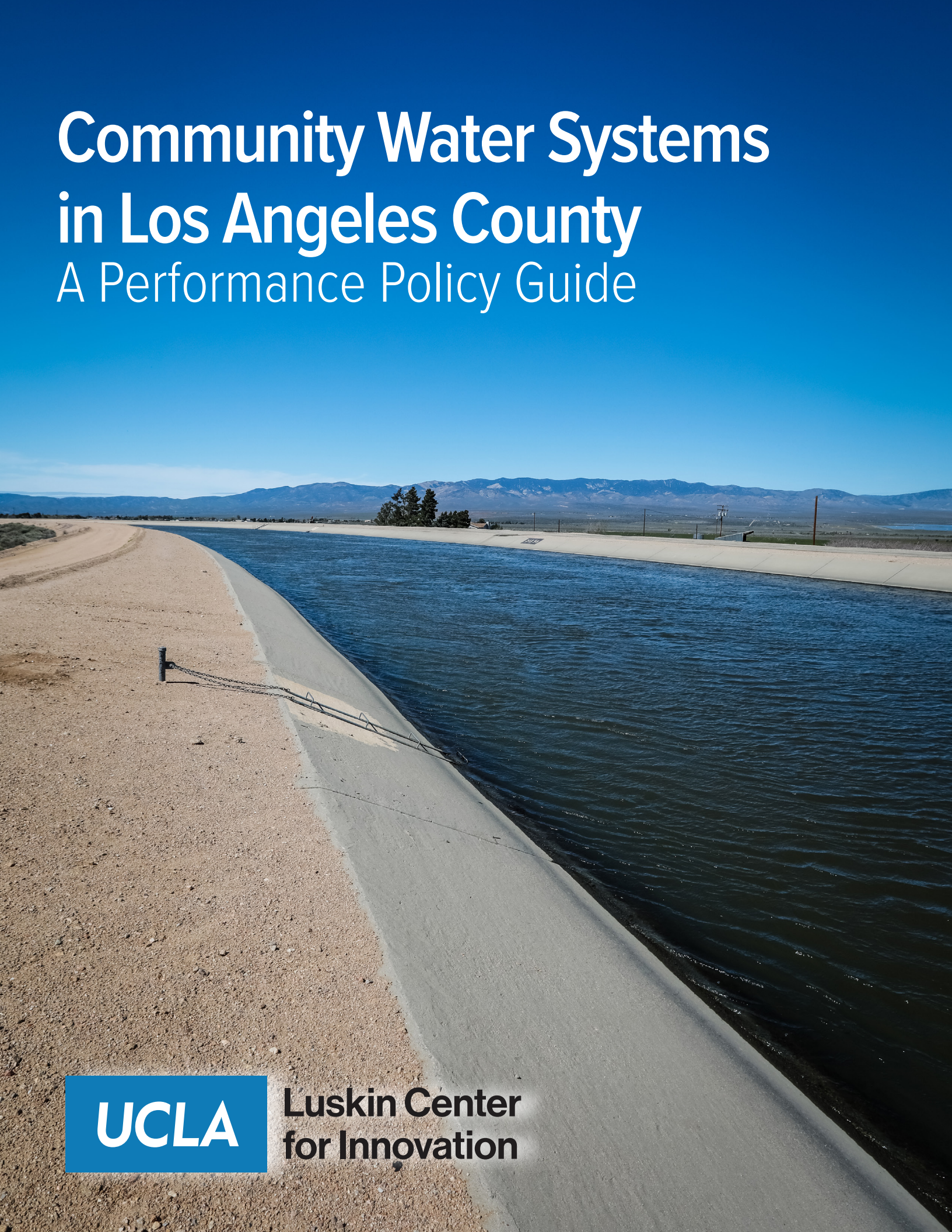
Community Water Systems in Los Angeles County

A Performance Policy Guide



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Executive Summary

Community water systems (CWS) are the fundamental building blocks of California's water supply network. While they perform essential roles in providing drinking water supplies and adapting to drought and climate change, they also face challenges from under-investment, aging infrastructure, and increasingly stringent regulatory standards. The Luskin Center for Innovation previously conducted the first county-wide analysis of CWS in Los Angeles in 2015 (Pierce et al. 2015). The 2020 policy guide builds on the first atlas to update and enhance our understanding of the current performance of CWS in the county and inform necessary policy interventions.

Since the passage of AB 685 in 2012, which established the Human Right to Water (HRW) for all Californians, multiple state and regional efforts have focused on ensuring safe, clean, affordable, and accessible water. The Los Angeles County Sustainability Office in particular has included HRW goals in its most recent sustainability plan, which was approved by the Board of Supervisors, signaling a commitment by the county to improving water system performance in the future.

To inform our 2020 policy guide update, we collected and reviewed data from a variety of sources on the 200+ Los Angeles County CWS for three main dimensions of the HRW: quality, affordability, and accessibility. We also collected and analyzed metrics related to water system performance: Technical Managerial Financial (TMF) factors, system governance, and socioeconomic characteristics of system populations. First, county-wide trends were reported as in our first atlas along the three dimensions. Next, performance review criteria were developed to account for systems' ability to deliver HRW outcomes along the three dimensions with the addition of certain TMF factors. The criteria are guided by previous assessments, literature, and available data and thus cannot conclusively determine that a system is doing well in all aspects. However, the performance review criteria can help identify systems that need future infrastructure investments or support to ensure the HRW for all in the County.

Key findings

Governance Trends

- There appear to be 10% fewer active CWS in the county than when last counted in 2014 which suggests consolidation of systems has occurred. This reflects progress in reducing the challenge of water system sprawl that results in many small, low capacity systems at higher risk of underperformance.
- Mutual water companies remain the most common system type (23%) followed by city-run (22%) and investor-owned utilities (18%).
- About 60% of CWS customers are served by city-run systems (LADWP serves 36% of the county alone) and mutual water companies only serve 8% of the population.

Quality Trends

- Compared to other Southern California counties, the number of health-related, primary (Maximum Contaminant Level) violations in LA is quite low, particularly on a per capita basis.
- The percent of county systems in violation of the Safe Drinking Water Act has rarely exceeded 10% over the past 25 years (never exceeding 20%), but the number of monitoring and reporting violations has notably jumped in the past decade.
- Arsenic is the most common primary health violation in the last 5 years (93 violations), followed distantly by Total Coliform Rule (26 violations). No other violation type has more than 3 occurrences.

Affordability Trends

- The average necessary household expenditure for 12 CCF of water per month in Los Angeles County saw a percent change increase of about 25% between 2015 and 2019, well above the increase in in median household income (11%) and inflation in the county over the same period.
- There remains great disparity in how much residents pay for water across systems; monthly rates for 12 CCF[1] of water range from $26 to $134 per month.

[1] This level of consumption is equivalent to the amount of water that provides an average family of four with sufficient indoor consumption to achieve the HRW and a modest amount of outdoor irrigation (SWRCB 2019a).

Accessibility Trends

- Few systems report producing less than the required Human Right to Water level (55 Gallons per Capita per Day) for their customer populations but systems in Santa Clarita and Antelope Valleys were especially likely to report declining groundwater levels and related low production levels.

System Performance

- Most Los Angeles County CWS provide sufficient, safe and relatively affordable water to their customers. Of 200 systems assessed, 98 systems (49%) were scored as 'no apparent cause for performance concern'.
- A small number of severe concern and failing/acute concern systems (19 total, or 10%) demonstrated a high number of quality violations and several risk factors. These are the highest priority for further evaluation.
- Small systems, particularly mobile home parks, RV parks, and mutual water systems, are most at risk for low Technical Managerial Financial (TMF) capacity and poor outcomes along the quality, affordability, and accessibility dimensions of the HRW.

Despite a majority of systems performing well across all three HRW outcomes, the number of systems with poor water quality, high water bills, and vulnerable supplies suggests the importance of continued interventions and investment to improve HRW outcomes for CWS across Los Angeles County. Moreover, there is a need for continued monitoring of performance as this report presents a framework and a snapshot in time of results, but the challenges water systems face are dynamic.

Introduction

Community water systems (CWS) are the fundamental building blocks of California's water supply network. While they perform essential roles in providing drinking water supplies and adapting to drought and climate change, they also face challenges from under-investment, aging infrastructure, and increasingly stringent regulatory standards. The Luskin Center for Innovation previously conducted the first system-wise analysis of CWS in Los Angeles County in 2015 (Pierce et al. 2015).

This current policy guide builds on the 2015 atlas to update and enhance our understanding of the current performance of Los Angeles County CWS and inform necessary policy interventions. In addition to updating certain analyses with newer data, this guide also provides additional analyses on water quality and production and a new performance review. However, this review represents only a snapshot in time. Future analysis will be required as new data becomes available and CWS address new challenges in successful drinking water provision.

Despite their importance to society, and the state's growing focus on system assistance, many water systems across Los Angeles still face challenges that impede the provision of clean, safe, affordable drinking water. Many systems suffer from chronic under-investment which makes replacing aging infrastructure difficult. In addition, more stringent water quality standards require additional costs for treatment and operator training. Some poorly-performing, small drinking water systems in the region operate under nominal public oversight in spatial patterns that do not fulfill environmental, efficiency, or equity criteria and do not cohere with existing administrative jurisdictions (Pierce et al. 2019a). These inconsistencies give rise to system inefficiencies, low capacity, and insufficient resource bases to perform well. The high proportion of small drinking water systems in Los Angeles County starkly contrasts with the economies of scale realized in other more consolidated utility sectors, leading to inequities in quality, affordability and accessibility.

To address these and related issues across California, the state enacted the Human Right to Water Act (Assembly Bill (AB) 685) in 2012, establishing a state policy that every person has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking and sanitary purposes. Since the passage of AB 685, the Legislature has passed and the Governor has signed various laws aimed at making this policy a reality.

Excluding water quality crises in Maywood and Compton, however, most of the focus at the state level has understandably been on rural and peri-urban communities, with relatively little attention paid to investments made in urban areas like Los Angeles. While the environmental justice community, the County, and some regional water suppliers are engaging with urban drinking water system problems in Los Angeles, these matters still require more support and attention. To continue the initial momentum, a critical need exists for a comprehensive understanding of gaps in water service which can inform advocates, systems, regulators, and politicians, as well as support the public's efforts to address current and emerging inequalities.

Many of Los Angeles County's 200+ CWS are well-functioning and, with proper oversight and strategic investment, will continue to adequately serve their customers for decades to come. On the other hand, some of the region's systems currently struggle, including publicized cases of drinking water quality, reliability, and affordability concerns which appear to violate HRW standards (for example, see Wilson 2011; Jennings 2018 in Maywood and Compton respectively). These issues occur in diverse communities across the County.

To address this issue of struggling CWS in Los Angeles County, the UCLA Luskin Center for Innovation (LCI) conducted an analysis of the performance of Los Angeles County CWS. The performance assessment reviewed each of the County's 200+ active CWS for which data were available with the particular aim of identifying systems in need of infrastructure or operational upgrades to ensure that their drinking water service fulfills each of the dimensions of the Human Right to Water (safety, affordability, and accessibility). The system-level performance review begins on page 30 of this report.

This guide and performance assessment also adds a more detailed water-system level perspective to other complementary efforts to review water delivery performance in Los Angeles County. For instance, in October 2019, UCLA's Institute of Environment and Sustainability and the Sustainable LA Grand Challenge published a report card on multiple dimensions of Los Angeles County water stewardship, including a section on drinking water (Federico et al. 2019). Moreover, the recent research of Reibel, Glickfeld and Roquemore (2020) has focused on the need to invest further in improvements to water systems serving disadvantaged communities in Southeast Los Angeles County. An associated assessment of systems is being supported by the Water Replenishment District within this region.

The Human Right to Water Framework: Recent Legislative and Planning Efforts

In 2012, Governor Brown signed Assembly Bill (AB) 685 into law, confirming California's unique commitment among U.S. states to ensuring a Human Right to Water (HRW) for every individual in the state (State Water Policy 2012). This bill recognizes that "every human being has the right to safe, clean, affordable, and accessible water" (State Water Policy 2012).

Several recent efforts at the state and regional-level have begun the task of implementing the Human Right to Water (see Figure 1). Most recently and focused on quality, Governor Newsom signed into law Senate Bill (SB) 200 which establishes the Safe and Affordable Drinking Water Fund. It provides support to water systems in the form of grants, loans, contracts, and services with the goal of improving operations and maintenance of water infrastructure to ensure safe drinking water provision (Drinking Water 2019). In a related effort, the State Water Resources Control Board (SWRCB or State Board) is undertaking a statewide needs assessment, which will identify small public water systems, domestic wells, and state small water systems violating, or at risk of violating, primary water quality standards. The work will also describe short-term and long-term solutions to address these problems.

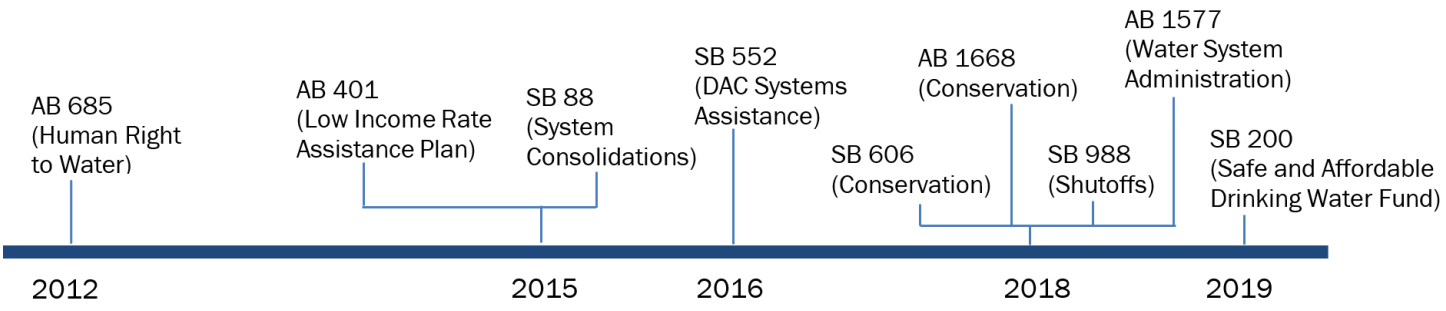
Specifically related to affordability, the Governor signed AB 401 in 2015, which directed the SWRCB to develop a statewide program to provide monetary assistance for low-income water customers' bills (Low-Income Water Rate Assistance Program 2015). A draft report by the State Board outlined potential program designs to provide direct on- and off-bill assistance and shutoff prevention measures for low-income customers (SWRCB 2019a). In 2018, SB 998 also addressed affordability by requiring CWS to have written policies on preventing water shutoffs and to report their number of shutoffs due to nonpayment (Discontinuation of Residential Water Service 2018).

Related to access broadly, in 2018, AB 1668 and SB 606 created new urban water efficiency standards and focused on building resilience through water conservation. These efforts can support the HRW accessibility outcome by reducing water demand, upgrading system and parcel level infrastructure, and potentially reducing rates while ensuring system-level accountability for water efficiency and resilience.

Additionally, several recent state bills create greater potential for water system consolidation, which can be a solution for small underperforming CWS. SB 88, passed in 2015, gives SWRCB authority to execute mandatory consolidation of systems that consistently violate water quality standards. SB 552 (2016) also allows SWRCB to require consolidation of and provide assistance to failing water systems serving disadvantaged communities, and AB1577 (2018) gives the SWRCB authority to appoint water system administrators.

At the regional level, Los Angeles County recently expressed its commitment to improving drinking water through its draft Sustainability Plan, "OurCounty LA," adopted in August 2019 (LA County Office of Sustainability 2019). The first of the Plan's 12 goals involves the county ensuring access to safe, clean, and affordable water, which directly aligns with the HRW framework. The targets within this strategy include reducing the number of public drinking water systems

Figure 1. Timeline of Recent Major Human Right to Water Legislation in California



incurring, and customers experiencing, Maximum Contaminant Level (MCL) violations for pollutants regulated by the Safe Drinking Water Act. This involves a target of fewer than 5 systems in violation or out-of-compliance serving less than 2,000 customers by 2025, fewer than 2 systems in violation or out-of-compliance serving less than 500 customers by 2035, and no systems in violation or out-of-compliance by 2045. Action item 18 to assist in this target involves an assessment of the "vulnerability of the region's drinking water systems" and the creation of "an action plan to reduce or eliminate vulnerabilities" (LA County Office of Sustainability 2019). Our policy guide provides research to help achieve the county's desired outcomes

Los Angeles County and EPA Region 9 have also already identified several of the worst-performing systems that represent a risk to customer health from repeated water quality violations and are mandating system improvements. Our policy guide scored these systems in the failing category, highlighting work that is already being done to improve HRW outcomes among poorly performing CWS in the County. More information on these systems and the interventions can be found in the "Reviewing Current System Performance" section of this policy guide.

Additional Los Angeles County efforts to improve water quality, local water supply, and public health will result from the recently voter-approved Measure W. Known as the Safe Clean Water Program, the measure implements a stormwater parcel tax of 2.5 cents per square foot of impermeable surface area. The $300 million a year of revenue will fund stormwater and green infrastructure projects with multiple goals in mind: to reduce flooding; to improve water quality, habitats, and public health; and to allow for water reuse, capture, and infiltration to diversify local water supply (SCWP 2019). While focused on stormwater, potential benefits could extend to drinking water.

Data and Methods

The findings described in this report characterize CWS using multiple different sources of publicly-available data, as there is no one repository of system attributes. We rely on data of the following specific indicators, obtained for each of Los Angeles County's active CWS wherever possible:

Governance and Socioeconomic Characteristics

Nearly every community water system adopts one of eight governance structures, which are governed by five distinct bodies of state law. In terms of governance and size, drinking water systems in Los Angeles County range dramatically from a mobile home park of twenty-five residents in Antelope Valley to the Los Angeles Department of Water and Power (LADWP) with nearly four million customers. Adding to this complexity, smaller water systems are often exempted from statewide water conservation, financial, and consumption reporting regulations.

Accordingly, we characterized each of the 200+ drinking water systems in Los Angeles County according to their:

a. Governing body of law: Understanding how many community water systems of each governance type serve the County helps us scope the potential local impacts when California policymakers change the water, government, public utilities, municipal, or corporation codes.

b. Size: System size can strongly influence the performance of water systems, with higher unit costs and lower TMF capacity generally observed among small systems.

c. Socioeconomic Status: The population under 200% of the Federal Poverty Level in each system provides an indicator of low-income customers potentially burdened by water affordability concerns and that may be eligible for future water rate assistance programs.

d. Technical and managerial capacity indicators: While potentially overcome in the short term, lack of system-level technical and managerial capacity in the long term will inevitably result in negative HRW outcomes at the customer level. Lack of capacity at the system level may be due to lack of resources, mismanagement, or corruption.

The SWRCB administers exams to certify water treatment and distribution system operators at levels of increasing expertise (T1-T5 and D1-D5 respectively) (SWRCB 2019b). Systems are required to have certified operators of differing levels based on the size and complexity of the system; systems must report the names and certification levels of these operators to the State Board via the Electronic Annual Reporting Form (EAR). The 2015 EAR provided names and levels of operators for CWS; this was the most recent complete EAR available on the State Water Board website. This data identified systems which have no certified operators or that have operators below the required certification level. This metric was used as a risk factor for technical capacity. Monitoring and reporting violations were used as a proxy for managerial capacity.

