Draft White Paper Discussion On:

Proposed Changes for the 2023 Drinking Water Needs Assessment & Preliminary Results

January 31, 2023

Table of Contents

Executive Summary

The annual Drinking Water Needs Assessment (Needs Assessment) is an analysis conducted by the State Water Board to help inform the implementation of the Safe and Affordable Funding for Equity and Resilience (SAFER) Program. The State Water Board's Drinking Water Needs Assessment (Needs Assessment) consists of three core components: the Affordability Assessment, Risk Assessment, and Cost Assessment.

The Needs Assessment is used by the State Water Board and the SAFER Advisory Group to inform prioritization of public water systems, tribal water systems, state 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.

- The 2022 Needs Assessment is available here: https://bit.ly/3uJSUFH
    - Explore the SAFER Dashboard here: https://bit.ly/3hLjb2q
- The 2021 Needs Assessment is available here: https://bit.ly/33wSpUC

Overview of Proposed Changes

The State Water Board is seeking stakeholder feedback on the following proposed changes to the Needs Assessment for 2023:

Risk Assessment for Public Water Systems

- **Remove two affordability risk indicators**: Percentage of Residential Arrearages and Residential Arrearage Burden.
- **Add one new affordability risk indicator**: Household Socioeconomic Burden
- **Updated Risk Indicator Calculation Methodology**: Treads Towards MCL and Contaminants of Emerging Concern.

Risk Assessment for State Small Water Systems and Domestic Wells

- **Inclusion of a new risk category**: Socioeconomic Risk. This new risk category is composed of the following indicators:

    County Water Quality Testing for Domestic Wells
    1. Water Quality Testing Requirements for Domestic Wells
    2. Water Quality Testing Type Required for Domestic Wells
    3. Water Quality Test Results Impacts on Permitting for Domestic Wells
    4. Does the County Have a Water Quality Monitoring Program

    County Level Services Category
    5. County Administrative Services
    6. County Website Quality
    7. County Funding Resources Available to Domestic Well Owners

Well Cost Category

8. Replacement Well Permit Cost
9. Average Number of Wells Drilled Per Unique Driller in the Past Two Years

Socioeconomic Burden Category

10. Household Socioeconomic Burden
11. Linguistic Isolation
12. Unemployment
13. Transportation Limitations

- **New combined Risk Assessment methodology** utilizing normalized risk scores from the State Water Board's Aquifer Risk Map, the Department of Water Resources' Drought Vulnerability Risk Tool, and the new socioeconomic risk map.

Cost Assessment

- The State Water Board is not conducting a Cost Assessment for the 2023 Needs Assessment report. The State Water Board is in the process of enhancing the Cost Assessment Model and will continue to host public workshops to solicit stakeholder input on the Model's methodology.
- The State Water Board intends on including an updated Cost Assessment in the 2024 Needs Assessment (released Spring 2024).

Affordability Assessment

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

Preliminary 2023 Needs Assessment Results

Table 1 summarizes the preliminary results of the Risk Assessment for public water systems, state small water systems, and domestic wells.

- The results of the Risk Assessment for individual public water systems and the underlying data utilized in the assessment is accessible online
    - **Raw Data**: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimrisk.xlsx
    - **Dashboard Map**: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimrisk.xlsx
- The results of the Risk Assessment for state small water systems and domestic wells is available here:

https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a

Table 1: Preliminary 2023 Risk Assessment Results

Systems	Total Systems Assessed	At-Risk	Potentially At-Risk	Not At-Risk
Public Water Systems	**3,033**	**852 (28%)**	**499 (16%)**	**1,682 (55%)**
Small systems[1]	2,724	817 (30%)	465 (17%)	1,442 (53%)
Medium systems[2]	309	35 (11%)	34 (11%)	240 (78%)
State Small Water Systems	**1,329**	**249 (19%)**	**636 (48%)**	**444 (33%)**
Domestic Wells	**291,401**	**81,579 (28%)**	**103,886 (36%)**	**105,936 (36%)**

Table 2 summarizes the preliminary results of the Affordability Assessment for all community water systems by disadvantage community status. The results of the Affordability Assessment for individual community water systems can be accessed here: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimaffordability.xlsx

Table 2: Preliminary 2023 Affordability Assessment Results

Community Status	Total Systems Assessed	High Affordability Burden	Medium Affordability Burden	Low Affordability Burden	None
DAC/SDAC Systems	1,709	76 (4%)	244 (14%)	1,073 (63%)	316 (18%)
Non-DAC Systems	1,499	19 (1%)	107 (7%)	432 (29%)	941 (63%)
Missing DAC Status	56	0 (0%)	1 (2%)	14 (25%)	41 (73%)
TOTAL:	**3,264**	**95 (3%)**	**352 (11%)**	**1,519 (47%)**	**1,298 (40%)**

[1] Public water systems with 3,300 service connections or less.

[2] Public water systems with 3,300 – 30,000 service connections; max 100,000 population served.

1. Proposed Changes to the Risk Assessment for Public Water Systems

Proposed Risk Indicators to be Removed

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" will not be 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. As the shut-off moratorium ends and data collection resumes, data on payment plans and the reason(s) for shut-offs (to confirm it is not due to account deactivation) would make the Affordability risk category more robust in identifying customers struggling to pay their water bills. Therefore, for future versions, the State Water Board and the Office of Environmental Health Hazard Assessment (OEHHA) recommend that the State Water Board collect residential arrearage and shut-off data in future Electronic Annual Reports (eAR).

Proposed Risk Indicator to be Added

The State Water Board 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 website.[3]

The State Water Board is proposing adding one new affordability risk indicator to the 2023 Risk Assessment and identified potential new affordability indicators to include once data becomes available. Details on the new proposed risk indicator calculation methodology, thresholds, scoring and weight can be found in Appendix A. The following provides a summary of the proposed new risk indicator:

Household Socioeconomic Burden

This indicator is a composite indicator that measures Poverty Prevalence Indicator (PPI) and Housing Burden Indicator (HBI). The 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 level and higher. The Housing Burden Indicator measures the percent of households in a census tract that are both low income (making less than 80% of the United States Department of 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).

[3] Needs Assessment website

https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html

Table 3 summarizes the proposed thresholds, scores, and weight for Household Socioeconomic Burden. See Appendix A for additional information.

Table 3: Proposed "Household Socioeconomic Burden" Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max Score	Risk Level
0	0 – 0.125	0	N/A	0	**None**
1	0.25 – 0.5	0.5	2	1	**Medium**
2	0.625 – 1.0	1	2	2	**High**

Updates to Existing Risk Indicator Calculation Methodologies

The State Water Board will be making modifications to the calculation methodologies to the individual risk indicators in Table 4. These updates are based on stakeholder feedback and internal deliberations on possible refinement opportunities.

Table 4: Risk Indicator Calculation Updates

Risk Indicator	Calculation or Method Update
Trends Towards MCL	• Adjusted accounting of how at-risk sources 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.
Contaminants of Emerging Concern	• Adjusted accounting of how at-risk sources are determined. Rather than assessing water quality source risk per contaminant *individually* (PFAS, 1-4 Dioxane, and Chrome-6), it is now done across all groups *simultaneously*. This improves the identification of water systems that have elevated presence of emerging contaminants in more than 25% of their sources. • Add a notification level of 3ng/L for PFHxS.[4]

[4] PFHxS Notification Level Issuance
https://www.waterboards.ca.gov/drinking_water/programs/documents/PFHxS-issuance.pdf

Preliminary Results of the Risk Assessment for Public Water Systems Incorporating Proposed Changes

The State Water Board has conducted a preliminary 2023 Risk Assessment incorporating the proposed changes to the methodology summarized in the sections above. Figure 1 and Table 5 summarize the results and compares them to the 2021 and 2022 Risk Assessment results.

