APPENDIX:
AFFORDABILITY ASSESSMENT
METHODOLOGY

CONTENTS

INTRODUCTION

The purpose of the Affordability Assessment is to identify disadvantaged community (DAC) and severely disadvantages community (SDAC) water systems, that have instituted customer charges that exceed the "Affordability Threshold" established by the State Water Board in order to provide drinking water that meets state and federal standards.[1]

WATER SYSTEMS ASSESSED

The Affordability Assessment is conducted annually for all California community water systems. It is worth noting that, while there is some overlap, the systems included in the Affordability Assessment differ from the list of water systems analyzed in the Risk Assessment for public water systems. The Affordability Assessment includes community water systems of all sizes but excludes non-transient, non-community water systems, like schools. The Risk Assessment, on the other hand, analyzed only community water systems with less than 30,000 service connections or that served a population of less than 100,000 people and non-transient non-community K-12 schools. Both assessments exclude all community water system wholesalers, transient water systems, state small water systems and domestic wells.

AFFORDABILITY ASSESSMENT METHODOLOGY DEVELOPMENT PROCESS

The State Water Board, in partnership with UCLA, began developing the initial Affordability Assessment in 2019. The State Water Board and UCLA hosted four public webinar workshops in 2020 to solicit feedback and recommendations on the development of the Affordability Assessment. Approximately 683 individuals[2] participated in these workshops through either Zoom or CalEPA's live webcast. Since the initial launch of the Affordability Assessment in 2021, the methodology has been refined through additional public workshops. The State Water Board encourages public and stakeholder participation in the Affordability Assessment refinement process and strives to provide opportunities for feedback and recommendations. Proposed Affordability Assessment methodology updates are detailed in publicly available white papers, presented at public webinars, and public feedback is often incorporated into the final methodology and results. These materials are hosted on the Needs Assessment webpage.[3]

In 2022, the State Water Board partnered with the Office of Environmental Health Hazard Assessment (OEHHA) to host three public Affordability Workshops to re-evaluate previously utilized affordability indicators, research new affordability indicators, and explore how to incorporate a new affordability indicator that measures disposable income limitations into the 2023 Needs Assessment and beyond.[4] These workshops also analyzed different approaches for determining DACs and establishing an "affordability threshold."

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[1] California Health and Safety Code, section 116769, subd. (a)(2)(B)
[2] Individuals that participated in more than webinar workshop are double counted in this figure.
[3] State Water Board Needs Assessment Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html
[4] Workshop 1 (August 11, 2022); Presentation: https://bit.ly/3jsI4k8

AFFORDABILITY ASSESSMENT METHODOLOGY

SB 200 calls for the identification of "any community water system that serves a disadvantaged community that must charge fees that exceed the affordability threshold established by the board in order to supply, treat, and distribute potable water that complies with federal and state drinking water standards."[5] Based on the legislative requirements, the Affordability Assessment is conducted following a two-step process summarized below:

STEP 1: Identify DAC/SDAC water systems that have instituted customer charges.

STEP 2: Of these DAC/SDAC water systems, the State Water Board must identify those that exceed an "Affordability Threshold" in order to provide drinking water that meets State and Federal standards.

STEP 1: DAC & SDAC DETERMINATION

SB 200 requires the identification of DAC and SDAC systems that meet the Affordability Threshold. For the purposes of the Affordability Assessment, the State Water Board determined DAC and SDAC economic status for water systems using available data.

> **Disadvantaged Community** or DAC means the entire service area of a community water system, or a community therein, in which the MHI is less than 80% of the statewide annual MHI level.

> **Severely Disadvantaged Community** or SDAC means the entire service area of a community water system in which the MHI is less than 60% of the statewide MHI.

The State Water Board utilizes the MHI methodology[6] to estimate DAC status. **It is important to note that the estimated designation of community economic status is for the purposes of the Affordability Assessment only and will not be used by the State Water Board's Division of Financial Assistance (DFA) to make funding decisions.** Further MHI analysis on a per system basis will be conducted by DFA when a system seeks State Water Board assistance.

