domestic well cluster or state small water system on the map. To cycle through the at-risk category indicators, click on the arrows at the bottom of indicators.

Figure F2: Summary Statistics

Summary Statistic Indicator	Details
Domestic Wells in at-risk areas	The count of domestic wells that are in at-risk areas and match any filtering criteria. There are four risk categories that this indicator can cycle through: • The default shows the combined risk, where at-risk is defined as a score ≥ 1. • For water quality risk, at-risk is defined as an area with one or more contaminants above the MCL.

Summary Statistic Indicator	Details
	• For water shortage risk, at-risk is defined as an area with a water shortage vulnerability score in the top 20th percentile. • For socioeconomic risk, at-risk is defined as an area with a socioeconomic score in the top 20th percentile.
State Small Water Systems in at-risk areas	The count of state small water systems that are in at-risk areas and match any filtering criteria. There are four risk categories that this indicator can cycle through: • The default shows the combined risk, where at-risk is defined as a score ≥ 1. • For water quality risk, at-risk is defined as an area with one or more contaminants above the MCL. • For water shortage risk, at-risk is defined as an area with a water shortage vulnerability score in the top 20th percentile. • For socioeconomic risk, at-risk is defined as an area with a socioeconomic score in the top 20th percentile.
Domestic Wells (total)	The total count of domestic wells that match the selected filtering criteria.
State Small Water Systems (total)	The total count of state small water systems that match the selected filtering criteria.

DATA REFRESH RATE

The combined risk data by square mile section is updated **yearly** to include updated category data and/or updates location information for state small water systems and domestic wells.

The datasets used to create the category risk scores are updated:

- **Water Quality**: The State Water Board's Aquifer Risk Map is updated each year on January 1st.
- **Water Shortage**: DWR's Water Shortage Vulnerability Tool is planned to be updated yearly in the fall.
- **Socioeconomic**: Census datapoints will be updated annually, however, the County-level data may be updated less frequently.

CATEGORY RISK DETERMINATION

The Risk Assessment for state small water systems and domestic wells first analyzes risk in each category and then aggregates those scores to determine total risk for the location. The table below summarizes the thresholds used per category. Learn more about how these calculations are conducted in Appendix B of the annual Drinking Water Needs Assessment report.

Figure F3: Category Risk Thresholds

Risk Category	High Risk	Medium Risk	Low Risk	Unknown
Water Quality	One or more contaminants above MCL	One or more contaminants above 80% of MCL	All contaminants < 80% of MCL	No water quality data
Water Shortage	≥ 0.534	0.452 – 0.534	< 0.452	N/A
Socioeconomic	≥ 0.885	0.667 – 0.885	< 0.667	N/A

DISTANCE TO NEARBY COMMUNITY WATER SYSTEMS

Distance to the nearest community water system was calculated for state small water systems by measuring the shortest distance between the state small water system point location and the edge of the community water system service area boundary[390]. For domestic wells, the distance was calculated by measuring the shortest distance between the centroid of each PLSS section with a domestic well and the edge of the community water system service boundary.

ACCESSING THE DATA

The GIS data can be accessed through the REST endpoint using this URL:

https://gispublic.waterboards.ca.gov/portalserver/rest/services/Hosted/Combined_Risk_Domestic_Wells_and_State_Small_Water_Systems/FeatureServer.

To connect to the GIS data using your own computer, click on the “Add Data From Path” option within your GIS platform. Copy and paste the above URL and press “Add”. The GIS layer will appear in your map and the user can save a local copy of the data,

[390] Community water systems were identified from the “California Drinking Water System Area Boundaries” map and filtering by “Community” in the “Federal Classification” attribute column. https://gispublic.waterboards.ca.gov/portalserver/rest/services/Drinking_Water/California_Drinking_Water_System_Area_Boundaries/FeatureServer

select/filter/summarize based on all available attributes, or create a live connection to the data from their own web service.