Given their unique geography, water systems in Los Angeles County serve very different customer bases with differing vulnerabilities and capacities to cope with and respond to system under-performance. In terms of socioeconomic characteristics of the customer base, we focus on factors shown to affect water consumption patterns and affordability, including variations in household income and poverty levels, and the share of renter vs. owner-occupied housing across drinking water systems.

Quality

The number and type of MCL (health-related) and monitoring and reporting violations was compiled from the California State Water Board's State Drinking Water Information System (SDWIS) for the years 1991 to 2018. We used information which we gathered from news stories and interviews on cases of secondary quality, distributional system or widespread premise plumbing concerns (see Pierce et al., 2019c).

Affordability

Data on rate structures were compiled directly from individual system rate sheets where available.[2] This allowed us to estimate the average household monthly water bill based on 12 CCF of consumption. This level of consumption is equivalent to the amount of water that provides an average family of four with sufficient indoor consumption to achieve the HRW and a modest amount of outdoor irrigation (SWRCB 2019a). Rate data allowed for a comparison of rates between 2015 and 2019, the last time that a countywide system rates analysis was performed (Pierce et al. 2015).

[2] If not readily available online, systems were contacted three times via phone and email to obtain rate data.

Accessibility/reliability

Several metrics obtained from different data sources were used to evaluate the accessibility dimension of the HRW for Los Angeles County CWS. First, data were obtained from the State Water Board from systems reporting on water conservation and production from 2015-2017. As part of the drought emergency, a special order (Resolution 2015-0032) required small CWS (with less than 3,000 service connections or production less than 3,000 AF per year) to report water production and water conservation measures to the State Board alongside large CWS (reporting for small CWS is otherwise voluntary) (DRINC Portal n.d.). The 2017 dataset included 208 CWS in L.A. County, including 81 small and 127 large CWS. The specific questions used from this dataset included: systems' reported water production in January and July 2017 (winter and summer) as compared to their reported residential population, whether the systems predicted water shortages for 2018, and whether groundwater levels were steady, declining, or recovering. Reported residential population figures were multiplied by 55GPCD and 31 days per month to obtain the required HRW level of monthly water production; this accessibility measure was compared to actual reported production for both January and July 2017. The 2016 dataset was limited to small CWS but included questions on conservation policies and water use restrictions not available in the 2017 dataset.

A complete dataset featuring the data collected for systems (as outlined above) will be available for download on the Luskin Center for Innovation website www.innovation.luskin.ucla.edu.

Exploratory Financial (TMF) Analysis

Financial capacity can also influence system performance (combined to form Technical, Managerial, Financial (TMF) capacity), which is discussed in the 'Next Steps' section but not included in our system performance review due to a lack of current data. We also expect the SWRCB's statewide needs assessment to create reliable metrics for analyzing system-level financial capacity in the future.

Most CWS are also required to report some form of financial data to one of three state or federal regulatory bodies; we used this data to assess financial capacity. A ratio was created of total revenues to total expenses to identify systems operating at a loss. The data were obtained from different sources based on the governance type of the system and relevant reporting requirement: mutual water systems must report financial data on 990 tax forms to the IRS; cities, counties, and special districts must report financial data to the state controller; private investor-owned utilities annually report to the California Public Utilities Commission (CPUC). Data from each source varied by year, with most mutual systems reporting data from 2016, cities/counties/special districts from 2017, and IOUs from 2018. The most recent three years of data available for each system were used to calculate and obtain a three-year average operating ratio.

We were not able to obtain financial data from very small private systems such as mobile home parks which traditionally are not required to report on such system metrics or may not even track such data. The CPUC data on IOUs was also excluded because some utilities reported only aggregated financial data for all systems under a single owner or by region. For large IOUs such as Golden State Water Company or California Water Service, which operate many systems statewide, this aggregated financial data did not provide an accurate system-level perspective. Given the inability to obtain adequate financial data for certain system types we do not include a financial metric in our performance review criteria. However, we do present a preliminary analysis of the available data in the report and recommend next steps for future analysis of the financial capacity of CWS.

Enabling or Constraining Factors of System Performance

Several characteristics either enable or constrain systems in their efforts to ensure the HRW for their customers. Below we discuss several of these factors, and how they vary across the landscape of CWS in Los Angeles County.

System Size

The type of water system, both in terms of number of connections and governance structure, directly impacts system performance. Small water systems tend to be under-resourced, experience more water quality issues, and have less capacity to address HRW concerns (Pierce & Gonzalez 2017). Large water systems can capitalize on certain economies of scale in distribution and treatment to provide higher quality water and more extensive infrastructure at a lower per unit cost (Pierce et al. 2019a). Like nearly all other parts of the state, Los Angeles County exhibits 'water system sprawl', with numerous small water systems serving smaller populations in close proximity. Many of these small systems may benefit from consolidation with nearby systems to harness economies of scale, increase resources and TMF capacity, and improve HRW outcomes (Pierce et al. 2019a). The final section of this policy guide identifies failing and severely concerning water systems via spatial analysis, the customers of which may benefit from system consolidation.

Our policy guide analyzes 200 of the 205[3] active community water systems in Los Angeles County; 77 (39%) of these are classified as small water systems by the State Water Board (less than 3,000 service connections or less than 3,000 AF of annual water production) while 123 of these (61%) are large water systems (more than 3,000 service connections). As an illustration of the extent of water system sprawl, Table 1 compares the number of systems and average system customer population in Los Angeles County to four other Southern California counties. Orange County exhibits the most consolidated water system array of all the counties, and also has the lowest number of water quality violations (Pierce et al. 2019b). While it also shows a relatively high level of persons per system, Los Angeles stands out for having the highest number of water systems, many of which are small.

Table 1. Number of Active Community Water Systems and Average Customer Population Served in Southern California's Most Populous Counties

County	Number of Systems[4]	Average System Customer Population
Los Angeles	205	49,296
Orange	40	78,895
Riverside	99	23,788
San Bernardino	150	14,141
San Diego	79	41,565

Source: 2019 SDWIS database and 2017 ACS population figures

In addition to the size of a water system, the governance type of a water system influences its regulating authority and the body of law which affects HRW outcomes and system performance. The following section reviews the customer socioeconomic status, additional system characteristics of governance, and technical and managerial capacity that impact system performance.

Customer Population Characteristics

The populations served by water systems can influence the system and its performance. Variation in income and poverty levels, population density, and the share of renter versus owner occupied housing across drinking water systems impacts water consumption patterns, water affordability, and accessibility outcomes.

Socioeconomic status data were obtained from American Community Survey (ACS) 5-year tract-level estimates (2012-2016) and spatially assigned to water systems.[5] Some systems, particularly certain mobile home parks and mutual systems, were too small to allow for accurate population counts using this method. It should be noted, however, that mobile home parks often have a high proportion of socioeconomically disadvantaged residents and more water quality challenges (Pierce & Gonzalez 2017). Systems without tra-

[3] Three CWS (Central Basin Municipal Water District, Metropolitan Water District, and Three Valleys Water District) were not scored as they are wholesalers and thus did not have direct customer populations. The remaining 2 active CWS in Los Angeles County, according to the SDWIS database, are two City of Los Angeles power plants, which, given their low likelihood of providing water to a residential population, were excluded from our analysis.

[4] These totals do not include non-transient non-community water systems which regularly supply water to at least 25 people at least six months per year such as schools, factories, or office buildings with their own water systems.

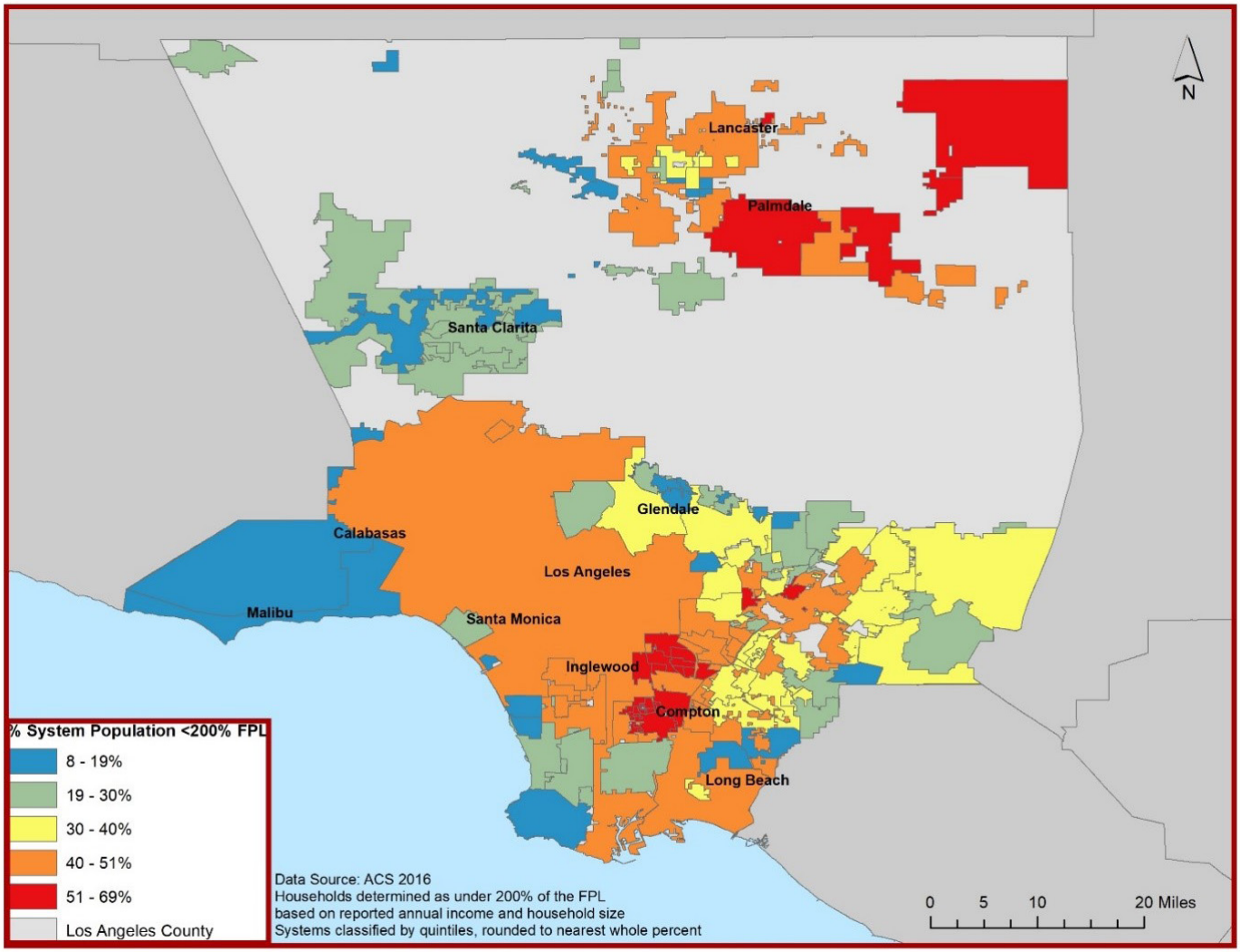
[5] Socioeconomic data came from the ACS 2012-2016 5-year estimates and was joined to Los Angeles County census tract layers with the ratio option. The intersect tool was used to match census tracts to CWS boundaries and dissolved to create water system shape files with population characteristics.

ditional residential populations, such as the few year-round camps and university campuses that are classified CWS in Los Angeles County, were also excluded. Thus, a total of 168 systems (of 202 total) are represented in this analysis.

The median household income was calculated for each system's population, with an average of $66,772 across systems (slightly above the 2017 ACS countywide median household income of $65,006). The system with the lowest median household income was Los Angeles County Waterworks District 40 Region 35 N.E. Los Angeles with $23,674 and the highest calculated median household income was $146,492 for Valley Water Company in La Canada-Flintridge. From the ACS data, we also calculated the percent of a system's population with income below the federal poverty level (FPL). The average for systems was 15% with a range from Mesa Crest Water Company's minimum of 1% to Tierra Nova Mobile Home Park's maximum of 39%.

While the State Water Board continues to develop a statewide water rate assistance program for low-income households in compliance with AB 401, draft recommendations suggest a basic eligibility threshold of 200% of the FPL, which we use as a proxy for economic capacity of the system in our analysis. Systems have an average of 36% of their populations at or below 200% of the FPL, suggesting that a substantial number of households in Los Angeles County CWS would be eligible for potential state assistance. The City of Vernon's water system had the highest proportion of residents below 200% of the FPL at 69% while Manhattan Beach's city-run system had the lowest with 9%. Figure 2 shows the proportion of eligible ratepayers by system, illustrating the significant number of customers[6] who would benefit from water affordability assistance.

Figure 2. Percent of System Customer Population Below 200% of Federal Poverty Level



[6] 2016 data from the Los Angeles County Department of Mental Health (LACDMH 2018) puts this number at about 3,851,597 individuals county-wide.

We were also able to match data on housing unit ownership status for 172 systems. The average percentage of units occupied by renters across all systems is 41% (median also 41%) with a minimum of 6% at the Lily of the Valley Mobile Village and a maximum of 85% within the boundaries of the Tract 180 Mutual Water Co. Renters face particular difficulty with accessing water affordability and water conservation assistance because they often do not pay a water bill directly (see SWRCB, 2019a). Thus, even if they are served by a system with an existing low-income rate assistance or conservation incentive program they often cannot participate. Most often the price of water is passed on from landlords to tenants in the form of increased rent.

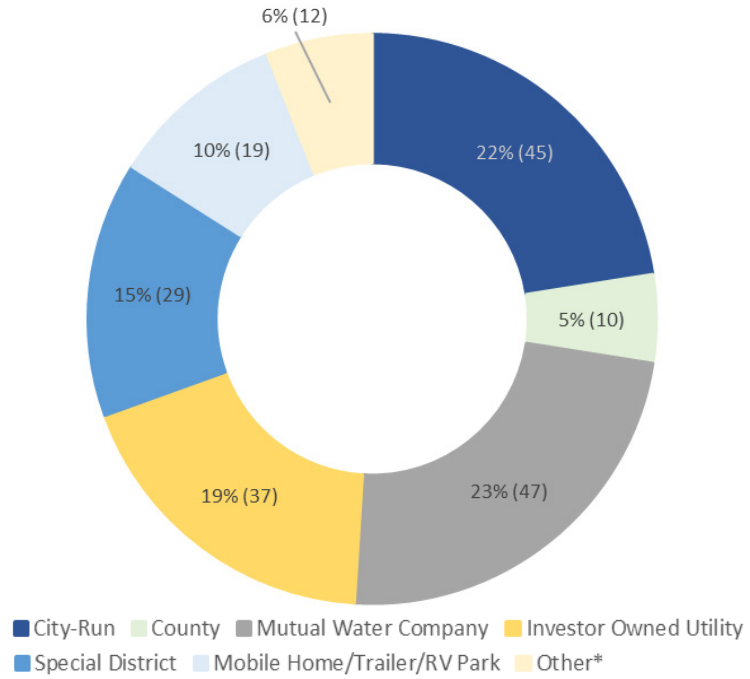
System Governance and Regulating Authorities

The range of CWS in Los Angeles County in terms of both size and governance type creates a complex landscape of regulatory authority, legal requirements, and system level powers that in turn impact system operation, capacity, and HRW outcomes. Interventions to improve system performance must consider these factors to determine the appropriate actions and implementing authority.

While systems can be distinguished by size or the number of connections, systems also differ in their performance depending on their governance structures (see Dobbin and Fencl, 2019). Systems in Los Angeles County can be categorized into at least eight different governance structure types: city-run systems, county-run systems, mutual water companies, investor owned utilities (private), special districts, mobile home parks, and other private systems. Figure 3 below details the number of systems exhibiting each type of governance in Los Angeles County that we assessed; systems are pretty evenly dispersed across types although the population is not (Fig. 4).

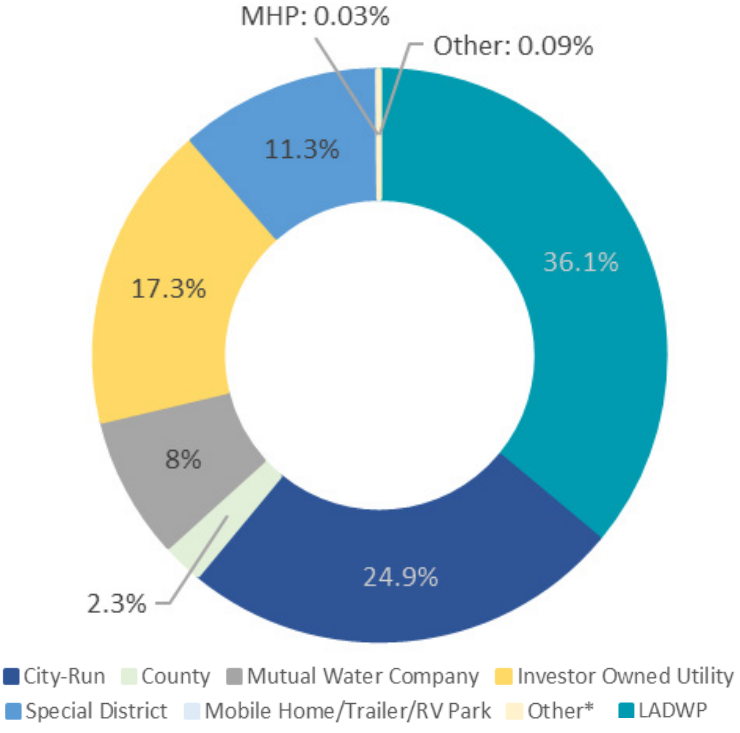
Figure 3 shows the makeup of CWS across Los Angeles County based on governance type. It highlights that CWS are very diverse based on system type, with no single one in the majority. Mutual water systems are the most common, at 23%, closely followed by city-run systems at 22%. However, when accounting for the residential customer populations served by these systems, a different picture emerges. As shown in Figure 4, 61% of LA County CWS customers are served by a city-run system, 36% of which are served by a single system (LADWP), and only 8% of customers are served by the 47 mutual water companies. This corroborates the existence of water system sprawl in the county (Pierce et al. 2019a, Pierce et al. 2015); most residents in the county are served by larger water systems but there are many small water systems that serve small populations in sometimes overlapping service territories.

Figure 3. Systems in Los Angeles County by Governance Type (n=200)



*Other includes 11 systems with unknown categorization and 1 other private system (not IOU)

Figure 4. Percent of Customers Served by CWS by Governance Type[7] 2019 (n=200)



*Other includes the Other Private and Unknown System Categories

[7] The number of customers is based on system residential customer populations available from SDWIS. Only 200 systems are represented here, the other 3 assessed systems are wholesalers and thus do not have residential customer populations to use in this calculation.

Each of the different types of water systems has different powers, regulatory authorities, and responsibilities (including reporting requirements). This section reviews each of these governance types and the implications of differing regulation and powers.