Figure 1: Comparison of Risk Assessment Results Using 2021, 2022, and Proposed 2023 Methodologies[5]

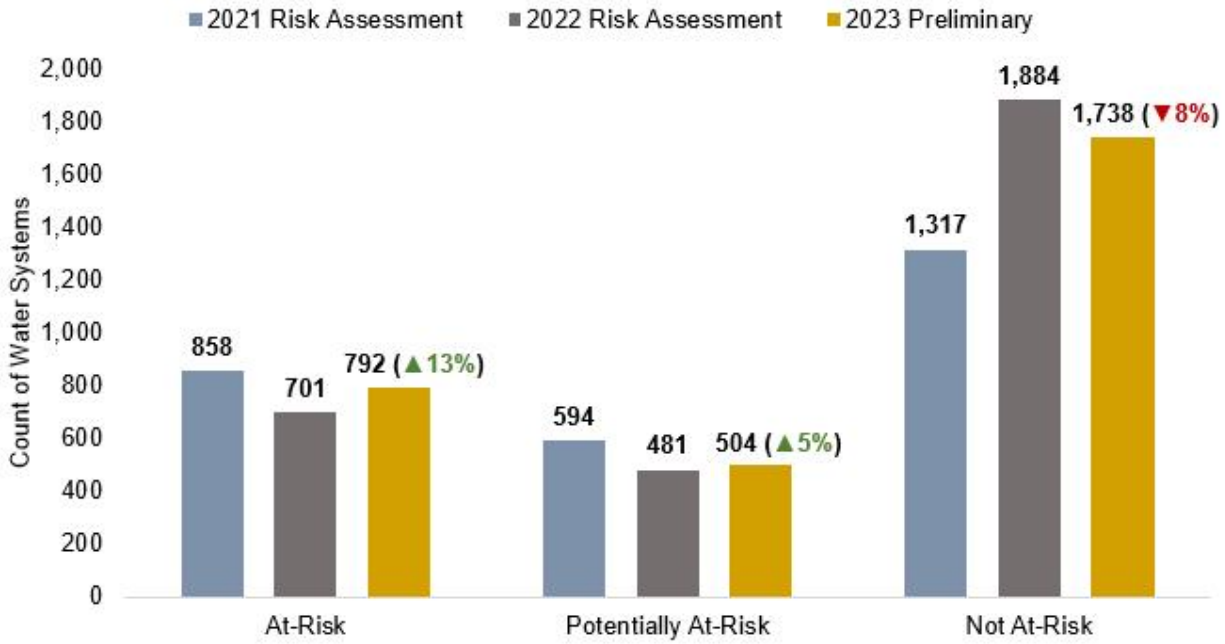


Table 5: Small and Medium Water System Comparison[6]

Risk Assessment Result	Small Systems (≤ 3,300 sc)	Medium Systems[7]	Total
2021 At-Risk	858	N/A	858
2022 At-Risk	671	30	701
2023 At-Risk	**757**	**35**	**792 (↑ 13%)**
2021 Potentially At-Risk	594	N/A	594
2022 Potentially At-Risk	450	31	481
2023 Potentially At-Risk	**470**	**34**	**504 (↑ 5%)**

[5] Failing: HR2W list water systems have not been excluded from the results.

[6] Failing: HR2W list water systems have not been excluded from the results.

[7] Medium-size systems (3,300 < service connections ≤ 30,000; and population served ≤ 100,000) have been included starting in 2022 assessment.

Risk Assessment Result	Small Systems (≤ 3,300 sc)	Medium Systems[7]	Total
2021 Not At-Risk	1,317	N/A	1,317
2022 Not At-Risk	1,636	248	1,884
2023 Not At-Risk	**1,497**	**241**	**1,738 (↓ 8%)**

Explanation of the Changes in the Risk Assessment Results from 2022 to 2023

The State Water Board has conducted an analysis to explain the 13% increase in the number of At-Risk systems in the 2023 Preliminary Risk Assessment results summarized in Table 5: Small and Medium Water System Comparison. A comparison of water system performance in each risk category was conducted between the 2022 and 2023 Assessments (Figure 2 and Table 6).

Figure 2: Change in Average Risk Score per Category

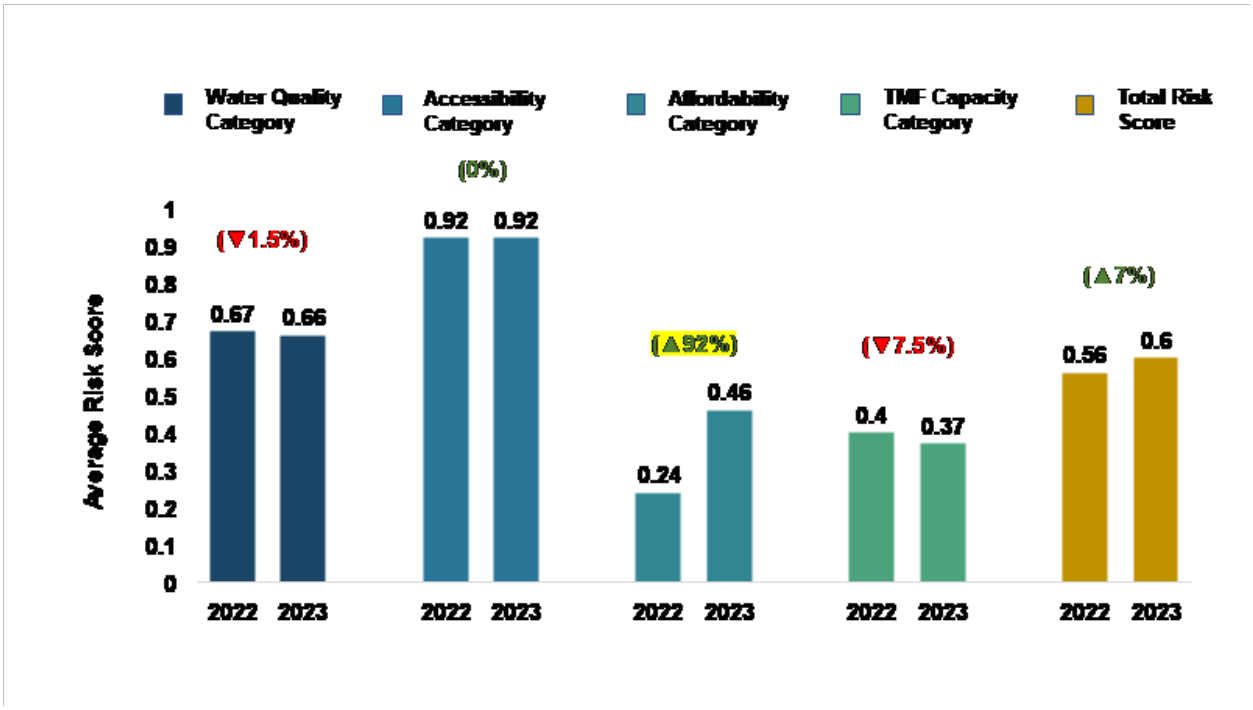


Table 6: 2022 and Preliminary 2023 Risk Assessment Weighted Score Comparison[8]

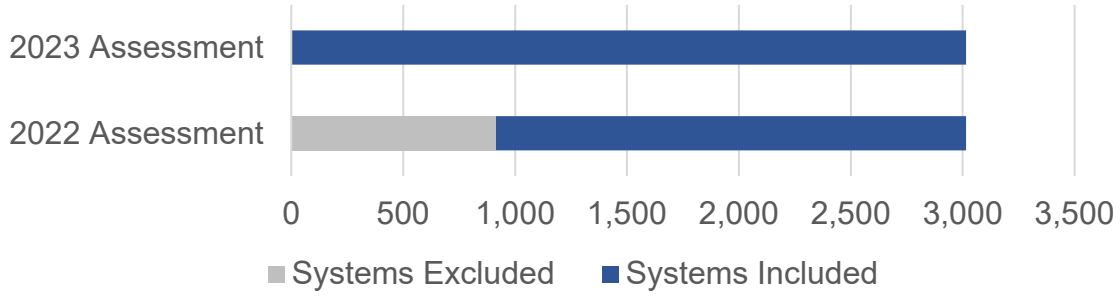
Weighted Score Difference	Water Quality Category	Accessibility Category	Affordability Category	TMF Capacity Category	Total Score of Risk Assessment
# Systems **risk score remained unchanged**	2,351 (78%)	2,245 (74%)	908 (30%)	1,479 (49%)	**389 (13%)**
# Systems **risk score increased**	329 (11%)	387 (13%)	1,518 **(50%)**	699 (23%)	**1,618 (54%)**
# Systems **risk score decreased**	335 (11%)	383 (13%)	589 (20%)	837 (28%)	**1,008 (33%)**
Total	**3,015**	**3,015**	**3,015**	**3,015**	**3,015**

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 preliminary 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 3). 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.