The tabular data with all risk indicators and scores per PLSS section is available online,[391] as well as a table with the risk indicators and scores joined to the list of state small water system locations.

[391] State Small Water Systems and Domestic Wells Risk Assessment Spreadsheet: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023sswsdwrisk.xlsx

APPENDIX G:
DRINKING WATER FINANCIAL CAPACITY & COMMUNITY AFFORDABILITY DASHBOARD

INTRODUCTION

In 2023, the State Water Board released a new web-based dashboard to help staff and interested external stakeholders explore the relationship between a water system's financial capacity and community affordability. The Water System Financial Capacity & Community Affordability Dashboard displays reported and calculated metrics/indicators that are used in the State Water Board's annual Drinking Water Needs Assessment. Figure G1 illustrates the nexus between affordability and water system financial capacity.

Figure G1: Nexus of Affordability and Water System Financial Capacity

(1) Household Affordability: The ability of individual households to pay for an adequate supply of water. Metrics measuring household level affordability have been included in both the annual Affordability Assessment and Risk Assessment.

(2) Community Affordability: The ability of households within a community to pay for water services to financially support a resilient water system. Metrics measuring community level affordability are included in both the annual Affordability Assessment and Risk Assessment.

(3) & (4) Water System Financial Capacity: The ability of the water system to financially meet current and future operation and infrastructure needs to deliver safe drinking water. The financial capacity of water systems affects future rate impacts on households. The inability to provide adequate services may lead households served by the system to rely on expensive alternatives such as bottled water. Metrics measuring the financial capacity of water systems are included in the annual Risk Assessment only.