Regardless of system type, two entities have regulatory power over some aspects of public water systems. The primary regulator is the State Water Resources Control Board (SWRCB or State Board) and its Division of Drinking Water. The State Board operates as the water quality regulator that enforces the Safe Drinking Water Act and ensures compliance with monitoring, reporting, and maximum contaminant level requirements. The Board also allocates water appropriations for surface water rights, and administers fines and penalties for systems out of compliance with water quality regulations. Perhaps most important for failing or underperforming systems identified in this assessment, the State Board acts as the operating authority that determines system integrity and mandates dissolution or consolidation of systems. In some circumstances, the SWRCB can also appoint an administrator, place the system in receivership, or suspend service.

The other main regulatory authority with certain oversight authorities over all public water systems is the county government (Board of Supervisors or Local Primacy Agencies). The county's police power allows the county to regulate entities, like water systems, whose actions impact public health, safety, and welfare. County intervention could mean addressing issues such as premise plumbing that causes quality concerns, non-responsive systems or shutoff prevention protection for tenants—actions which can also fall under city housing or planning departments. Meanwhile, the land use powers of counties allows them to require certain actions from developers which can impact water supply and consumption, such as requiring investment in efficiency to offset demand or payment of drought impact fees. Counties (and incorporated cities) also approve developments that can profoundly alter the service network, population size, and water demands of a system. Particularly important for the many small systems facing challenges identified in this performance assessment, Los Angeles County's environmental health department has a delegated authority to regulate the water quality of private wells and water systems with fewer than 200 connections. Half of the counties in the state (30 of 58) have health departments with this authority, known as Local Primacy Agencies (LPA) (SWRCB 2017). The small mobile home parks that tend to struggle with TMF capacity and water quality often fall under this regulation.

The remainder of this section provides additional details on the governance of the 7 main system types identified in Los Angeles County in Figure 3.

City-Run Systems

City-run systems are those water systems that operate as a department or enterprise within a city government. Our review identified 45 city-run CWS in Los Angeles County (23% of systems). In other words, only half of the 88 cities in the county operate their own system. All city-run systems in our performance assessment are classified as large CWS, meaning they must annually report to the State Board using the EAR form and likely have higher TMF and revenue-raising capacity than smaller systems.

City-run water systems, because of their higher TMF capacity and more flexible and numerous funding strategies, may be better positioned to provide HRW outcomes than those system types without access to these strategies. City governments can exercise police and taxation powers to financially support their water systems—a strategy that other types of water systems may not have access to. Increasingly city governments are also employing new, more flexible funding mechanisms like creating enterprise funds which operate distinctly from traditional government-collected funding for city-run water systems (general funds). (Enterprise Funds n.d.). Despite this additional flexibility, city-run water systems are subject to Proposition 218, which requires voter approval for imposing taxes or fees for water and other services. Importantly, it requires rates be set proportional to the cost of providing service to each customer.

County-Run Systems

Similar to city-run systems, county-run systems are directly operated by local government and also regulated by the State Water Board. For example, there are several different water systems operated by the Los Angeles County Waterworks Districts within the Department of Public Works. These county water districts have the authority to raise revenue from existing taxes, assessments, fees, and bonds. They are also constrained by Propositions 218, 26, and 13 which limit their ability to raise or set new taxes and fees for services and may require voter approval. County districts set water rates and can sell excess water outside the district. Both cities and counties have some eminent domain powers that enable them to acquire land or easements for delivering water service or operating the district. Only 10 systems (5%) in Los Angeles County are county-run water districts of which 4 are classified as small CWS and 6 as large CWS.

Mutual Water Companies

Mutual Water Companies (Mutuals) are cooperatives or Home Owners Associations (HOA) where landowners who receive the water are both member-owners arnd users. Mutuals can be formed for residential, fire protection, or irrigation purposes. Mutuals can only sell excess water to non-members in specific circumstances such as emergencies or when a shareholder has a lease in writing to deliver water to a non-shareholder (California PUC §2705). The property owner members of the company vote to elect board members of the company and to adopt annual fees, dues, and assessments. Mutual water companies operate under corporate law and thus are monitored by the California Secretary of State. Legislation also requires mutual water companies to report their service areas to Local Agency Formation Commissions (LAFCOs) in each county (CalMutuals n.d.). They are required to report financial data in annual 990 tax filings. Mutuals do not have taxation power and members pay annual dues for water and vote to approve capital projects or assessments and fees. 24% of the CWS in this performance assessment (47) are mutual water companies, of which the majority are small CWS (32, 68%).

Investor Owned Utilities (IOUs)

Large private water companies are regulated by the SWRCB for water quality but their rates are separately regulated by the California Public Utilities Commission (CPUC) (the only type of water system regulated by the CPUC). As described in the affordability section, IOUs follow different rate setting procedures depending on size; the largest Class A utilities (10,000 connections or larger) follow a more formal procedure than smaller IOUs (CPUC 2019). IOUs do not have taxation powers but are less constrained in their rate setting abilities since they are not subject to Proposition 218. Of the 37 (19%) IOUs in Los Angeles County, only 6 are small CWS and only 3 are Class C or D small systems.[8]

Special Districts

Special Districts are a broader category of local government entities that can include water districts but also fire, flood control, cemetery, library, vector control districts etc. Distinct from cities or counties, these are government entities created for a specific purpose within defined boundaries and provide one or multiple public services (Senate Local Government Committee 2009). These can be created from a principal act (generic state law applicable to all special districts of certain types) or special act (created by the legislature for a particular district). Enterprise districts are the type of special districts that provide services which can be funded by customer fees, such as water utility districts, while other non-enterprise districts rely mostly on property taxes for revenue. Special districts can be independent and run by an elected or appointed board or dependent and governed by city councils or county boards of supervisors (Senate Local Government Committee 2009). 29 special districts (15% of systems) serve as CWS in Los Angeles County and tend to be Municipal Water Districts or County Water Districts (distinct from city or county operated systems respectively).

Irrigation districts are a type of special district. Our performance assessment only reviews those irrigation districts which provide drinking water, and can be classified as CWS. These districts are historically exempt from local oversight and are subject to periodic elections with voting from members. These irrigation districts that provide drinking water are still subject to SWRCB regulation. Only 5 systems reviewed here are classified as irrigation districts.

Mobile Home Parks

The final major category of systems are those that serve mobile home parks. While mobile home parks are regulated in terms of general sanitary conditions by the California Housing and Community Development Department, water system operations or finances are not monitored by the agency. Park-run systems often disproportionately underperform in terms of water quality, monitoring and reporting, and TMF capacity (Pierce & Gonzalez 2017). Many of these systems operate a single groundwater well and are small enough (<200 connections) to be regulated by the county. These parks make up 10% (19 systems) of all systems reviewed, all of which are small CWS. Due to fewer reporting requirements, some data analyzed in this study was unavailable for these systems; 27% of the systems with 'insufficient data' to score in this performance assessment are mobile home parks.

Other System Types

An additional two categories of 'other private' and 'unknown' were created for systems that do not fit into the above categories. The 'unknown' category encompasses those systems whose governance structure does not fit with the other types. For example, certain facilities like the California State Polytechnic University Pomona, the County's Peter Pitchess De-

[8] The other 3 small CWS IOUs are each owned by California Water Service Co. which is classified as a Class A Utility by the CPUC and regulated as a single IOU with multiple systems.

tention Center, Fenner Canyon Conservation Camp, and the Los Angeles Residential Community Foundation, which is a residential ranch for developmentally disabled adults, are all regulated as their own small CWS. Figure 5 shows CWS in Los Angeles County based on regulatory authority. The map shows the complexity of overlapping authorities that occur based on system type and size for water quality, rates, and governance oversight."

Technical Managerial Financial Analysis

TMF refers to the technical, managerial, and financial capacity of public water systems. For the purposes of our study, we collected available data on the financial operations and technical treatment system operations of Los Angeles County CWS. TMF capacity must be assessed and demonstrated for water systems to be eligible for certain state funding and TMF capacity is directly linked to water system outcomes (Balazs & Ray 2014). Yet there is little research assessing the appropriate dimensions or metrics for TMF analysis. Additionally, financial data are not readily available for some systems. Our analysis examines trends in system TMF capacity across the county in connection to HRW outcomes and resources for interventions.

We collected TMF data for most systems[9] in Los Angeles to include an analysis and discussion of the following metrics:

- Presence and training level of certified operator (technical capacity)
- Monitoring and reporting violations (managerial capacity)

At present, data on system finances are not consistently available enough to allow for its use as a risk factor in performance review. We include a discussion of financial capacity in the 'Next Steps' section of this report. That section includes analysis of preliminary data collected from systems on the following metrics:

- Operating ratio (expenses/revenue)
- Revenues (fiscal capacity)

Technical Capacity

To assess the technical capacity of systems, we utilized data from the State Water Board on operator certification. The State Water Board administers exams to certify water treatment and distribution system operators at levels of increasing expertise (T1-T5 and D1-D5 respectively) (SWRCB 2019b). Systems are required to have certified operators of differing levels based on the size and complexity of the system; systems must then report the names and certification levels of these operators to the State Board via the Electronic Annual Reporting Form (EAR). Names and levels of operators for CWS were obtained from the 2015 EAR available on the State Water Board website. This data were used to identify systems which have no certified operators or operators below the required certification level. The presence of a certified operator is important for system performance to ensure proper system operation and address quality concerns that may arise. Thus, the presence of a certified treatment operator was included as a metric in our system performance review criteria. An operator at a certification level below what is required, or lacking a certified operator (even if none is legally required), was considered an indicator of poor technical capacity and a risk factor in system performance.

Of the 197 systems identified in the 2015 State Water Board data, the vast majority of systems (182 or 92%) had treatment operators certified at a level at or above what was legally required. Only 4 systems[10] (2%) were out of compliance with treatment operators below the required certification level in 2015. An additional 11 (6%) of systems did not have a trained treatment operator although one was not legally required; we considered these systems as moderately at-risk for low technical capacity due to the absence of technical expertise in operations. Notable however, is that many systems shared their highest certified operator with one or more water systems. In particular, numerous small trailer park systems listed the same certified operators, suggesting that the operators manage multiple systems and are not consistently present at all systems. Thus, some systems may have lower technical capacity than is otherwise suggested by their highest certified operator. 85 systems (43%) had at least half of their listed certified treatment operators working at another water system while 112 (57%) had more than half of their treatment operators working uniquely at their respective system. However, it should be noted that sharing operators may also provide benefits for very small water systems; pooling resources may enable several small systems to obtain a higher level operator or more technical expertise and service than would otherwise be available for a single system alone.

[9] We were able to obtain at least one year of revenues and expenses for 144 systems, although for most IOUs these figures were listed at the broader utility and not system level and thus not detailed enough to allow system-level analysis. 194 of 200 CWS provided data on certified system operator levels in the 2015 EAR.

[10] Golden Valley Municipal Water District, San Gabriel Valley Water Company El Monte, SPV Water Company, West Valley County Water District

Managerial Capacity

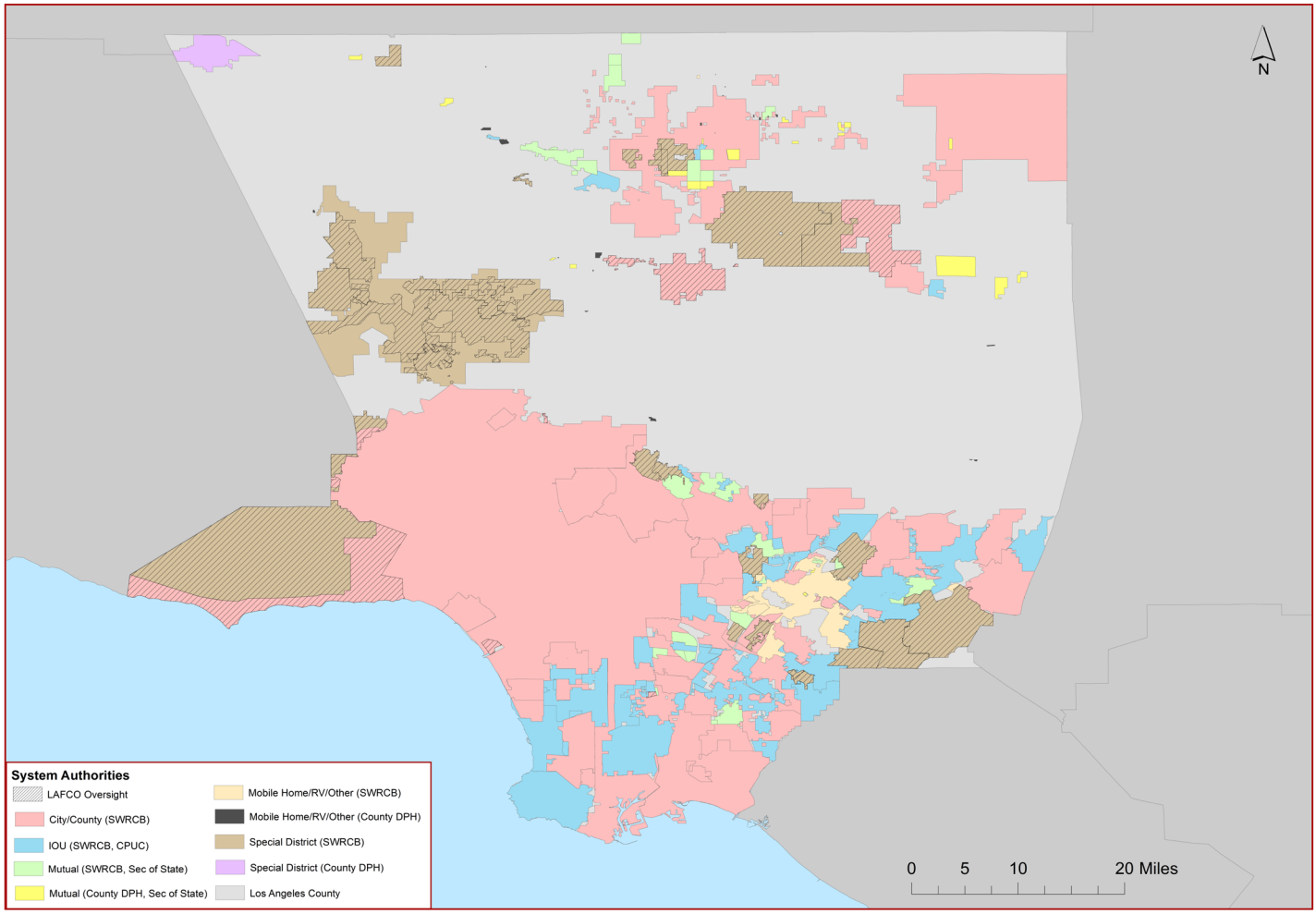
For the managerial component of TMF analysis, we examined monitoring and reporting violations as an indicator; failure to comply with regulations for water quality sampling and reporting to both consumers and regulators can be an indicator of poor water system management, operation, and governance. We note that this metric was also used as a measure of managerial capacity in OEHHA's draft Human Right to Water framework (OEHHA, 2019).

The next section of this report discusses the monitoring and reporting violation trends across the county. Monitoring and reporting violations are consistently more common than MCL (health) violations and are typically incurred repeatedly or multiple times per year by a smaller number of systems. Data on these violations is much more accessible and reliable than the data available on the technical and financial components of water system TMF.

As noted above, the data available on system financial capacity is preliminary and thus could not be included in our final performance review criteria. Further discussion of findings on systems' finances can be found in the 'Next Steps' section of this report, highlighting the opportunities for future research with better data on water system finances.

Transitioning from enabling or constraining factors for system performance, the following three chapters evaluate trends in Los Angeles County along the three dimensions of the HRW (quality, affordability, and accessibility) to assess overall drinking water outcomes for county residents served by CWS. Our system-level analysis and performance review follows.

Figure 5. Map of Los Angeles County CWS by Regulatory Authority



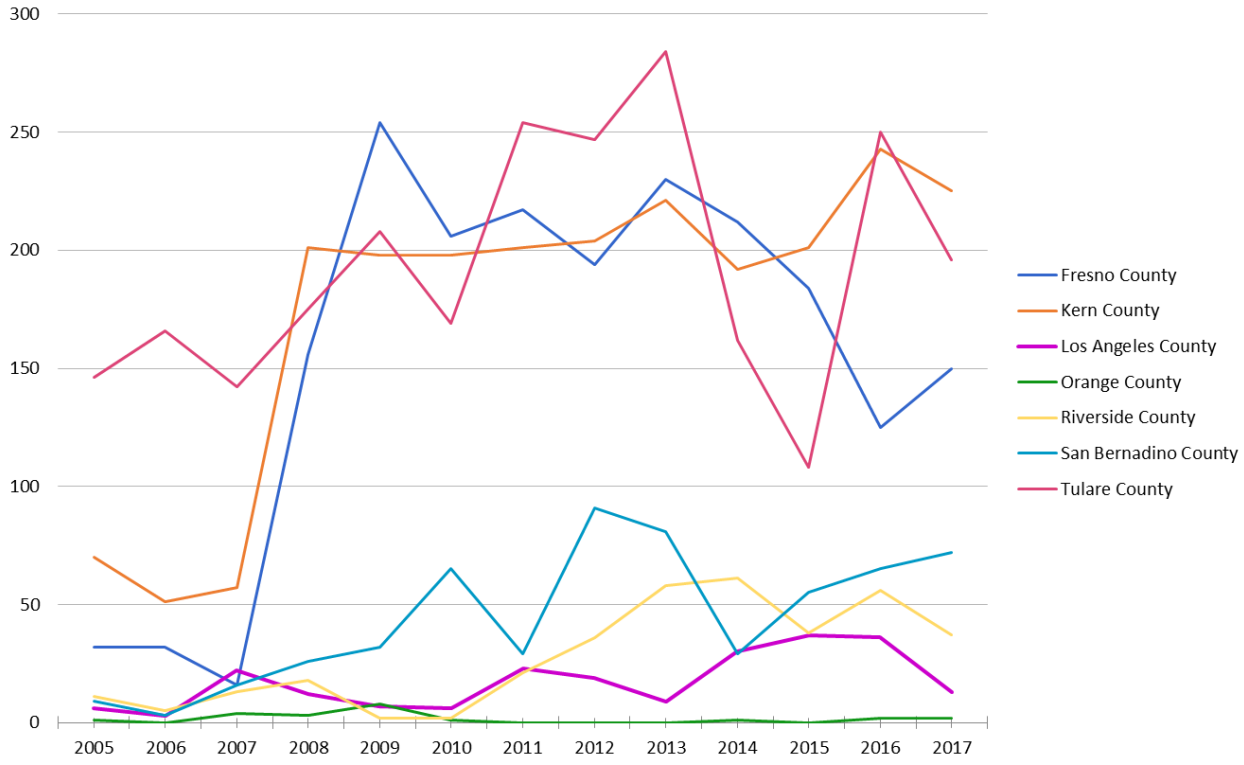
County-Wide Trends: Quality

Quality is the first of the three main HRW dimensions, as regulatory standards still primarily aim to ensure that people have access to safe, clean water at the tap. Here we focus on primary water quality across the county, although we also incorporate other quality concerns where possible.[11] This analysis complements the work of the UCLA IoES report card, which gave a B+ score to the county on drinking water quality, largely based on primary health violations from 2012-2017 and system failures to report quality violations in annual consumer confidence reports (Federico, 2019).