STEP 2: CONDUCT AFFORDABILITY ASSESSMENT

OVERVIEW OF AFFORDABILITY ASSESSMENT METHODOLOGY

The Affordability Assessment methodology relies on two core elements which are utilized to identify water systems serving communities that may be experiencing drinking water

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Workshop 2 (September 20, 2022); Presentation: https://bit.ly/3juZwEI; White Paper: https://bit.ly/3HXrliS
Workshop 3 (November 1, 2022); Presentation: https://bit.ly/3CKoBlG; White Paper: https://bit.ly/3HVIsll
[5] California Health and Safety Code section 116769 (a) (2) (B).
[6] MHI Calculation Methodology
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2024/2024MHI-caclulation.pdf

affordability challenges affordability indicators and thresholds. The methodology employed by the current Affordability Assessment utilizes the same affordability indicators and minimum thresholds used in the Risk Assessment.

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

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

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

AFFORDABILITY INDICATORS

Since 2020, the State Water Board and its partners have hosted workshops to feather refine and update the Affordability indicators used in the Risk and Affordability Assessments as data becomes available or is no longer available. Affordability indicators can be categorized based on the following attributes:

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

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

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

receive a water bill. Examples include mobile home park residents who pay for services in their rent.

2021 Affordability Indicators

In 2020, the State Water Board conducted an Affordability Assessment for community water systems, which analyzed one affordability indicator, water charges as a percent of median household income (%MHI), for the FY 2020-21 Safe and Affordable Drinking Water Fund Expenditure Plan.[7] From April through October 2020, the State Water Board and UCLA conducted extensive research and public engagement to identify potential affordability indicators for the Needs Assessment.[8] This effort identified 23 potential affordability indicators (white paper, Table 10).[9] In 2021, the State Water Board selected two new affordability indicators from the list of 23 to incorporate into the 2021 Risk Assessment and 2021 Affordability Assessment. These two indicators were: 'Extreme Water Bill' and '% Shut-offs.'

2022 Added and Removed Affordability Indicators

In 2020, Governor Newsom issued an Executive Order that prohibited water shut-offs beginning March 4, 2020, through December 31, 2021.[10] Therefore, data for '% Shut-offs' was unavailable for the majority of 2020 and was not collected from water systems in the 2020 electronic Annual Report (eAR). Thus, the State Water Board removed this affordability indicator from the 2022 Needs Assessment.

The State Water Board has replaced '% Shut-offs' with two new affordability indicators: 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden.' These indicators were used to identify water systems that have a community that is experiencing household affordability challenges and are a direct measure of household drinking water affordability.

2023 Added and Removed Affordability Indicators

Remove Two Affordability Indicators

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

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[7] The Fund Expenditure Plan used an affordability threshold of 1.5% MHI to identify DAC water systems that may have customer charges that are unaffordable: FY 2020-21 Fund Expenditure Plan
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/docs/sadwfep_2020_07_07.pdf

[8] The identification of additional affordability indicators was undertaken in conjunction with the identification of possible affordability risk indicators for the Risk Assessment. A full list of potential affordability indicators considered can be found in the white paper *Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems:* October 7, 2020 White Paper:
Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems
https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

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

[10] Governor Newsom Executive Order
https://www.gov.ca.gov/2020/04/02/governor-newsom-issues-executive-order-protecting-homes-small-businesses-from-water-shutoffs/

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

The initial data used for these two risk indicators came from the State Water Board's 2021 Drinking Water Arrearage Payment Program.[11] Eligible community water system applicants were able to apply for a one-time payment to cover residential arrearages that accrued during the COVID-19 pandemic (March 4, 2020, through June 15, 2021). This dataset is not up-to-date and does not reflect current affordability challenges. Therefore, these two indictors were removed from the Assessment until updated data becomes available.