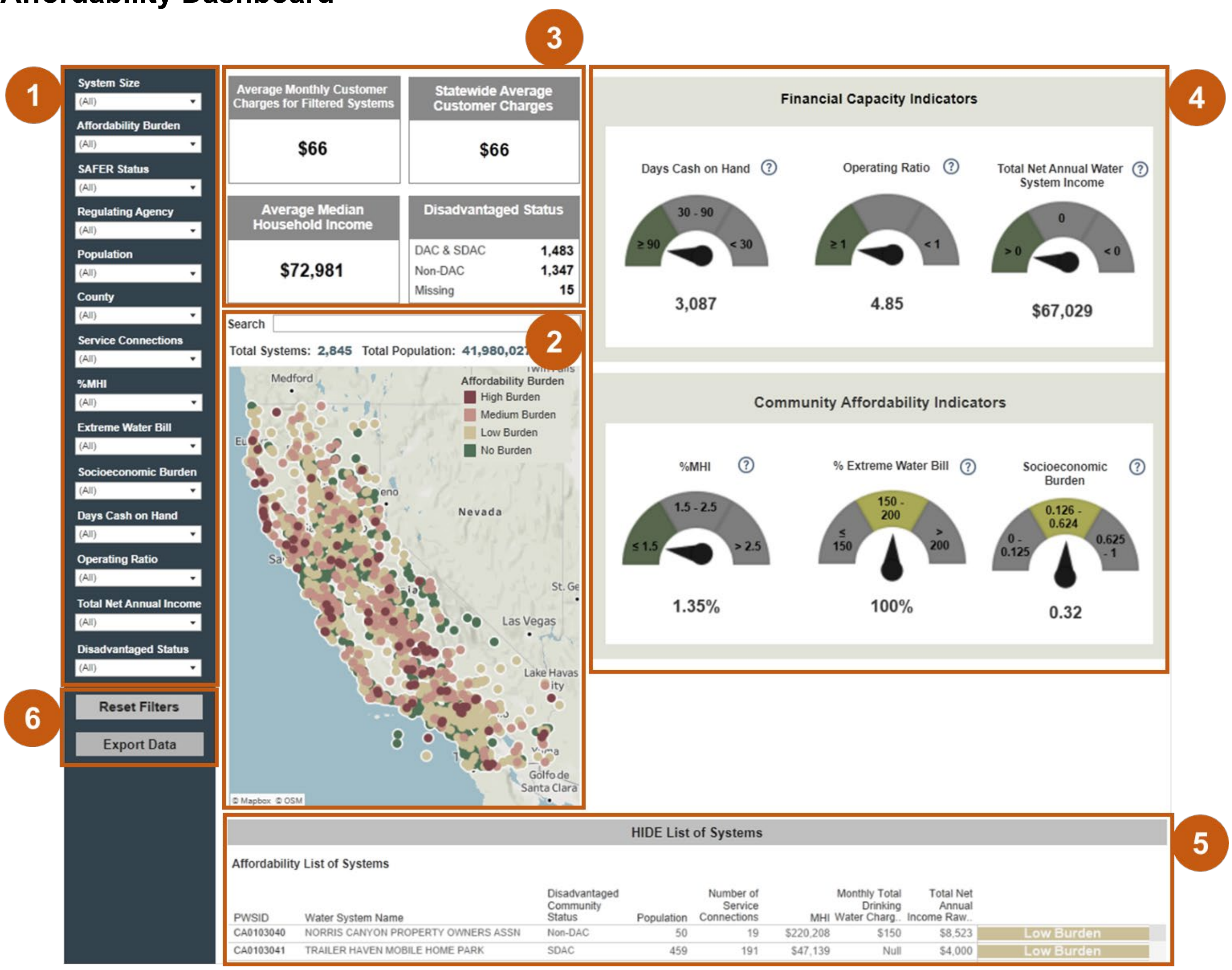
NAVIGATING THE DASHBOARD

The Dashboard can be viewed in the State Water Board's website at the URL below:

https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/afforddashboard.html

By default, the Dashboard displays the full statewide dataset of community water systems and their affordability and financial capacity information. Figure E1 and the sections below provide an overview of the information and functionality currently available in the Dashboard.

Figure G2: Statewide View of the Water System Financial Capacity & Community Affordability Dashboard



1. FILTER OPTIONS

Users can filter the Dashboard to change the data summaries displayed. Users can select multiple filters at a time using the drop-down menu options on the left side of the Dashboard. Table G1 summarizes the filter options currently available.

Table G1: Filter Options in the Affordability Dashboard

Filter Option	About
System Size	The water system size filter is determined by population served and the number of service connections. For small water systems, they have 3,000 service connections or less. For medium water systems, they have between 3,001-30,000 service connections or serve a population of less than 100,000. For large water systems, they have more than 30,000 service connections or serve a population that is 100,000 or more.
Affordability Assessment	Whether a water system is High, Medium, Low or No Affordability Burden.
SAFER Status[392]	Whether a water system is Failing, At-Risk or Potentially At-Risk of failing, Not At-Risk of failing, or Not Assessed.
Service Connections	The total number of service connections served by the water system.
Population	The total estimated population served by the water system.
County	The primary County where the water system is physically located.
Regulating Agency	The State Water Board District Office or Local Primacy Agency that is responsible for regulatory oversight of the system.
Service Area Economic Status	The disadvantage community status of the water system, determined with U.S. Census median household income (MHI) data. “Disadvantaged community” or “DAC” means the entire service area of a community water system, or a community therein, in which the MHI is less than 80% of the statewide annual MHI level.[393] “Severely disadvantaged community” or “SDAC” means the entire service area of a community water system in which the MHI is less than 60% of the statewide MHI.[394]
%MHI	This indicator measures annual system-wide monthly residential customer charges for six hundred cubic feet (HCF) relative to the annual Median Household Income (MHI) within a water system’s service area.

[392] Failing criteria is summarized in the Drinking Water Needs Assessment and detailed online at the link below. The criteria used to determine At-Risk, Potentially At-Risk, and Not At-Risk water systems is detailed in Appendix A of the annual Drinking Water Needs Assessment report.
Failing Criteria: https://www.waterboards.ca.gov/water_issues/programs/hr2w/docs/hr2w_expanded_criteria.pdf
[393] Health & Saf. Code, § 116275, subd. (aa).
[394] Water Code § 13476, subd. (j)).