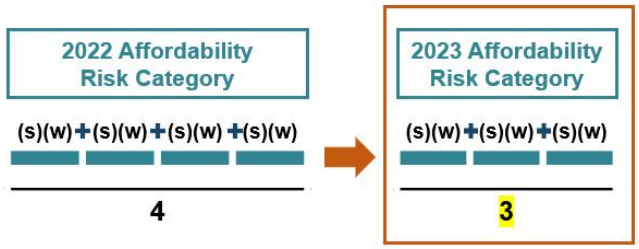
[8] This analysis excluded 19 water systems that were not included in ***both*** the 2022 and 2023 Risk Assessments.

Figure 3: 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 decreasing from four to three (Figure 4). This results in a higher overall category risk score for systems accruing risk points for the affordability risk indicators.

Figure 4: Affordability Category Calculation Method Changes from 2022 to 2023



Predictive Power of the Risk Assessment

The State Water Board conducted an analysis comparing the "predictive power" of the 2021, 2022, and 2023 Risk Assessments in accurately identifying water systems at risk of failing. To conduct this analysis, the State Water Board compared the list of systems that met the thresholds for At-Risk and Potentially At-Risk to the list of unique water systems that were on the Failing: HR2W list in 2021 and 2022 (Table 7).[9] The Failing: HR2W list from 2022 was used for both the 2022 and the preliminary 2023 Risk Assessment to analyze their predictive power. Overall, the proposed changes to the Risk Assessment for public water systems improves its predictive power to identify water systems at risk of failing by approximately 5%.

[9] Deactivated water systems were removed from the 2021 and 2022 Risk Assessment results to facilitate the comparison. Systems that were on the Failing: HR2W list in 2021, but came off the list, are included.

Table 7: Predictive Power of the Risk Assessment

Risk Assessment Result	Total Systems	Systems on the Failing List within Calendar Year	Predictive Power of Risk Assessment
2021 *based on 2020 data*		2021 Failing	
At-Risk	858	303	77.49%
Potentially At-Risk	594	40	10.23%
Not At-Risk	1,317	48	12.28%
TOTAL:	**2,769**	**391**	**100%**
2022 *based on 2021 data*		2022 Failing	
At-Risk	701	297	72.62% (↓ **4.88%**)
Potentially At-Risk	481	72	17.60% (↑ **7.37%**)
Not At-Risk	1,884	40	9.78% (↓ **2.50%**)
TOTAL:	**3,066**	**409**	**100%**
Preliminary 2023 *based on 2022 data*		2022 Failing	
At-Risk	792	316	77.26% (↑ **4.65%**)
Potentially At-Risk	504	52	12.71% (↓ **4.89%**)
Not At-Risk	1,738	41	10.02% (↑ **0.24%**)
TOTAL:	**3,034**	**409**	**100%**

2. Proposed Changes to the Risk Assessment for State Small Water Systems & Domestic Wells

After the release of the 2021 Needs Assessment, stakeholders called for the inclusion of additional risk indicators within the Risk Assessment for State Small Water Systems (SSWSs)[10] and domestic wells (DWs) that more closely aligns with the methodology used for public water system. The 2021 Risk Assessment relied solely on modeled groundwater water quality risk to identify At-Risk SSWSs and DWs. The 2021 Risk Assessment for public water systems used risk indicators beyond water quality,

[10] "State small water system" or "SSWS" means 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).)

including accessibility, affordability, and technical, managerial, and financial capacity. In response to this feedback, the State Water Board worked in partnership with the Department of Water Resources (DWR) to develop a new combined Risk Assessment in 2022 for SSWSs and DWs that utilizes both the Aquifer Risk Map (water quality risk) and DWR's Drought Risk Vulnerability Tool[11] (drought risk).

To further align the two approaches for conducing the Risk Assessments for public water systems, SSWSs, and DWs, the State Water Board worked in partnership with OEHHA to develop a new socioeconomic risk layer to better capture affordability and available technical and financial resources for communities served by SSWSs and DWs.

NEW Socioeconomic Risk

A new map layer of Socioeconomic Risk was developed for the 2023 Risk Assessment for SSWSs and domestic wells which includes a suite of 13 indicators. The suite includes seven county-level measures capturing water quality regulations and administrative services or resources available to domestic well users. Two indicators that capture well costs at the county level. Four socioeconomic indicators use demographic information included in the 2019 and 2021 American Communities Survey and are available at the Census Tract and Block Group level. Together, these 13 indicators, as well as thresholds and scoring, are shown in Table 8 below. Additional information on the data and how the indicators are calculated is in Appendix B.

Table 8: Indicators included in the SSWSs and DWs 'Socioeconomic Risk' map layer

Category	Indicator	Geography
County Water Quality Testing for Domestic Wells	1. Testing Requirements	County
	2. Testing Type	
	3. Testing Impacts Permitting	
	4. Water Quality Monitoring	
County Level Services for Domestic Wells	5. Administrative Services	County
	6. Website Quality	
	7. Funding Resources Available to Domestic Well Owners	
	8. Replacement Well Permit Cost	County

[11] https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/County-Drought-Planning

Well Costs	9. Average Number of Wells Drilled Per Unique Driller in the Past Two Years	
Socioeconomic Burden	10. Household Socioeconomic Burden (Poverty Prevalence and Housing Burden)	Census Tract and Block Group
	11. Linguistic Isolation	Census Block Group
	12. Unemployment	Census Block Group
	13. Transportation Limitations	Census Block Group

OEHHA reviewed available information on domestic wells for each of California's 58 counties in developing the first seven indicators of county water quality regulations and county administrative services. This set of indicators capture information on county services beyond permitting fees charged for DW construction (Indicator 8), as counties may provide a wide range of administrative or financial services. Information such as well water quality sampling, permitting requirements, administrative services, and financial assistance for DWs provide a more comprehensive picture of the financial burdens DW communities may face. To develop the first seven indicators, OEHHA evaluated information available online related to DWs on each county's website in 2022, including attachments and links, and reviewed DW ordinances, fee schedules, and drought assistance webpages. These resources were compiled to develop the seven county-level water quality and administrative services risk indicators used to assess a counties' overall administrative, technical, and managerial capacity as it relates to communities served by DWs. A spreadsheet of the county DW water quality and county administrative services data is available on the SAFER website.[12]

Two county-level indicators (Indicators 8 and 9) are included as surrogates to capture affordability concerns related to DW drilling and associated costs. OEHHA developed the first well cost indicator, Replacement Well Permit Cost indicator, by researching well permitting fees and calculating the permitting costs required for a replacement well. The State Water Board and OEHHA developed the Average Number of Wells Drilled Per Unique Driller in the Past Two Years indicator by calculating the average number of wells per county drilled between 2020-2022 by unique drillers as a proxy for availability of services and drilling demand.

Four indicators representing socioeconomic burden at the census block group level were included to estimate other factors that affect a community's ability to afford and acquire water. Census-based measures of household socioeconomic burden (poverty

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

and housing burden), linguistic isolation, unemployment, and transportation limitations reflect the ability to pay for water at a neighborhood level and are included in this risk layer. Additional details on these 13 Socioeconomic Risk indicators for SSWSs and DWs can be found in Appendix B.