The Safe Drinking Water Act, originally passed by Congress in 1974—and amended in 1986, 1996, and 2016—authorizes the U.S. EPA (with some responsibilities devolved to state and regional level agencies like California's State Water Resources Control Board) to regulate public water systems nationwide to ensure the safety of drinking water with respect to certain natural and man-made contaminants (Tiemann 2017). The Act establishes monitoring and reporting requirements for public water systems to ensure systems do not violate set water quality standards.

The main way to assess water quality compliance is through reported primary health violations, known as Maximum Containment Level (MCL) violations for various pollutants. Primary violations (also known as health or MCL violations) occur when systems' drinking water exceeds the MCL levels established for a given pollutant (Tiemann 2017). Other violations can occur depending on which requirements of the Safe Drinking Water Act a system fails to comply with. Maximum residual disinfectant level (MRDL) violations occur when a system's water exceeds the threshold level for disinfectants such as chlorine (U.S. EPA 2018). Treatment technique violations and violations of the Surface Water Treatment Rule occur when a system fails to adhere to proper procedures to treat drinking water for contaminants (U.S. EPA 2016). Other non-health related violations include monitoring and reporting violations, in which systems fail to regularly monitor water or submit results to the relevant state agency or EPA, and public notice violations from failing to adequately alert customers of serious water quality violations or failing to produce an annual Consumer Confidence Report (U.S. EPA 2019a).

Figure 6. Primary Health (MCL) Violations by County (2005-2017)



[11] In separate work, we focus on perceived quality and mostly "secondary" contaminants. LA County has one of the highest levels of mistrust of tap water among metropolitan areas in the U.S., nearly three times the national average (Javidi and Pierce, 2018).

Data collected from the State Water Board reveals that Los Angeles historically has fewer primary health violations compared to other counties in Southern California (see Figure 6). The only exception to this is Orange County, which consistently has the lowest MCL violations and also has a more consolidated landscape of fewer, larger water systems serving the county's customers (see Pierce et al. 2019b). Los Angeles County consistently performs even better in terms of per capita MCL violations than counties such as Kern, Riverside, and Tulare (Figure 7).

Los Angeles County does, however, continue to have systems experiencing MCL violations which require attention. Figure 8 shows the historic trend of water quality violations among CWS in Los Angeles County from 1991-2018. While MCL violations (dark red) historically remain below monitoring & reporting (non-health related) violations, a slight increase has occurred in recent years (2014-2018).

Figure 7. Primary Health (MCL) Violations per Capita by County (2005-2017)

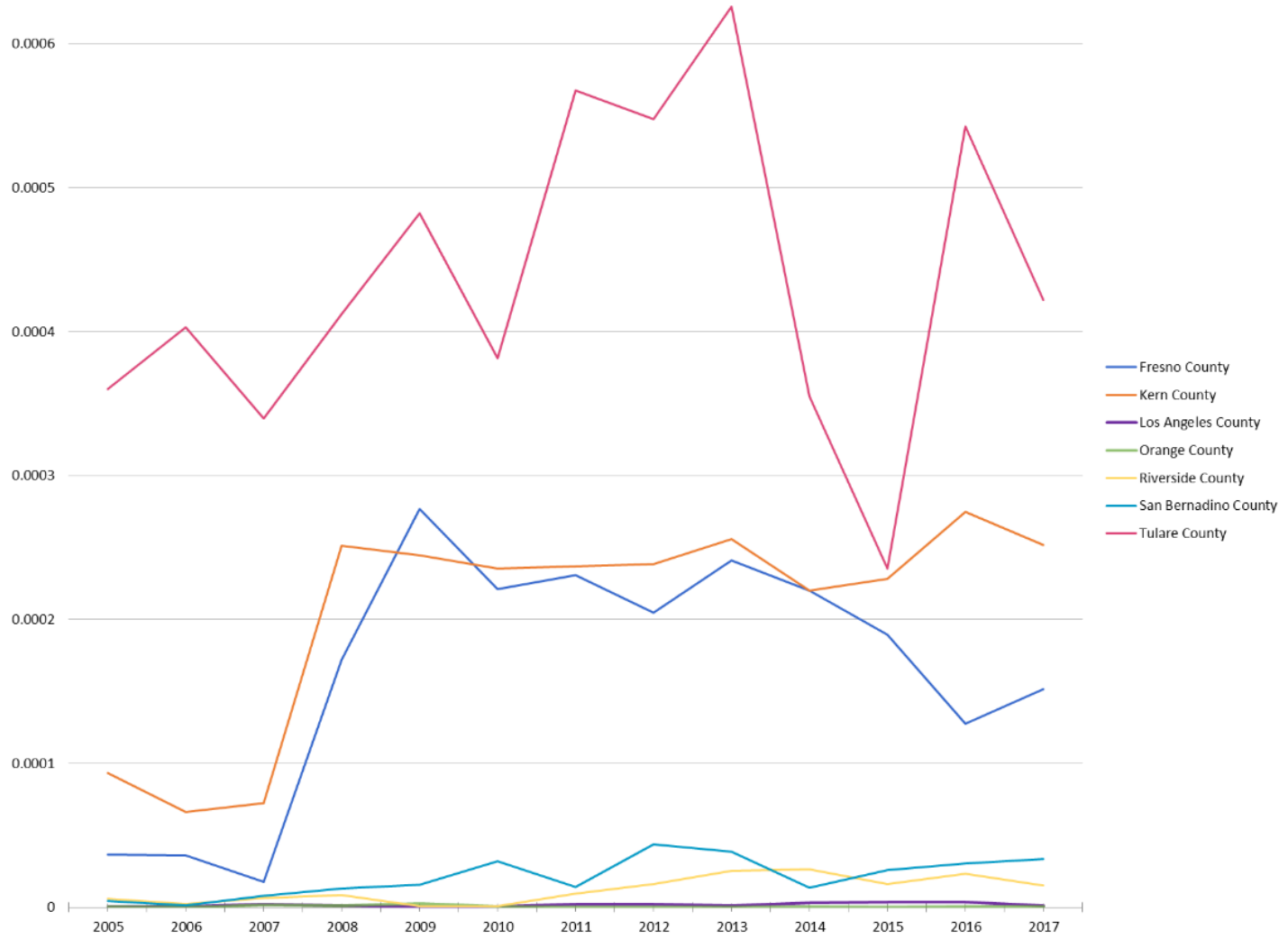
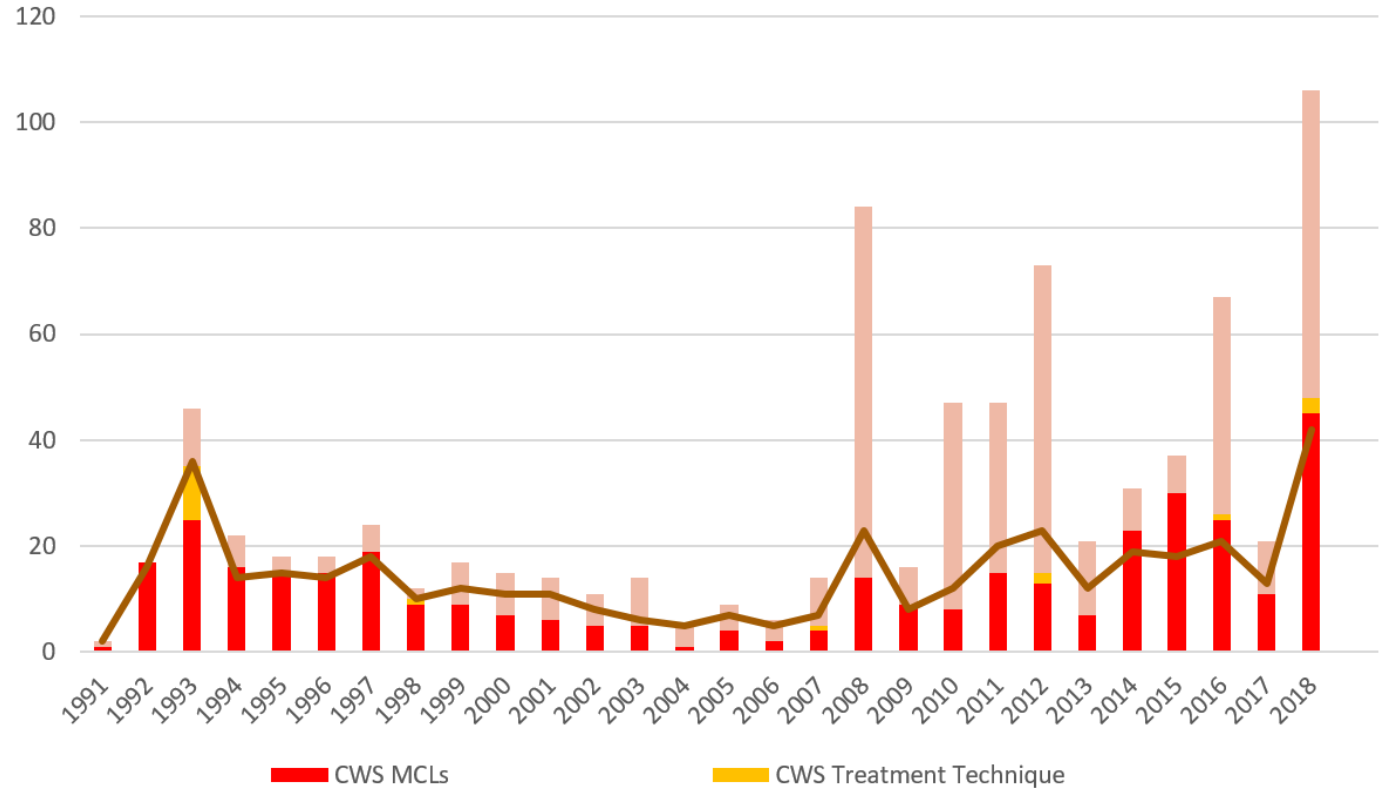


Figure 8. Total MCL and Monitoring & Reporting Violations for CWS in Los Angeles County (1991-2018)



Systems in the county appear to exhibit a steady trend of few violations until 2008, after which fluctuations occur between years with more and fewer violations. Many of these newer violations are monitoring and reporting violations, with health violations remaining more or less stable since 1991 (until 2018). The number of systems (shown in brown) incurring violations is often much lower than the number of violations, reflecting that violating systems tend to incur multiple violations in a single year.

Using SDWIS data to track water system violations, 56% of the county's systems (111 CWS) have not incurred a violation of any kind in the last 10 years (2008-2018). Of 535 total violations across the County in the last 10 years, 64% were monitoring and compliance-related rather than health-related. However, the total number of systems incurring MCL violations remains above the county's target of 5 or fewer systems by 2025 outlined in the recent county sustainability plan (see Table 2). For the purposes of system performance review, we focused on MCL violations in the last 5 years (2014-2018), to hone in on those systems that more recently underperformed in water quality and thus represent systems of present concern for HRW outcomes. Only 25 systems (12%) incurred MCL violations in the last 5 years, meaning a much higher proportion (88%) of systems have been in compliance since 2014 than 2008.

Fifteen of these 25 violating systems incurred two or more MCL violations in the last five years (2014-2018)—our identified threshold for violating systems along the quality HRW dimension. Six of those systems incurred more than 10 MCL violations in the last five years[12], representing especially problematic and consistently failing performance in terms of water quality. All six of these systems are small water systems, which often face challenges from lower fiscal and technical capacity. Most of these six systems are located in the northern, less urban areas of the county. Five of these six systems have already been identified by the EPA, Los Angeles County, and the State and Regional Water Boards as having high levels of arsenic in violation of MCL thresholds (U.S. EPA 2019b). Meanwhile, 10 systems incurred one MCL violation in the last five years. This means 175 systems of the 200 we assess incurred no MCL violations in the last five years.

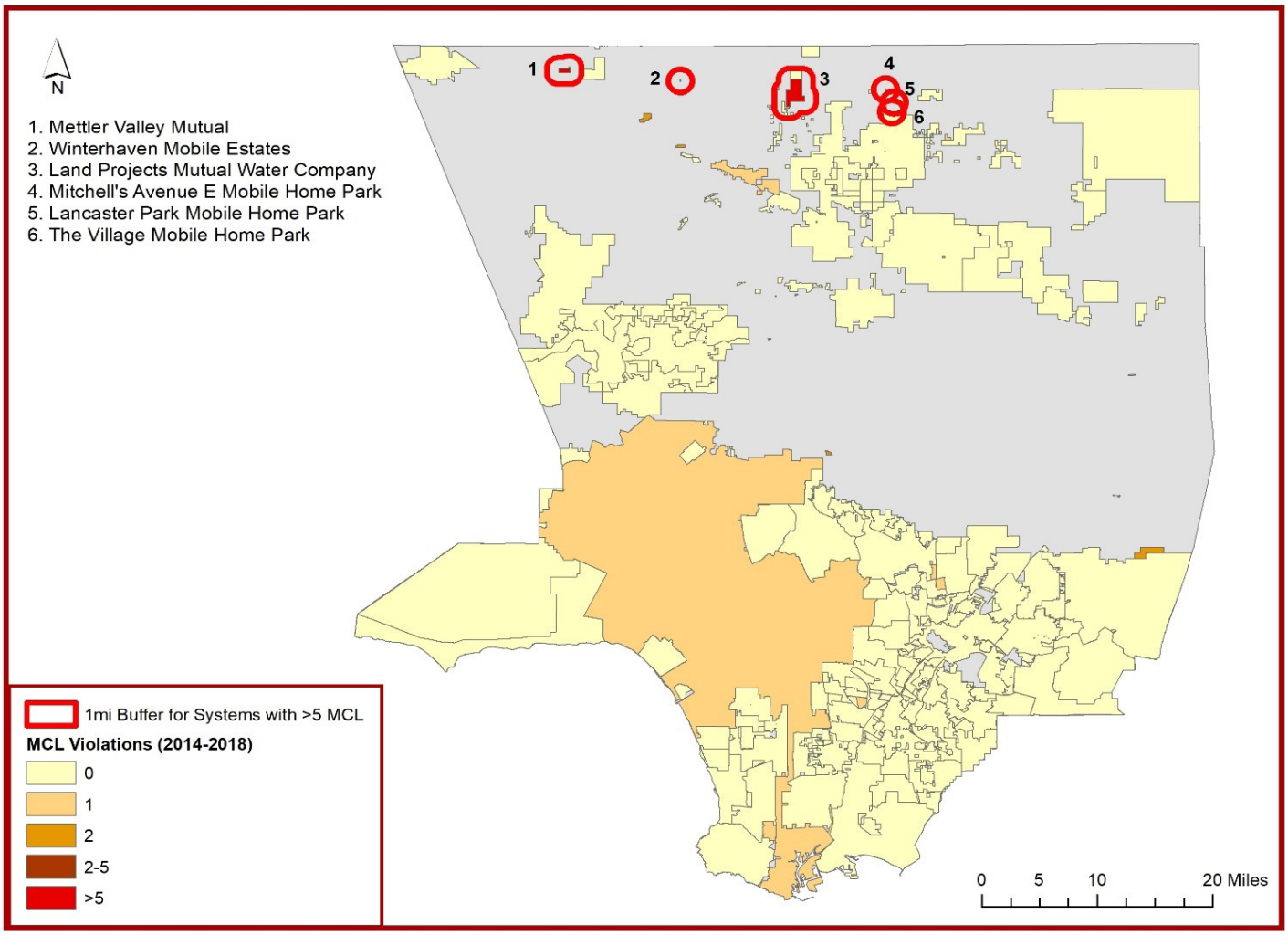
[12] Lancaster Park Mobile Home Park, Land Projects Mutual Water Company, Mettler Valley Mutual, Mitchell's Avenue E Mobile Home Park, The Village Mobile Home Park, and Winterhaven Mobile Estates.

Table 2. Los Angeles CWS with MCL Violations in the last 5 years	
Number of MCL Violations Incurred 2014-2018	**Number of Systems**
More than Five	6
Two to Five	9
One	10
None	175
Total	**200**

Figure 9 shows the northern area of the county which features the most systems with five or more MCL violations from 2014-2018. The map shows the CWS boundaries within the area and number of MCL violations incurred by each system in the last five years. As the map shows, often the small systems have the most quality violations.

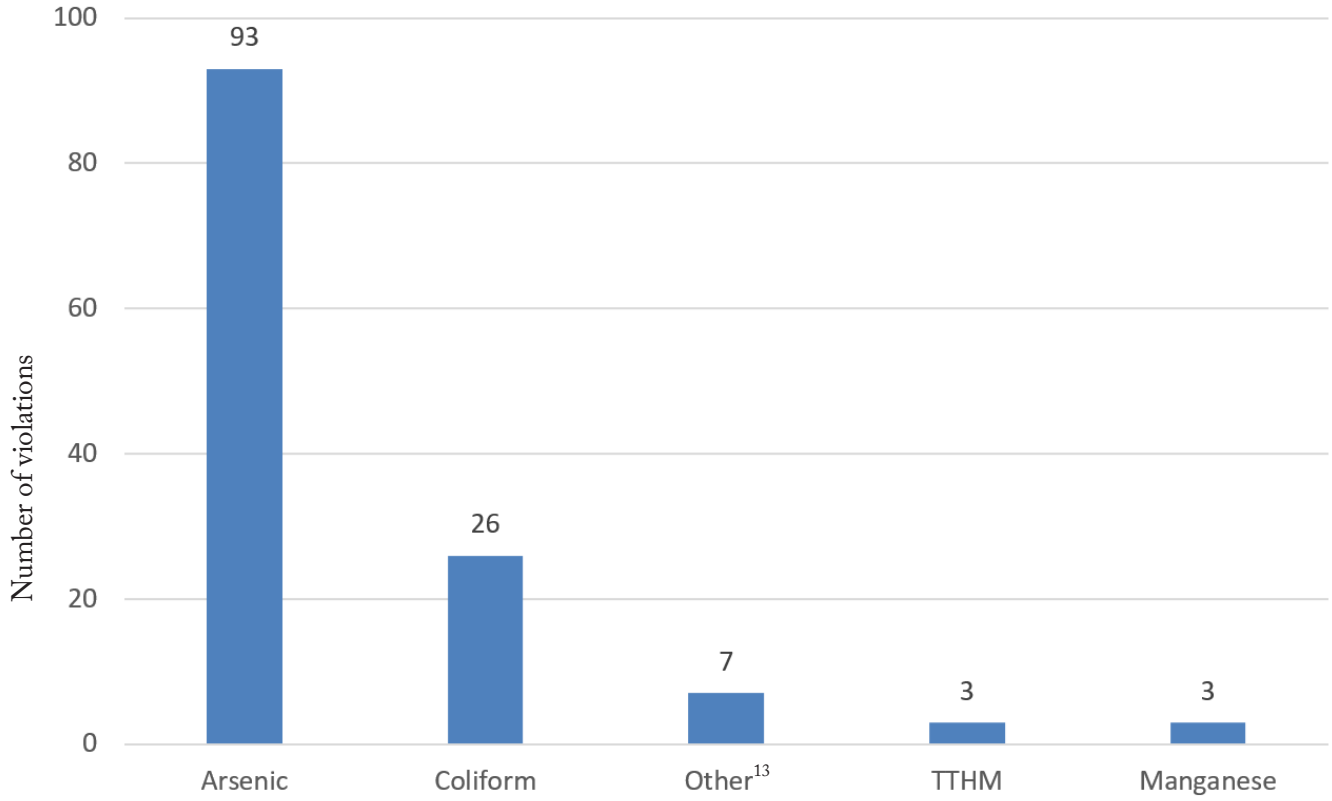
Violations for certain contaminants also occur more frequently than others among Los Angeles County CWS. Figure 10 shows the most common MCL violations incurred by water systems in the last 5 years (2014-2018). Arsenic and Coliform violations occur far more frequently than violations for other contaminants. Arsenic is commonly found in soils, putting groundwater sources particularly at risk for arsenic contamination (Welch et al. 1988). Coliform is a bacterial organism that naturally occurs in the environment and the feces of mammals (U.S. EPA 2017a). While unlikely to cause illness, coliform often indicates the presence of other pathogens in water, which is why coliform testing is a first step to identifying possible contamination. Total coliform bacteria are generally harmless and found in soil or vegetation, so fecal contamination is not likely. However, if total coliform bacteria are entering a water system there is the chance that other pathogens are as well. Fecal coliform bacteria are a subset of total coliform (and includes E. coli) and occur in feces

Figure 9. Map of CWS MCL Violations in the Last 5 Years (2014-2018)



of mammals including humans; this suggests recent fecal contamination which creates a greater risk for contamination from other pathogens beyond total coliform alone (U.S. EPA 2017a). Allaire et al. (2018) examined nationwide total coliform levels and found a higher prevalence of violations in the West and Midwest. This could result from many different factors such as source water quality and state-level regulatory enforcement (Allaire et al. 2018).

