Learning From Existing Studies and Non-Board Data Sources to Inform the California Wastewater Needs Assessment

Rapid Baseline Review

July 2025

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Acronyms

CCRH	California Coalition for Rural Housing
CIWQS	California Integrated Water Quality System Project
CSWRCB	California State Water Resources Control Board
CWA	Clean Water Act
CWNS	Clean Watershed Needs Survey
CWSRF	Clean Water State Revolving Fund
DACTIP	Disadvantaged Community Tribal Involvement Program
DWR	Department of Water Resources
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GAO	United State Government Accountability Office
IHS	Indian Health Services
LAMPs	Local Agency Management Programs
NCRP	North Coast Resource Partnership
NPDES	National Pollutant Discharge Elimination System
OSTS	Onsite Sewage Treatment Systems
OWP	California State University Sacramento - Office of Water Programs
OWTS	Onsite Wastewater Treatment Systems
RCAC	Rural Community Assistance Corporation
SCWW	Small Community Wastewater
SSO	Sanitary Sewer Overflow
TKFA	Tulare Kern Funding Area
UCANR	University of California, Agriculture and Natural Resources
WDRs	Waste Discharge Requirements
WWNA	Wastewater Needs Assessment
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

Terms

At-risk of Inadequate Wastewater System*	Systems at-risk of inadequacy may be confronting circumstances which threaten its ability to continue adequately treating and disposing of wastewater.
Collection System	Generic term for any system of pipes or sewer lines used to convey wastewater to a treatment facility.
Inadequate Wastewater System*	An inadequate wastewater system is one that does not effectively treat and dispose of wastewater, leading to environmental, health, and operational issues.
National Pollutant Discharge Elimination System (NPDES)	Section 402 of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a permit is issued that complies with the Clean Water Act. The State Water Board and the Regional Water Quality Control Boards issue WDRs that serve as NPDES permits in California.
Onsite Sewage Treatment Systems (OSTS)	Any individual residential sewage treatment and wastewater dispersal system.
Onsite Wastewater Treatment Systems (OWTS)	Onsite wastewater treatment systems (OWTS) commonly known as septic systems, primarily treat domestic wastewater and employ subsurface disposal. Instead of the wastewater being transported to a wastewater treatment plant, the wastewater is treated on-site.
Sanitary Sewer Overflow (SSO)	Any overflow, spill, release, discharge or diversion of untreated or partially treated wastewater from a sanitary sewer system.
Sanitary Sewer System	Any system of pipes, pump stations, sewer lines, or other conveyances, upstream of a wastewater treatment plant headworks, and which is comprised of more than one mile of pipes and sewer lines, used to collect and convey wastewater to a publicly owned treatment facility.
Septic System	An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a system of tile lines or a pit for disposal of the liquid effluent (sludge) that remains after decomposition of the solids by bacteria in the tank. Must be pumped out periodically.
Septic-to-Sewer	Senate Bill 1215 established the funding and regulatory framework for a statewide program to facilitate the consolidation of inadequate onsite sewage treatment systems with existing sewer systems. These projects are colloquially called “septic-to-sewer.”

Sewage	The waste and wastewater produced by residential and commercial sources and discharged into sewers.
Waste Discharge Requirements (WDR)	The order adopted by the regional boards that regulates discharges of waste to surface water and discharges of waste to land. WDRs are often synonymous with “permits.”
Wastewater Treatment Facilities (WWTF)	A facility that treats or reclaims industrial or sewage waste.
Wastewater Treatment Plant (WWTP)	A facility containing a series of tanks, screens, filters and other processes by which pollutants are removed from water.
Sanitation*	Sanitation (in the context of the WWNA) is being defined as access to safe, functional, affordable, and dignified collection and disposal of wastewater from fecal and urine disposal, hygiene, and cooking; including adequate sanitation systems, practices, and wastewater treatment to protect public health and the environment.
Sanitation equity*	Sanitation equity is achieved when social, geographic, economic, and demographic attributes no longer predict people’s access to or quality of sanitation.

** The WWNA project team created these definitions but are working definitions and subject to change throughout the life of the WWNA.*

Executive Summary

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Background

As part of the initial phases of the Wastewater Needs Assessment (WWNA), the University of California, Agriculture and Natural Resources (UC ANR) conducted a survey for the Rapid Baseline Assessment (contract Task 1B). The survey's goal is to qualitatively illustrate the breadth, depth, geographic areas of concern, and public health endangering sanitation issues in California.

To supplement the survey effort, UCLA rapidly reviewed existing readily available data sources and reports. Most of these were produced external to the State Water Resources Control Board (non-Board data sources) and provided a high-level summary of existing statewide knowledge on sanitation needs and associated costs (hereafter, the Baseline Studies Review report).

UCLA initiated the review, which resulted in a full report, to better understand wastewater needs and wastewater equity in California, as well as to differentiate the WWNA project from the many other current/recently conducted efforts.

We primarily reviewed the following studies and reports:

- Clean Watershed Needs Survey (CWNS) (2024)
- Recent, published septic-to-sewer analyses in California (2009-2019)
- Department of Water Resources Individual Funding Area Needs Assessments (2018-2023)
- Recent published studies on tribal housing, including wastewater, needs in both California and nationally.
    - "California Tribal Housing Needs and Opportunities: A Vision Forward" prepared by the California Coalition for Rural Housing (CCRH) and Rural Community Assistance Corporation (RCAC) (2019)
    - "Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects" by the United States Government Accountability Office (GAO) (2018)

We reviewed these studies to better understand wastewater needs and wastewater equity in California in terms of:

- Previous system mapping efforts,
- Methodologies used to identify communities of wastewater concern,
- Definitions and criteria for failing/at-risk wastewater systems,

- Cost and affordability estimates to address inadequate wastewater systems, and
- Statewide funding estimates to better understand and address wastewater needs and equity in California.

Clean Watershed Needs Survey (CWNS)

The CWNS is a comprehensive assessment of the capital costs ("needs") required to meet the water quality goals of the Clean Water Act and address water quality and related public health concerns. Though similar sounding, the CWNS and WWNA differ in their methodologies, including the scope of wastewater systems analyzed and the data collection methods used. The CWNS cost estimate is the most relevant to the WWNA in terms of scope. However, since it focuses on larger wastewater systems, it underestimates the costs for smaller systems. Still, the CWNS Cost Estimation Tools can help guide future methods in the WWNA.

Septic-to-Sewer analyses

Unlike the broad CWNS, published septic-to-sewer analyses in California focus more narrowly on the feasibility of septic-to-sewer conversions in specific areas. Further assessing potential and ongoing septic-to-sewer projects is one of the primary motivations of the WWNA. The septic-to-sewer analyses are useful for understanding previous septic-to-sewer efforts, cost-benefit analyses, methods for obtaining septic system location data at scale, and general conversion efforts. Since these projects are mostly grant-funded, the application process is lengthy, and it could often take up to five years to reach the construction phase. As a result, statewide studies and detailed information on planning and construction costs are limited. Additionally, cost assessment and solution methodologies vary.

DWR Regional Needs Assessment

As part of the Disadvantaged Community Tribal Involvement Program (DACTIP) efforts, each of California's Integrated Regional Water Management (IRWM) regions developed an Individual Funding Area Needs Assessment (DWR Regional Needs Assessment).

The DWR Regional Needs Assessments vary from region to region. Many reports do not quantify wastewater needs in terms of number of systems failing or at-risk of failing nor do they conduct cost, or affordability estimates to address wastewater needs. The DWR Regional Assessments typically broadly describe wastewater issues within their respective regions. However, some reports provide more details on their wastewater systems that can benefit the WWNA efforts, including potential data sources that the WWNA could utilize and support ongoing WWNA methods, such as a survey.

Tribal Studies

The Tribal-focused Studies in California rely on surveys and interviews to determine wastewater needs. The CCRH and RCAC study reviews housing needs in California

including wastewater issues. Their report has limited wastewater specificity but does review wastewater system capacity. The GAO study reviews water and wastewater needs for all federally recognized tribes in the US and relies on surveying government agencies to determine the current state of infrastructure. The report has a limited geographic scope but does quantify estimated costs to address wastewater needs for tribes.

Conclusion and Next Steps

Overall, we find that existing non-Board data sources and studies have and will continue to inform the WWNA approach. This report and its compilation process have already assisted with the risk assessment and mapping efforts. It will continue to guide the WWNA's framework for solutions and costs, as well as Phase 2's initial mapping, which will include machine-learning-generated OWTS/unconnected to sewer maps. These initial mapping efforts will involve a model that uses new machine-learning techniques to identify likely OWTS locations across California. The model will determine if areas need sanitation infrastructure and, if so, whether they require OWTS or sewer systems.

Previous studies, while valuable, do not replace the need for the WWNA as they are limited in relevance, accuracy, and coverage. The WWNA process will help fill gaps in existing data sources and literature.

1 Background and Data Sources

1.1 Motivation

As part of the initial phases of the Wastewater Needs Assessment (WWNA), University of California, Agriculture and Natural Resources (UC ANR) conducted a survey and follow-up interviews for the Rapid Baseline Assessment (Task 1B) (2024-2025). The survey's goal is to qualitatively illustrate the breadth, depth, geographic areas of concern, and public- health endangering sanitation issues in California. The questionnaire focused on sanitation equity experiences and communities, as described further in Phase 1B: Baseline Survey Report.

To supplement the survey effort, UCLA rapidly reviewed existing readily available data sources and reports, the vast majority of which were produced external to the State Water Resources Control Board, and provided a high-level summary of existing statewide knowledge on sanitation needs and associated costs.[1] This report summarizes that effort.

The WWNA project team initiated the review to better understand wastewater needs and wastewater equity in California, as well as to differentiate the WWNA project from the many other current/recently conducted efforts. We did not conduct a traditional scholarly literature review because relevant studies are scant, and because non-profit organizations and government agencies primarily document wastewater needs and sanitation equity in California (and in the US more broadly) in other document types: existing needs assessments, engineering reports, or wastewater studies.

This exercise enabled the project team to identify and characterize 1) previous system mapping efforts, 2) methodologies used to identify communities of wastewater concern, 3) definitions and criteria for failing/at-risk wastewater systems, 4) cost and affordability estimates to address inadequate wastewater systems, and 5) state-wide funding estimates to address needs (Figure 1). These prior efforts help to inform the remainder of the WWNA methodology and enable the project team to better understand wastewater needs in California, as well as potentially motivate investment in the needs assessment process itself beyond the initial WWNA effort.

[1] We note that the Office of Water Programs, as part of the WWNA effort, is more extensively reviewing, collecting, and ensuring the accuracy of internal State Water Resources Control Board and California Rrgional Water Quality and Control Board (plus other sources) data to inform many parts of the WWNA (Task 1C).

Figure 1. Outline of this Report

At the same time, we note that existing data sources and published reports are limited in their relevance, accuracy, and coverage with respect to the mandate for the WWNA effort. See Table 1 for an overview of data sources we reviewed in this initial stage. As scoped, later parts of the WWNA project will provide a cost estimate based on a precise definition of sanitation needs. The resulting cost estimate will be more thorough and defensible than any other existing effort to date.

1.2 Overview of Major Non-Board Data Sources

Table 1. Overview of Data Sources

Issued by	Data Type	Year(s) published	Definition of need	Data source	Methodology	Other pros and cons
U.S. Environmental Protection Agency (US EPA)	Clean Watershed Needs Survey (CWNS)	2024	Covers the range of Clean Water Act issues.	Scraped from agency websites, Regional Water Boards' adopted orders, or CIWQs.	Fully articulated within public documentation.	Informs CWSRF.

Issued by	Data Type	Year(s) published	Definition of need	Data source	Methodology	Other pros and cons
Varied; Engineering consulting firms	Recent, published septic-to-sewer studies in California.	2009-2019	Connecting (at risk) Onsite Wastewater Treatment Systems (OWTS) to sewer collection systems.	Engineering consulting firm efforts in coordination with a local agency sponsor. These reports were obtained via email correspondence with the engineering consultants.	Basic articulation within reports, but transparent.	The most clearly but narrowly defined approach. Statewide extrapolation could be misleading.
California Department of Water Resources	Department of Water Resources Individual Funding Area Needs Assessments	2018-2023	Varied.	Varied.	Varied.	Each region in California determined how to collect and report data so the reports are not comparable to one another.
California Coalition for Rural Housing Rural Community Assistance Corporation United States Government Accountability Office (GOA)	Recent published studies on tribal housing, including wastewater, needs both in California and nationally.	2018 and 2019	Varied between reports.	Predominantly surveys and data collected through the Indian Health Services.	Varied.	Data is largely unavailable for public use. Begins to identify wastewater need for tribal communities.