Water Quality Risk

Water quality risk is derived from the 2023 Aquifer Risk Map. The Aquifer Risk Map is intended to help prioritize areas where SSWSs and DWs and may be accessing groundwater that does not meet primary drinking water standards (maximum contaminant level or MCL). In accordance with California Health and Safety Code, section 116772, subd. (a)(1), the Aquifer Risk Map is updated annually. The 2023 Aquifer Risk Map uses the same methodology to calculate water quality risk as the 2022 map, but includes new data collected in 2022. The full 2023 Aquifer Risk Map methodology is available online.[13] In short, the Aquifer Risk Map uses available raw source groundwater quality data to estimate the water quality risk to SSWSs and DWs.

Drought & Water Shortage Risk

The drought and water shortage physical vulnerability risk scores are from DWR's "Water Shortage Vulnerability Assessment" scoring. Detailed methodology for the Water Shortage Vulnerability Assessment scores and data is available online.[14] In summary, the DWR assessment utilizes a suite of physical vulnerability factors to assess drought and water shortage risk for square mile sections, including exposure to hazard, climate change, physical vulnerability, and record of outages.

The DWR drought and water shortage vulnerability assessment scores used for the 2023 Needs Assessment were provided for each square mile Public Land Survey System (PLSS) section, updated in 2022.

Proposed Methodology for Combined Risk Assessment

The three categories of water quality, water shortage, and affordability are combined following a similar methodology as the combined Risk Assessment for public water systems. The score for each category is normalized into four bins based on the following thresholds in Table 9.

Table 9: Category Risk Thresholds for Communities Served by SSWSs & DWs

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

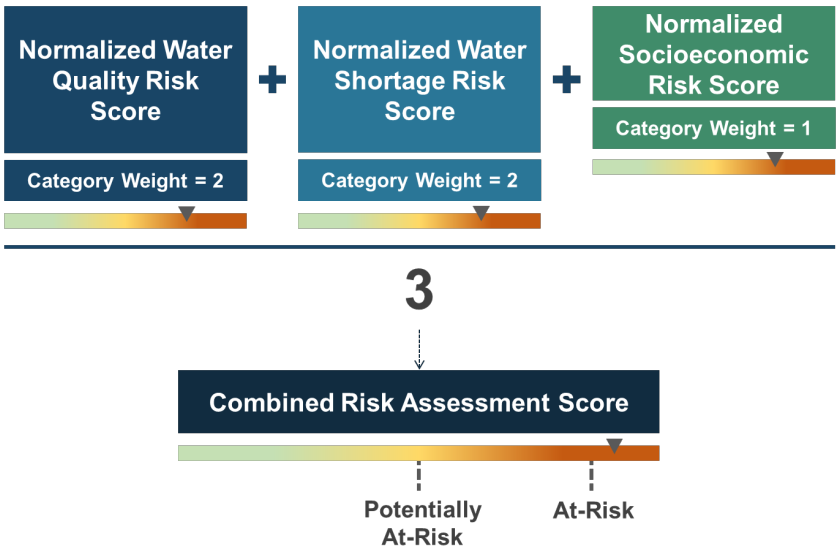
[13] https://gispublic.waterboards.ca.gov/portal/home/item.html?id=a00ee2ed17464141900131c46e126c45

[14] Water Shortage Vulnerability Assessment Scoring https://data.cnra.ca.gov/dataset/i07-water-shortage-vulnerability-sections

	No data available	N/A	N/A	N/A	N/A
Water Shortage Risk	Score below top 40th percentile of areas with a DW or SSWS	0	2	0	Low
	Score in top 40th percentile of areas with a DW or SSWS	0.25	2	0.5	Medium
	Score in top 20th percentile of areas with a DW or SSWS	1	2	2	High
	No data available	N/A	N/A	N/A	N/A
Socioeconomic Risk	Score below top 40th percentile of areas with a DW or SSWS	0	1	0	Low
	Score in top 40th percentile of areas with a DW or SSWS	0.25	1	0.25	Medium
	Score in top 20th percentile of areas with a DW or SSWS	1	1	1	High
	No data available	N/A	N/A	N/A	N/A

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” (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”.

Equation 1: Combined Risk Score Calculation Method



Preliminary Results of the Combined Risk Assessment for State Small Water Systems & Domestic Wells

The 2023 combined Risk Assessment assessed 1,329 SSWSs and 291,401 DWs. SSWS locations were provided to the State Water Board through county reporting required through SB 200. DW locations were sourced from the Online System for Well Completion Records[15] (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.

Explore the combined Risk Assessment map and data here: https://gispublic.waterboards.ca.gov/portal/apps/dashboards/4f7795ba4349464f9883827ad2e6b67a

The State Water Board has limited water quality, water shortage, and location data for SSWS and DWs, as these systems are not regulated by the state nor are maximum contaminant levels directly applicable to DWs.[16] Due to the lack of data from SSWS and DWs, it is difficult to precisely determine the count of systems and wells at-risk. The risk analysis described above uses proxy groundwater quality data to identify areas where shallow groundwater quality may exceed primary drinking water standards, and a suite of risk indicators to indicate where water shortage issues may occur. The socioeconomic risk is partially based on census data, which does not differentiate between SSWS/DW-reliant users and individuals served by a public water system. Therefore, the socioeconomic risk of an area may not represent the socioeconomic risk of SSWS/DW-reliant users in the area. These proxy risk categories do not assess the compliance, water shortage status, or accessibility of any individual well or system. As a result, the presence of a given SSWS or DW within an "at-risk" area does not signify that they are accessing groundwater above primary drinking water standards or that the well has gone dry. Conversely, a SSWS or DW within a "not at-risk" area may be accessing groundwater above primary drinking water standards or be experiencing water shortage issues. Physical monitoring and testing of SSWSs and individual DW water is needed to determine if those systems are unable to access safe drinking water.

Table 10: Preliminary 2023 Risk Assessment Results for SSWSs[17]

Assessment	At-Risk	Potentially At-Risk	Not At-Risk	Not Assessed
Combined Risk Assessment	**249 (19%)**	**636 (48%)**	**444 (33%)**	**0 (0%)**

[15] Department of Water Resources OSWCR database

[16] 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.

[17] Percentages may not add to 100% due to decimal rounding.

Assessment	At-Risk	Potentially At-Risk	Not At-Risk	Not Assessed
Water Quality Risk Only	713 (54%)	80 (6%)	397 (30%)	139 (11%)
Drought Risk Only (80/60 threshold)	265 (20%)	189 (14%)	875 (66%)	0 (0%)
Socioeconomic Risk Only	206 (16%)	288 (22%)	835 (63%)	0 (0%)

Table 11: Preliminary 2023 Risk Assessment Results for Domestic Wells[18]

Assessment	At-Risk	Potentially At-Risk	Not At-Risk	Not Assessed
Combined Risk Assessment	**81,579 (28%)**	**103,886 (36%)**	**105,936 (36%)**	**0 (0%)**
Water Quality Risk Only	99,688 (34%)	15,889 (5%)	117,134 (40%)	58,690 (20%)
Drought Risk Only (80/60 threshold)	101,393 (35%)	69,393 (24%)	120,763 (41%)	0 (0%)
Socioeconomic Risk Only	71,156 (24%)	53,734 (18%)	166,511 (57%)	0 (0%)

The 2021 Risk Assessment for SSWS and DWs only examined water quality risk, and the 2022 Risk Assessment only examined water quality risk and water shortage risk. The 2023 Risk Assessment examined water quality risk, water shortage risk, and socioeconomic risk. When comparing SSWS and DW counts for previous years, note that several methodology changes were implemented in both the source data for each category and in the methodology and risk categories used to calculate the final score. From 2021 to 2022 the Aquifer Risk Map changed the definition of “At-Risk”, including the expansion of “recent” results from two years to five years, and the addition of GeoTracker (monitoring well) data. From 2022 to 2023 the Aquifer Risk Map added new water quality data from the US Geological Survey National Water Information System dataset and the Irrigated Lands Regulatory Program dataset that was not included in previous assessments. From 2022 to 2023 the water shortage data changed to exclude socioeconomic census data from the score calculation and report scores by PLSS section. Additionally, updated SSWS and DW location counts were used for the risk

[18] Percentages may not add to 100% due to decimal rounding.

assessment each year that changed the total number of systems assessed.[19] Table 12 summarizes the differences between the different assessments.