Figure 10. Most Common MCL Violations among Los Angeles County CWS (2014-2018)



Monitoring and Reporting Violations

While MCL violations provide the clearest nexus between water quality and system performance concerns, non-health violations such as monitoring and reporting violations can also serve as useful indicators of poor system operation or management. Nationally, non-health violations are more numerous than health violations; 81% of violations incurred by small systems and 68% of violations incurred by large systems in 2015 and 2016 were non-health violations (Irvin 2017). This general trend holds true across Los Angeles County as well, as shown in Figure 8 which compares health to non-health violations from 1991 to 2018. Looking at the monitoring and reporting violations highlights the more recent fluctuation in the number of these violations since around 2008, after a decade-plus of consistently low numbers of annual non-health violations. With the exception of 2018, a small number of systems (less than 20) incur all of the violations each year. Although not necessarily resulting in unsafe water quality, monitoring and reporting violations are included as a risk factor in our performance assessment to indicate systems which may not have adequate system management or communication of mandated information to the public and regulators.

Additionally, there is evidence that monitoring and reporting violations are generally indicative of poorer water quality and correlate with water quality violations (Marcillo & Krometis, 2019). While 49 systems incurred 1-4 monitoring and reporting violations in the last 5 years (2014-2018), only 3 systems experienced 5 or more (two of which were small CWS). One of these in particular, Land Projects Mutual Water Company, had 25 monitoring and reporting violations in the last 5 years in addition to 23 MCL violations.

[13] Other includes one violation each of the following contaminants: methyl tertiary butyl ether, uranium, nitrate, perchlorate, chromium 6, E. Coli, 1,2,3 trichloropropane

Secondary Water Quality, Distributional System and Premise Plumbing Issues

MCL violations represent the most immediate and pressing health concern for drinking water while monitoring and reporting violations are a readily-available proxy for management concerns. However, an additional list of contaminants are assigned "secondary" standards for which compliance by systems is non-binding. The levels set for these 15 secondary contaminants are largely focused on aesthetic concerns like taste, color, and odor (U.S. EPA 2017b).

Secondary water quality issues that do not trigger health violations can still impair system outcomes. Secondary water quality issues—especially distributional system and premise plumbing issues such as aging pipe infrastructure that leads to high levels of secondary contaminants—often result in aesthetic issues such as odor and color which can lead to mistrust of tap water and result in customers relying on expensive alternative sources like bottled water and water stores (Javidi & Pierce 2018; Pierce & Lai, 2019). Poor secondary water quality can still significantly impair Human Right to Water outcomes; thus we included these concerns in our system performance criteria. Further analysis and better data collection on secondary quality should be a next step for future CWS assessment.

Given that these issues are not as strictly regulated as MCLs but are more likely to cause mistrust and tap avoidance, we used the presence of well-documented cases of secondary quality or distributional system issues (e.g., in news stories) as a moderate risk factor for system performance review. In our assessment we incorporate this issue into our review criteria with the measure of sufficient recent news coverage to indicate management or secondary water quality concerns. Well-publicized water system operation challenges like those of Sativa-L.A. County Water District and Maywood Mutual Water Company #2 are identified. These two systems suffer from high levels of manganese, a secondary contaminant which resulted in brown water that customers have struggled with (Wilson 2011; Jennings 2018). Often, poor secondary water quality can result from issues in the distribution system, such as aging pipe infrastructure either at the system level or with premise plumbing at residential sites (Palma 2015). We included known or publicized issues with the distribution system network as an additional moderate risk factor in our system performance review criteria for this reason. Future review of CWS performance would benefit from a more systematic approach to studying secondary water quality issues with better monitoring and reporting.

County-Wide Trends: Affordability

Water affordability is a second essential component of HRW implementation and vital to ensure the health and safety of low-income households. Given the already high cost of living and housing affordability concerns in the region, systems charging high rates for this essential public service pose serious equity concerns. When water is unaffordable, low-income customers may be forced to make difficult tradeoffs that impact health and quality of life. Shutoffs are an extreme result but many households who do not experience a shutoff still struggle with water affordability. Water affordability challenges result in negative HRW outcomes.

LCI's 2015 Los Angeles County Water Atlas showed that households in some systems pay as little $200 per year while comparable households in other systems pay over $2,000 for the same amount of water. To update this analysis, we collected rate data and rate structures for the approximate 119 CWS (serving 80%+ of the county's population) for which we could obtain data in 2019. We then:

a. calculate the county average and distribution of water bills across systems for 12 CCF of monthly household consumption, including comparison to water rates from a previous county-level review (Pierce et al. 2015) and

b. use system-reported data on household water shutoffs to examine the extent of households facing water shutoffs due to their inability to pay CWS water bills

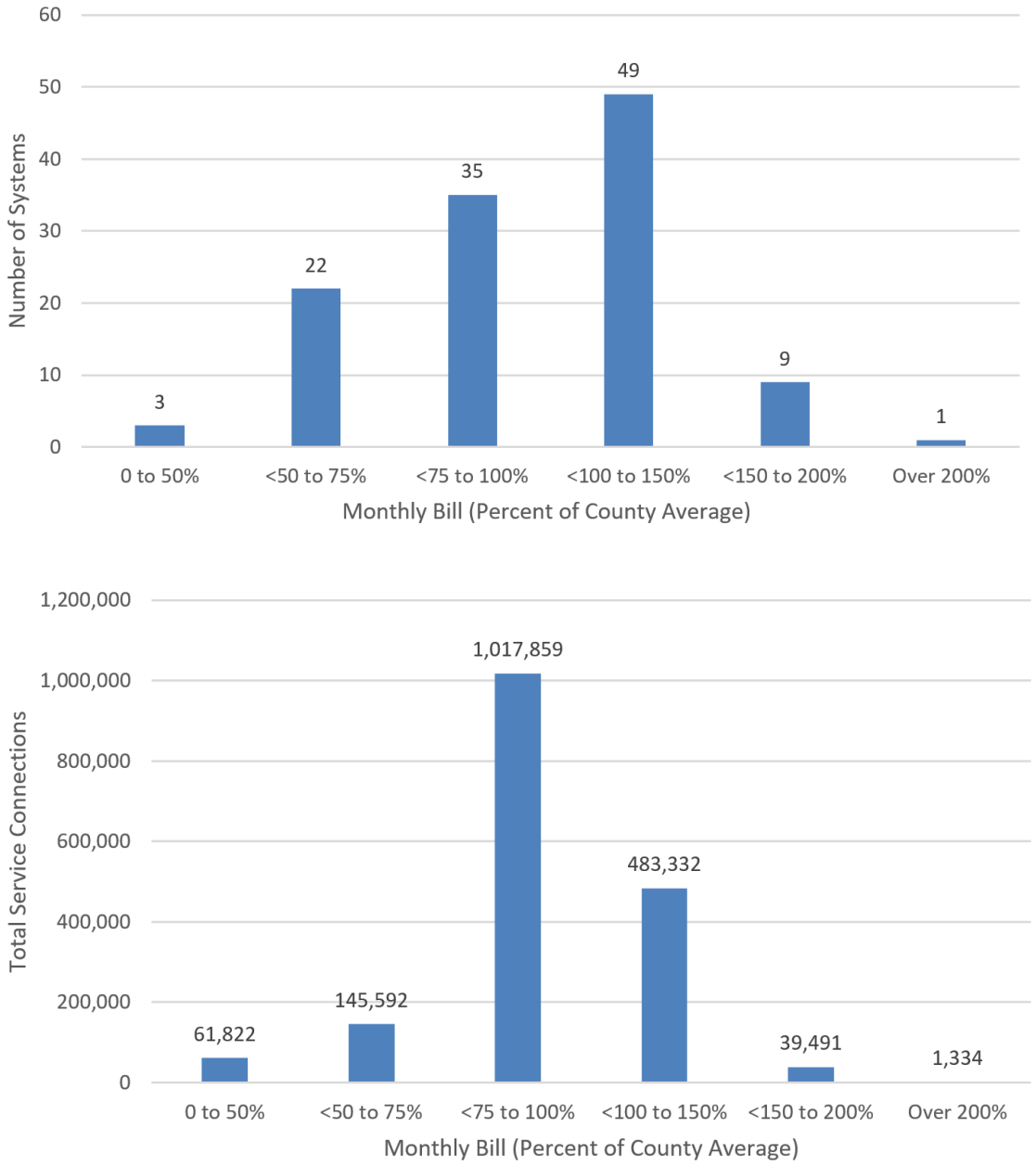
Water Rates in Los Angeles County

Water's retail price significantly affects households—both in terms of managing cash flow and by altering incentives for water conservation and enrollment in needs-based assistance programs. There are four general types of water rate structures: only fixed fees, fixed fee + uniform quantity rates, fixed fee + tiered quantity rates, and only variable rates (either uniform or tiered). An exclusive fixed fee charges customers the same amount regardless of water use; this provides the most revenue stability for water systems but does not incentivize conservation or enable customers to adjust expenditures by altering consumption. Meanwhile, an exclusively variable rate charges customers exactly in proportion to water use, which provides the greatest opportunity for customers to reduce their costs by reducing consumption, but also creates greater revenue uncertainty for water systems.

Our data collection involved calculation of the average household water bill for 12 CCF of consumption at each of the 119 water systems for which data were available in 2019. The calculation aims to include all relevant surcharges and fees which a single family residential customer with the smallest meter size would be required to pay for water service, while excluding any non-water related charges which may be included in the bill. The 12 CCF level provides enough water for a household of four to consume the state standard level of 55 Gallons per Capita Day (GPCD) for HRW implementation along with a modest amount of outdoor irrigation, as outlined in a recent State Water Board report (SWRCB 2019a). The average monthly expenditure for 12 CCF of water in Los Angeles County is $63.27 (Median $61.00).[14] By comparison, our recent study in Orange County identified the average bill for 12 CCF in Orange County to be $53.82 (Pierce et al 2019). This average, however, masks a significant amount of variability in water rates across systems countywide. Figure 11 shows the distribution of expenditures across the county for a customer to consume 12 CCF of water per month, which can range by more than a factor of five, from a low of $25.71 up to $134.07 depending on the system. When graphing by the total service connections served in each price range, the majority of connections pay between 75 and 100% of the county average.

[14] The weighted average monthly water rate based on the number of residential service connections for each system (from the 2019 SDWIS database) in Los Angeles County is $69.25.

Figure 11. Los Angeles County Monthly Water Rates for 12 CCF of Consumption, 2019 (n=119)



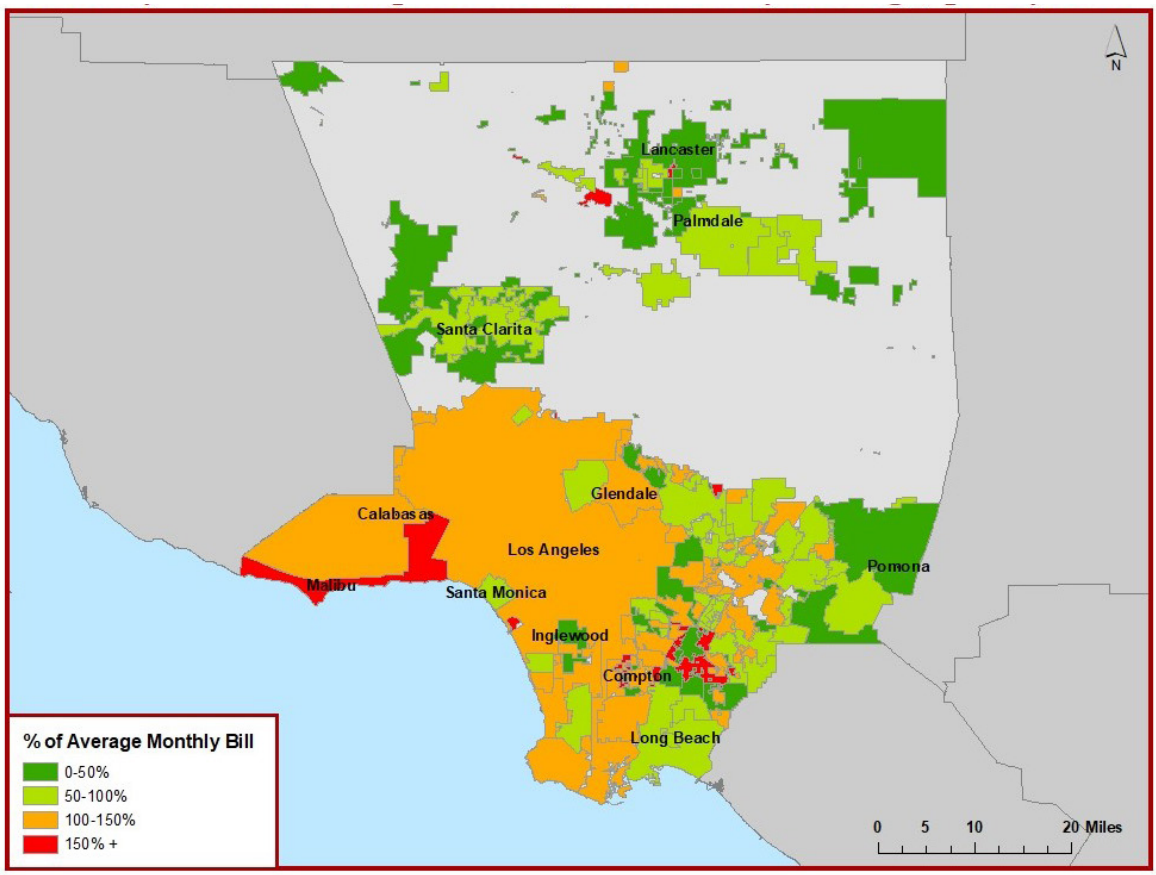
Water rates vary due to internal system decisions and cost constraints, but also due to the different regulatory authorities and respective laws which govern rate-setting by different types of water systems. In California, public water systems are subject to Proposition 218. Approved by state voters in 1996, it restricts raising rates or imposing new fees without public hearings and/or voter approval (Hanak et al. 2014). Perhaps most important to water affordability, Proposition 218 mandates that fees cannot exceed the proportional cost of providing service (Hanak et al. 2014). Despite fears that Prop 218 would effectively prevent them, many public systems have and continue to use tiered pricing to improve water efficiency and conservation through accurate price signals. However, the proportional cost of service requirement does limit some rate structure designs and the opportunity for systems to provide rate-funded low-income affordability assistance. Publicly-owned systems cannot cross-subsidize low-income ratepayers with additional revenues from higher income customers. The passage of Assembly Bill 401 in 2015, however, mandated that the State Water Resources Control Board develop a statewide Low-Income Rate Assistance (LIRA) program, which is currently in development and would provide assistance that potentially overcomes this concern with dedicated statewide funding for low-income customers (AB 401 2015).

Large private water systems, or Investor Owned Utilities (IOUs), on the other hand, are not subject to Proposition 218. Their rates are regulated by the California Public Utilities Commission (CPUC). Large Class A IOUs (with more than 10,000 connections) must submit General Rate Cases (GRCs) to the CPUC which then hosts public hearings and makes recommendations for rates for the next three years (CPUC 2019). Smaller IOUs (less than 10,000 connections) undergo a less formal process and can request a rate increase by filing with the CPUC and notifying customers at least 30 days in advance (CPUC 2019). The CPUC encourages large (Class A) IOUs to implement Low Income Rate Assistance (LIRA) programs (UNC EFC 2017).

This does not mean, however, that these systems do not also have affordability concerns. As seen in Los Angeles County, a mix of public and privately owned water systems have above-average water rates that pose affordability challenges to HRW implementation. We found that the average water rate for public (city, county, and special district) systems was $59.47 (n=68), compared to $54.45 for mutual water companies (n=16) and $74.69 for private IOUs (n=35).[15] While private systems on average have higher water rates, some of the systems with the highest monthly bills are public or mutual; Los Angeles County Waterworks District 29 &80 (Malibu) has the highest bill in the County at $134.07 for 12 CCF of water per month.

As a metric to identify systems for which affordability presents an obstacle to HRW implementation, we established a severe risk factor threshold for necessary expenditure levels 150% above the county average for 12 CCF (See SWRCB, 2019). With the County average at $63.27, this metric identifies systems that charge $94.80 or more for 12 CCF of monthly household water consumption. Ten water systems in Los Angeles County (8% of the 119 systems for which data were collected) surpass this threshold for water expenditures; one system, the Los Angeles County Waterworks District 29 & 80 in Malibu, charges more than 200% of the county average. Figure 12 shows the county CWS' monthly bills for 12 CCF of water consumption, expressed as a percentage of the countywide average, and demonstrates the variability of bills for customers across the county.

Figure 12. Map of Los Angeles County CWS Monthly Water Bills (for 12 CCF consumption)



[15] When weighting each of the three averages by number of connections, we calculate the following: IOUs (n=35) $66.07, Mutual Water Companies (n=16) $62.01, Public (n=68) $70.63.