Add New Affordability Indicator: Household Socioeconomic Burden
The State Water Board and OEHHA developed a new affordability indicator, incorporating stakeholder feedback from the three Affordability Workshops, 'Household Socioeconomic Burden,' a composite indicator that is a combined measure of Housing Burden and Poverty Prevalence that measures the extent at which low-income customers may have affordability challenges now or in the future because their disposable income is constrained by high housing costs. This allows for the inclusion of water systems that do not charge customers directly for water in the assessment.[12]

Table 1: Affordability Indicators Over Time

Indicators	Household / Community	Rates-Based?	2021	2022	2023-24
Percent of Median Household Income (%MHI)	Community	Yes	✓	✓	✓
Extreme Water Bill	Community	Yes	✓	✓	✓
% Shut-Offs (Removed 2022)[13]	Household	Yes	✓		
Percentage of Residential Arrearages (Removed 2023)[14]	Household	Yes		✓	
Residential Arrearage Burden (Removed 2023)[15]	Community	Yes		✓	
Household Socioeconomic Burden	Community	No			✓

AFFORDABILITY INDICATOR THRESHOLDS

To develop thresholds for the affordability indicators in the Affordability Assessment and Risk Assessment, the State Water Board reviewed multiple available types of evidence, looking

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[11] California Water and Wastewater Arrearage Payment Program
https://www.waterboards.ca.gov/arrearage_payment_program/
[12] 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).
[13] Data not collected.
[14] Data not collected.
[15] Data not collected.

both within California, across other state agencies nation-wide, and at the U.S. EPA's standards. Sections below provide more details about the rationale for the thresholds developed for each indicator. The minimum thresholds developed for the affordability indicators in the Risk Assessment are the same thresholds used in the Affordability Assessment.

Moving forward, the State Water Board will continue to refine the affordability indicator thresholds as data availability improves and the SAFER Program matures. The process may include refining thresholds by analyzing historical data trends such as looking at the relationship between historical thresholds and debt and shut-off data once it becomes available.

Table 2: Affordability Indicator Thresholds

Indicators	Affordability Threshold
Percent of Median Household Income (%MHI)	1.5% MHI or greater
Extreme Water Bill	Greater than 150% of the statewide average.
Household Socioeconomic Burden	Combined Poverty Prevalence and Housing Burden score of 0.25 – 1

AGGREGATED AFFORDABILITY ASSESSMENT & THRESHOLD BURDENS

The Affordability Assessment utilizes the count of affordability thresholds met across all three affordability indicators. The current approach does not include scoring or weighting of the individual affordability indicators, like they are in the Risk Assessment, they are all assessed equally in Affordability Assessment analysis.

Table 1: Current Aggregated Affordability Assessment Thresholds

Current Affordability Assessment Thresholds	Total Affordability Burden
0 Affordability Indicator Thresholds Exceeded	None
1 Affordability Indicator Thresholds Exceeded	Low
2 Affordability Indicator Thresholds Exceeded	Medium
3 Affordability Indicator Thresholds Exceeded	High

AFFORDABILITY INDICATOR DETAILS

PERCENT OF MEDIAN HOUSEHOLD INCOME (%MHI)

This indicator measures the annual system-wide average residential water bill for six hundred cubic feet (HCF) per month relative to the annual Median Household Income (MHI) within a water system's service area.

Calculation Methodology

Required Data Points & Sources:

- Water system service area boundaries: SABL[16]
- Block group-Income in the Past 12 Months: U.S. Census Bureau's American Community Survey[17]
- Drinking Water Customer Charges: electronic Annual Report (eAR)
- Other Customer Charges: eAR

Average monthly drinking water customer charges are collected through the eAR. Historically this data has not been required for reporting leading to poor data coverage and accuracy issues. Extensive changes have been made to the 2021 electronic Annual Report making reporting customer charges mandatory with checks in place to improve the data quality.

Calculation Methodology:

Median household income (MHI) is determined for a water system using American Community Survey data for household income. Community water system boundaries typically do not align with census boundaries where per capita income data is regularly collected. To assign an average median household income to a community water system spatially weighted income data is aggregated by census block group within the water system service area.

The methodology for this indicator was based on the Division of Financial Assistance (DFA) MHI methodology. While the MHI calculation methodology for the Affordability Assessment generally aligns with DFA's MHI determination methodologies, there are slight differences. The differences found in the calculation of MHI's for cities and census designated places and in the application of the Margin of Error (MOE).