Table 12: Comparison of 2021, 2022, and 2023 Risk Assessment Results for State Small Water Systems and Domestic Wells[20]

Assessment	At-Risk	Potentially At-Risk	Not At-Risk	Not Assessed
2021 SSWS *water quality risk only*	**611 (42%)**	**71 (5%)**	**553 (38%)**	**228 (16%)**
2022 SSWS				
Combined Assessment	**378 (30%)**	**438 (34%)**	**455 (36%)**	**2 (0%)**
Water Quality Risk Only	631 (50%)	75 (6%)	426 (33%)	141 (11%)
Drought Risk Only	321 (25%)	411 (32%)	535 (42%)	6 (0%)
2023 SSWS				
Combined Assessment	**249 (19%)**	**636 (48%)**	**444 (33%)**	**0 (0%)**
Water Quality Risk Only	713 (54%)	80 (6%)	397 (30%)	139 (11%)
Water Shortage Risk Only	265 (20%)	189 (14%)	875 (66%)	0 (0%)
Socioeconomic Risk Only	206 (16%)	288 (22%)	835 (63%)	0 (0%)
2021 Domestic Wells *water quality risk only*	**77,973 (24%)**	**15,791 (5%)**	**147,185 (43%)**	**84,800 (26%)**
2022 Domestic Wells				
Combined Assessment	**64,176 (21%)**	**90,840 (29%)**	**157,146 (50%)**	**25 (0%)**
Water Quality Only	92,635 (30%)	17,078 (5%)	134,282 (43%)	68,192 (22%)
Water Shortage Risk Only	90,974 (29%)	88,340 (28%)	132,709 (43%)	164 (0%)
2023 Domestic Wells				

[19] Page 7 of the 2023 Aquifer Risk Map methodology contains more detailed breakdown of 2022/2023 comparison stats for water quality risk https://gispublic.waterboards.ca.gov/portal/home/item.html?id=a00ee2ed17464141900131c46e126c45

[20] Percentages may not add up to 100% due to decimal rounding.

Assessment	At-Risk	Potentially At-Risk	Not At-Risk	Not Assessed
Combined Assessment	**81,579 (28%)**	**103,886 (36%)**	**105,936 (36%)**	**0 (0%)**
Water Quality Only	99,688 (34%)	15,889 (5%)	117,134 (40%)	58,690 (20%)
Water Shortage Risk Only	101,393 (35%)	69,393 (24%)	120,763 (41%)	0 (0%)
Socioeconomic Risk Only	71,156 (24%)	53,734 (18%)	166,511 (57%)	0 (0%)

3. Cost Assessment

The 2023 Needs Assessment will not include an updated Cost Assessment. 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:

- Determine if physical consolidation is a viable model solution at the beginning of the Cost Assessment, rather than the end. Therefore, physical consolidation will not be assessed against other potential treatment-based model solutions. This ensures physical consolidation is not under-selected by the Model due to higher estimated costs compared to other solution types, i.e., Point of Use/Point of Entry (POU/POE) devices.
- 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 2022 Risk Assessment for state small water systems and domestic wells identified locations at risk for water quality and/or drought. 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 an updated cost assumptions reflecting current infrastructure market prices.

The State Water Board hosted a public workshop on August 8, 2022 and provided an overview of the proposed changes along with proposed modeled solution selection criteria.[21] Further details on the proposed changes in the Cost Model are discussed in the Draft White Paper.[22] The State Water Board will host a series of public workshops in 2023 to continue to provide opportunities for stakeholders to learn about and contribute to this effort. The State Water Board will release an updated Cost Assessment within the 2024 Needs Assessment.

4. Proposed Changes to the Affordability Assessment

Senate Bill 200 requires the State Water Board to conduct an annual Affordability Assessment to determine which community water systems that serve disadvantaged communities (DACs) have exceeded an "affordability threshold" in order to provide drinking water that meets State and Federal standards. In 2020, 23 Affordability indicators were identified and evaluated through public workshops for potential inclusion in both the Affordability Assessment and Risk Assessment.[23] 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. Two affordability indicators that were identified for potential inclusion were Poverty Prevalence and Housing Burden indicators.

The State Water Board, in partnership with the Office of Environmental Health Hazard Assessment (OEHHA), hosted three Affordability Workshops in 2022 to re-evaluate previously utilized affordability indicators, research new affordability indicators, and explore how to incorporate Poverty Prevalence and Housing Burden indicators into the 2023 Needs Assessment and beyond. These workshops also analyzed different approaches for determining DACs and establishing an "affordability threshold."

- **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

[21] Proposed Changes for the Cost Assessment Presentation: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/2022-proposed-changes-to-cost-model-bt.pdf

[22] Proposed Changes for the Cost Assessment White Paper: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/cost-assessment-white-paper.pdf

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

- White Paper: https://bit.ly/3HVIsll

Based on the 2022 Affordability Workshops, the State Water Board and OEHHA recommend the following for the 2023 Needs Assessment the:

Remove Two Affordability Indicators

The State Water Board is recommending removing 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.[24] 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 will be 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. This allows for the inclusion of water systems that do not charge customers directly for water in the assessment.[25] See Appendix A for more information.

2023 Affordability Assessment and Beyond

In addition to the new Household Socioeconomic Burden affordability indication, the Affordability Assessment will continue to use the rate-based indicators of Water Bill Percent of Median Household Income (%MHI) and Extreme Water Bill. For future assessments, the State Water Board and OEHHA recommend collecting residential arrearage and shut-off data in the State Water Board's Electronic Annual Report (eAR) survey to enable the reincorporation of Percentage of Residential Arrearages, Residential Arrearage Burden, and shut-off metrics into future iterations of the Needs

[24] California Water and Wastewater Arrearage Payment Program
https://www.waterboards.ca.gov/arrearage_payment_program/

[25] 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. The history and future direction of affordability indicators in the Needs Assessment is shown in Table 13.

Table 13: Affordability Indicators in the Needs Assessment Over Time

Indicator	Definition	2020	2021	2022	2023	Future
Percent of Median Household Income (%MHI)	Annual system-wide average residential water bill for six hundred cubic feet per month relative to the annual MHI within a water system's service area.	X	X	X	X	X
Extreme Water Bill	Drinking water customer charges that meet or exceed 150% of statewide average drinking water customer charges at the six hundred cubic (HCF) level of consumption.		X	X	X	X
% Shut-Offs	Identifies water systems that have residential customers struggling to pay their water bills due to affordability challenges.		X			X
Percentage of Residential Arrearages	Identifies water systems that have a high percentage of their residential customers that have not paid their water bill and are at least 60 days or more past due. The higher the percentage of residential customers, the more vulnerable the community is to affordability challenges.			X[26]		X
Residential Arrearage Burden	Identifies water systems that would have a high residential arrearage burden if they were to distribute their residential arrearages accrued across their total residential rate base. This indicator measures how large of a burden non-payment is across the water system's residential customers.			X[27]		X

[26] The source of this data was from the 2021 Drinking Water Arrearage Program. It collected arrearage data from the COVID-19 pandemic period (March 4, 2020 through June 15, 2021).

[27] The source of this data was from the 2021 Drinking Water Arrearage Program. It collected arrearage data from the COVID-19 pandemic period (March 4, 2020 through June 15, 2021).

Indicator	Definition	2020	2021	2022	2023	Future
Household Socioeconomic Burden	This indicator is a composite indicator that measures Poverty Prevalence and Housing Burden together. 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 level and higher. Housing Burden measures the percent of households in a census tract that are both low income (making less than 80% of the HUD Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).				X	X

Preliminary Affordability Assessment Results

The State Water Board conducted a preliminary Affordability Assessment for all community water systems utilizing the proposed changes to the affordability indicators summarized in the sections above. The results of this analysis are detailed in Table 14 and Table 15.