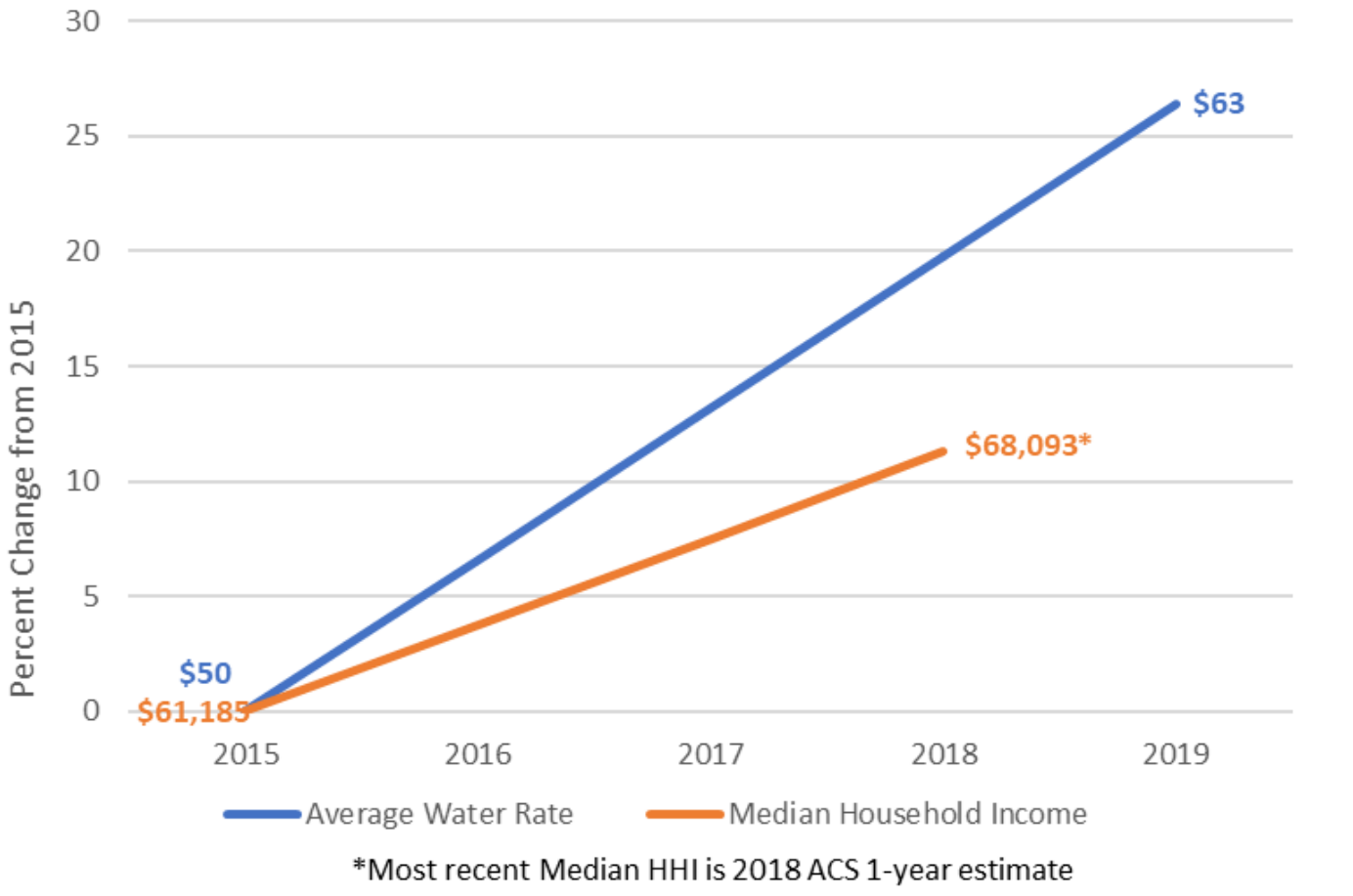
We also compare the current 2019 water rates to those we collected and analyzed in 2015. This provides an understanding of general trends in water affordability across the county over time. The average monthly bill in 2015 was $50[16], indicating that rates increased about 6% per year to result in the 2019 average of around $63. Consumer Price Indices (CPI) data from the California Department of Finance indicate the average percent change in the CPI for the last three years (2015-2018) in the Los Angeles region was 2.43% (CADOF 2019). Thus, the average water rate has generally outpaced inflation, potentially presenting affordability challenges for low-income households that need to balance water consumption with other increasingly expensive essential household expenses. Figure 13 illustrates how water rates also increased more quickly than median household income in Los Angeles County from 2015 to 2019. While median household income only increased 11% from $61,185 to $68,093 between 2015 and 2018, the average monthly water bill increased 26% from $50 to $63 from 2015 to 2019.

The 10 identified systems posing affordability concerns in 2019 range across size and governance types (see Table 3). Five of the 10 are small CWS and 5 are large CWS. In terms of governance and water system type, 6 are private Investor Owned Utilities (IOUs), 2 are County systems, and 2 are Special Districts.

Consequences of Affordability and Water Shutoffs

While water shutoffs are not as concentrated, nor experience the same media visibility, as in some cities like Detroit and Baltimore, they still present a concern in Los Angeles County. Data on shutoffs due to non-payment collected in 2018 by the State Water Board from systems on the Electronic Annual Report form provides a rough overview of some of the affordability challenges to HRW implementation. Not all systems provided data, suggesting the prevalence of water shutoffs may be larger than reported. Additionally, these questions were asked preliminarily in 2017 and 2018 on the EAR

Figure 13. Percent Change in Average Monthly Water Rates and Median Household Income, Los Angeles County (2015 to 2018/2019)



[16] The average before rounding, for the 120 systems that provided 2015 data, was $49.98, with a median of $46.53.

in advance of implementation of SB 998. As SB 998 becomes enforceable in 2020, water systems with more than 200 connections will be required to report shutoff information in the EAR and the questions will be updated (Discontinuation of Residential Water Service 2018). Thus, existing EAR data on shutoffs represents an emerging metric and more conclusive information will come in EARs after the implementation of SB 998 in 2020. Nonetheless, preliminary analysis of 2018 data can identify some trends for the county.

Among 86 large CWS providing data in 2018, a total of 24,954 occupied single family residential connections and 656 occupied multifamily residential connections experienced one water shutoff due to nonpayment. Perhaps more concerning, and indicative of recurring and persistent water affordability challenges, 82 systems in the county reported 8,441 occupied single family and 219 occupied multifamily connections that were shut off more than once in 2018 due to nonpayment. Table 4 provides statistics on the number of recurrent shutoffs per system. The large difference between the average and median number of recurrently shutoff connections highlights that a small number of systems report a high number of shutoffs compared to many systems in Los Angeles County experiencing very few or no shutoffs.

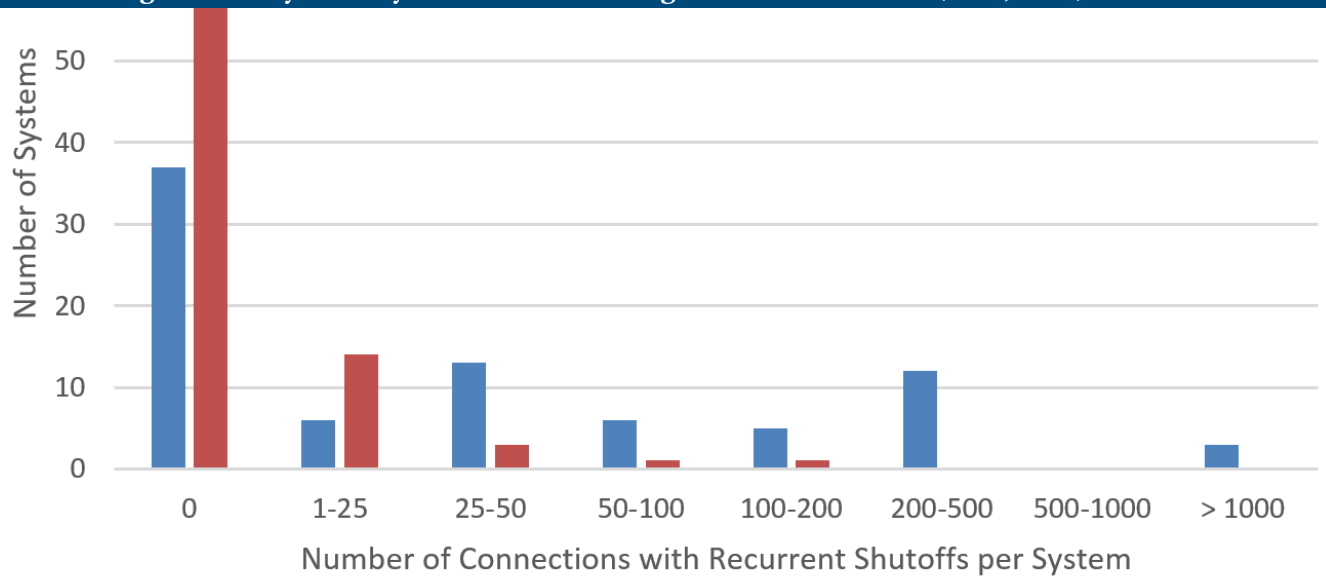
This is also demonstrated in Figure 14, which shows the systems in Los Angeles County categorized by the number of recurrent shutoffs that occurred in 2018. Only three systems account for 63 % (5,283) of the single family connections experiencing recurrent shutoffs in 2018. Each of these systems had more than 1,000 occupied single family residences with recurrent shutoffs due to nonpayment in 2018 (1,197, 2,298, and 1,788 respectively17). These shutoffs suggest that some households repeatedly face challenges with paying for water. This likely indicates low levels of income and high water rates that are sufficiently challenging to result in nonpayment and recurring shutoffs throughout the year.

Table 4. Recurrent Shutoffs due to Nonpayment in Los Angeles County Large CWS (2018, n=82)

	Occupied Single Family	Occupied Multifamily
Average Number of Connections with Recurrent Shutoffs per System	102.94	2.67
Median Number of Connections Experiencing Recurrent Shutoffs per System	6.51	0
Total Number of Connections Experiencing Recurrent Shutoffs in 2018*	8,441	219

*This gives the number of connections that had water shutoff more than once during 2018- it does not individually tally each shutoff occurrence

Figure 14. Los Angeles County CWS by Number of Recurring Residential Shutoffs (2018, n=82)



[17] LA County Waterworks Districts 4&34 Lancaster (8,323 shutoffs), Palmdale Water District (6.268 shutoffs), and Suburban Water Systems San Jose Hills (4,224 shutoffs).

County-Wide Trends: Accessibility

The final HRW dimension which we analyze is accessibility: whether households have a sufficient quantity of water reliably available and accessible. This is the most difficult HRW aspect to measure at the system level. We focus on the quantity of water available to and used by the average household within each system across the county, as well as system-level support to provide low-income households with opportunities to conserve.

There is reason for concern on both sides of the water quantity management coin, potentially that some households may have insufficient access to a volume of water to meet the current state indoor standard of 55 GPCD while other households may use excessive amounts of water. The need for urban conservation has been recognized for decades but has only recently been enshrined in state legislation in the "Making Water Conservation a California Way of Life" policy initiative (SB 606 (2018); AB 1668 (2018)).

For the purposes of evaluating water systems in Los Angeles County, accessibility can be interpreted as ensuring a reliable, sufficient but not excessive supply to a system's customers. Our analysis entails assessing systems' water production, primary water sources, and self-reported water source reliability.

We use the following data sources:

- Monthly production figures of large and small systems compared to their residential population in 2017[18]
- Monthly reported residential gallons per capita day consumption from Urban Water Suppliers in 2019
- New reporting on expected water shortages, groundwater levels, and the presence of system level conservation measures and leak detection programs in 2017

Water Production

During the drought, both large and small systems were asked to report monthly water production and other conservation data to the State Water Board. By comparing these production figures from the 2017 dataset, in gallons, to the reported system populations we can identify systems producing less than the amount considered sufficient by the Human Right to Water. This sufficiency level comes from the state standard of 55 GPCD multiplied by a system's reported residential population and the 31 days in the month for both January and July 2017 (a winter and summer month respectively).

Of the 154 systems reporting non-zero production[19] in January 2017, 84% (130 systems) produced a sufficient quantity of water for their population (see Table 5). Of the 24 systems with insufficient production, 11 of them produced 80-99% of the required amount. It is possible these systems were not underperforming in accessibility, due to potential factors such as inaccurate self-reported populations or production values and potential seasonal populations. In order to use this indicator as a moderate risk factor in system performance assessment, we only identify systems with monthly water production less than 80% of the calculated required amount.[20] A total of 13 systems (8%) reported producing less than 80% of the HRW level sufficient for their residential population in January 2017.

While some systems reported producing an insufficient quantity for their reported populations in both months, fewer systems produced insufficient quantities of water during the summer (July 2017) than winter (January 2017).[21] Of the 151 systems reporting non-zero water production in July 2017, only 10 systems (6.6%) produced less than 55GPCD for their reported residential population, and only 8 of these (5.3%) produced less than 80% of the required amount. These insufficiently producing systems are most concerning when they face other risk factors such as small system size, constrained resources, or reliance on a single or contaminated groundwater source.

[18] The last year for which data are publicly available for large and small systems

[19] The spreadsheet did not list all CWS in Los Angeles County, particularly very small systems, and some systems were listed but gave zero values for water production and deliveries. These systems reporting zero production were excluded from analysis, as the zero values were interpreted as not providing data (given that actual zero production or delivery is unlikely). In the data, water production signifies 'water produced, purchased, and sold'. Differences in water production and water delivery to customers may signify water loss in distribution.

[20] Systems were only given this moderate risk factor if they were small CWS reporting <80% production levels in January and/or July 2017.

[21] All 10 systems self-reporting an insufficient level of production for their reported residential population in July 2017 also reported an insufficient level of production in January 2017.

Table 5. Sufficiency (55GPCD) of Monthly Water Production in 2017		
	January 2017 (n=154)	July 2017 (n=151)
Sufficiently Producing Systems	130 (84.4%)	141 (93%)
Systems Producing 80-99% of Sufficient Quantities	11 (7.2%)	2 (1.3%)
Systems Producing <80% of Sufficient Quantities	13 (8.4%)	8 (5.3%)

Excess Water Use

Since 2014, Urban Water Suppliers22 have reported monthly water production and conservation figures to the State Water Board. This publicly available data includes monthly residential gallons per capita day consumption figures on the 15th of each month (SWRCB 2019d). This data includes both system reported figures and values calculated by the State Board using an established methodology (See SWRCB n.d.). Data were obtained for 74 Los Angeles County CWS (Urban Water Suppliers) that reported R-GPCD figures for December 15th through January 15, 2019 and for 71 systems for May 15th through June 15th, 2019.23 Table 6 details the average R-GPCD reported by these systems during these months of 2019. We compared systems to the countywide average and identified systems with consumption above 150% and 200% of the average as a metric for potentially excessive water use. As expected, overall average consumption is lower in the winter month than the summer and both months have an average greater than the minimum HRW threshold of 55 GPCD. Only 4 systems had consumption over 150% of the average in January while 13 systems consumed more than 150% of the average in June. Only 2 systems, Quartz Hill Water District and Valley Water Company, had residential consumption over 200% of the average (265 and 290% respectively). This suggests concerns about the effectiveness of residential conservation during summer months in these two systems and may also suggest the existence of leaks in the water distribution network that can lead to further water waste. Overall, however, a significant effort by urban water systems during and after the drought to improve residential conservation means consumption has declined over time and significant strides have been made in efficiency and reduced use across the county.

Table 6. System Reported Residential Gallons per Capita Day Consumption (2019)		
	January 2019 (n=74)	June 2019 (n=71)
Average R-GPCD	72.51 GPCD	99.35 GPCD
Systems Above Average	29	23
Systems > 150% of Average	4	13
Systems > 200% of Average	0	2

[22] Urban water suppliers are public or private systems that provide potable water to more than 3,000 end users or supply more than 3,000 acre-feet of potable water annually (CA DWR 2016).

[23] Four systems only had reported data available until 5/15/2019- this reporting month (4/15-5/15/2019) was included in place of the missing 6/15/2019 data for these 4 systems in the June 2019 average. Four additional systems were in the dataset but only reported until 2017 or 2018 and were not included in this analysis.

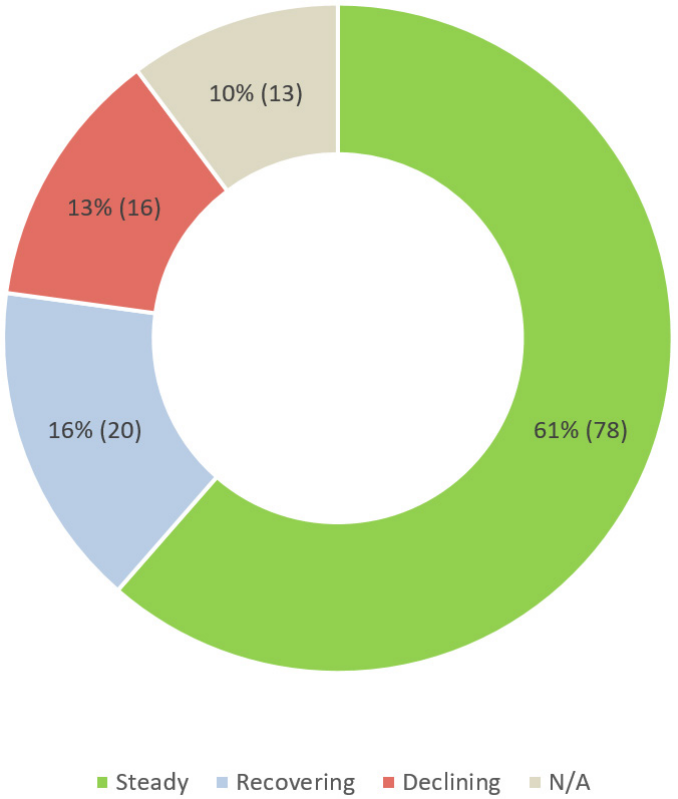
Water Source Reliability: Groundwater Well Levels and Shortages

In addition to the quality concerns of reliance on groundwater, the quantity and reliability of groundwater available to systems can also impact accessibility. As part of the data collected on conservation by the State Water Board in 2017, systems were asked to report on the status of their groundwater wells.

As shown in Figure 15, Los Angeles County systems generally do not report major concerns regarding groundwater well levels. The majority of the 127 systems that answered this question, 78 systems (61%), had steady well levels and 20 (16%) saw recovering well levels after the drought. Only 16 systems (13% of reporting systems) experienced declining groundwater levels in 2017. This represents a moderate risk factor for system accessibility in our system performance assessment. The other 13 systems replied that the question was not applicable (10%), indicating they did not have groundwater wells to report on. Figure 16 shows the distribution of systems across the county with differing reported groundwater well levels.