The DFA methodology dictates that when it is determined that a system boundary exactly matches city boundaries or closely matches a census designated place boundary, the MHI for the entire city or census designated place should be directly applied to the system rather than using areally-interpolated block group data. This likely leads to more accurate MHI estimation in these cases. However, this method was not used in the Needs Assessment given that a case-by-case determination of matching of cities and census designated places to system boundaries was not feasible for the entire state. The MHI for each water system is a population weighted MHI, using census block group area and population data. A population factor is generated based on the area of each census block group that falls within the water system boundary. The water system MHI is then calculated using population adjusted MHIs for each census block group that falls within the water system boundary using the formula below:

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[16] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[17] Census Bureau Table B19013: MEDIAN HOUSEHOLD INCOME IN THE PAST 12 MONTHS:
https://data.census.gov/table/ACSDT5Y2021.B19013?t=Income+and+Poverty&g=040XX00US06$1500000&y=2021

Equation D1: MHI Calculation

$$\sum \frac{(Block\ Group\ MHI) \times (Adjusted\ Block\ Group\ Population)}{(Total\ Adjusted\ Block\ Groups\ Population)}$$

MOE for MHI American Community Survey data is also included in the MHI calculation. A service area adjusted MOE is found using the same methodology described for MHI. The lower range of the MOE will be applied to a community's estimated MHI up to a maximum MOE value of $7,500 for communities with more than 500 people and $15,000 for communities with 500 or fewer people. The MOE will be subtracted from the estimated MHI.

The DFA methodology uses a lower bound MHI by subtracting the block group MOE from the block group MHI, with limits based on community size prior to applying the population factor to MHI and MOE. The methodology applied in the Needs Assessment set margin of error limits and then applied them to population adjusted MHI figures, resulting in slightly different community water system MHI calculations than the DFA methodology.

As a result of these slight variations and the changing nature of household income, all funding related financial assessments must be completed by the DFA as their assessments are water system specific as opposed to the aggregated analysis done for the purposes of the Needs Assessment.

Average monthly drinking water customer charges are calculated using:

- Drinking water service costs estimated at six HCF Feet per month. This level of consumption is in line with statewide conservation goals of 55 gallons per capita per day, in an average 3-person household.
- When data becomes available, additional approximated customer charges (not collected through a customer's bill) will be added to this figure to calculate Total Drinking Water Customer Charges.

Equation D2: %MHI Calculation
%MHI = [Average Monthly Drinking Water Changes] / [MHI]

Threshold Determination
%MHI is commonly used by state and federal regulatory agencies and by water industry stakeholders for assessing community-wide water charges affordability for decades. %MHI is utilized by the State Water Board (at 1.5% threshold) and the U.S. EPA (at 2.5% threshold) for assessing affordability. The State Water Board and DWR use %MHI to determine Disadvantaged Community (DAC) status, among other income-related metrics. DAC status is often used to inform funding eligibilities for different financial programs offered by the State and other agencies. OEHHA's Human Right to Water (HR2W) Tool also utilizes[18] the thresholds

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[18] There has been criticism of this metric by academics, water system associations, and the broader water sector mostly around its accuracy in measuring household affordability for those truly in need and the setting of arbitrary %MHI thresholds, limitations which the U.S. EPA has recently acknowledged.

determined by the State Water Board for this indicator.[19] Other states, including North Carolina,[20] presently or have recently used 1.5% of MHI spent on water and sewer costs as a threshold for water system funding decisions. For the purposes of the Affordability Assessment, the threshold used is 1.5%.

Table 3: %MHI Affordability Thresholds

Threshold Number	Threshold	Affordability Burden
0	**Below 1.5% MHI**	**No**
1	**1.5% MHI or greater**	**Yes**

EXTREME WATER BILL

This indicator measures drinking water customer charges that meet or exceed 150% of statewide average drinking water customer charges at the six hundred cubic feet (HCF) level of consumption.