Filter Option	About
Extreme Water Bill	This indicator measures drinking water customer charges that meet or exceed 150% of the statewide average drinking water customer charges for the six hundred cubic feet (HCF) level of consumption. 2021 statewide average is $65.85.
Socioeconomic Burden	This indicator is a combination of two metrics: the Poverty Prevalence Indicator (PPI) and Housing Burden. The two components of Household Socioeconomic Burden were combined using a matrix approach detailed in Appendix D of the Needs Assessment.
Days Cash on Hand	This indicator measures the estimated number of days a water system can cover its daily operations and maintenance costs, relying only on their current cash or liquid reserves, before running out of cash. Days cash on hand measures a system's financial capacity and is an estimate of how long a water system can operate without new revenues or additional funding.
Operating Ratio	This indicator is a ratio of the water system's annual revenues compared to annual operating expenses. To be self-supporting, a water system should have at least as much annual revenue as it has operating expenses, e.g., an operating ratio equal to or greater than 1.0. The operating ratio does not include planned investments in future years.
Total Net Annual Income	The purpose of this risk indicator is to identify water systems whose total annual revenue is unable to cover their total annual expenses. A water system should generate enough revenue to cover all incurred annual expenses (including operational expenses). Total Net Annual Income of a water system should be a positive value.

2. MAP DISPLAY & SEARCH OPTIONS

Users can use the search box to look-up a water system. Users can enter either a water system's name or a Public Water System ID (PWSID) number to search the list of active community water systems and schools.

Note: To clear the search box and re-set the map, the user must select the entered text, delete it, and hit enter with your keyboard within the search box.

The map will display the systems that meet the filtered criteria (1) or the water system the user has looked-up using the search box.' The color of the point location represents the Affordability Burden of the water system (Learn more in Appendix D of the Drinking Water Needs

Assessment). Above the map is a summary of the total number of systems meeting the filter criteria and the total population served by those water systems.

3. INFORMATION ON THE SYSTEMS DISPLAYED IN THE MAP

The top of the Dashboard contains both static and dynamic data points. As filters are applied to the Dashboard, the dynamic numbers will automatically update to reflect the systems meeting the filtered criteria.

Table G2: Informational Data Summary

Informational Data	About
Average Monthly Statewide Customer Charges for 6 HCF (static)	The average monthly statewide customer charges for 6 HCF that is static and does not change when filters are applied.
Monthly Average Statewide Customer Charges for 6 HCF (Dynamic)	The average monthly statewide customer charges for 6 HCF that is dynamic and does change when filters are applied.
Average Median Household Income (MHI)	The average median household income is based on the U.S Census MHI. The MHI for each water system is a population weighted MHI, using census block group area and population data. The water system MHI is then calculated using population adjusted MHIs for each census block group that falls within the water system boundary.
Disadvantaged Status	A Disadvantaged Community or DAC means the entire service area of a community water system, or a community therein, in which the MHI is less than 80% of the statewide annual MHI level. A Severely Disadvantaged Community or SDAC means the entire service area of a community water system in which the MHI is less than 60% of the statewide MHI. DAC and SDAC are presented together in the Affordability Dashboard and are compared to Non-DAC and missing status systems.