Most concerning are the two small water systems[24] who reported declining well levels and also projected water shortages for 2018. Overall, very few systems self-reported concerns with water accessibility to the State Board in 2017 and 2018. Only five systems predicted water availability shortages for 2018, and one system each reported water shortfalls in 2017 and anticipated mandatory water rationing in 2018.[25]

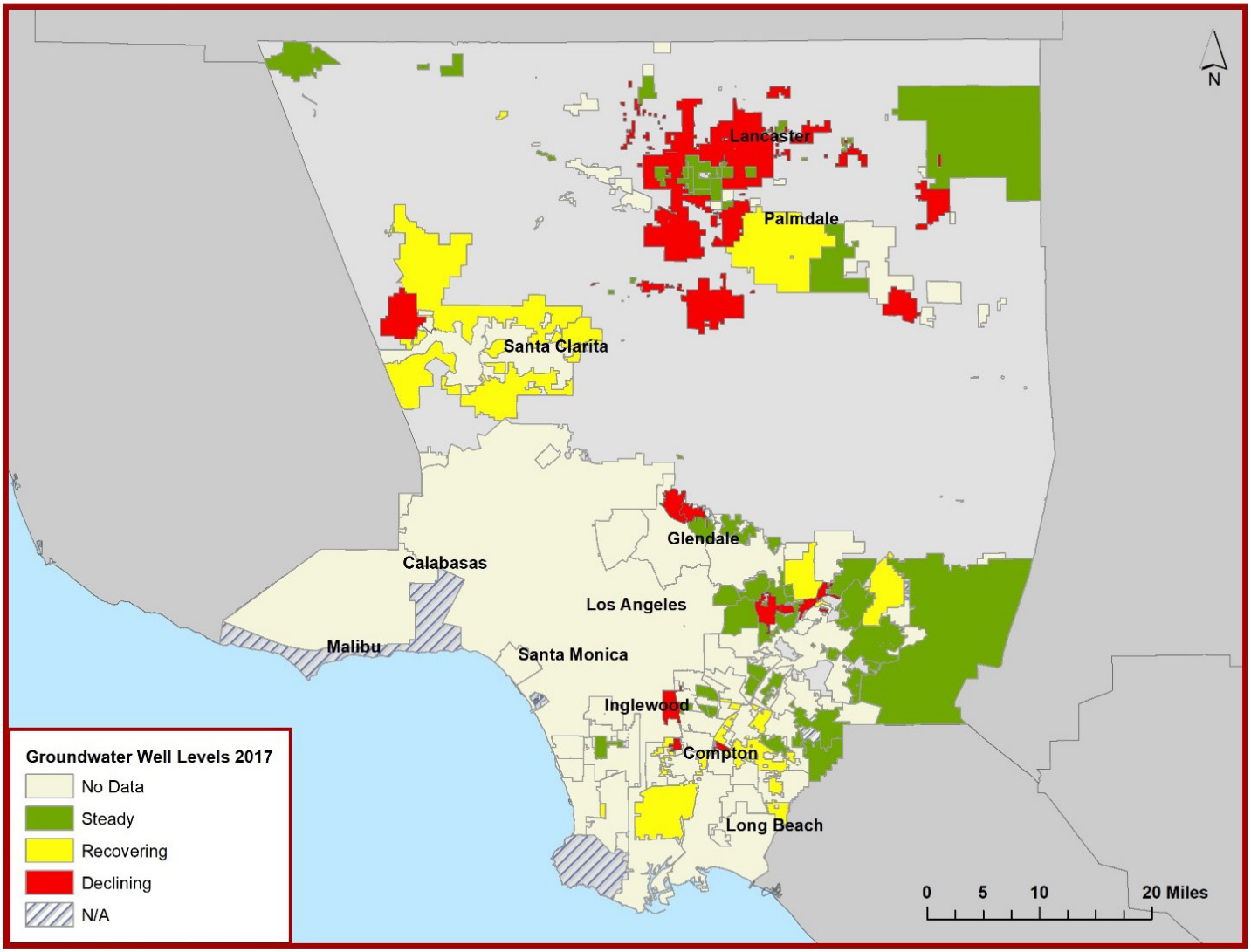
Figure 15. 2017 Groundwater Well Levels (n=127)



[24] Rurban Homes Mutual Water Company and Sleepy Valley Mutual Water Company

[25] Azusa Light and Water (Large CWS), Rurban Homes Mutual Water Company, Sleepy Valley Mutual Water Company, SPV Water Company, and Sterling Mutual Water Company are the five systems (4%) which predicted water shortages in 2018. SPV Water Company reported a shortfall of 2 million gallons in 2017 and Hemlock Mutual Water Company anticipated the need for mandatory water rationing in 2018. Hemlock is one of the systems which produced insufficiently in both January and July 2017.

Figure 16. Map of Groundwater Well Levels by System, 2017



Reviewing Current System Performance

We next brought together the performance criteria reviewed above to assess each community water system in the county's ability to deliver all three HRW outcomes. These criteria help to identify systems which need future investment or support to ensure the Human Right to Water for all Los Angeles County residents.

A review system was developed (see below) to categorize systems based on performance across HRW dimensions. Quality violations, directly linked to unsafe water served to customers, were identified as the main variable of interest. In particular, all systems with quality violations were listed as of severe concern or failing. The exact category depended on the extent of violations in the last 5 years and various other risk factors.

For those systems without quality—or extensive monitoring—violations, classification depends on the presence of risk factors in affordability, TMF, and accessibility/reliability categories. Based on the number and severity of these risk factors, systems without quality violations but some risk factors could be categorized as being of moderate, limited, or minimal cause for concern.

On the other hand, the 98 systems (49% of all systems) with no quality violations within the last 5 years or any of the identified risk factors were labeled as, "no apparent cause for concern." Not all systems had enough data on each metric to allow for performance review; these systems are labeled as 'insufficient data'. Small systems in particular are not subject to the same reporting requirements as large systems. See Appendix: Classification of Los Angeles County CWS for the full list of systems and their resultant classifications.

The State Water Board also maintains a Human Right to Water List to identify CWS statewide that are in violation at any point in time. It is based on primary water quality (the systems on the list are those which currently have MCL violations). The list contains seven systems in Los Angeles County; six are the same systems listed above with more than 10 MCL violations in the last 5 years while the final system is East Pasadena Water Co. (listed as a system of moderate concern in our classification). This overlap between the systems of concern in our performance review and those on the state's list reinforces the value of our assessment in identifying particularly underperforming systems. Our assessment incorporates additional criteria beyond water quality that also influence system performance, risk factors for both the HRW dimensions (quality, affordability, and accessibility/reliability) and underlying TMF capacity. We plan to update criteria and weighting over time as more and better information is available, and new policies are put in place.

Performance Review System

Insufficient Data- Small systems for which not enough data were available to accurately classify the system (missing data on 2-3 risk factors and not already classified as failing or severely underperforming for quality violations). Excluding these systems is a conservative approach; it both avoids labeling a system with unknown status as 'well performing' or 'poorly performing' simply because nothing was reported, although we would expect systems reporting less data generally to be lower-performing.

Acute Performance Concern/Failing- systems with 2 or more MCL violations in the last 5 years need immediate assistance. Systems within this category with additional underperformance in other categories are the highest priority for interventions

Severe Performance Concern- Systems with at least one quality violation (or 3+ monitoring violations) and 1 severe risk factor or two moderate risk factors noted below

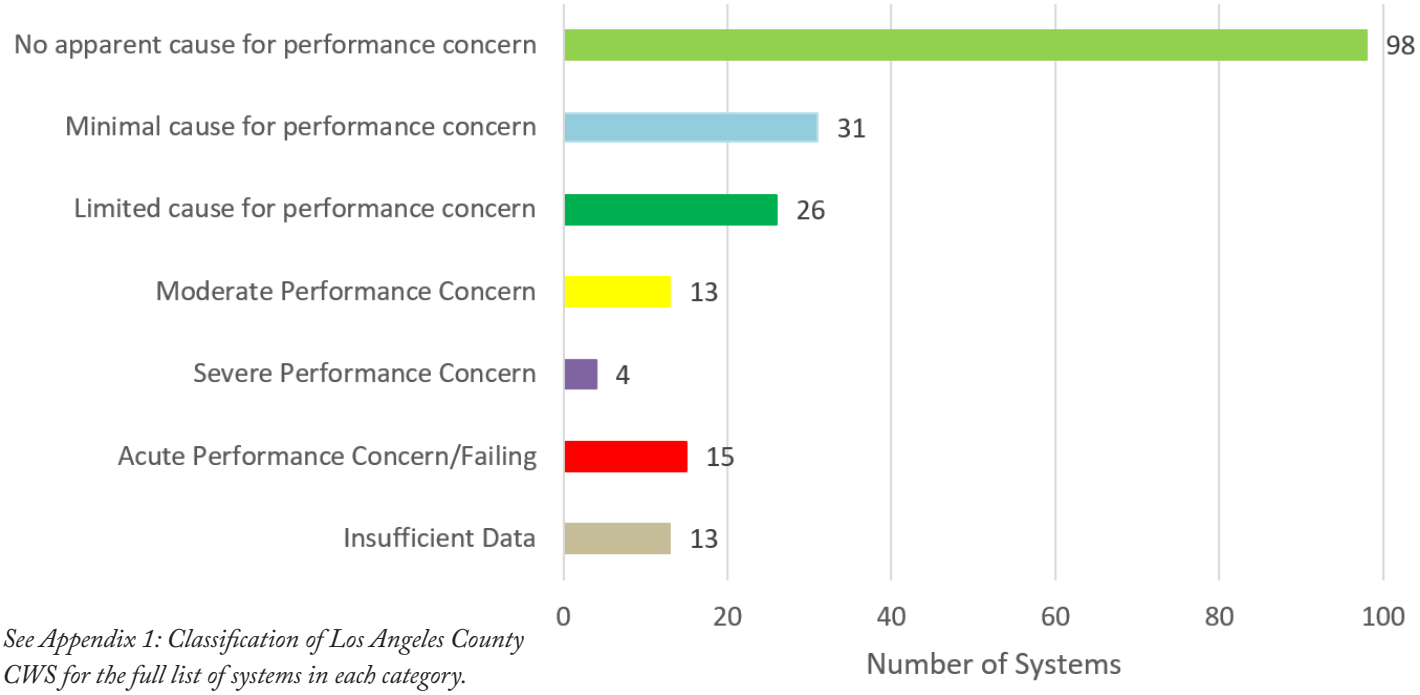
Moderate Performance Concern- Systems with one quality violation (or 3+ monitoring violations) and no severe risk factors or at most 1 moderate risk factor

Limited Cause for Performance Concern- Systems with no quality violations (and less than 3 monitoring violations) but one or more severe risk factors or two moderate risk factors

Minimal Cause for Performance Concern- Systems with no quality violations (and less than 3 monitoring violations) but at least one moderate risk factor

No apparent cause for performance concern- Systems with no risk factors, quality violations, or monitoring and reporting violations.

Figure 17. Los Angeles CWS Performance Classification (n=200)



See Appendix 1: Classification of Los Angeles County CWS for the full list of systems in each category.

Performance Review Methods and Data

Thresholds were established for each risk factor for each of the three HRW dimensions (quality, accessibility/reliability, affordability) and the TMF-related metrics. We developed the following thresholds based on existing criteria for evaluating California water systems (see Feinstein 2018) and the data available for Los Angeles County systems on each metric.

List of severe risk factors:

i. Affordability- Average necessary expenditure for household water bill (12 CCF of consumption) is 150% or more of the countywide average (n=10 systems)

ii. Technical/Managerial- Presence of a trained water treatment system operator below the required level for the system type (n=4 systems)

iii. Accessibility- Production less than 80% of the amount required for 55GPCD for reported residential population or system predicted shortages and classification as a small CWS (n=14 systems)

List of moderate risk factors:

i. Quality- Systems experiencing sufficient, recent distributional system issues to raise widespread water quality concerns (n=4 systems)

ii. Technical/Managerial- 1 or more monitoring and reporting violations in the last 5 years (n=52 systems) or sufficient, recent news coverage of management concerns (n=2 systems), no certified treatment operator of any level present (if none are required) (n=12 systems)

iii. Accessibility- Declining groundwater well levels (n=16 systems)

Severe risk factors were selected as those likely to cause major impacts to a system's ability to meet HRW standards. In particular, systems with very high water bills as compared to the county average, lacking expertise in water treatment and system management, and producing volumes of water too low to sufficiently accommodate their customer population were deemed as at severe risk.

The moderate risk factors were those which might likely contribute to negative HRW outcomes but did not necessarily directly indicate poor system performance (e.g. monitoring and reporting violations for quality) or which were based on non-traditional sources of data (e.g. news reports of poor system management). Declining groundwater well levels were deemed a moderate risk factor, given that they signify vulnerable water supplies but are not indicative of currently inaccessible or insufficient water provision.

Additional factors were analyzed, but not listed as risk factors due to insufficient data. One of these is system operating ratio (from the most recent three years available for each system) of less than 1, indicating operation at a loss with revenues less than expenses. The other is reliance on groundwater, including systems with primary groundwater sources (according to SDWIS).

System Performance Outcomes

As seen in the general county trends for quality, affordability, and accessibility, the majority of CWS in Los Angeles County continue to reliably provide sufficient, safe water to their customers. Of the 200 systems with sufficient data to assess, 98 systems (49%) were classified with no apparent cause for performance concern.

Additionally, 31 systems (16%) had minimal cause for performance concern. These systems also perform well in terms of HRW outcomes, although they experience one risk factor which may cause some future concern for system operations. For example, the city-run water system for Signal Hill incurred no MCL violations or severe risk factors but did have 1 M&R violation in the last 5 years. The final category for systems without quality violations was limited cause for performance concern. The 26 systems (13%) in this category generally performed well enough in terms of primary quality (no MCL violations and less than 3 M&R violations in the last 5 years), but did have at least 1 severe or 2 moderate risk factors. For example, the West Valley County Water District did not incur any MCL violations in the last 5 years, but did exhibit a severe risk factor that raises concern for future system performance (having a certified treatment operator below the required level in 2015).

The next category, 'moderate performance concern', contained 13 systems (7%). These systems received 1 MCL or 3 or more monitoring and reporting violations in the last 5 years but had no risk factors or 1 moderate risk factor. Some of these systems are large and therefore likely have higher TMF capacity which reflects less concern than the severe concern systems in the next category.[26]

More concerning were those systems which were classified as systems of severe performance concern or as failing. These systems (19 total or 10% of systems) warrant additional consideration when assessing potential interventions or investments to improve HRW outcomes in the county. Only 4 systems (2%) were labeled as severe concern. But 15 systems (8%) are failing and thus represent an acute performance concern, with more than 2 MCL violations in the last five years; many of these systems also experienced other risk factors. Nearly all acute concern systems are small CWS.[27]

Particularly problematic were the 6 systems with more than 10 MCL violations within the past 5 years: Winterhaven Mobile Estates, The Village Mobile Home Park, Mitchell's Avenue E Mobile Home Park, Mettler Valley Mutual, Land Projects Mutual Water Company, and Lancaster Park Mobile Home Park. These systems consistently fail to provide safe water to customers and are repeatedly out of compliance with the Safe Drinking Water Act, suggesting the necessity for intervention or assistance. All six of these systems are small CWS and the majority are mobile home parks, both of which are system types most at risk for quality concerns and low TMF capacity (Pierce & Gonzalez 2017). Five of these six systems[28] recently reached settlements with the U.S. EPA regarding continued arsenic MCL violations in August 2019 (U.S. EPA 2019b). Four of these systems will be working with Los Angeles County, and Land Projects Mutual will work with the State Water Board to upgrade system operations, infrastructure, and water sources to reach compliance by 2021 or 2022 (depending on the system). Thus, many of the systems with the most extreme HRW concerns, particularly for water quality, have already been identified as needing government interventions or assistance.

As noted above, certain systems did not have sufficient data to classify according to the classification criteria, and thus require future review. In particular, small systems missing data to determine the presence of 2-3 risk factors, but without enough quality violations to be classified as failing or severely underperforming, were flagged as having 'insufficient data'. A total of 13 systems (7%) fall into this category.

[26] For example, the City of South Gate's city-run water system incurred 7 M&R violations in the last 5 years but is a large CWS that exhibited no other risk factors in our assessment process. Additionally, LADWP is classified into this category but likely presents less concern than its classification suggests. LADWP received 1 MCL violation and 2 monitoring and reporting violations in the last 5 years, but is by far the largest system in the county with high TMF capacity system, it will likely continue functioning well and address any emerging quality or management concerns in the future

[27] The city of La Verne is the only large CWS in these two categories. La Verne experienced 2 MCL violations in 2017 but may still be considered lower risk due to its higher TMF capacity and ability to address treatment issues as a large CWS.

[28] Winterhaven Mobile Estates, The Village Mobile Home Park, Mitchell's Avenue E Mobile Home Park, Land Projects Mutual Water Company, and Lancaster Park Mobile Home Park

Solutions for Systems of Acute and Severe Performance Concern

For those systems identified as failing or of severe concern, additional spatial analysis enables us to prioritize interventions and suggested solutions. Geographic location, and therefore proximity to better-performing systems, determines whether consolidation or standalone investment is the recommended solution. We created three categories of these systems of acute or severe concern, each of which has its own suggested priority intervention.

Group A: Small systems which, due to their spatial isolation, can only continue to operate in a standalone fashion.

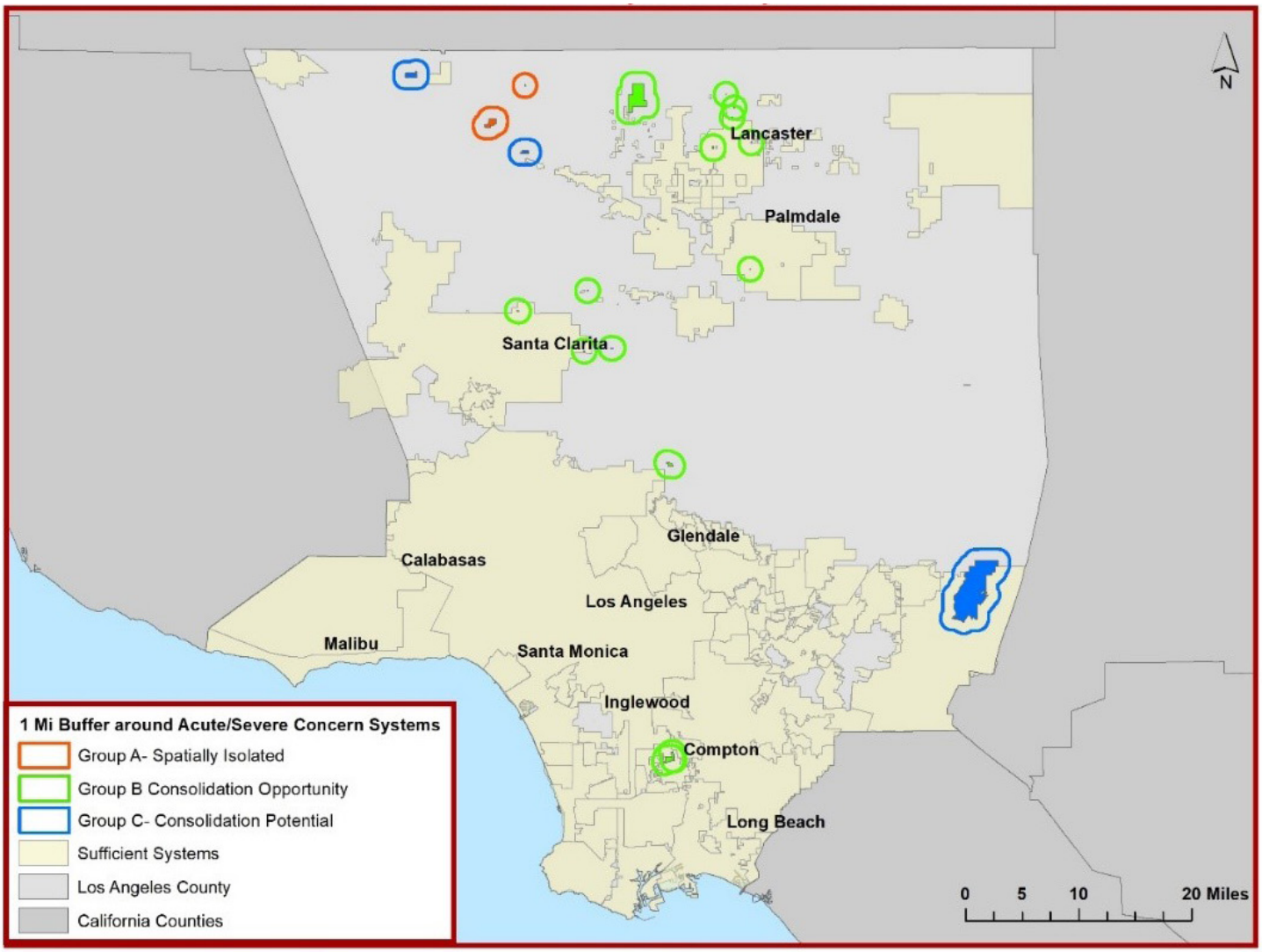
Group B: Small and medium sized systems which would best serve their customers by being physically or operationally-consolidated with one or more other nearby water systems.