1.2.1 Clean Watershed Needs Survey (CWNS) (2023)

The US Environmental Protection Agency (EPA), in partnership with states, territories and the District of Columbia, conducts the Clean Watershed Needs Survey (CWNS) typically every four years.[2] The CWNS is a comprehensive assessment of the capital costs ("needs") required to meet the water quality goals of the Clean Water Act and address water quality and related public health concerns. These capital investment needs are reported to Congress and inform state and territory level Clean Water State Revolving Fund (CWSRF) allocations, which are discussed further in Section 7. While the CWNS provides a rigorously documented statewide estimation of wastewater needs, it is much broader in scope and time than the WWNA. On the other hand, it primarily includes only larger wastewater facilities[3] (collection, treatment system or both) whereas the WWNA will include smaller systems such as small packaged WWT systems, onsite sewage treatment system(s) (OSTS), and onsite wastewater treatment systems (OWTS).[4]

Completed in May 2023, California's most recent CWNS highlights wastewater infrastructure projects' planned needs for the next 20 years, 2022-2042. The CA CWNS team input data for 720 wastewater facilities (collection, treatment system, or both) which they found publicly available.[5] They also examined publicly available data for OWTS, though they found this data more difficult to locate. Two types of data were collected and reported – technical and needs. The CA CWNS team categorized projects by type of work.

- *Technical data* covers who is responsible for the facility or treatment plant, such as a city or special district, and may include information about the population served by the facility, flow from facility, discharge information, or treatment level of the facility. This information is gathered on the facilities website or by permit info.
- *Needs data* covers what types of projects the city or district plans self-report that they plan to complete in the next 20 years to update/improve the wastewater infrastructure.

[2] For more information on the CWNS, see https://www.epa.gov/system/files/documents/2024-05/2022-cwns-report-to-congress.pdf
[3] The average total flow of the facilities is 10.24 MGD but ranges from 0-450 MGD.
[4] We note that throughout this report, we refer variously to OWTS, OTST, septics, and septic systems. When we are referring to a report, we are using the terminology used by the report authors.
[5] Publicly available information was found on the wastewater facilities website or by reviewing wastewater permit information.

1.2.2 Septic-to-Sewer Analyses (2009-2024)[6]

A few existing published reports ("**Septic-to-sewer Analyses**") quantify the prevalence of OWTS within local-regional areas, along with their "risk of failure" and estimate the cost of connection to sewer collection systems in those areas. The six studies that we review are the Sanitation Priorities Task Order for the Eastern Coachella Valley (2019), Inland Empire Utilities Agency Septic System Conversion Feasibility Study (2018), Sacramento Sewer District Septic System Program Plan (2009), the Willow Creek Community Services District Preliminary Engineering Report - Wastewater Facilities (2014), the Riverview Mobile Home Estates Sewer Project (2024), and the Sunset Vista Mobile Home Park Sewer System Consolidation (2024). An engineering consulting firm and the Wastewater/Sewer District or Agency conducted these studies responsible for wastewater infrastructure in the local region.

We can use these estimates to potentially develop a statewide estimate of septic-to-sewer conversions specifically. At the same time, this is a narrower conception of wastewater needs than the WWNA employs, and we must be careful when extrapolating to other geographic, local agency capacity, and cost profiles in the state.

1.2.3 Department of Water Resources (DWR) Regional Needs Assessments (2018-2023)

As part of the Disadvantaged Community Tribal Involvement Program (DACTIP) efforts,[7] each of California's Integrated Regional Water Management (IRWM) regions developed an Individual Funding Area Needs Assessment (**DWR Regional Needs Assessments**). These DWR Regional Needs Assessments evaluate the region's needs, their successes, and their challenges in outreach and involvement of disadvantaged communities and Tribes in the regional programs. The Needs Assessments vary in terms of methodology and breadth but typically include surveys of community members, water institutions, and/or tribal communities as well as interviews, focus groups, and/or listening sessions. The North Coast Region, San Francisco Bay Area, and Tulare Kern funding area reports provide the most relevant insight for the WWNA as they specifically identify wastewater needs in their prospective regions.

1.2.3.1 The North Coast Region

The North Coast Resource Partnership (NCRP) conducted the Disadvantaged Community and Tribal Water and Wastewater Service Provider Needs Assessment Summary (2020). This effort included surveying water suppliers and wastewater treatment operators in economically disadvantaged communities and Tribes in the North

[6] For more information on the Septic-to-sewer Analyses, please see Appendix B.

[7] For more information on the DACTIP, see https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs/Proposition-1/DAC-Involvement-Program

Coast Region as well as in-depth interviews. NCRP evaluated the affordability of wastewater services, system size, and the adequacy of the wastewater treatment supplier[8] for disadvantaged communities and tribal communities. However, NCRP notes that it was challenging to identify tribal needs despite a relatively high survey response rate of 22 Tribal entities (72%). Many respondents did not answer all the questions because they were inapplicable. NCRP also notes that some water and wastewater providers did not want to participate due to general grievances with state regulations, dissatisfaction in previous survey efforts for a similar process, and distrust of organizations offering assistance.

1.2.3.2 The San Francisco Bay Area

In 2017, the Bay Area Disadvantaged Community Tribal Involvement (DACTI) Program and the Environmental Justice Coalition for Water (EJCW) partnered with 14 community-based organizations and the California Indian Environmental Alliance (CIEA) partnered with six Tribal partners to carry out the Regional Needs Assessment (SFEP 2022). The Bay Area DACTI Program used a community and tribal specific strategy to conduct thirteen needs assessment surveys in the Bay Area.

Most notably, the report found significant wastewater concerns in the Point Reyes Station and Dillon Beach areas as both areas are primarily served by domestic wells and individual OWTS. The Marin County Community Development Agency (MCCDA) conducted the Point Reyes Station and Dillon Beach area's Needs Assessment. Other areas, such as Antioch, Pittsburg, Bay Point, South Vallejo, and North Richmond identified concerns in aging wastewater infrastructure and plumbing and sea-level rise but did not quantify these issues in terms of affordability or quality.

1.2.3.3 Tulare Kern Region

Unlike the other DWR Regional Needs Assessments, the Final Needs Assessment for the Tulare Kern Funding Area (TKFA) included the development of a Disadvantaged Community mapping tool rather than conducting surveys or focus groups to determine water and wastewater needs (2020). The project team identified areas not served by an existing wastewater treatment facility that are assumed to rely on septic systems. It is assumed in the report that many communities which rely on private wells also rely on septic systems. The team relied on Local Agency Management Programs (LAMPs) for OWTS, however, they acknowledge LAMPs vary across counties.[9] Kern County reports having a comprehensive list of septic systems.

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[8] The NCRP does not provide a definition for "wastewater treatment suppliers" but does provide examples of the types of water suppliers and wastewater treatment providers including cities, special districts, mutual water associations/companies, public utilities, and "other." The NCRP does specify that almost all North Coast Region wastewater collection and treatment systems are owned and operated by local agencies – either cities or special districts.

[9] We note that the WWNA will also rely on LAMPs to inform parts of the WWNA (Task 1C).

1.2.4 Tribal Communities (2018-2019)

Two relatively recent studies which specifically highlight tribal community wastewater needs ("**Tribal Communities**") are: "California Tribal Housing Needs and Opportunities: A Vision Forward" prepared by the California Coalition for Rural Housing (CCRH) and Rural Community Assistance Corporation (RCAC) and "Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects" by the United State Government Accountability Office (GAO). The DWR Regional Needs Assessments occasionally include Tribal Community Needs but largely vary in their methodology. CCRC and RCAC's report primarily focuses on housing needs but does specify water and wastewater needs in this context. GAO's report's scope is at the federal level but provides insight into the challenges of identifying Tribal communities' needs.

1.2.4.1 "California Tribal Housing Needs and Opportunities: A Vision Forward" (2019)

The California Coalition for Rural Housing (CCRH) and Rural Community Assistance Corporation (RCAC) conducted this study to reveal the current housing and living conditions of California's tribal communities and provide a blueprint for how the state can help to improve these conditions in the coming years. While this study specifically looks at housing and infrastructure needs, it includes "Section IV: Analysis of Tribal Population, Housing, and Water-Wastewater Characteristics" which includes an assessment of individual tribal water and wastewater systems. In this section, the authors acknowledge that "the adequacy of existing water and sewer infrastructure is a major barrier to the development of new homes in Tribal California" (CCRH & RCAC, 2019, p. 29).

1.2.4.2 "Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects" (2018)

This study was conducted by the U.S. Government Accountability Office (GAO) to determine the extent to which seven federal agencies[10] (most notably the Indian Health Services (IHS) and U.S. Environmental Protection Agency (EPA)) identified Native American tribal drinking water and wastewater infrastructure needs; funded tribal drinking water and wastewater infrastructure projects and collaborated to meet Native American tribal drinking water and wastewater infrastructure needs. This study was conducted with a national scope and only reviewed federally recognized tribes.

[10] Indian Health Services (IHS), Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), Department of Housing and Urban Development (HUD), Department of the Interior's Bureau of Reclamation, U.S. Army Corps of Engineers, and Department of Commerce's Economic Development Administration (EDA)

1.3 Overarching Review Findings

Overall, we find that, while existing non-Water Board data sources and studies can inform the WWNA approach, they do not replace the need for the WWNA as they are generally limited in their relevance, accuracy, and coverage. The WWNA process will help fill gaps in existing data sources and extant literature.

In particular, while similar sounding, the CWNS and WWNA vary in terms of methodologies including the breadth of the wastewater systems included in the analysis and the methods for obtaining data. Largely, the CWNS has a more comprehensive list of wastewater systems. The WWNA primarily focuses on residential wastewater systems and does not include commercial or stormwater-related facilities. Additionally, the WWNA includes a survey to identify wastewater systems and communities that have significant wastewater needs. The CWNS did not utilize a survey and predominantly relied on existing documentation of wastewater needs from the local wastewater related agencies. Where recent and relevant documentation did not exist the CWNS relied on Cost Estimation Tools (USEPA 2024).

In contrast to the broad CWNS, published septic-to-sewer analyses in California provide a narrower focus, specifically on the feasibility of septic-to-sewer conversions for a given area. Further assessing potential and on-going septic-to-sewer projects is one of the primary motivations of the WWNA. The septic-to-sewer analyses are useful for understanding previous septic-to-sewer efforts, cost-benefit analyses, and general conversion efforts. However, the studies are limited in statewide generalizability and largely vary in terms of methodology applied to assessing potential costs and solutions.

Similarly, but even more wide-ranging, the DWR-commissioned Regional Needs Assessments vary largely from region to region. Many reports do not quantify wastewater needs in terms of the number of systems failing or at-risk of failing nor do they conduct cost, or affordability estimates to address wastewater needs. The DWR Regional Needs Assessments broadly describe drinking water and wastewater issues in their prospective regions. However, some reports provide more detail on their wastewater systems, such as the North Coast, the San Francisco Bay Area, and the Tulare Kern regions. The North Coast Region identifies the condition and adequacy of its wastewater suppliers. The San Francisco Bay Area Region utilizes community group meetings and surveys to identify wastewater concerns in the prospective regions. The Tulare Kern Region used geographic data, rather than qualitative survey data, to identify wastewater needs in their region. Many of the DWR Regional Needs Assessments do identify communities with wastewater needs through qualitative surveys or interviews but do not quantify the wastewater issues (see Appendix A).

Finally, the Tribal-focused Studies in California rely on surveys and interviews to determine wastewater needs. The CCRH and RCAC study reviews housing needs in California including wastewater issues. Their report is limited in specificity to

wastewater; however, the report does review wastewater system capacity. The GAO study reviews water and wastewater needs for all federally recognized tribes in the US and relies on surveying government agencies (notably the EPA and IHS) to determine the current state of infrastructure. Their report is limited in its broad geographic scope, however, the report does quantify estimated costs to address wastewater needs for tribes.

2 Wastewater infrastructure mapping efforts

Overall, all types of wastewater systems and infrastructure, but especially septic systems, are much less mapped in a publicly available fashion than drinking water systems.