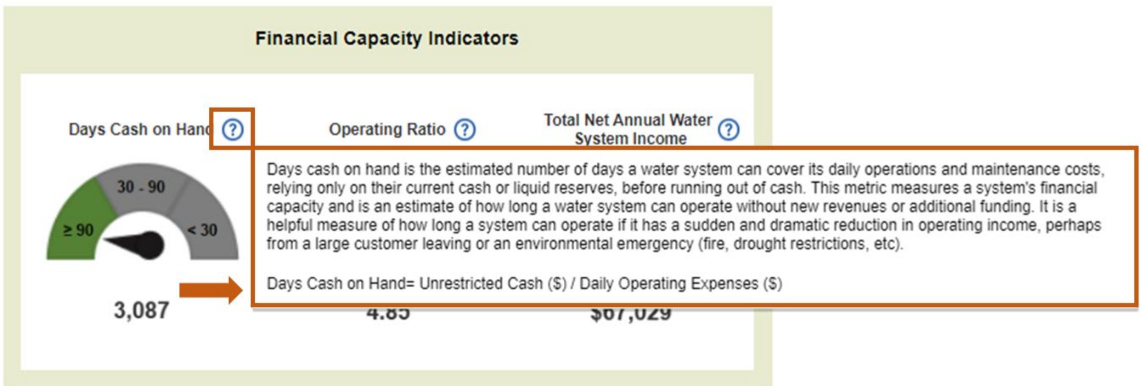
4. COMMUNITY AFFORDABILITY AND FINANCIAL CAPACITY INDICATORS

The right-side of the Dashboard displays how water systems are performing in the individual affordability and financial capacity indicators used in the Drinking Water Needs Assessment. The dials display the thresholds used in the Needs Assessment to identify high, medium, low and/or no risk associated with the values displayed per indicator.

The blue value displayed under the dial represents the average value for all community water systems meeting the filter criteria applied in the Dashboard. If a single water system is selected, the value displayed reflects that individual water system’s data/information.

Learn More: Users can hover over the question mark icon to reveal the indicator's definition (Figure G3).

Figure G3: Accessing Indicator Definitions



5. LIST OF WATER SYSTEMS

Selecting the 'List of Water Systems' button at the bottom of the Dashboard will Show and Hide the list of water systems that are meeting the applied filter criteria (1) or search box fields (2).

6. CLEAR FILTERS & EXPORT DATA BUTTONS

Selecting the 'Clear All Filters' button will de-select and re-set the filter options on the left side of the Dashboard (1). *Note*: This button will NOT clear the search box fields (2). To clear the search box, the user must select the entered text, delete it, and hit enter with your keyboard within the search box.

The 'Export Data' button will open a pop-up window with options for how to download the data displayed in the Dashboard. *Note*: This feature in the Dashboard is known to have issues. Users are encouraged to use the links above the Dashboard to access the data in a more user-friendly format.

DATA REFRESH RATE

The Dashboard displays data from many different sources that is collected and analyzed at different frequencies. The sections below provide a summary of the data refresh rate.

FAILING WATER SYSTEMS

The Failing list of water systems is updated **daily** in the Dashboard before noon. The Failing list of water systems is generated by reviewing all new and historical violation and enforcement data for active community water systems and non-community schools and identifying which systems are currently meeting the Failing criteria.[395] Systems that are meeting the criteria are listed as Failing in the Dashboard, those that are not Failing will have their results from the Risk Assessment displayed: At-Risk, Potentially At-Risk, Not At-Risk, or Not Assessed.

SAFER STATUS & INDICATOR DATA

The SAFER Status (Risk Assessment results) and corresponding performance for individual indicators are updated in the Dashboard on a **quarterly** basis. Important to note that all of the indicators in the Dashboard are dependent on data that is not collected or updated more than **once a year**. For example, 'Days Cash in Hand,' is dependent on water system reporting through the electronic Annual Report (eAR). This indicator will stay constant throughout the year unless a data change request is made or when new eAR data becomes available.

ACCESSING THE DATA

A hyperlink for a user-friendly excel spreadsheet is accessible at the top of the Dashboard screen. It contains a snapshot in time of the Affordability Assessment results and the Failing list.

[395] Failing Criteria
https://www.waterboards.ca.gov/water_issues/programs/hr2w/docs/hr2w_expanded_criteria.pdf