Table 14: Total Number of Systems that Exceeded a Minimum Risk Indicator Affordability Threshold

Community Status	Total Systems	%MHI Thresh.	Extreme Water Bill Thresh..	Household Socioeconomic Burden Thresh.
DAC/SDAC Systems	1,709	364 (21%)	103 (6%)	1,322 (77%)
Non-DAC Systems	1,499	117 (8%)	214 (14%)	372 (25%)
Missing DAC Status	56	0 (0%)	2 (4%)	14 (25%)
TOTAL:	**3,264**	**481 (15%)**	**319 (10%)**	**1,708 (52%)**

Table 15: Preliminary 2023 Affordability Assessment Results

Community Status	Total Systems Assessed	High Affordability Burden	Medium Affordability Burden	Low Affordability Burden	None
DAC/SDAC Systems	1,709	76 (4%)	244 (14%)	1,073 (63%)	316 (18%)
Non-DAC Systems	1,499	19 (1%)	107 (7%)	432 (29%)	941 (63%)
Missing DAC Status	56	0 (0%)	1 (2%)	14 (25%)	41 (73%)
TOTAL:	**3,264**	**95 (3%)**	**352 (11%)**	**1,519 (47%)**	**1,298 (40%)**

The results of the Affordability Assessment for individual community water systems can be accessed here: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2023prelimaffordability.xlsx

5. Next Steps

Public Workshop Webinar

The State Water Board will be hosting a public webinar workshop on February 3, 2023 to solicit stakeholder feedback and recommendations on the proposed changes to the Needs Assessment methodologies summarized in this white paper.

Registration for SAFER Webinar on February 3, 2023 (9:00 – 12:00 pm pacific)[28]:
https://waterboards.zoom.us/webinar/register/WN_SF8sKRu9Qy6Jv5mLH9I25g

Materials on past Risk Assessment workshops can be found at SAFER website:
https://www.waterboards.ca.gov/safer/calendar.html

Finalizing 2023 Needs Assessment

The State Water Board will review and consider public and stakeholder feedback on the recommended changes to the Needs Assessment methodologies from February 3, 2023 through February 24, 2023 to determine the final 2023 Needs Assessment methodologies. Public feedback and recommendations should be submitted:

- During the February 3, 2023 webinar workshop; or
- By email: SAFER@waterboards.ca.gov

The final 2023 Needs Assessment results will be published in Spring 2023.

Water System Requests for Data Updates

The State Water Board is accepting inquiries related to underlying data change requests for the preliminary 2023 Needs Assessment results. The data used across the Needs Assessment are drawn from multiple sources. Data sources for the new proposed changes are detailed in Appendix A and Appendix B; data sources for unchanged risk and affordability indicators are detailed in the Appendixes of the 2022 Needs Assessment report.[29] Water systems are encouraged to reach out via the online webform below.

Water System Data Change Request Webform:
https://forms.office.com/g/10QNjq35PH

[28] A recording of the webinar will be available on the State Water Board's website: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs

[29] 2022 Drinking Water Needs Assessment

https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Appendix A: Household Socioeconomic Burden Calculation Methodology

Household Socioeconomic Burden

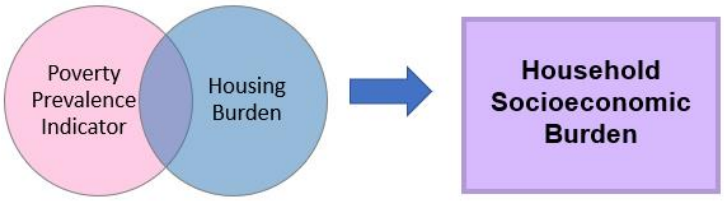
The State Water Board and the Office of Environmental Health Hazard Assessment (OEHHA) hosted a series of three Affordability Workshops in 2022. These workshops included a deep exploration of how to incorporate two previously identified affordability indicators, Poverty Prevalence and Housing Burden, into the Risk Assessment and Affordability Assessment.

- **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).

PPI accounts for poorer, low-income communities while Housing Burden accounts for both low-income communities and factors in their housing and utility cost burden. 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.

The State Water Board and OEHHA explored various methodologies to include PPI and Housing Burden in the set of affordability indicators for public water systems. In Workshop 2, the State Water Board and OEHHA recommend combining PPI and Housing Burden, into a combined indicator called "**Household Socioeconomic Burden**." This combined indicator will be analyzed in conjunction with two previously used rate-based indicators (%MHI and Extreme Water Bill) in the 2023 Needs Assessment.

Figure 5: PPI and Housing Burden Components Combined to Create Household Socioeconomic Burden Indicatory



Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Poverty Prevalence Indicator: From the 2017-2021 American Community Survey[30], 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),[31] 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).[32] 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 applied to remove estimates considered statistically unreliable. The suppression criteria applied to both components can be found in Appendix B. Although unreliable estimates were identified, water systems were not excluded if they did rely on

[30] https://data.census.gov/cedsci/

[31] HUD CHAS Data. https://www.huduser.gov/portal/datasets/cp.html

[32] California Drinking Water System Boundaries. https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

block groups or census tracts that had potentially unreliable data.

Proposed Component Thresholds

Poverty Prevalence (PPI): For PPI, various thresholds have been explored by other organizations and researchers including the use of 30%[33] or multiple categories such as less than 10%, 10% to 30%, 30% to 50%, and greater than 50%.[34] 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[35,36,37,38]. 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 16: Recommended PPI Component Threshold Scores

Component	Thresholds	Score	Risk Level = Affordability Burden
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 nation-wide 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

[33] https://internetofwater.org/wp-content/uploads/2021/12/Blog010_WaterAffordability_Patterson.pdf

[34] https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248

[35] https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813

[36] https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260

[37] https://www.allianceforwaterefficiency.org/sites/www.allianceforwaterefficiency.org/files/highlight_documents/AWE_Water_Affordability_Detroit_Final_2020_0.pdf

[38] https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf

burdened.[39] 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."[40] 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.[41] 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 17: Recommended Housing Burden Component Threshold Scores

Component	Thresholds	Score	Risk Level = Affordability Burden
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**

Combined Household Socioeconomic Burden Score Calculation Method & Thresholds

Since no regulatory thresholds exist currently for the combined indicator of PPI and Housing Burden, a similar scoring approach was applied from the Risk Assessment for state small water systems and domestic wells. Each component's low category received a 0 score, the medium category received a 0.25 score, and the high category received a 1 score.

[39] https://curs.unc.edu/wp-content/uploads/sites/400/2017/02/Extreme-Housing-Conditions-in-North-Carolina.pdf

[40] https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf

[41] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/

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.[42] 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 6 shows how much each calculated score represents a degree of PPI and Housing Burden within the matrix.

$$\textit{Household Socioeconomic Burden Score} = \frac{\text{PPI score} + \text{Housing Burden score}}{2}$$

Figure 6: Household Socioeconomic Burden scores within the matrix represents varying degrees of PPI and Housing Burden

PPI		Unknown (N/A)	Low (0)	Med (0.25)	High (1)
	High (1)	N/A	0.5	0.625	1
	Med (0.25)	N/A	0.125	0.25	0.625
	Low (0)	N/A	0	0.125	0.5
	Unknown (N/A)	N/A	N/A	N/A	N/A
		Housing Burden			

These combined scores are converted into risk designations, as shown in Table 18.

Table 18: Recommended 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**

[42] 2022 Needs Assessment. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Proposed 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 proposed threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's 2022 public workshops, the weight of 2 is suggested for the "Household Socioeconomic Burden" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table 19 summarizes the proposed thresholds, score, and weights for Household Socioeconomic Burden.