2.1 Septic-to-Sewer Analyses

We identified six septic-to-sewer analyses of any scale in California, and two of these are not easily accessible. Out of the six septic-to-sewer analyses we reviewed, five of them mapped existing septic-to-sewer locations (i.e., Coachella Valley Water District's Sanitation Priorities Task Order for the Eastern Coachella Valley, Inland Empire Utilities Agency Septic System Conversion Feasibility Study, the Sacramento Area Sewer District Septic System Program Plan, Riverview Mobile Home Estates Sewer Project, and Sunset Vista Mobile Home Park Sewer System Consolidation). Septic system location data is based on shapefiles provided by the respective water district/agency, aerial imagery, septic system permits, and stakeholder input. Unpermitted septic system locations were additionally estimated based on factors such as households with trash service bills that are not connected to a wastewater treatment facility. However, we note that these maps were used for internal analysis purposes and are not available to the public.

In addition to the septic locations, studies have mapped potential septic-to-sewer projects. Septic-to-sewer projects were delineated using several considerations, including:

- Density and age of septic systems
- Proximity to existing sewer systems
- Existing population centers, and potential population growth
- Physical boundaries (such as waterways or roads)
- Parcel boundaries
- Political boundaries (such as member agency boundaries, city boundaries or census block grounds)
- Topography
- Redevelopment or infill underway
- Community input

Boundary maps were provided to water and wastewater agencies and comments on the boundaries were incorporated into the final boundary maps.

2.2 DWR Regional Needs Assessments

2.2.1 The North Coast Region

The North Coast Needs Assessment did not include sanitation mapping efforts but did ask questions to the wastewater system operators regarding their need for mapping assistance and the adequacy of current wastewater system maps. Around 70% of respondents indicated that their system (both water and wastewater systems) components are not accurately mapped.

2.2.2 The San Francisco Bay Area

The Bay Area Needs Assessment largely did not map wastewater infrastructure or concerns. The mapping efforts for the Bay Area Needs Assessment predominantly focused on mapping the community locations and Federal Emergency Management Agency (FEMA) flood zones.

The Point Reyes Station and Dillon Beach mapped their wastewater infrastructure, but since these two communities primarily rely on septic systems the mapping efforts only include one wastewater facility.

The Petaluma and the Springs communities in Sonoma County identified sewage manhole overflows as a large public health concern. The San Francisco Bay Area Assessment maps the locations of discharges between 10,000 and 100,000 gallons of sewage in disadvantaged communities using Sanitary Sewer Overflow (SSO) from the State Water Resources Control Board (CSWRCB).

2.2.3 Tulare Kern Region

Among the DWR Regional Needs Assessments, the Tulare Kern Funding Area (TKFA) utilized sanitation mapping as their main source of identifying wastewater needs. Through the TKFA efforts, the project team created a Community Water Needs Assessment Tool to provide a better understanding of the water management needs of disadvantaged communities (DACs) in the TKFA. Among others, this tool includes a separate map layer that ranks the level of community need, a map layer of wastewater treatment facilities in relation to disadvantaged communities, and a map layer of private well communities. The community needs ranking map is based on four categories: disadvantaged community status, water quality, source of water supply, and whether project funding is currently in progress. The map of wastewater treatment facilities is based on information from the California Integrated Water Quality System (CIWQS).

This mapping tool does not include septic system locations. However, the report does identify that Kern County has comprehensive knowledge of its septic system locations.[11]

The TKFA, however, states that comprehensive septic system information is not readily available for the whole region. Data that is known on septic systems came from Local Agency Management Programs (LAMPs). However, it is assumed that areas served by private domestic wells (which are known through Well Completion Reports) and do not have a local wastewater treatment facility are served by individual septic systems.

2.3 How this informs the WWNA

Part of the Phase 2 WWNA efforts will include developing mapping tools using available sanitary sewer system GIS boundaries, available National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirements (WDRs) wastewater treatment plants and facility locations, and other available data. The WWNA team will also produce machine-learning-produced OWTS maps. The result will categorize the geographic extent of sanitation infrastructure in California and, if requiring additional sanitation infrastructure, as sewer or OWTS.

The septic-to-sewer analyses provide useful information regarding the methods of obtaining septic system location data at scale, septic-to-sewer considerations, and the cost of consolidating underperforming septic systems. However, the septic-to-sewer analyses largely vary in terms of risk criteria, and statewide extrapolation could be misleading.

The DWR Regional Needs Assessments largely confirm data sources that the WWNA intends to use to identify and map wastewater treatment systems and facilities such as SSO system boundaries and observation data from the State Water Resources Control Board and the location of WWTFs from CIWQS. The DWR Regional Needs Assessments also further justify the need for broader mapping efforts to identify wastewater concerns in California, but do not provide enough empirical specificity to directly incorporate in the WWNA with the potential exception of the North Coast Region.

3 Communities of concern

Communities of concern are concentrated geographical areas or populations that have challenges regarding adequate access to sanitation. Communities of concern include areas without access to sanitation, access to sanitary plumbing, non-functioning

[11] It should be noted that the State Water Board does not permit or regulate septic systems, they are regulated at the county level.

sanitary plumbing, no access or use of portable toilets, inadequate sewage systems, or no access to running water.

The survey and follow up interviews that UCANR is conducting further identifies communities of concern, where this review of existing wastewater reports and literature supplements these efforts and characterizes previous efforts which attempted to determine communities of concern in California.

3.1 Tribal Communities

Both reports on tribal communities recognize the difficulty in estimating the status of Tribal wastewater systems. The largest barrier to identifying wastewater needs is that most Tribal homes are not connected to a centralized wastewater system and instead rely largely on septic systems.

3.1.1 "California Tribal Housing Needs and Opportunities: A Vision Forward" (2019)

The CCRH and RCAC study identified wastewater communities of concern via EPA Technical, Managerial, and Financial (TMF) capacity assessments and Operations and Maintenance Evaluations, interviews with the Senior Environmental Engineer for IHS, California, other IHS engineers, and wastewater systems operators. This study found that almost all the wastewater systems on tribal trust lands are septic systems. On many reservations and rancherias, steepness of terrain, parcel size, and soils conditions are the environmental factors most likely to impact the ability to develop water, wastewater, storm drain, and infrastructure services to support new housing. However, the main factor limiting infrastructure improvements is lack of funding for wastewater system installation, expansion, or upgrades.

3.1.2 "Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects" (2018)

The GAO study identified wastewater communities of concern by surveying seven federal agencies that provide water and wastewater services to tribal communities. The GAO report emphasizes that many tribal homes lack any wastewater system, instead using portable toilets, privies, or discharging waste directly to the ground. The GAO report does not specifically estimate where the locations of these communities are. The GAO describes efforts by the Indian Health Service (IHS) to identify homes that are eligible for their Sanitation Facilities Construction program. However, the IHS relies on the tribes to provide this information, and some tribes chose not to provide the information.

3.2 Septic-to-Sewer Analyses

Sanitation systems that are poorly designed, installed, or managed can contaminate drinking water supplies and release harmful pollutants into the environment. According to a study on the geography and socioeconomic characteristics of U.S. households reliant on private wells and septic systems, households reliant on septic systems are more likely to reside outside urban areas than those reliant on publicly regulated service (Hernandez & Pierce, 2023). The identification of rural populations relying on septic systems indicates potential challenges for proper maintenance that sewer connections could overcome.

The septic-to-sewer analyses provide a narrow insight into communities of concern for septic systems in California. However, they provide case studies of septic-to-sewer prioritization projects. It is important to note that they are not representative statewide and further motivate future work in the WWNA, such as modeling sewered and unsewered areas in California in Phase 2.

3.2.1 Coachella Valley Water District

The Coachella Valley Water District provides services in Coachella Valley and Riverside County. The eastern region is home to many rural communities that are not connected to the district's sanitary sewer collection system. The district is evaluating the consolidation of individual septic systems in the Eastern Coachella Valley. Projects were scored and prioritized based on population served, known public health issues, regional sewer system, cost, time to implement, and proximity to existing sewer.

3.2.2 Inland Empire Utilities Agency

The Inland Empire Utilities Agency Septic System Conversion Feasibility Study assessed its member cities, including the City of Chino, Chino Hills, Cucamonga Valley Water District, Fontana, Montclair, Ontario, Fontana Water Company, and Monte Vista Water District. The study indicates there are approximately 21,800 septic systems within the IEUA service area. The septic systems were assigned to Sewer Service Regions (SSRs) to prioritize septic systems more easily for conversion by first converting those septic systems that will provide the highest benefit and/or serve the greatest need at the lowest cost. The IEUA and its member agencies proposed 66 SSRs. Projects were scored and prioritized based on the potential for multiple benefits (i.e. extend sewer alongside extension of recycled water pipelines, add reliability to existing sewer systems), septic system failure or potential failure, conditions not suitable for septic system function (i.e. presence of high groundwater table, presence of poor draining soil), ease of conversion (i.e. proximity to existing sewer), and optional categories such as grant eligibility.

3.2.3 Sacramento Area Sewer District

The Sacramento Area Sewer District supports Citrus Heights, Elk Grove, Rancho Cordova, parts of Sacramento, parts of Folsom, and some unincorporated areas of the County. The septic systems in the district are estimated to be over 20 to 30 years old, and there are concerns about potential failures due to improper maintenance. The County has the authority to require conversions to the public sewer system if a property is within 200 feet. However, many septic systems are not within this criterion, so the County cannot mandate the connections. While many communities in the district support septic conversion plans, the programs in Rincon Point and Los Osos were delayed due to opposition from small interest groups. The study proposed septic system conversion areas but does not prioritize which projects to fund. However, the sewer needs, including the length of gravity and trunk sewers, and the number of pump stations, are estimated.

3.2.4 Willow Creek Community Services District

The unincorporated community of Willow Creek located in Humboldt County, does not have a community-wide wastewater collection system, and all residents and businesses rely on individual septic systems. Many of these systems are very old and failing, leading to negative environmental and health outcomes. This study focused specifically on the feasibility of creating a wastewater treatment and collection system for the downtown area of Willow Creek. The conclusion suggests that the best project option includes a simple treatment and disposal system that would be easy to operate and maintain. It is important to note that out of the six septic-to-sewer analyses, the Willow Creek Community is the only one that did not serve a disadvantaged community. While a cost-benefit analysis is absent, the report estimates the cost of a gravity collection system, a recirculating gravel filter treatment system, and a leach field. Overall, this report places greater emphasis on the design of a new wastewater treatment plant rather than on a collection system.

3.2.5 Riverview Mobile Home Estates

The Riverview Mobile Home Estates (RMHE) located in Modesto, CA, relies on 52 septic systems that are privately owned and operated by the RHME owners. The RMHE system does not have wastewater collection infrastructure or a wastewater treatment plant and instead relies on individual septic tanks, seepage pits, and leach fields as the collection, treatment, and disposal process for the wastewater from the mobile homes. The septic tanks and seepage pits are approximately 45 years old and have been gradually showing signs of deterioration and failure. This study considers the feasibility of three options: 1) No Action; 2) Consolidation with the City of Hughson; and 3) On-Site Wastewater Treatment System (OWTS). These three options were evaluated by their 30-year life cost, environmental sustainability, operations and maintenance, benefits to

the community, and reliability and redundancy. The final recommendation was the OWTS option.

3.2.6 Sunset Vista Mobile Home Park

The Sunset Vista Mobile Home Park (SVMHP) is in the northeast corner of Kings County near the City of Lemoore. SVMHP relies on a series of eleven septic tanks where the final septic tank pumps into a buffer tank which feeds a package aeration treatment plant. The treatment plant is past its useful life and not functioning effectively. Between 2018 and 2020, there were thirty violations of the effluent limits for BOD, TSS, and settleable solids. This study considers the feasibility of constructing a wastewater treatment plant, consolidation with other sewer systems, and no action. The preferred alternative is to consolidate with the City of Lemoore. The projects were evaluated by their costs and perceived advantages and disadvantages.

3.3 DWR Regional Needs Assessments

The DWR Regional Needs Assessments largely vary in terms of how they define wastewater inadequacies and determined communities of concern. The UCLA project team reviewed the DWR Regional Needs Assessments and pulled out a list of communities that have known wastewater issues. Please see Appendix A, for a full list of communities of concern in all the DWR Regional Needs Assessments. However, this list is only the communities that were mentioned in the report and is not inclusive of all communities in California which may have wastewater concerns.