Calculation Methodology
Required Data Points & Sources:

- Drinking Water Customer Charges: eAR
- Other Customer Charges: eAR

Calculation Methodology:

Extreme Water Bill for a water system is determined using Average Monthly six HCF Drinking Water Customer Charges and Other Customer Charges divided by the State's Monthly Average Drinking Water Charges. Due to data quality concerns, water systems that reported less than $5 or greater than $500 in monthly customer charges for six HCF were excluded from the analysis and the calculated statewide average.

Threshold Determination
The State Water Board's AB 401 report[21] recommended statewide low-income rate assistance program elements utilize a minimum affordability indicator threshold of 150% of the state average drinking water bill for six HCF.

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[19] Arkansas Natural Resources Commission (2020). Safe Drinking Water Fund Intended Use Plan SFY 2019: https://www.agriculture.arkansas.gov/wp-content/uploads/2020/05/0_-_2019_DWSRF_IUP_-_AMENDED_January_2019_01082019_1156hrs.pdf

[20] North Carolina Department of Environmental Quality. Joint Legislative Economic Development and Global Engagement Oversight Committee (March 17, 2016) https://webservices.ncleg.gov/ViewDocSiteFile/29349

[21] AB 401 Final Report: Recommendations for Implementation of a Statewide Low-Income Water Rate Assistance Program https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf

Table 4: Extreme Water Bill Affordability Thresholds

| Threshold Number	Threshold	Affordability Burden
0	**Below 150%** of the statewide average.	**No**
1	**Greater than 150%** of the statewide average.	**Yes**

HOUSEHOLD SOCIOECONOMIC BURDEN

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

- **Poverty Prevalence Indicator (PPI)** measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level.

- **Housing Burden Indicator** measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).

The combination of these two variables creates a more comprehensive picture of socioeconomic vulnerability while accounting for the varying levels of income and cost burdens throughout California.

Figure 1: PPI and Housing Burden Components Combined to Create Household Socioeconomic Burden Indicator
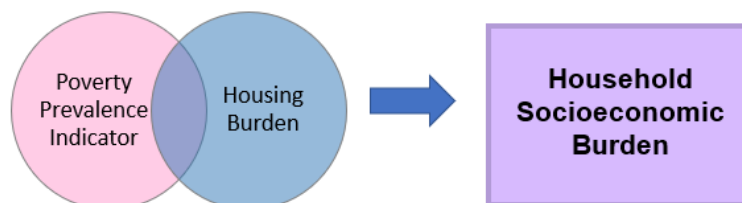
Calculation Methodology

Required Data Points & Sources:

- Poverty Prevalence Indicator: From the American Community Survey (Census),[22] 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 U.S. Department of Housing and Urban Development (HUD) Comprehensive Housing Affordability Strategy (CHAS),[23] a dataset containing cost burdens for households by HUD-adjusted median family income (HAMFI) category was downloaded by census tract for the state of California (8,057 in the state).

Calculation Methodology:

Prepare Poverty Prevalence Indicator data: The number of individuals below 200 percent of the FPL was calculated by subtracting the reported estimate of individuals in poverty (2x FPL) by the total estimate. The number of individuals below 200% of the poverty level was divided by the total population for whom poverty status was determined.

Prepare Housing Burden Indicator data: CHAS— a special analysis of census data specific to housing— is only available at the census tract and other larger geographies. For each census tract, the data were analyzed to estimate the number of households with household incomes less than 80% of the county median and renter or homeowner costs that exceed 50% of household income. The percentage of the total households in each tract that are both low-income and housing-burdened was then calculated. Each census tract was associated with the block groups within it to maintain consistency with the PPI indicator, which is at the block group level.

PPI and Housing Burden at the block group level were area-weighted to CWS boundaries. These boundaries were downloaded from the System Area Boundary Layer (SABL).[24] using the Intersect Tool in ArcPro, the area was determined for each portion of a water system boundary that intersected with a block group boundary. A weighted average, using area as the weight, was calculated for both PPI and Housing Burden for all water systems in the assessment.

The ACS and CHAS estimates come from a sample of the population and suppression criteria were assessed to flag estimates considered statistically unreliable.