Table 19: Proposed "Household Socioeconomic Burden" Thresholds & Scores

Threshold Number	Threshold	Score	Weight	Max 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**

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/3XpzF01

Appendix B: Risk Assessment for State Small Water Systems and Domestic Wells

The 2021 Risk Assessment for State Small Water Systems (SSWSs) and domestic wells (DW) 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 for SSWSs and DWs that utilized both the Aquifer Risk Map (water quality risk) and DWR's Drought Risk Vulnerability Tool[43] (drought risk). For the 2023 Risk Assessment for SSWSs and DWs, the State Water Board partnered with OEHHA to develop a new Socioeconomic Risk map to include the Risk Assessment. This new layer aims to capture affordability, technical, and financial risk for communities served by SSWSs and DWs.

Updates on Water Quality Risk Map

Water quality risk scores are derived from the 2023 Aquifer Risk Map.[44] The methodology for calculating water quality risk in the 2023 Aquifer Risk Map is very similar to the methodology used in the 2022 Aquifer Risk Map and includes new water quality data from 2022. The Aquifer Risk Map methodology involves summarizing publicly available water quality data from previously sampled wells of a similar depth to SSWSs and DWs, since these systems are largely unregulated by the state and there is no comprehensive database of water quality data available directly from these systems. Water quality data is summarized for each square mile section where data is available. Sections that do not contain a water quality data well but are adjacent to a section with a water quality data well are assessed using the summarized results for all neighboring sections with source data. Sections are assessed on two metrics: average water quality over the last twenty years, and the highest recent sample from the last five years. Sections are assigned a risk bin using the following criteria:

Water Quality Risk Bin	Criteria
High Risk	Twenty-year average OR highest recent sample are above the MCL for one or more contaminants
Medium Risk	Twenty-year average OR highest recent sample are within 80% - 100% of MCL for one or more contaminants

[43] https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/County-Drought-Planning

[44] Methodology for 2023 Aquifer Risk Map

Low Risk	Twenty-year average AND highest recent sample are below 80% of the MCL for all sampled contaminants
Unknown Risk	No water quality results meeting time or depth filters was available in this area

The State Water Board has limited water quality and location data for SSWSs and DWs, as these systems are not regulated by the state nor are maximum contaminant levels directly applicable to DWs. Therefore, a very different approach for conducting a risk assessment for these systems was developed in comparison with the water quality risk assessment for public water systems. The water quality risk assessment for SSWSs and DWs uses modeled and estimated data based on nearby wells of similar depth to assess risk, because data directly from these systems is unavailable in most cases. The water quality risk presented here is not intended to depict actual groundwater quality conditions at any given SSWS and DW location. The purpose of the Aquifer Risk Map is to identify areas that may not meet primary drinking water standards and prioritize them for additional outreach and sampling efforts. The current lack of available SSWS and DW water quality data makes it difficult to characterize the water quality for individual SSWSs and DWs. The analysis described herein represents a best effort at using the available data to estimate water quality risk for SSWSs and DWs.

Updates on Water Shortage Vulnerability Risk Map

To improve the Water Shortage Vulnerability Map, 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 20.[45]

Table 20: Mayor Revisions Made to DWR's Water Shortage Vulnerability Assessment for SSWSs and DWs

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

[45] Draft -- Technical Methods for the Drought and Water Shortage Vulnerability Assessment Update https://data.cnra.ca.gov/dataset/water-shortage-vulnerability-technical-methods/resource/e7e9eb8a-7c9d-4d9d-b860-e543a9320641

Revision Description	2021 Version	2022 Version
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

NEW: Socioeconomic Risk Map

Historically, the Needs Assessment has not included affordability indicators in the Risk Assessment for SSWSs and DW communities. Based on stakeholder feedback, the State Water Board and OEHHA explored potential affordability and broader socioeconomic indicators in 2021-22, applicable to SSWSs and DWs, for inclusion in the Needs Assessment.

Thirteen indicators were identified to develop a new Socioeconomic Risk map for the 2023 Risk Assessment for SSWSs and DWs (Table 21). The suite includes seven county level measures capturing water quality testing practices and administrative services or resources available to DW 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 American Communities Survey.

Table 21: Socioeconomic Risk Indicators for SSWSs and DWs

Category	Risk Indicator	Geography
County Water Quality Testing for Domestic Wells	1. Testing Requirements	County
	2. Testing Type	
	3. Testing Impacts Permitting	
	4. Water Quality Monitoring	
	5. Administrative Services	County

County Level Services for Domestic Wells	6. Website Quality	
	7. Funding Resources Available to Domestic Well Owners	
Well Costs	8. Replacement Well Permit Cost	County
	9. Number of Active Drillers	
Socioeconomic Burden	10. Household Socioeconomic Burden (Poverty Prevalence and Housing Burden)	Census Tract and Block Group
	11. Linguistic Isolation	Census Block Group
	12. Unemployment	Census Block Group
	13. Transportation Limitations	Census Block Group

County Data Collection Effort
During the Fall and Winter of 2022, OEHHA and the State Water Board reviewed county-specific information about DWs for 58 California counties to develop the dataset needed for risk indicators numbered 1 through 8 in Table 21. This effort included:

1. Evaluation of publicly available information related to DWs on each county's website, including attachments and links.
2. Review of DW 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 SSWS and DWs.

County Water Quality Testing for Domestic Wells

State and federal law do not require quality testing for DWs, both before and during operation. However, many California counties have water quality testing requirements for DWs. These requirements and programs were evaluated to assess risk for communities served by DWs. Counties with fewer DW 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 DW owners are informed of potential water quality concerns. 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.

1. Water Quality Testing Requirements for Domestic Wells

This indicator reflects whether a County requires any level of water quality testing for new DWs during the permitting process. It has three thresholds: Testing required, testing recommended but not required, and testing neither recommended nor required.

> **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.[46] 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."[47] 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 category. These counties were classified as having "No testing required," indicating the highest risk level.

2. Water Quality Testing Type Required for Domestic Wells

This risk indicator is intended 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).

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[46] This was observed in Butte County.

[47] https://www.co.fresno.ca.us/departments/public-health/environmental-health/water-surveillance-program/water-well-permitting-program

Bacteria + Other (Threshold 0): This threshold applies to counties that recommend/require testing for bacteria and at least one non-bacteria test.

The number of contaminants tested varies widely by county; some counties require an extensive panel for all chemicals listed in Title 22,[48] 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.[49] 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 DWs. 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."[50] 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.

3. Water Quality Test Results Impacts on Permitting for Domestic Wells

While several counties require water quality testing as part of the DW 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.

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[48] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Lawbook.html

[49] Merced County.

[50] Sacramento County Municipal Code 6.28.030.8.b

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 DW 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.

4. Does the County Have a Water Quality Monitoring Program?

Many counties have programs to conduct voluntary DW water quality sampling and monitoring by county staff or through third-party partnerships. These programs not only help inform DW 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 DW water quality for contamination.

County Run or Funded Program (Threshold 0): Counties that have a program or staff that will sample or test DWs fall in this threshold. These programs may vary in scope, with some counties taking samples for every new well, while other counties may 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.

County Level Services Category

Aside from water quality, another important aspect of risk to DW users is the availability of administrative resources and county capacity to DW users when a well runs dry or becomes contaminated. County staff, resource information, and funding programs are all services needed to support DW and SSWSs when preparing for or responding to challenges.

5. County Administrative Services

The administrative services risk indicator reflects whether counties have specific programs or advertised administrative capacity to assist DW 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.

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 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 DW owners. This threshold is considered high risk.

6. County Website Quality

Large discrepancies have been observed between county websites with regards to the quality and quantity of information made available for DW. 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.

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 DW owners or have minimal relevant information. This threshold represents the highest risk.

7. County Funding Resources Available to Domestic Well Owners

Some counties have financial resources available to DW owners experiencing challenges. Most of these 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 DW owners.

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.

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 SSWSs or DWs. 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.

8. Replacement Well Permit Cost

This risk indicator measures the cost to obtain permits for a replacement well in each county. Information on DW permits and associated fees were collected by calling county DW 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 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. 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. See Table 19 below for well replacement costs by county.