Below, we review the North Coast, the San Francisco Bay Area, and Tulare Kern Funding Areas as they provide the most detailed assessment of their wastewater concerns.

3.3.1 The North Coast Region

The North Coast effort predominantly included surveying water suppliers and wastewater treatment operators in economically DACs and Tribes in the North Coast Region as well as in-depth interviews. The North Coast region determined communities of concern via the survey and the interview by asking the water supplier and/or wastewater treatment operator questions about the characteristics of the water or wastewater system that they serve. These questions included topics such as technical assistance needs, pollutants, financial deficiencies, affordability of rates, infrastructure age, size of population served, regulatory compliance, etc.

3.3.2 The San Francisco Bay Area

The Bay Area effort included thirteen individual needs assessments to understand water and wastewater needs in the Bay Area. The UCLA team determined wastewater

communities of concern by identifying which individual needs assessments included information on wastewater deficiencies in that specific area.

While most regions do not quantify wastewater concerns in terms of affordability or quality, if they find wastewater an issue at all, the Point Reyes Station and Dillon Beach area go into detail regarding their wastewater needs and concerns. In Point Reyes Station and Dillon Beach, approximately 70% of survey respondents indicated that they have concerns regarding their onsite wastewater systems (SFEP 2022). These concerns include odor, concerns about health risk, system failure, contaminating waterways, and constraints on development (SFEP 2022). Both communities indicated an interest in a feasibility study for a community water system.

3.3.3 Tulare Kern Region

Unlike the majority of the DWR Regional Needs Assessments, the TKFA utilized a mapping tool rather than a community survey. The mapping tool gathered publicly available data including Wastewater Treatment Facilities (WWTF), WWTF capacity, and WWTF compliance issues from the California Integrated Water Quality System (CIWQS) (Kern County nd.). The TKFA reviewed Local Agency Management Programs (LAMPs) for Onsite Wastewater Systems (OWTS); otherwise, the TKFA assumed a community was served by an OWTS if it was not served by an existing WWTF.

The main wastewater concerns that the TKFA identified include reliance on septic systems that may be failing or potentially contaminating the groundwater, failing or insufficient sewer collection systems, or wastewater treatment systems that are not capable of meeting the WDR. The TKFA identified 106 WWTF in the funding area and determined that 58 have had a violation and 29 have had enforcement actions in the past five years. The TKFA also identified Wastewater Treatment Plants and Wastewater Treatment Facilities, which have received Clean Water State Revolving Fund assistance to address wastewater needs.

3.4 How this informs the WWNA

Through the WWNA Rapid Baseline Assessment survey and future analysis throughout the WWNA, we will further identify and characterize wastewater communities of concern in terms of physical geographic location or population due to potential wastewater inadequacies. The initial baseline needs assessment efforts of this report is to identify data sources or existing communities of concern identified in previous studies.

Earlier methods to identify communities of wastewater concern largely support the ongoing WWNA method of utilizing a survey sent to community-based organizations, government agencies, wastewater system operators, etc.

The WWNA will utilize a machine-learning model to characterize geographic areas as sewered and unsewered. This modeling will allow for an analysis of potential septic-to-

sewer mapping opportunities. It is important to note that not all inadequate septic systems require connecting to a sewer system, and solutions largely depend on system geography and prevailing sewer rates, connection fees, and general desire to be connected to a publicly regulated system. As previously noted, the septic-to-sewer analyses offer a narrow insight into identifying communities of concern but do provide relevant case studies regarding septic-to-sewer projects.

Additionally, like the TKFA, the WWNA plans to utilize CIWQS and the Division of Financial Assistance's LGTS (loans and grants tracking system) to identify wastewater violation and enforcement status as well as the list of wastewater systems which have received funding from the Clean Water State Revolving Fund.

4 Definitions and criteria for inadequate systems

One of the initial goals for the WWNA is to establish risk and inadequacy definitions and contributing factors for the three types of wastewater systems of interest:

- Collection systems (SSO permitted)
- And two types of treatment systems (WDR and NPDES permitted).

Unlike on the drinking water side (and as analyzed in the Drinking Water Needs Assessment), regulators have not fully created synthetic definitions of inadequacy or risk of inadequacy for different types of regulated wastewater systems. Further defining the criteria for regulated systems of highest concern is essential to inform future funding and regulatory efforts to improve sanitation access. The exact terminology that we are using is still under development at this point in the WWNA process, and ultimately dependent on State and Regional Boards as well as Advisory Group input. Accordingly, below we identified definitions and methods for defining inadequacy in wastewater systems from existing reports and efforts.

4.1 Tribal Communities

4.1.1 "California Tribal Housing Needs and Opportunities: A Vision Forward" (2019)

The CCRH and RCAC study performed capacity assessments of nineteen wastewater systems where information was available. Information was obtained through RCAC TMF analyses and Operations and Maintenance Evaluations performed by RCAC at the request of EPA, interviews with system operators, and interviews with Indian Health Service engineers responsible for tribal health. This study focused on capacity

assessments[12] as adequate water and wastewater capacity is necessary for any new housing development.

The CCRH and RCAC used the following categories for the capacity assessment "at capacity," "beyond capacity," "not yet at capacity," or if "capacity unknown." See Table 2 (Figure 7 in the CCRH and RCAC report) from the study for their capacity assessment.

Table 2. Status of Tribal Wastewater Systems by California Region

	Northern	Southern	Central	Total
# Systems at Capacity	2	2	0	4
# Systems Beyond Capacity	0	0	0	0
# Systems Not Yet at Capacity	12	1	2	15
# Systems Where Capacity Unknown	0	0	0	0
# Systems	14	3	2	19

4.1.2 "Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects" (2018)

The GAO report focused on the IHS definitions of need since the EPA's definitions provided primarily focus on drinking water. The Indian Health Care Amendments of 1988 require that IHS report annually to Congress on the sanitation deficiency levels for Indian tribes and communities, including, among other things, the amount of funds necessary to raise all Indian tribes and communities to zero sanitation deficiency. The act identifies five deficiency levels, and IHS uses a deficiency level of 0 to represent the absence of a deficiency in its data systems. See Table 3 from the GAO report to review the definitions of need that the IHS uses.

Table 3: Drinking Water and Wastewater Sanitation Deficiency Levels Used by the Indian Health Service (IHS)

Deficiency level	Description of a sanitation deficiency
5	Community or home that lacks a safe water supply and a sewage disposal system.
4	Community or home that lacks either a safe water supply system or a sewage disposal system.

[12] We note that the capacity assessments are not defined in the report but assumed to be based on volume/flow of the wastewater systems.

Deficiency level	Description of a sanitation deficiency
3	Community or home that has an inadequate or partial water supply and a sewage disposal facility that does not comply with applicable water supply and pollution control laws.[13]
2	Sanitation system that complies with all applicable water supply and pollution control laws, and in which the deficiencies relate to capital improvements that are necessary to improve the facilities to meet the needs[14] of the tribe or community for domestic sanitation facilities.
1	Sanitation system that complies with all applicable water supply and pollution control laws, and in which the deficiencies relate to routine replacement, repair, or maintenance needs.
0	Sanitation facilities are adequate.

Note: The Indian Health Care Amendments of 1988 define deficiency levels 1 through 5. IHS uses deficiency level 0 to indicate the absence of a deficiency in its data systems.

According to agency policy, IHS's Sanitation Facilities Construction program and EPA's clean water set-aside program prioritize and select projects to fund according to the projects' rankings in each IHS area's SDS list. To create the ranked lists, IHS staff assign scores to each project based on a set of eight scoring factors, each with a different number of points that may be assigned to a project. See Table 4 of the GAO report to see the IHS scoring factors.

Table 4. Indian Health Service's (IHS) Scoring Factors for Ranking Projects in the Sanitation Deficiency System (SDS)

Factor	Description	Minimum and maximum points awarded
Health impact	Potential for occurrence of a disease or other adverse human health effect directly attributable to the failure of (or lack of) water or sewer facilities.	0 to 30 points
Project deficiency level	Reflects the deficiency level of facilities to be replaced or modified by the	0 to 18 points

[13] IHS also uses deficiency level 3 for a community or home that does not have a solid waste disposal facility.
[14] IHS documents that "needs" arise from a sanitation deficiency in existing drinking water or wastewater infrastructure (or lack thereof) that can negatively affect public health.

Factor	Description	Minimum and maximum points awarded
	proposed project. Projects with higher deficiency levels receive more points.	
Capital cost	Relative cost per home served by the project compared to similar projects in the area. Projects with lower cost per home served receive more points.	-20 to 16 points
Operations and maintenance capability	Probability of adequate operations and maintenance of facilities provided through the project.	0 to 16 points
Local tribal priority	Tribe's documented priorities for its preferred projects.	0 to 16 points
Contributions	For projects that leverage funding contributions from non-IHS sources.	0 to 8 points
Adequate previous service	For projects that serve communities that have not been provided adequate water and sewage facilities.	0 to 4 points
Local conditions factor	Area can adjust the project's overall score to compensate for unusual circumstances, such as project sequencing needs and status of project planning.	-15 to 0 points
Total possible points		108 points

4.2 Septic-to-Sewer Analyses

The six septic-to-sewer reports which we were able to identify do not outline a clear definition for "failure" or other terms of inadequacy for wastewater systems. The reports largely define failure as septic systems contaminating/impacting groundwater, drinking water, and/or surface water. Refer to Table 5 for more information on definitions/criteria used to determine the adequacy of the system. Table 5 also indicates whether a cost-

benefit analysis was conducted to determine which septic systems to convert into sewage systems.

Table 5. Septic-to-Sewer Inadequacy Definitions and Cost-benefit Analysis

Name of Report	Definition/Impact of Failure	Cost-Benefit Analysis
Coachella Valley Water District Sanitation Priorities Task Order for the Eastern Coachella Valley (2019)	N/A, but considers "violations" related to septic systems in the cost-benefit analysis	Yes, refer to Table 6
Inland Empire Utilities Agency Septic System Conversion Feasibility Study (2018)	Septic system failure is not defined clearly but is referred to as leading to nitrate, phosphate, bacteria, and virus contamination in groundwater.	Yes, refer to Table 7
Sacramento Area Sewer District Septic System Program Plan (2009)	Septic system failure is broadly defined as contamination of drinking water due to age, poor placement of septic drain fields, systems located too close to surface water and drinking water wells, inadequately constructed percolation systems, or high-density placement of septic systems.	N/A
Willow Creek Community Services District Preliminary Engineering Report-Wastewater Facilities (2014)	Failing septic systems are defined as impacting ground and surface water, including raw sewage overflowing into the downtown storm drains.	N/A
Riverview Mobile Home Estates Sewer Project (2024)	Septic system failure results in septic tank overflows which can spread illness causing pathogens, chemical contaminants, and dangerous gases.	Yes, refer to Table 8
Sunset Vista Mobile Home Park Sewer System Consolidation (2024)	N/A but considers "violations" as a basis to consolidate the system.	N/A

The Eastern Coachella Valley septic-to-sewer study (Table 6) includes the most comprehensive cost-benefit analysis framework among the six reports. The highest weighted criteria are cost, and population served (make up 50% of the total criterion weight).

Table 6. Coachella Valley Water District's Sanitation Priorities Task Order for the Eastern Coachella Valley: Criteria for Project Prioritization and Weight

Criterion	Criterion Weight	Sub-Criterion	Sub-Criterion Weight
Known Public Health Issues (i.e., violations related to the septic systems)	11%	–	–
Regional Sewer System	11%	–	–
Time to Implement	14%	Environmental and permitting	50%
		Right-of-Way Acquisition	50%
Relative Proximity to Existing Sewer	14%	–	–
Population Served	25%	–	–
Cost	25%	Project Costs per Connection	25%
		Likelihood of External Funding	75%

The Inland Empire Utilities Agency septic-to-sewer study (Table 7) includes the second most comprehensive cost-benefit analysis framework among the septic-to-sewer reports. The highest weighted criteria are cost and potential to meet multiple benefits (70% of the total criterion weight).

Table 7. Inland Empire Utilities Agency Septic System Conversion Feasibility Study: Criteria for Project Prioritization and Weight

Benefits	**Weight**
Septic system failure or potential failure	7.5%
Ease of conversion	7.5%
Conditions not suitable to septic system function	15%

Potential to meet multiple benefits[15]	20%
Costs	**Weight**
Unit cost (capital cost per septic system; scored 1-10)	50%

The RMHE Sewer Project does not include a cost-benefit analysis but does include the evaluation criteria to evaluate the project alternatives including consolidating and an OWTS. The highest weighted criteria are the benefits to the community (30%).