Suppression Criteria for PPI
- Unlike the U.S. Census, ACS estimates come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error

[22] Census
https://data.census.gov/cedsci/
[23] HUD CHAS Data
https://www.huduser.gov/portal/datasets/cp.html
[24] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

(SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.

- The SE was calculated for each block group using the formula for approximating the SE of proportions provided by the ACS.[25] When this approximation could not be used, the formula[26] for approximating the SE of ratios was used instead.
- The RSE is calculated by dividing a tract's SE by its estimate of the percentage of the population living below twice the federal poverty level and taking the absolute value of the result.
- Block group estimates that met either of the following criteria were considered reliable and included in the analysis:
  - o RSE less than 50 (meaning the SE was less than half of the estimate); or
  - o SE was less than the mean SE of all California block group estimates for poverty.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block groups with scores were included in the indicator.

Suppression Criteria for Housing Burden
- Like ACS estimates, CHAS data come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.
- The SE was calculated for each census tract using the formula for approximating the SE of proportions provided by the ACS.[27] When this approximation could not be used, the formula[28] for approximating the SE of ratios was used instead.
- The RSE was calculated by dividing a tract's SE by its estimate of the percentage of housing-burdened low-income households and taking the absolute value of the result.
- Census tract estimates that met either of the following criteria were considered reliable and included in the analysis:
  - o RSE less than 50 (meaning the SE was less than half of the estimate); or
  - o SE was less than the mean SE of all California census tract estimates for housing burdened low-income households.
- All census tract level Housing Burden scores were associated with the block groups within them.
- Block groups with unreliable estimates were flagged as potentially unreliable. All block groups with scores were included in the indicator. Block groups that met the inclusion criteria were sorted and assigned percentiles based on their position in the distribution.

Component Thresholds

Poverty Prevalence (PPI): For PPI, various thresholds have been explored by other

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[25] American Community Survey Office, 2012, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[26] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[27] American Community Survey Office, 2013, equation 4
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf
[28] American Community Survey Office, 2013, equation 3
https://www2.census.gov/programs-surveys/acs/tech_docs/accuracy/MultiyearACSAccuracyofData2011.pdf

organizations and researchers including the use of 30%[29] or multiple categories such as less than 10%, 10% to 30%, 30% to 50%, and greater than 50%.[30] 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[31,32,33,34]. 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 5: PPI Component Threshold Scores

Component	Threshold	Score
PPI	**Threshold N/A =** Missing or not reliable PPI data	**N/A**
	Threshold 0 = < 20%	**0**
	Threshold 1 = 20% - 35%	**0.25**
	Threshold 2 = > 35%	**1**

Housing Burden: Based on a nationwide literature review, consistent thresholds for Housing Burden have not yet been established by other organizations or identified in scientific literature. A report by the University of North Carolina on housing conditions in North Carolina identified census tracts in the top 20% of state as severely burdened.[35] 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."[36] Lastly, one study showed that 16% of children in Los Angeles County live in severe housing-cost burdened households, but this was

[29] Lauren Patterson (2021): Water Affordability
https://internetofwater.org/wp-content/uploads/2021/12/Blog010_WaterAffordability_Patterson.pdf
[30] David Mitchell, and Elizabeth Stryjewski (2020): Technical Memorandum on Water/Sewer Service Affordability Analysis
https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248
[31] Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector (2019)
https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813
[32] American Water Works Association: Measuring Water Affordability and the Financial Capability of Utilities
https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260
[33] Alliance for Water Efficiency (2020): An Assessment of Water Affordability and Conservation Potential in Detroit, Michigan
https://www.allianceforwaterefficiency.org/impact/our-work/assessment-water-affordability-and-conservation-potential-detroit-michigan
[34] Duke University, Nicholas Institute: Exploring the Affordability of Water Services within and across Utilities
https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf
[35] William Rohe, Todd Owen, and Sarah Kerns; The University of North Carolina at Chapel Hill, Center for Urban and Regional Studies (2017): Extreme Housing Conditions in North Carolina
https://nchousing.org/wp-content/uploads/2017/02/Extreme-Housing-Conditions-in-North-Carolina-1.pdf
[36] Lucresia Graham(2021): A Cartographic Exploration of Census Data on Select Housing Challenges Among California Residents
https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf

based on survey data.[37] 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 6: Housing Burden Component Threshold Scores