Thresholds: 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).

9. Average Number of Wells Drilled Per Unique Driller in the Past Two Years

In an effort to approximate the cost associated with wait-time and increased demand for drillers, the State Water Board analyzed DW drilling data to identify the average number of wells drilled per unique driller per county. A higher number of active well drillers in an area may also be associated with areas experiencing high demand and the significant costs associated with drilling a well.

Data on well completion reports was extracted from OWSCR (Online System of Well Completion Reports).[51] 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 DWs drilled between 2020-2022 in each county were identified. This indicator was calculated by dividing the number of DWs drilled was by the number of active unique drillers per county (results shown in Table 20). This ensures that counties with lower demand will not receive lower scores simply because they have fewer active drillers.

Thresholds: Percentiles were calculated for each county, where the county with the highest average number of DWs per driller (Nevada County with an average DW per driller of 80) received a percentile of 100 and the county with the lowest average number of DWs per driller (Orange County with an average DW 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).

Table 22: Well Cost Category Indicator Data

County	Replacement Well Permit Cost (Indicator 8)	Number of DWs Drilled	Unique Drillers (DWs)	Average DWs per Driller (Indicator 9)
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

[51] OWSCR Well Completion Report Well

data.ca.gov/dataset/well-completion-reports

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	NA	NA	NA
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
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 DW or SSWS 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 PWS called 'Household Socioeconomic Burden', which is a combination of poverty and housing-burdened low-income households, is proposed here the same reasons outlined in the November 2022 white paper.[52] 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[53] as well as the five socioeconomic factors included in CalEnviroScreen.[54] 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.

10. Household Socioeconomic Burden

The Household Socioeconomic Burden indicator is derived from combining the housing burden (measure of low-income households that spend more than 50% of their income on housing) and the overall poverty prevalence (number of individuals below 200% of

[52] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/affordability-whitepaper-workshop3-nov2022.pdf

[53] https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

[54] https://oehha.ca.gov/calenviroscreen/population-indicators

the federal poverty line). This indicator is described in more detail in the November 2022 Affordability Whitepaper.[55] Socioeconomically burdened households may have a harder time paying for well repairs, replacements, or alternatives.

Thresholds and calculation methodology are detailed on Appendix A. For this DW and SSWS indicator, percentiles were calculated at the block groups 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.

11. Linguistic Isolation

Linguistic isolation measures limited English-speaking where nobody 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 small water systems. From the 2017-2021 American Community Survey, a dataset containing the number of households classified as limited English-speaking was downloaded by block groups for the state of California. Percentiles were calculated for at the block group scale.

> **Thresholds:** 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), where 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). 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.

12. 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. From the 2017-2021 American Community Survey, a dataset containing the number of unemployed individuals was downloaded by block groups for the state of California. Percentiles were calculated for at the block group scale.

> **Thresholds:** 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), where 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

[55] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2022/affordability-whitepaper-workshop3-nov2022.pdf

40th (percentiles below 60) were assigned a threshold of 0 (no risk). 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.

13. 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 well or SSWS is experiencing problems. From the 2017-2021 American Community Survey, a dataset containing the number of households without a vehicle was downloaded by block groups for the state of California. Percentiles were calculated for at the block group scale.

Thresholds: 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), where 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). 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.

Table 23: Proposed Socioeconomic Risk Indicators for Communities Served by SSWSs and DWs

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
County Water Quality Testing [56]					
Water Quality Testing Requirements for Domestic Wells	**Threshold N/A =** Data missing for location	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Required water quality testing	0	N/A	0	**None**
	Threshold 1 = Recommended testing, but not required	0.5	3	1.5	**Medium**
	Threshold 2 = No testing required or recommended	1	3	3	**High**
Water Quality Testing Type Required for Domestic Wells	**Threshold N/A =** Data missing for location	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Bacterial + Other	0	N/A	0	**None**
	Threshold 1 = Bacterial Only	0.5	1	0.5	**Medium**
	Threshold 2 = Not applicable, no testing required or tests are unspecified	1	1	1	**High**
Water Quality Test Results Impacts on Permitting for Domestic Wells	**Threshold N/A =** Data missing for location	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Yes, failure requires corrective actions	0	N/A	0	**None**
	Threshold 1 = Unknown, it's unclear if the failed test will result in corrective actions prior to permit finalization	0.25	2	0.5	**Low**
	Threshold 2 = No, testing is for owner information only	0.5	2	1	**Medium**

[56] No data is missing (Threshold N/A) for counties in this category.

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
	Threshold 3 = Not applicable, no testing required	1	2	2	**High**
Does the County Have a Water Quality Monitoring Program?	**Threshold N/A =** Data missing for location	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Yes, county either operates of funds a program	0	N/A	0	**None**
	Threshold 1 = Yes, program is operated through a non-county provider	0.5	2	2	**Medium**
	Threshold 2 = No program either operated by the county or non-county provider	1	2	2	**High**
County Level Services[57]					
County Administrative Services	**Threshold N/A =** Data missing for location	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Administrative services are provided by the county	0	N/A	0	**None**
	Threshold 1 = Services provided by a non-county provider	0.5	2	2	**Medium**
	Threshold 2 = No administrative services provided or referenced on county website	1	2	2	**High**
County Website Quality	**Threshold N/A =** Data missing for location.	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Substantial information about water quality, available resources,	0	N/A	0	**None**

[57] No data is missing (Threshold N/A) for counties in this category.

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
	and/or services provided.				
	Threshold 1 = Some information about water quality, available resources, and/or services provided.	0.5	1	0.5	**Medium**
	Threshold 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	**Threshold N/A =** Data missing for location.	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = County funding resources available.	0	N/A	0	**None**
	Threshold 1 = County provides information on funding available from non-county sources.	0.5	1	0.5	**Medium**
	Threshold 2 = No funding resources available or information provided.	1	1	1	**High**
Well Costs					
Replacement Well Permit Cost	**Threshold N/A =** Data missing for location.	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Percentile less than 60.	0	N/A	0	**None**
	Threshold 1 = 60 to less than the 80 percentile.	0.5	2	2	**Medium**
	Threshold 2 = Percentile 80 to 100 (top 20% of counties.)	1	2	2	**High**
Average Number of Wells Drilled Per Unique Driller in the	**Threshold N/A =** Data missing for location.	N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Percentile less than 60.	0	N/A	0	**None**
	Threshold 1 = 60 to less than the 80 percentile.	0.5	2	2	**Medium**

Risk Indicator	Thresholds	Score	Weight		Max Score	Risk Level
Past Two Years	**Threshold 2** = Percentile 80 to 100 (top 20% of counties.)		1	2	2	**High**
Economic Characteristics						
Household Socio-economic Burden	**Threshold N/A =** Data missing for location.		N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = 0-0.125		0	N/A	0	**None**
	Threshold 1 = 0.25-0.5		0.5	3	1.5	**Medium**
	Threshold 2 = 0.625-1.0		1	3	3	**High**
Linguistic Isolation	**Threshold N/A =** Data missing for location.		N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Percentile less than 60.		0	N/A	0	**None**
	Threshold 1 = 60 to less than the 80th percentile		0.5	1	0.5	**Medium**
	Threshold 2 = Percentile 80 to 100 (top 20% of block groups)		1	1	1	**High**
Unemployment	**Threshold N/A =** Data missing for location.		N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Percentile less than 60		0	N/A	0	**None**
	Threshold 1 = 60 to less than the 80th percentile		0.5	2	1	**Medium**
	Threshold 2 = Percentile 80 to 100 (top 20% of block groups)		1	2	2	**High**
Transportation Limitations	**Threshold N/A =** Data missing for location.		N/A	N/A	*Missing*	**Unknown**
	Threshold 0 = Percentile less than 60		0	N/A	0	**None**
	Threshold 1 = 60 to less than the 80th percentile		0.5	1	0.5	**Medium**
	Threshold 2 = Percentile 80 to 100 (top 20% of block groups)		1	1	1	**High**