Table 8. Riverview Mobile Home Estates Sewer Project: Evaluation Criteria

Evaluation Criteria	Weighting Factor
30-year Life Cycle Cost	0.20
Environmental Sustainability	0.10
Operations and Maintenance	0.20
Benefits to the Community	0.30
Reliability and Redundancy	0.20

4.3 DWR Regional Needs Assessments

4.3.1 North Coast Region

Among the DWR Regional Needs Assessments, the North Coast Resource Partnership (NCRP) evaluates the status of their wastewater systems based on survey responses, information from county planning documents, and system websites. NCRP was able to provide information for 49 systems that provide wastewater services. They use the following terms to describe the status of the wastewater treatment supplier:

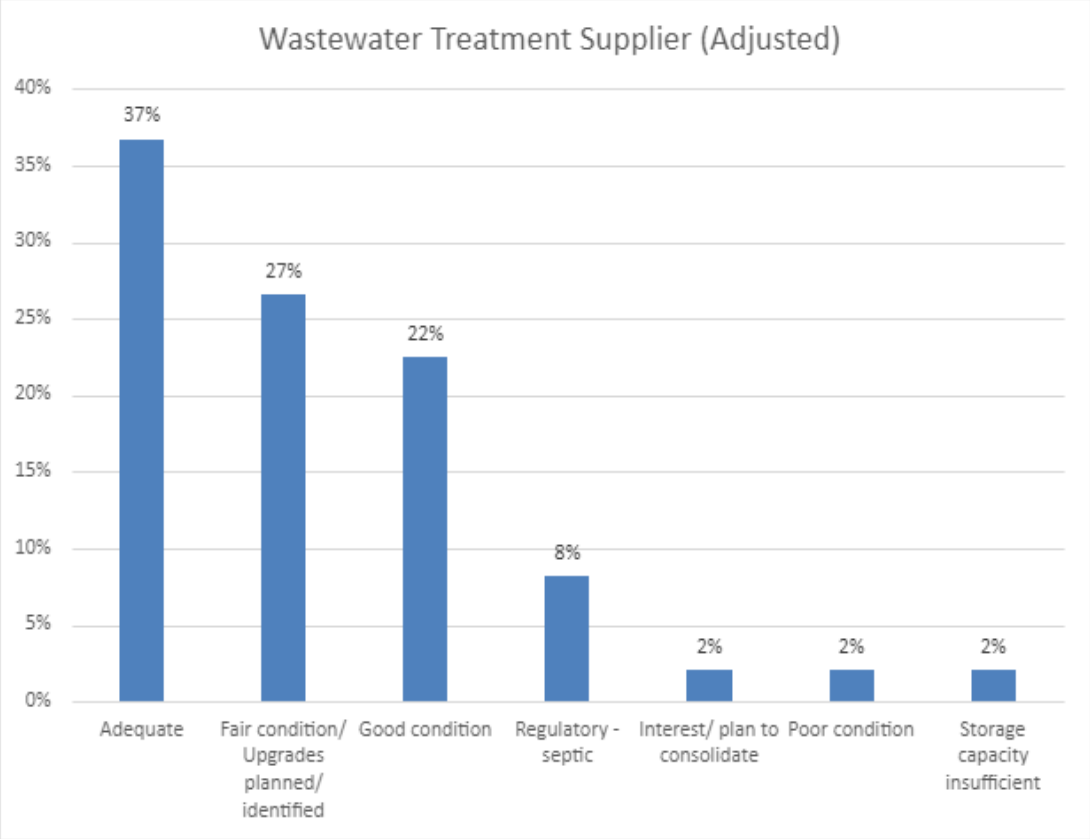
- Adequate
- Fair condition/upgrades planned/identified
- Good condition
- Poor condition
- Regulatory issues - septic systems
- Storage capacity insufficient

However, the NCRP does not give clear definitions of the criteria for wastewater treatment suppliers. They provide some clarification that the “regulatory issues-septics” are related to the widespread use of septic systems in the community - however, they

[15] Multiple benefits include potential to extend sewer alongside extension of recycled water pipelines, potential for adding reliability to the existing sewer system, and potential for stormwater management improvements or low-impact development.

don't use regulatory issues-septic as a catch-all for septic use. They identified twelve septics in their analysis, and only four were determined to have regulatory issues. See Figure 2 for NCRP's analysis of the status of wastewater treatment suppliers in the North Coast Region.

Figure 2. Wastewater Treatment Supplier Status in the North Coast Region



4.3.2 The San Francisco Bay Area

The Point Reyes Station and Dillon Beach communities provide the most relevant information regarding wastewater system failure than the other Bay Area Needs Assessment areas.

A large concern for the Point Reyes Station and Dillon Beach communities is the capacity of their septic systems. Through community meetings, the MCCDA reports that these communities would be unlikely to be able to have the septic capacity to handle a crowd in the case of an emergency in Point Reyes Station indicating that system capacity was a concern in their community.

The MCCDA does not further define "failure" or "inadequacy" but does acknowledge concern in the community. Utilizing a survey, 53% of respondents in Dillon Beach were concerned that the OWTS in their communities are failing. In Point Reyes Station, 38%

of survey respondents were concerned that the OWTS in their communities are failing, and 44% were concerned that businesses in Point Reyes Station have inadequate systems. Additionally, 22% were concerned with health risks associated with OWTS, 27% were concerned with OWTS permitting requirements, and 41% were concerned with OWTS contaminating local waterways.

4.3.3 Tulare Kern

The TKFA indicates that many septic systems are “old and failing” or “potentially contaminating the groundwater” but does not provide metrics on what failure encompasses for septic systems. For WWTFs, the TKFA utilizes WDR and NPDES permit violations and enforcement actions to understand which wastewater treatment systems are inadequate. Of the approximately 106 WWTFs with active WDRs or NPDES permits, about 58 have had violations and 29 have faced enforcement actions in the past five years.

4.4 How this informs the WWNA

The WWNA will develop a risk-inadequacy definition and contributing factors for the three types of systems identified (NPDES, WDR, and SSO permitted facilities). These definitions will focus on DACs/SDACs and communities with a historical lack of access to adequate sanitation and climate-related factors. It is important to note that the WWNA will not fully develop these definitions for OWTS and other decentralized systems.

Previous studies show that wastewater system capacity, violation, and enforcement actions, known public health concerns, and community priorities are used to characterize failing or inadequate wastewater systems. However, many of the previous studies predominantly focused on failing septic systems, which the WWNA will not define per se. However, the WWNA does plan to identify potential septic-to-sewer opportunities and priority areas for decentralized systems.

Overall, there is dissonance in terminology and factors used to characterize risk and failure across study efforts. The two tribal studies use capacity assessments as well as scoring factors (including health impact, cost, system capability, tribal priority, etc.) to prioritize wastewater projects. However, these definitions do not give the WWNA a clear definition of failing or inadequate systems.

The septic-to-sewer analyses provide useful information on the costs and benefits associated with connecting households to sewer systems. However, the criterion weights for the two cost-benefit analysis tables presented are inconsistent and do not list disadvantaged community status or consider demographic factors other than total population as a criterion for project prioritization, which the WWNA will consider.

The North Coast Regional Needs Assessment evaluates the status of the wastewater systems it identified, but does not provide definitions for the criteria used. Similarly, the

San Francisco Bay Area Needs Assessments notes concern in their community regarding wastewater but does not provide a definition of risk, inadequacy, or failure. The TKFA relies on WDR and NPDES permit violation and enforcement actions to determine failing and inadequate wastewater systems.

5 Wastewater Need Solution Identification

After identifying definitions for systems risk and inadequacy, the WWNA will apply those definitions to each system, and evaluate potential solutions for systems identified as inadequate. This also entails developing a new methodology for matching solutions with identified failure modes of actual systems. The goal of the WWNA is to estimate a high-level cost to inform funding needs based on the solutions determined and not necessarily to select definitive solutions for any particular system or community.

5.1 CWNS project cost estimates

The planned infrastructure projects and associated cost estimates from the CWNS represent the solutions self-identified and proposed by local agencies to address their wastewater infrastructure needs. The categories of projects listed by local agencies to improve wastewater systems, also known as capital investment needs, include the following:

- Secondary Wastewater Treatment
- Advanced Wastewater Treatment
- Infiltration / Inflow (II) Correction
- Sewer Replacement / Rehabilitation
- New Interceptor Sewers and Appurtenances
- Combined Sewer Overflow (CSO) Correction
- Decentralized Wastewater Treatment Systems

5.2 Tribal Communities

The two Tribal studies highlight the lack of funding for installation, expansion, or upgrades as the major limiting factor for improving tribal wastewater infrastructure. In response, the key solutions include securing funding through federal programs like the Indian Health Service Sanitation Facilities Construction Program to construct new wastewater systems, upgrade/expand existing small systems, and install proper septic systems where needed to improve wastewater infrastructure on tribal lands. Additionally, the Tribal studies recommend better collaboration between federal agencies like IHS, EPA, USDA, and HUD in identifying and prioritizing tribal wastewater projects as a potential solution to wastewater needs.

5.3 Septic-to-Sewer Analyses

The primary solution to failing and inadequate septic systems in the septic-to-sewer analyses is connecting an existing sewer system, where communities reliant on septic systems are connected to nearby municipal sewer collection and treatment systems. For areas without existing centralized systems, the solution involves constructing a new community wastewater collection, treatment, and disposal system to replace septic systems. Proper planning, cost estimation, and prioritization frameworks are critical components highlighted across the studies.

5.4 DWR Regional Needs Assessments

The DWR Regional Needs Assessments emphasize the need for investment in wastewater infrastructure, particularly in disadvantaged communities relying on failing or inadequate septic systems. A combination of septic-to-sewer projects, new decentralized systems, affordability programs, and community capacity-building efforts were proposed, but no precise solutions were given.

Many disadvantaged communities have outdated or failing septic systems. Consolidating these systems has been identified as a potential solution in multiple regions. However, for rural areas where connection to municipal systems is not feasible, constructing new decentralized community-scale wastewater treatment and disposal facilities is mentioned as a solution, particularly for tribal communities. Another option is upgrading and replacing aging wastewater infrastructure. Several regions highlight the need to upgrade aging sewer pipelines, pump stations, and treatment plants to improve system reliability and meet discharge standards. To prevent the exacerbation of affordability challenges because of upgrades and conversions, funding assistance or rate restructuring should be considered. Overall, the DWR Regional Assessment determined that more community input to identify solutions to meet wastewater sanitation needs is needed.

Other solutions include improving septic system management and building technical and managerial capacity. Some regions suggest better management of septic systems through local agency programs, permitting, and monitoring to address potential groundwater contamination issues. Additionally, challenges with staffing, operations, and maintenance of small wastewater systems are noted, indicating solutions may involve hiring and training more wastewater system operators and/or connecting to larger utilities. Many DWR Regional Reports indicated that a “silver tide” of retiring staff was a substantial concern for operating the wastewater systems as well as retaining an institutional knowledge of the system.

5.5 How this informs the WWNA

The WWNA will establish a rubric for evaluating solutions for inadequate systems. This will involve developing a methodology for matching solutions with the identified risk/inadequacy modes of the actual systems. The CWNS' solutions identified are more wide-ranging than the scope of the WWNA, as the CWNS is a comprehensive assessment of the capital costs ("needs") required to meet the water quality goals of the Clean Water Act and address water quality and related public health concerns. CWNS solutions and their costs are also self-identified by systems.

The Tribal Community Studies provide valuable insight into solutions that tribal communities have identified for their communities, such as improved funding, upgrading/expanding systems, and installing proper septic systems. However, these studies do not provide insight into the methods used to identify these solutions.

Additionally, the WWNA will conduct a feasibility and cost analysis for solutions, including septic-to-sewer potential. The septic-to-sewer analyses provide valuable insight into conversion considerations and highlight that solutions and costs vary greatly by system geography and prevailing sewer rates and connection fees. Like the Tribal Community Studies, the DWR Regional Needs Assessments provide insight into the type of solutions[16] that different DWR Regions identified via surveys and interviews.