Component	Threshold	Score
Housing Burden	**Threshold N/A =** Missing or not reliable Housing Burden data	**N/A**
	Threshold 0 = <14%	**0**
	Threshold 1 = 14% - 21%	**0.25**
	Threshold 2 = >21%	**1**

Threshold Determination
The two components of Household Socioeconomic Burden were combined using a matrix approach and following the same methodology as the Risk Assessment for state small water systems and domestic wells.[38] 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 2 shows how much each calculated score represents a degree of PPI and Housing Burden within the matrix.

Equation 3: Calculating Household Socioeconomic Burden Score

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

Figure 2: Household Socioeconomic Burden Scores Within the Matrix Represents Varying Degrees of PPI and Housing Burden

Poverty (PPI)	High Risk ≥ 35%	Score = 1	*Missing*	0.5	0.625	1

[37] Tabashir Z. Nobari, Shannon E. Whaley, Evelyn Blumenberg, Michael L. Prelip, and May C. Wanga (2018): Severe Housing-Cost Burden and Obesity Among Preschools-aged Low-Income Children in Lost Angeles County.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/
[38] 2022 Needs Assessment
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Med Risk 20% - 35%	Score = 0.25	*Missing*	**0.125**	**0.25**	**0.625**
None < 20%	Score = 0	*Missing*	**0**	**0.125**	**0.5**
Unknown	Score = *Missing*	*Missing*	*Missing*	*Missing*	*Missing*
		Score = *Missing*	Score = 0	Score = 0.25	Score = 1
		Unknown	**None** < 14%	**Med Risk** 14% - 21%	**High Risk** ≥ 21%
		Housing Burden			

These combined scores are converted into threshold Affordability Burden designations, as shown in Table 7.

Table 7: Thresholds for Household Socioeconomic Burden

Threshold Number	Threshold	Affordability Burden
0	Combined score of **0 – 0.125**	**No**
1	Combined score of **0.25 – 1**	**Yes**

AFFORDABILITY ASSESSMENT LIMITATIONS

The Affordability Assessment strives to identify communities that may be struggling with water affordability challenges; however, the State Water Board has identified the following limitations that are worth noting:

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

Affordability Indicator Data
The State Water Board acknowledges that there are some data coverage issues and data quality uncertainties for all the affordability indicators utilized in the Affordability Assessment. Customer charges, MHI, and/or residential arrearage data are not available for some water systems included in this assessment. Water system customer charge and residential arrearage data is self-reported and is difficult to verify its quality. Finally, water system boundaries, which

are used to calculate MHI, and DAC status may not be accurate. In some cases, they reflect a water system's jurisdiction boundary rather than their service area boundary.

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

Affordability Indicators

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

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

AFFORDABILITY ASSESSMENT REFINEMENT OPPORTUNITIES

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

Improved Data Collection Efforts

The State Water Board has taken necessary steps to improve data coverage and accuracy for the Affordability Assessment in the past and will continue to do so into the foreseeable future. Improvements began for the 2020 reporting year eAR included new requirements for

completing survey questions focused on customer charges and affordability.[39] eAR functionality has developed to help auto-calculate average customer charges for six HCF, which has helped reduce data errors. Furthermore, the eAR will be able to better distinguish between water systems that do not charge for water compared to those that do.

Refinement of Affordability Indicators and Thresholds
In 2022, the State Water Board hosted three public workshops to solicit feedback on current and future affordability indicators. Based on public feedback during these workshops, the State Water Board will begin developing a strategy to collect arrearage (customer debt), shut-off, and customer assistance program data from water systems to further enhance the data used in the Affordability Assessment. The State Water Board will conduct proper research and stakeholder engagement to develop new affordability indicators and the appropriate affordability thresholds necessary for inclusion in the Risk and Affordability Assessment.

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

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