6 Costs of Solutions and Affordability

While this section summarizes cost-related findings for wastewater needs of various jurisdictions and levels of government, note that affordability (i.e., the amount of money customers are actually paying now and would be required to pay once a wastewater need solution(s) is implemented) is not directly addressed in any of the following reports. Part of the WWNA efforts will include a more detailed evaluation of existing cost estimates and funding options for solutions.

6.1 Tribal Communities

6.1.1 "California Tribal Housing Needs and Opportunities: A Vision Forward" (2019)

The CCRH and RCAC study does not estimate costs, but it does identify costs as a barrier to adequate sanitation in tribal communities.

[16] These solutions included a combination of septic-to-sewer projects, constructing new decentralized community-scale wastewater treatment and disposal facilities, upgrading and replacing aging wastewater infrastructure, affordability programs such as funding assistance or rate restructuring, include improving septic system management, building technical and managerial capacity, hiring and training more wastewater system operators and community capacity-building efforts.

6.1.2 "Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects" (2018)

The GAO study used the IHS and EPA estimated costs for tribal water infrastructure needs to address wastewater infrastructure in federally recognized tribes. IHS identified at least $3.2 billion in estimated costs for infrastructure projects to address existing drinking water and wastewater infrastructure needs for fiscal year 2016 and EPA estimated the costs of future tribal drinking water infrastructure needs at an additional $2.4 billion over the following 20 years. However, IHS's estimate of existing needs is likely too low because IHS has not identified all eligible tribal homes that may have existing sanitation deficiencies—drinking water or wastewater infrastructure needs—and some data in the system that IHS uses to track home-specific infrastructure needs are not accurate. The $3.2 billion estimated costs represent more than 2,000 projects in the Sanitary Deficiency System (SDS) to address water and wastewater needs.

6.2 CWNS estimates

The CWNS highlights planned wastewater infrastructure projects for the next 20 years, 2022 - 2042. The CA CWNS calculated costs for infrastructure repairs, upgrades, or new construction using an EPA-created code for wastewater facilities and onsite sewage treatment systems (OSTS). The CA CWNS team had to report specific details about the systems for EPA to be able to accurately estimate the costs of projects. To identify wastewater systems and communities that have significant wastewater needs, the CWNS did not utilize a survey. Instead, the State predominantly relied on existing documentation of wastewater needs from the local wastewater related agencies. However, for some projects, costs were not readily available. In these cases, states submitted projects with documentation describing and demonstrating a need for the project. Cost Estimation Tools were then used to assign a dollar amount to the projects. The EPA developed Cost Estimation Tools (CETs)[17] for the following wastewater-related systems (Table 9):

Table 9. Wastewater Need Categories with Cost Estimation Tools developed by the EPA

Need Category	
I and II	Wastewater Treatment
III and IV	Conveyance
V	Combined Sewer Overflow (CSO) Correction
XII	Decentralized Treatment System

[17] These CETs may be used to inform methods in the WWNA.

The most recent Clean Watersheds Needs Survey shows that California needs an estimated $65.5 billion for wastewater treatment and collection, wastewater recycling, and stormwater pollution prevention. Out of the total need estimate, $36.3 billion is needed specifically for wastewater-related needs (Table 9), and of that $36.3 billion, $3.4 billion is estimated for decentralized wastewater treatment systems. Because decentralized wastewater treatment system needs have not previously been estimated in California (as demonstrated by the Base Amount of $5 million (Table 10)), the CWNS team reached out to California counties to develop a state-specific approach.[18] This allowed them to estimate decentralized wastewater treatment needs over 20 years on the order of $3.4 billion.

The most recent Intended Use Plan for the state's Clean Water State Revolving Fund (CWSRF) explicitly notes that "CWSRF loan financing is projected to total $12 billion over the same period ($600 million per year for 20 years), which is significant but far shy of the needs identified" by the CWNS (Draft CWSRF IUP, 2024-2025).

Table 10. CWNS Wastewater Need Costs by Category[19]

Need Category		Base Amount	Official Amount
I	Secondary Wastewater Treatment	$6,781,742,503	$7,023,873,720
II	Advanced Wastewater Treatment	$10,691,566,837	$10,776,318,436
III-A	Infiltration/Inflow (I/I) Correction	$44,769,244	$46,355,769
III-B	Sewer Replacement/ Rehabilitation	$12,369,168,632	$12,459,726,154
IV-A	New Collector Sewers and Appurtenances	$526,487,332	$575,632,522
IV-B	New Interceptor Sewers and Appurtenances	$1,852,714,775	$1,952,271,435
V	Combined Sewer Overflow (CSO) Correction	$123,237,094	$125,784,031
XII	Decentralized Wastewater Treatment Systems	$5,665,000	$3,382,372,715
Total		$32,395,351,417	$36,342,334,782

[18] The state specific approach included reaching out to California Counties for the number of repairs or replacements for the past five years and estimate a yearly average for new installations and repairs for each county in California. The cost would then be determined by multiplying the yearly average for the new installation and repairs by 20 (to cover the period of the CWNS), then multiplying this result by the average cost of an appropriate septic system repair or installation utilizing EPA's cost estimation tool.

[19] The Base Amount is the number directly entered by the state. The Official Amount includes the number adjusted to January 1st, 2022, dollars, based on the associated document's publication date, the amount changed based on the final audit results for the CWNS IDs that did not receive a full review, and the adjust for the IDs that used Cost Estimation Tools (CETs). EPA calibrated the CETS with data collected from the survey during post processing.

6.3 Septic-to-Sewer Analyses

The method for prioritizing septic-to-sewer conversion projects can also vary, and the cost of connecting individual households to sewer collection systems can range greatly. Septic-to-sewer connections with high unit costs generally require a significant amount of infrastructure to connect to a local sewer system and connections with low unit costs generally require only a lateral pipe to connect a household to a sewer main.

The Inland Empire Utilities Agency (IEUA) Septic System Conversion Feasibility Study (2018), prepared by Woodard & Curran, has the most comprehensive, detailed cost estimates out of the six reports that were analyzed, and ranks each potential septic-to-sewer conversion based on their cost-benefit analysis. The Coachella Valley Water District's (CVWD) Sanitation Priorities Task Order for the Eastern Coachella Valley (2019), though less detailed in reporting how cost estimates are derived, also presents the ranking results of each potential conversion project. The remaining septic-to-sewer reports do not rank priority conversion projects based on a cost-benefit analysis framework.

Conversion cost estimates from the IEUA Septic System Conversion Feasibility Study are based on preliminary pipeline alignments and required facilities and include "Total Capital Cost Estimates." Construction costs were estimated using unit costs developed from past construction projects, industry cost estimate resources (e.g., National Estimator software), and the Inland Empire Utilities Agency Engineering team's developed unit costs. Additionally, the cost estimate was developed through unit costs based on facility items, with variation for gravity sewers depending on the pipe diameter pipe. The estimates also include local costs associated with connecting to the sewer system. Allowances added to the baseline construction cost include a 5% mobilization/demobilization allowance, a 30% allowance for contingencies for unknown conditions, and a 25% of construction cost for engineering, administration, and legal costs. This is intended to account for engineering/design, construction management, ESDC, internal administrative work at IEUA, and legal costs. Table 11 compares the cost of septic-to-sewer conversions by cost per connection.

Table 11. Septic-to-Sewer Cost Comparison

Name of Report	Cost per Connection
Coachella Valley Water District Sanitation Priorities Task Order for the Eastern Coachella Valley (2019)	Average: $2,059,153 Median: $308,996 Connections over 30K: 94% Connections over 60K: 78%
Inland Empire Utilities Agency Septic System Conversion Feasibility Study (2018)	Average: $44,500 Median: $58,444 Connections over 30K: 94% Connections over 60K: 14%

Sacramento Area Sewer District Septic System Program Plan (2009)	Average: $37,000 Median: $44,733 Connections over 30K: 67% Connections over 60K: 20%
Willow Creek Community Services District Preliminary Engineering Report-Wastewater Facilities (2014)	Average: $25,068 Median: N/A Connections over 30K: N/A Connections over 60K: N/A
Riverview Mobile Home Estates Sewer Project (2024)*	Average: NA Median: NA Connections over 30K: NA Connections over 60K: NA
Sunset Vista Mobile Home Park Sewer System Consolidation (2024)*	Average: NA Median: NA Connections over 30K: NA Connections over 60K: NA

**It is difficult to provide a specific cost/connection estimate for these two projects since they are still in the planning phase. Usually, those exact numbers are unknown until the Construction Phase.*

6.4 How this informs the WWNA

The WWNA will evaluate the costs of solutions for systems identified as inadequate. These costs will include construction and upgrades of wastewater collection systems, wastewater treatment systems, wastewater treatment facilities, and OWTS using existing cost of solution factors and recent cost modeling approaches. It will also evaluate the community and customer affordability impacts of these new costs (after external funding is applied) to the extent possible.

While the GAO Federal Tribal Community studies do provide estimates of their Tribal wastewater infrastructure needs, the cost assessment relies on self-reported data from the tribes to the IHS and EPA and is combined with drinking water infrastructure needs. These costs are likely underestimated and the cost estimate methodology to determine is varied by project.

The CWNS cost estimate is arguably the most relevant to the WWNA in terms of scope compared to the other cost estimates previously described as it describes most thoroughly the wastewater need for California in terms of types of need and cost of meeting needs for a wider breadth of wastewater systems. The CWNS estimates that approximately $36.3 billion is needed for wastewater related needs. However, because this cost estimate predominantly focuses on larger wastewater systems, it provides an underestimate of smaller wastewater systems, such as OWTS. The CETs used in the CWNS, however, may be used to inform future methods in the WWNA.

Lastly, the wide range of average and median costs per connection across the septic-to-sewer studies indicates that more data is required to create an accurate cost estimate of a statewide septic-to-sewer conversions.

7 Statewide External Funding Sources for Systems and Gaps Estimates

Finally, in the context of the WWNA, we consider funding sources (and gaps) to address the costs of solutions for systems self-identifying or independently identified as inadequate or in need. Funding to construct and operate wastewater systems is primarily derived from direct customer bills and property tax charges based on service; we call these "internal" sources of funding for systems. Most major sources of "external" funding for wastewater systems and infrastructure in California are routed through the Board-managed Clean Water State Revolving Fund (CWSRF), and reporting on the CWSRF is managed by the Board's Division of Financial Assistance.[20] Thus, this section of the rapid baseline report is the only one that relies heavily on state Board data and documents.

The annual CWSRF allocation to California is determined federally and is fairly stable year after year, but exact funding levels are also subject to change on an annual basis (Ramseur, 2023). The CWSRF, as discussed above in relation to the CWNS and below in relation to the Intended Use Plan (IUP) process, traditionally funds a broader array of projects than wastewater, although it does have a designated wastewater equity sub-focus.

7.1 History of Funding for Wastewater Systems in Small and Disadvantaged Communities

The external funding landscape for wastewater equity solutions in California (and the U.S. more broadly) generally appears lacking and less flexible compared to that for drinking water. For instance, the Safe and Affordable Funding for Equity and Resilience or SAFER fund (SB 200) was passed by the California legislature in 2019, and provides ~$200 million a year for drinking water equity efforts, including to pay for technical assistance and O&M efforts, but has no direct wastewater component.[21] Whereas other

[20] There are other sources of potential external funding for systems including from USDA, HUD and USEPA programs. These sources which will be fully evaluated for inclusion in the final WWNA funding gap analysis but are not considered in this chapter given their relative historical importance.
[21] The SAFER Fund (2019), Resolution No. 2021-0050 (Racial Equity Resolution), and other State Water Board efforts laid the groundwork and further motivated a Wastewater Needs Assessment. For more information, see https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2022/rs2022_0019.pdf

state and federal funding packages (including the CA General Fund Infrastructure Allocation of 2021, the federal Bipartisan Infrastructure Law of 2021, various state Propositions financed by bonds such as Prop 1 and Prop 68) include wastewater projects as eligible for funding. However, the funding allocated to wastewater projects in these and other funding measures tend to be less— or at best equal— in terms of dollars allocated compared to drinking water projects.

That being said, a formal focus by the State Water Resources Control Board on funding for small, disadvantaged community wastewater infrastructure dates back to at least 2008, with what is now called the Small Community Wastewater (SCWW) Program. Funding for this program was initially quite small ($8 million) and entirely based on fee revenue. Accordingly, as recently as FY 2013/2014, only $15 million was awarded to 13 projects across the state via this program. At the same time, major one-off allocations to this program have occurred, such as via Proposition 1 (2014), which allocated $260 million to Small Community Wastewater (SCWW) funding out of $7.8 billion.

There also began a policy change in 2019 such that "all new applications [to the SCWW] from small SDACs, [and] from small DACs, as defined in the CWSRF Policy, received since February 2019, are fundable in accordance with this IUP" (CWSRF IUP, 2019-2020). This change has had a mixed impact on funding levels. In some years, actual annual funding for projects within the program remained low. The table below shows the last 5 years of agreements in the SCWW (CWSRF IUP, 2024-2025).

On the other hand, another major one-off tranche of funding was allocated in the form of a $250 Million Set-Aside for septic-to-sewer Projects (Budget Act of 2021)— out of $650 million for wastewater overall— as part of California's 2021 budget surplus awards, and this is reflected in the 2022-2023 year being double any other year in dollars awarded.

Table 12. Last 5 Years of SCWW Financing

Year	Number of agreements	Total $ amount awarded
2019-2020	33	$56.9 million
2020-2021	25	$63.0 million
2021-2022	20	$76.7 million
2022-2023	18	$166.2 million
2023-2024	17	$67.4 million

7.2 How the Intended Use Plan Needs Estimates and Process inform the WWNA

The most important thing to understand about external funding sources for wastewater systems is that the need expressed for funding by wastewater systems and

communities of all sizes in California continues to outpace the funding availability via the CWSRF, by any measure, even with the sizable recent one-off allocations noted above. The generally high demand for CWSRF funding includes larger systems seeking low-interest loans rather than grants to make major capital investments. Regionally, many systems are facing heightened regulatory changes including addressing nitrates and biosolids. Many large systems are also seeking out new opportunities (and associated requirements) around water reuse and recycling for potable supply.

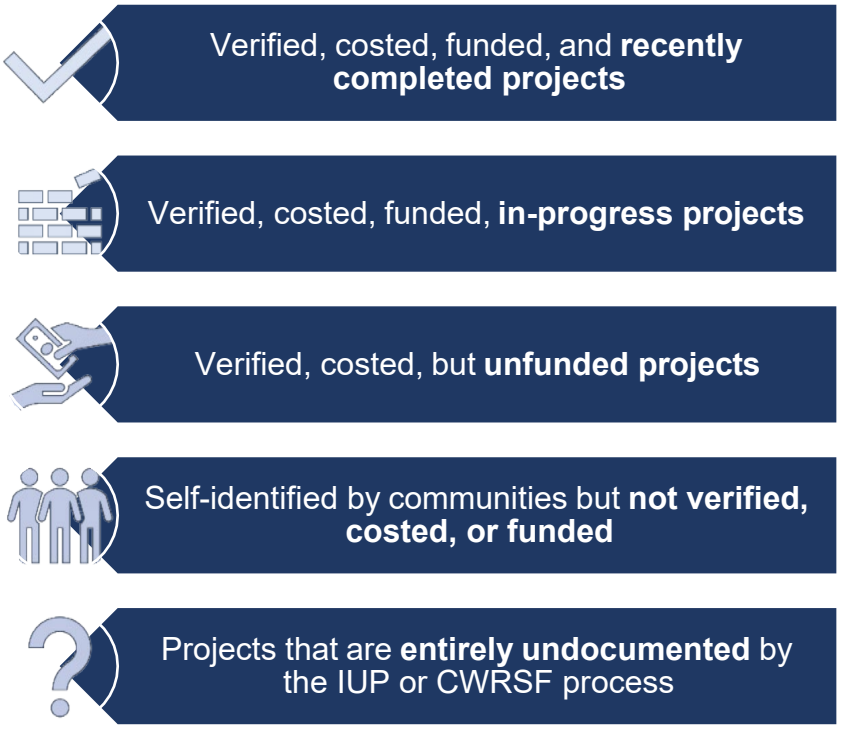
As an example, given the ongoing high loan demand on the CWSRF compared to the funds available, the State Water Board will not be able to fund all projects currently requesting loan funding in SFY 2023-2024 or the near future. Based on applications, the Board annually creates a "Fundable List," which is a list of projects that are eligible to receive funding from the CWSRF and its related programs. Applicants whose projects are not on the Fundable List are encouraged to evaluate their prospects for getting on the Fundable List based on the information in the IUP and evaluate all viable, alternative financing options for their projects considering any deadlines they must meet.

At the state level, an Intended Use Plan (IUP) is prepared annually, and published publicly, to account for how the CWSRF will be used during a state fiscal year. The IUP helps to prioritize projects based on a scoring system and determines which projects can be funded. Within the IUP, the CWSRF "comprehensive" list includes all applications submitted for CWSRF.[22] The "fundable" list contains projects which the Board's Division of Financial Assistance (DFA) has verified as ready to move forward and authorized as eligible to be funded (including with an initial cost estimate) based on its prioritization and scoring methodology, which is outlined in IUP documents, but largely based on relative risk to public health, water quality impacts, and Regional Board's priority projects.

Interacting IUP needs with the remainder of the WWNA analysis process is complex but essential. Below we outline five different stages of wastewater equity need and dollar-value estimates (where possible) with respect to the IUP process, and how these different stages of need interact with the in-progress and future WWNA stages. All dollar values quoted should be viewed as low-bound and point-in-time estimates. The bottom line or major takeaway no matter how we analyzed it, is that recent and current IUPs motivate the need for more costing and funding for wastewater solutions in California, especially for small, disadvantaged communities.

[22] Many of the projects on the comprehensive list are incomplete by design. To get on this list is, applicants must submit at least a general application in order to be assigned a project manager, who then helps applicants to submit a more robust application for further consideration. For a non-DAC SCWW project to be added to the Fundable List, a complete application needs to be submitted.

Figure 3. Stages of Wastewater Equity Need



First, there are verified, costed, funded, and recently completed CWSRF Small SDAC, Small DAC, and Wastewater Grant/Principal Forgiveness (PF) Eligible Construction Projects. Assuming these projects fully meet community needs, "need" identified by the WWNA using our inadequacy and risk assessment process (which relies on recent years' data) may already be addressed and can be removed from a statewide cost and funding gap estimate.

Second, there are verified, costed, CWSRF-funded projects for which construction is currently in progress. Again, these recent and in-progress projects and communities, if they were funded to the full level of system or community need, will be excluded from WWNA statewide cost and funding gap estimates. The solution and cost information from both recently completed and in progress projects, however, will be used to inform solution and cost estimation techniques used in the WWNA.

Third, there are both IUP-verified, fully construction-cost estimated, yet unfunded projects as well as projects which are verified but are in progress of being fully

construction-costed (known as “planning”) projects.[23] For instance, as shown below, the latest existing estimate of only Small SDAC, Small DAC and Wastewater Grant/PF Eligible Construction Projects funding need is around $1.838 billion for 164 projects, compared to $181 million available. For reference, there were only 74 planning and construction applications in FY 20/21 requesting approximately $443 million on the comprehensive list of SCWW Projects (CWSRF IUP, 2024-2025). The existing estimate of need includes $81 million for 59 planning studies projects, but if calculating and applying the construction projects average cost from the same document to the projects in these planning studies, this might add upwards of $900 million to the verified but unfunded need.

At the moment, we envision each of these third category of projects will be included in WWNA statewide funding gap estimates, but we will endeavor to coordinate with DFA on the status of these projects in particular so as not to duplicate both cost estimates for individual projects, and to avoid an overestimate of extant need as these projects move from the fundable to the in-progress funded construction list.

Fourth, several types of wastewater equity projects have been self-identified by communities or systems but have not been verified, costed, and/or funded by the CWSRF. These include applications to the CWSRF that were rejected for TA, planning, or construction funding or withdrawn from the fundable list.

Finally, there are projects and communities with wastewater needs which are entirely undocumented in the IUP or CWSRF process. This includes any communities or systems which for whatever reason have not applied for CWSRF funding, and most OWTS conversion opportunities. Inherently, we do not have a precise estimate of the number of communities, projects, or funding needs which are undocumented through formal channels. Various elements of the WWNA, including the UCANR-deployed survey, OWTS location and priority modeling, and regulated system inadequacy and risk assessment, will identify system needs, which will then be analyzed to propose solutions and associated cost estimates and funding gaps in later stages of the WWNA.

Accordingly, our lowest-bound best estimate of unfunded wastewater equity needed in California is approximately $2.6 billion, but will easily exceed $5 billion and could exceed $10 billion[24] in the final WWNA analysis with the addition of the $3.4 OWTS

[23] Our best understanding after consultation with DFA is that the 2021 GFIA project need lists routed up to the State Board from regions have already been incorporated into existing IUP Comprehensive and Fundable Lists, so we do not report on these cost-estimated needs separately.

[24] For reference, on the drinking water side, the Water Board’s 2024 Drinking Water Needs Assessment just released estimated that “local communities and private well owners may need to cover $13.9 billion to achieve the Human Right to Water.” (SWRCB DDW, 2024).

system needs estimated in the CWNS, the regulated systems that have not applied to the CWSRF, as well as a subset of larger and non-DAC regulated systems as well as a subset of OWTS. As noted above, the much broader wastewater need of $36 billion identified by the CWNS is also very unlikely to be addressable with recent levels of funding. With current annual CWSRF allocations and the recent pace of one-off state and federal funding allocations, especially given recent state budget downturns, it is hard to foresee wastewater equity needs in California being fully addressed over the next decade, if not several decades.

8 Conclusion

To better understand wastewater needs and wastewater equity in California, the WWNA team rapidly reviewed existing readily available data sources and reports. This report also sought to differentiate the WWNA from existing efforts. This report primarily reviewed the Clean Watershed Needs Survey (CWNS), recent, published septic-to-sewer studies in California, Department of Water Resources Individual Funding Area Needs Assessments, and recent, published studies on tribal housing.

This report specifically focuses on previous efforts that mapped wastewater systems, identified wastewater communities of concern, defined inadequate wastewater systems, identified wastewater needs solutions, and developed cost estimation tools and affordability estimates for inadequate wastewater systems. These steps are parallel steps in the WWNA effort.

8.1 Next steps

This report and associated steps to compile it have already informed the risk assessment and mapping efforts and will continue to inform the WWNA's rubric for solutions and cost of solutions, as well as Phase 2's initial mapping efforts, which will include machine-learning produced OWTS/unconnected to sewer maps. Again, this report otherwise generally informs our understanding of the baseline from which the remainder of the WWNA process will be working.

However, the next immediate steps from this report will include:

1. Follow up with consultants and communities who participated in relevant septic-to-sewer studies to inquire about their cost-benefit analysis methods and request any GIS files available of wastewater systems.
2. Review IHS and CWNS cost estimation tools to determine their relevance to the WWNA.

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Appendix

Table A. DWR Regional Assessment Overview

IRWM Region	Areas of Concern	Methods and Estimates
Central Coast	Chualar, Shandon, Santa Margarita, California Valley, Watsonville, Freedom, San Miguel, North County: Prunedale, North County: Bolsa Knolls - 580 San Juan Grade Rd, Soledad: Santa Teresa Village, Carrillo Farms, Walnut Ave, Collegeville, Greenfield, Castroville, Mercado Camp, Pajaro, Lockwood, California Valley, San Lorenzo River Watershed area, Davenport, Alpine Court, Apple Avenue (City of Greenfield), Toro Camp, Hacienda Apartments	DWR's DAC mapping tool served as a baseline source of information to identify disadvantaged communities. The mapping tool data was augmented with additional U.S. Census Bureau's American Community Survey (ACS) five-year datasets along with MHI income surveys in some communities. Methods for determining specific water management needs included: public record searches (e.g., water quality data, water system information, property ownership/rental, maps); field assessments; interviews with water system owners or managers, community members, property owners, County Health staff, water districts, Regional Water Management Group members, underrepresented communities, and others; and through questionnaires. Several regions mapped the communities in relation to private and public water system service boundaries to understand existing water system management and/or opportunities for extension or consolidation of services.
Colorado River	Quail Valley area, Brawley, El Centro, Anza, Lake Riverside, Banning, Morongo Band of Mission Indians, Ripley, Blythe	The project team conducted a survey questionnaire and community meetings.
Lahontan (not currently available)		
Los Angeles	Lower San Gabriel-Lower Los Angeles River region and South Santa Monica Bay region, Fillmore District region of Ventura County, Tribes in	Partners administered a survey to conduct the needs assessment to understand community needs as well as outreaching to tribal communities and schools and other institutions.

IRWM Region	Areas of Concern	Methods and Estimates
	Ventura County, Thousand Trails area	
Mountain Counties	Bieber, Linda, Marysville	Utilized data from the U.S. Census Bureau, community meetings, focus groups, and surveys of water service providers. Community assessments were conducted by Sierra Institute for Community and Environment; assessments of water concern and needs of water purveyors were conducted by Sierra Water Workgroup.
North Coast	Covelo, Hopland, Weaverville, Crescent City, McKinleyville, Samoa, Week/Siskiyou County, Del Norte County, Mendocino, Ukiah, Newell, Montague, Rohnert Park, Cloverdale, Lewiston, Dorris, Fieldbrook, Glendale, Trinidad	This effort included surveying water suppliers and wastewater treatment operators in economically DACs and Tribes in the North Coast Region as well as in-depth interviews. This analysis does not include cost estimates. NCRP evaluated the system status based on the survey responses, information from county planning documents, and system websites.
Sacramento River	Linda, Marysville, Anderson, Adin, Biggs City, California Pine, Canby, Gridley	Community-based needs assessments and needs assessments for water purveyors were conducted as well as case studies.
San Diego	Alpine, Bostonia County/Lakeside, Central Mountain, El Cajon, Imperial Beach, Barrio Logan, Watsonville, City Heights, Clairemont Mesa, College Area, Eastern Area, Encanto, Greater Golden Hill, Greater North Park, Kensington-Talmadge, Normal Heights, Ocean Beach, Old San Diego, Otay Mesa-Nestor Southeastern San Diego University, North County, Ramona, Borrego Springs	The outreach strategy included a water needs questionnaire and community meeting discussions.

IRWM Region	Areas of Concern	Methods and Estimates
San Francisco Bay Area	Dillon Beach Village, Point Reyes Station, South Vallejo, Bay Point, Antioch, Pittsburg, North Richmond, East Palo Alto	A peer-to-peer survey was developed in collaboration with partners to characterize access to WASH and understand how gaps could be improved from the perspectives of people experiencing homelessness. Partners conducted interviews as well. The Bay Area DACTI Program, in collaboration with Disadvantaged Community and Tribal Partners, used a community- and Tribal-specific strategies to develop tailored needs assessment surveys for each location.
San Joaquin River		A database was developed of communities identified in the SJRFA. The project team compiled data from local, state, and federal sources to create the database. Geographic Information Systems (GIS) was utilized to map the location of communities in the SJRFA and other available and relevant data to identify needs. Median household income statistics were used to assist in classifying whether communities had a disadvantaged status. The database is a collection of information from DWR, Safe Drinking Water Information System (SDWIS), California Integrated Water Quality System (CIWQS), Provost & Pritchard GIS data resources, as well as other sources.
Santa Ana	Garden Grove	SAWPA conducted ethnographic research to analyze the social context around water needs in the Santa Ana region including listening sessions.
Tulare Kern	Southern Sierra region	Used geographic data to identify the needs in their region. The project team developed a DAC Tool mapping rather than conducting a community survey. Approximately 106 Wastewater Treatment Facilities (WWTFs) were identified in the TKFA. This includes both DAC and non-DAC communities, cities, and county service areas. Of the active WWTFs, approximately 58 (55%) have

IRWM Region	Areas of Concern	Methods and Estimates
		had violations, and approximately 29 (27%) have had enforcement actions in the past five years. Many DACs are not served by WWTF, and rely on individual septic systems, which are often old and failing.

Table B. Septic-to-Sewer Analyses Comparison

	Sanitation Priorities Task Order for the Eastern Coachella Valley (2019)	Inland Empire Utilities Agency Septic System Conversion Feasibility Study (2018)	Sacramento Area Sewer District Septic System Program Plan (2009)	Willow Creek Community Services District Preliminary Engineering Report-Wastewater Facilities (2014)	Riverview Mobile Home Estates Sewer Project (2024)	Sunset Vista Mobile Home Park Sewer System Consolidation (2024)
Notes	During stakeholder meetings, consensus was obtained for the ranking of the top five projects to implement.	This study has the most comprehensive cost estimates and cost-benefit analysis out of the six reviewed.	This plan identifies septic system conversion areas but does not prioritize which projects to fund.	This report's focus is on the design of a new wastewater treatment and disposal facility. The collection system component is a small aspect of this report.	While this report does consider consolidation as an option, they ultimately decide to remain on a decentralized system.	This project is still in its early stages and does not have financial resources to improve or replace their sewer system.
Population served	108,000 people (2018)	875,000 people (2018)	1.4 million people (2010)	1,712 people (2014)	540 people (2024)	400 people (2024)
Number of septics/ OWTS	89 total; 55 grouped into 18 projects	21,800 total; all grouped into 66 projects	3,830; 2,247 grouped into 15 projects	812 total	52 total	11 total
Identification of septics/ OWTS	Mapped based on data from CVWD's East Coachella Valley Water Supply Project and the Sanitation	IEUA provided a shapefile of potential parcels with septic systems; member agencies also shared septic	Based on septic system permits; unpermitted septics estimated based on and households with trash service bills	Based on the number of households in Willow Creek, since there is no centralized wastewater	Based on the number of households in the Riverview Mobile Home Park, since there is no centralized	Based on the number of households in the Sunset Vista Mobile Home Park, since there is no centralized

	Sanitation Priorities Task Order for the Eastern Coachella Valley (2019)	Inland Empire Utilities Agency Septic System Conversion Feasibility Study (2018)	Sacramento Area Sewer District Septic System Program Plan (2009)	Willow Creek Community Services District Preliminary Engineering Report-Wastewater Facilities (2014)	Riverview Mobile Home Estates Sewer Project (2024)	Sunset Vista Mobile Home Park Sewer System Consolidation (2024)
	System Master Plan; use of aerial imagery	system location data		system for the community	wastewater system for the community.	wastewater system for the community.
DAC consideration	Yes	Yes	Yes, but indirect	Yes, but indirect	Yes	Yes
External stakeholder involvement	Yes	No	No	No	Yes	Yes

Table C. Additional Resources on Tribal Wastewater Needs

Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
California Tribal Housing Needs and Opportunities: A Vision Forward[a]	California Coalition for Rural Housing (CCRH) and Rural Community Assistance Corporation (RCAC)	2019	"Section IV: Analysis of Tribal Population, Housing, and Water-Wastewater Characteristics" includes an assessment of individual tribal water and wastewater systems.	In this section, the authors acknowledge that "the adequacy of existing water and sewer infrastructure is a major barrier to the development of new homes in Tribal California" (CCRH & RCAC, 2019,	Primarily focuses on housing needs in California but does specify water and wastewater needs in this context.

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Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
				p. 29).	
Drinking Water and Wastewater Infrastructure: Opportunities Exist to Enhance Federal Agency Needs Assessment and Coordination on Tribal Projects[a]	United State Government Accountability Office (GAO).	2018	Determine the extent to which seven federal agencies 7 (most notably the Indian Health Services (IHS) and U.S. Environmental Protection Agency (EPA) identified Indian tribe's d rinking water and wastewater infrastructure needs; funded tribal drinking water and wastewater infrastructure projects and collaborated to meet Indian tribes' drinking water and wastewater infrastructure needs.	According to EPA, thousands of Indian homes are not currently served by a regulated, centralized drinking water or wastewater system, due in part to the logistical and other challenges associated with Indian water systems that must serve widely dispersed populations in remote locations. Instead, as we reported in September 2017, homes that are not served by water systems may have private wells and septic systems, or they may be entirely unserved. For homes without access to a wastewater disposal system, residents may use a privy, use honey buckets, or discharge	Scope is at the federal level and only reviews federally recognized tribes but provides insight into the challenges of identifying Tribal communities' needs.

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Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
				waste directly to the ground. Wastewater need is not well identified as EPA is not required to collect this information and the other federal agencies rely on the tribes to propose or identify projects to meet any needs based on the tribes' priorities.	
Water Boards Tribal Affairs 2023 Annual Report	California Water Boards	2023	Summary of Tribal Affairs activity by the Water Boards in 2023	N/A	Includes a list of executed funding agreements supporting tribal drinking water, wastewater, and stormwater projects in California.
Strengthening the Nation-to-Nation Relationship with Tribes to Secure a Sustainable Water Future	EPA Office of Water	2021	Provides recommendations for the office to partner with tribes to address water- related challenges. "Tribal communities	"Barriers to addressing these and other water- related challenges in Indian country include: A significant shortfall of funding to address water infrastructure	Focuses on national tribal needs and does not specifically address tribal needs in California.

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Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
			are more likely than other populations in the United States to lack access to wastewater services and piped drinking water."	needs; A lack of water quality standards that enable full implementation of the Clean Water Act on tribal waters; and the need for training and professional development of qualified tribal water and wastewater operators."	
Universal Access to Clean Water for Tribes in the Colorado River Basin	Heather Tanana et al.	2021	Describes current conditions among CRB Tribes, examine existing federal assistance programs, and develop policy recommendations to address Tribal community water needs	IHS, EPA, USDA program funding and format. O&M	Includes a table on relevant agency programs and tribal specific funding for California, Nevada, Arizona, New Mexico, Utah, and Colorado.
Universal Access to Clean Water for Tribes Recommendations for Operational, Administrative, Policy, and Regulatory Reform	Bidtah Becker et al.	2021	Describes in detail the steps that should be taken by the federal agencies with programs that can ensure every tribal household has access to clean water.	"The multiplicity of programs and requirements creates a very difficult navigational challenge for Tribal communities and water/wastewater providers. Limited	Includes thorough recommendations. Also includes list of Tribally Owned Water and Sanitation Projects in the States of the Colorado River Basin by state

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Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
				historical funding for these programs has also meant that the responsible agencies have prioritized and circumscribed the projects and efforts to which agency funding will be directed. These limitations may not be necessary or appropriate when more funding is available."	
La Jolla Band of Luiseño Indians Adaptation Plan -	Jasperse, L., & Pairis, A. D. In collaboration with the La Jolla Band of Luiseño Indians Environmental Protection Office. Climate Science Alliance.	2019	Climate adaptation plan put together by the Tribe for the Tribe to plan for climate change	"Emergency response centers, water filtration plants, groundwater monitoring systems, and wastewater treatment facilities, are highly vulnerable to the impacts of wildfire." "Storms, flooding, and landslides could result in more traffic accidents, and	Includes descriptions of opportunities to increase tribal resilience. Also describes current programs and measures the Tribe has in place to combat climate change impacts on their wastewater system.

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Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
				further buildup, movement, and spillage of waste and materials. These factors could increase the risk for hazardous material in contact with the community, in addition to fire risk."	
Pala Band of Mission Indians Climate Change Adaptation Plan	Pala Band of Mission Indians	2019	"Synthesizes and presents the results of a planning process designed to help the Pala Band of Mission Indians more proactively prepare for and adapt to the impacts of climate change."	N/A	Includes strategies to support the sewer system. Prior to this report, Pala assessed its vulnerability to climate change, which was summarized in its Vulnerability Assessment.
A Survey of Efforts to Achieve Universal Access to Water and Sanitation in California	ACLU NorCal and the Pacific Institute	2018	Addresses wastewater and sanitation access in disadvantaged communities	N/A	

Data Source	Prepared By	Year Published	Summary	Identified Challenges	Notes
Yurok Tribe Climate Change Adaptation Plan for Water & Aquatic Resources	"Prepared by the Yurok Tribe Environmental Program in collaboration with the Yurok Tribe community members, staff, and several organizations– the Institute for Tribal Professionals and Adaptation International."	2014-18	"The goal of this Adaptation Plan was to assess the vulnerabilities and resiliencies of Yurok waters, aquatic species, and people in the face of climate change and to identify actions and strategies that will allow Yurok lifeways, culture, and health to grow despite the changing climate."	"Sea level rise and heavier precipitation events could also lead to higher water tables that could affect septic systems' ability to function." "Septic systems that are not maintained or are beyond their life expectancy and feral or unfenced cattle that defecate in or near tributaries can contaminate streams with waterborne pathogens such as E. Coli, Cryptosporidium, and Giardia." "If fire damages septic system components, this could contaminate water supplies as well (Waskom et al. 2013)."	Includes adaptation strategies for these issues

[a] *Referenced throughout the report*

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