Group C: Small and medium sized systems which need regional or state funding consideration and application support to continue to operate satisfactorily in a standalone fashion, but do not fit within the above groups.

To delineate between candidate systems for Groups A, B and C, we first use ArcGIS to map the boundaries of all systems in the county. We identify which small systems are not within the boundaries of, or in close spatial proximity to, medium or large systems, and which are in unincorporated County area (Group A). Underperforming systems which are also spatially isolated are a high priority for intervention in the form of regional or state funding assistance for capital improvements or potential operating and maintenance costs. We next identify which small or medium sized systems are failing or of severe concern and are within the boundaries of, or in close spatial proximity to, sufficiently performing medium or large systems which might reasonably take on their operation—contingent upon receiving state or regional financial assistance to do so (Group B). Candidate systems for Group C are those which are still of acute or severe concern and thus likely need regional or state funding or support but which do not fit into Groups A or B.

Using ArcGIS, buffers of 1, 3, and 5 miles were created around the target water systems and the intersect tool was used to find water systems whose boundaries were partly or wholly contained within the buffers. Notation was made for systems of limited concern or moderate concern, for whom consolidation with a severe or acute concern system may not sufficiently improve HRW outcomes. Systems with at least one system of minimal or no apparent concern within 3 miles were classified as Group B. Systems with no sufficient systems within 5 miles were classified as Group A. Systems with only systems of limited or moderate concern within 3 or more miles were classified as Group C, along with large systems for whom consolidation may not represent the most likely solution. Figure 18 shows the systems of acute and severe concern in Los Angeles County according to their potential intervention group (A, B, or C).

Figure 18. Map of Acute and Severe Concern CWS by Suggested Intervention Type



Sufficient systems are those scored as no apparent concern, minimal, or limited concern.

Table 7 lists the systems analyzed in this analysis with their assignment to groups A, B, and C. Only 2 systems fall into Group A and are sufficiently spatially isolated to require continued standalone operation. The 14 systems in Group B are small and medium sized systems which could be consolidated with nearby water systems to improve operational outcomes. Three systems are in Group C and would likely need regional or state funding consideration and support to operate satisfactorily but do not fit into Groups A or B. The first two of these systems, The Oaks and Mettler Valley Mutual, are close to other systems but these systems are small and of limited concern (as opposed to minimal or no concern) and thus may not be sufficiently high performing to suggest consolidation alone will improve outcomes. The third, La Verne, is a large system, which suggests that it may require a different solution to the consolidation that is suggested for small and medium systems in this analysis.

Table 7. Classification of Acute and Severe Concern CWS by Potential Intervention	
Group A (Spatially Isolated)	Bleich Flats Mutual Winterhaven Mobile Estates
Group B (Consolidation Opportunity)	Alpine Springs Mobile Home Park Clear Skies Mobile Home Ranch Lancaster Park Mobile Home Park Lancaster Water Company Land Projects Mutual Water Company Los Angeles Residential Community Lynwood Park Mutual Water Company Mitchell's Avenue E Mobile Home Park Oak Grove Trailer Park Rivers End Trailer Park Sativa-LA County Water District The Village Mobile Home Park Valhalla Water Association White Rock Lake RV Park
Group C (Consolidation Potential)	The Oaks, Mettler Valley Mutual La Verne (City)

The majority of severe concern and acute concern/failing systems (14 of 19 systems or 74%) are small systems located spatially proximate to other systems currently operating with minimal concern for HRW outcomes. These systems may be good candidates for consolidation to improve performance. The few systems that are currently spatially isolated from sufficiently-performing systems may require funding or other interventions to continue standalone operation. This is purely a spatial analysis which only considers the location of systems, but other factors may be essential to determine whether consolidation is appropriate for a system. For example, as noted earlier, when the EPA and County began working with 5 poorly performing systems to improve quality outcomes they determined consolidation would not be the appropriate solution (U.S. EPA 2019b). Three of these systems in our analysis—Village Mobile Home Park, Land Projects Mutual, and Lancaster Park Mobile Home Park—are located within 1 mile of an existing system and thus fall into Group B of our classification (consolidation potential). Appendix 2 lists the systems located within the 1, 3, and 5 mile boundaries of each of the 19 analyzed systems.

While our analysis illustrates one major factor in system solutions, spatial proximity to other systems, other engineering, political and economic factors may be important to determine the most appropriate solutions for failing or poorly performing CWS. As noted earlier, five failing systems identified in our performance review are already working with the EPA, Los Angeles County, and the State and Regional Water Boards to address persistent quality violations (U.S. EPA 2019b). In these cases, consolidation has not yet been pursued, as the agencies have identified other methods and solutions to pursue with the systems. More research is needed regarding factors that determine when the potential for consolidation is realizable in a particular case.

Next Steps for Performance Review

In addition to updating this analysis over time, we have identified some metrics for which the data are not yet ready to be incorporated in a county-wide performance review framework. As new data becomes available, existing metrics may also change or improve. Below, we outline four potential moderate risk factors which may be included in future county-wide reviews.

Financial Capacity

We compiled available data on annual total system expenses and revenues from a variety of financial sources which we identified (see Data & Methods section). This data were used to calculate simple operating ratios (expenses/revenue). Some systems lacked this data and not all systems had data from the same year(s). Due to the incomplete nature of the data, we elected not to include operating ratio as a risk factor in our performance review criteria.

Water system revenues and expenses have the potential to fluctuate from year to year given changes in expenses such as infrastructure investments or changes in revenue from changing water consumption (especially in times of drought). Thus, a single year operating ratio is not an ideal metric to assess the financial capacity of systems. We utilized a three year average from the most recent three years of consecutive data available for each system. Most mutual systems provided data from 2014-2016 while most cities and special districts provided data from 2015-2017. IOUs, which report financial data to the CPUC, were excluded from this analysis because some of their financial data reporting aggregates numerous separate systems under the same ownership. The general trends found in our data on the other system types are still included here as a preliminary indicator of the potential to assess the TMF of CWS, which we will refine as additional or more consistent data become available.

We calculated operating ratios as total expenses divided by total revenues; systems with a ratio of less than one operated at a loss for that year. The ratios of the three most recent years of data available for each system were then averaged to obtain a final metric. For the 106 CWS with available financial data, 78% of systems had ratios above 1. While a limited metric, this suggests most systems are not operating at a loss. [29] Future financial analysis may consider depreciation and the existence of reserves in the calculation of operating ratios to provide a more detailed picture of water system finances. Given the increasing pressures of ageing infrastructure, increasingly stringent quality and treatment standards, and rising costs of water, our initial findings of positive operating ratios may not necessarily ensure long term TMF capacity.

As additional data become available, more detailed assessment of county level trends in system TMF capacity could be undertaken. This is an important area for future study given the strong links between TMF capacity and system performance (Balazs & Ray 2014). Even if a system is not currently underperforming, poor TMF capacity could suggest future challenges in HRW implementation that may result from declining resources or technical expertise.

Incomplete Plumbing

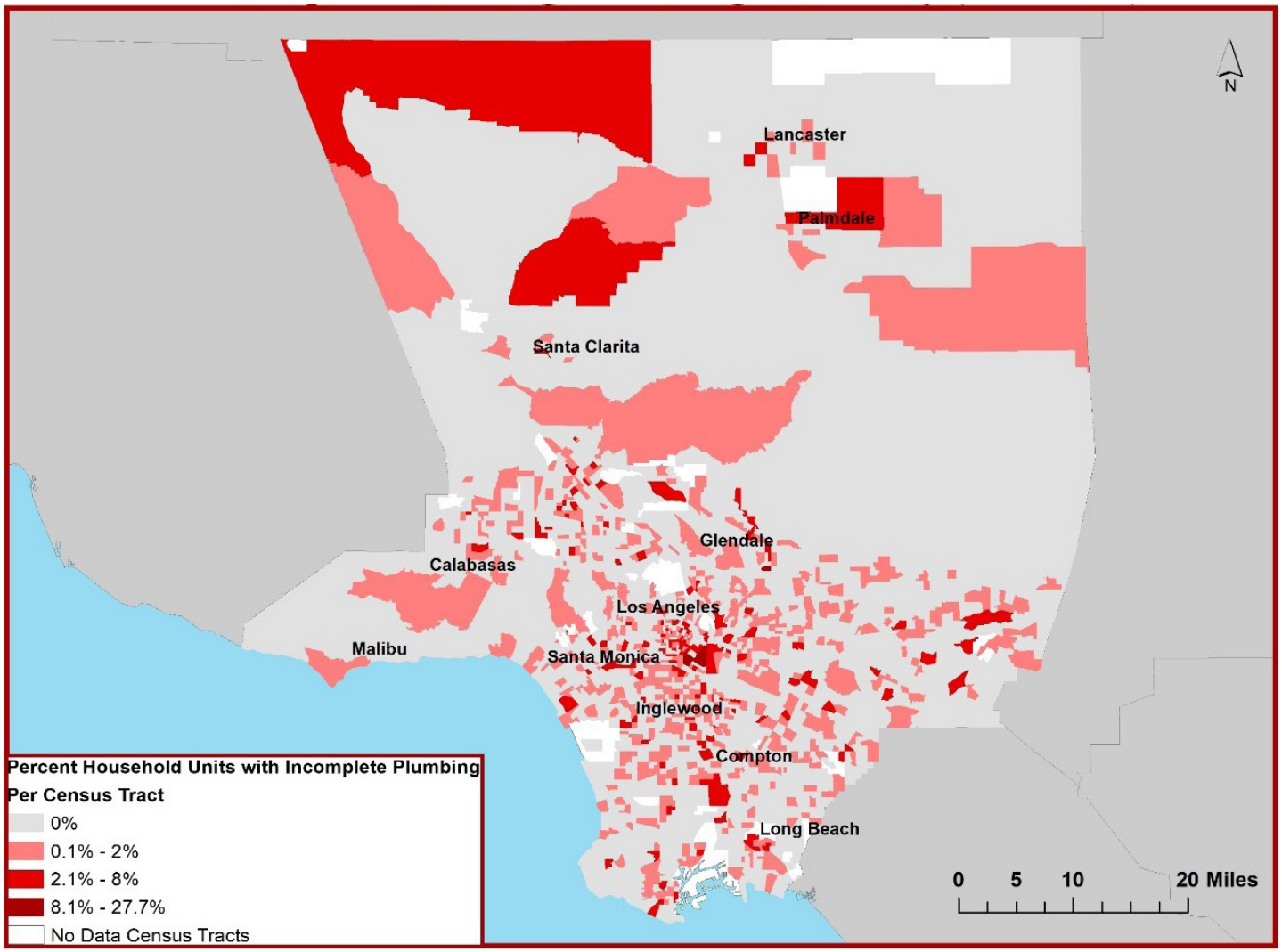
Another major concern that impacts the fulfillment of the HRW is households that lack complete plumbing, including those without indoor flush toilets, hot and cold piped water, or other complete plumbing. A recent Pacific Institute study (Feinstein & Daiess 2019) analyzed ACS data and homeless counts to assess the prevalence of households with incomplete plumbing across the state. Based on census tract data from 2011-2015, an estimated 16,000 households across the county lacked complete plumbing. This includes 11,000 households without indoor flush toilets and 9,400 households without hot and cold piped water. This translates into 39,000 individuals without complete plumbing, 25,000 individuals without indoor flush toilets, and 25,000 individuals without hot and cold piped water.

Figure 19 shows the percentage of household units without complete plumbing by census tract in Los Angeles County. The top 5 census tracts in the county with the highest percentage of households with incomplete plumbing are those located directly in or adjacent to 'Skid Row' in the City of Los Angeles, an area with a high proportion of homeless individuals.[30] In addition to addressing water system issues of water quality and affordability, HRW interventions must prioritize ensuring all Californians have access to complete indoor plumbing. However, given that premise plumbing is the legal responsibility of landlords— not CWS— it remains unclear how to incorporate this factor into a system-wise analysis.

[29] 23 systems (22%) had average operating ratios below 1; 15 of these systems had ratios above 0.90, indicating revenues that cover 90% of expenses on average over a 3-year period. This likely still indicates healthy financial capacity if sufficient reserves are available to buffer temporary revenue shortfalls or high capital expenditures. Only 3 systems had ratios below 0.75, the lowest was City of Cerritos (0.696).

[30] Skid Row encompasses census tracts 2062, 2063, and 2073. The top five census tracts for incomplete plumbing are as follows: 2063 (28 %), 2062 (22%), 2260.02 (19%), 2240.10 (18%), and 2240.20 (8%). They are the five census tracts in the highest category in Figure 16 (8-28%).

Figure 19. Percentage of Household Units with Incomplete Plumbing by Census Tract (2011-2015)



System Governance and HRW Outcomes

While extensive research links governance of drinking water systems to HRW outcomes in low- and middle-income countries, relatively little governance research in this vein has occurred in the U.S. context, except in extremely egregious cases such as the Flint lead scandal. One example of such novel governance research which could we build upon, however, comes from the work of the Community Water Center in the San Joaquin Valley in California. Their analysis focused on gender and racial-ethnic representation on local water board elections (Weiner 2018). There may be other potential means to measure system level accountability to customers, mismanagement, or corruption in future reviews.

Groundwater Contamination Data

A final next step that would enable better assessment of CWS performance would be to improve data and reporting on groundwater contamination as a risk factor. While a report from the State Water Board in 2013 assessed reliance on contaminated groundwater wells by system in California, more recent information on this issue has not been publicly available. Updating this data to ascertain the extent to which systems are still relying on contaminated sources of groundwater would be valuable to improve our assessment of system performance and HRW outcomes, both in Los Angeles County and statewide.

Conclusion

Since the passage of AB 685 in 2012, which established the Human Right to Water for all Californians, efforts have been made at the state, regional and local levels to enhance the mandate of universal safe, clean, accessible water. Los Angeles County's recent inclusion of HRW goals in its sustainability plan signals the continued momentum toward this goal in the region.

This report supports and informs policies and plans to ensure the HRW is experienced across the county. As a starting point, we collected and reviewed data from 200+ Los Angeles County CWS along the three main dimensions of the HRW (quality, affordability, and accessibility) as well as related metrics that influence water system performance (TMF, system governance, socioeconomic characteristic of system populations). Performance review criteria were developed to account for quality violations and moderate to severe risk factors to identify systems with the potential for future investment or consolidation to improve outcomes. We used data collected from a variety of sources and datasets, including the State Water Board, SDWIS, State Controller, and the U.S. Census.

Overall, as identified in our final system classification, the majority of systems in Los Angeles perform well and will likely continue to adequately provide safe and reliable water to customers for decades to come. Half of reviewed systems did not have any quality violations in the last 5 years or any of the risk factors identified in our performance review. However, we did identify a number of consistently underperforming systems with concerning water quality, inadequate or unreliable supplies, high above average monthly water bills, and low TMF capacity. As new or more detailed data becomes available we will be able to refine our review method.

We isolated the small systems classified as failing or severely concerning and performed additional spatial analysis to evaluate potential interventions. Three categories of systems resulted: spatially isolated small systems which must continue standalone operation (Group A), small and medium systems which could be physically or operationally consolidated with one or more nearby systems (Group B), and small or medium systems requiring regional or state funding consideration and support to continually operate standalone but that do not fit in the other groups (Group C).

This performance analysis and policy guide provides a valuable resource to better understand the current landscape and status of CWS across Los Angeles County. It builds on and updates previous work by the UCLA Luskin Center for Innovation to study the status of CWS in the county (Pierce et al. 2015), as well as efforts by the UCLA IoES (Federico et al. 2019) and the LA County CSO (LA County Office of Sustainability 2019).

Further study of CWS in the county is important to understand the complex regulatory and water supply landscape and target investment to improve outcomes. As Los Angeles County commits to improving the HRW for its residents at the county level, this policy guide and performance assessment highlights the current status of drinking water provision and identify opportunities for intervention. While statewide actions to achieve the HRW continue, more regional, local, and system level work will also be necessary to improve delivery of safe, affordable, and accessible water to all Los Angeles County residents.

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Appendix 1: Classification of Los Angeles County CWS

Classification Category	Water Systems
Failing /Acute Performance Concern (2+ MCL Violations in the last 5 years)	Alpine Springs Mobile Home Park
	Bleich Flats Mutual Water Company
	Clear Skies Mobile Home Ranch
	Los Angeles Residential Community Foundation
	Lancaster Park Mobile Home Park
	Lancaster Water Company
	Land Projects Mutual Water Company
	La Verne, City Water Division
	Mettler Valley Mutual
	Mitchell's Avenue E Mobile Home Park
	The Oaks
	The Village Mobile Home Park
	Valhalla Water Association
	White Rock Lake RV Park
	Winterhaven Mobile Estates
Severe Performance Concern (1 MCL or 3+ monitoring violations and 1+ severe or 2+ moderate risk factors)	Lynwood Park Mutual Water Company
	Oak Grove Trailer Park
	Rivers End Trailer Park
	Sativa-L.A. County Water District
Moderate Performance Concern (1 MCL or 3+ monitoring violations and 0-1 moderate risk factors)	Cal Poly Pomona University (1 MCL No Risk Factors)
	Californian Mobile Home Park (5+ M&R No Risk Factors)
	City of Arcadia
	East Pasadena Water Company (1 MCL No Risk Factors)
	Evergreen Mutual Water Company (1 MCL No Risk Factors)
	Golden State Water Company Claremont (1 MCL No Risk Factors)
	Lake Elizabeth Mutual Water Company (1 MCL No Risk Factors)
	Lomita- City, Water Department (1 MCL No Risk Factors)
	Los Angeles Department of Water and Power (1 MCL, 1 Moderate Risk Factor)

Classification Category	Water Systems
Moderate Performance Concern (cont.) (1 MCL or 3+ monitoring violations and 0-1 moderate risk factors)	South Gate- City, Water Department (3+ M&R No Risk Factors)
	The Painted Turtle Camp
	The River Community
	Tract 180 Mutual Water Company (1 MCL 1 Moderate Risk Factor)
Limited Cause for Performance Concern (No MCL, <3 monitoring violations, 1+ severe or 2+ moderate risk factors)	Aqua J Mutual Water Company
	California Water Service Company- Lake Hughes
	California Water Service Company-Leona Valley
	California Water Service Company-Lancaster
	Casa Dulce Estates
	Crescenta Valley Water District
	Del Rio Mutual
	Golden Sands Mobile Home Park
	Golden State Water Company- Southwest
	Golden Valley Municipal Water District
	Hemlock Mutual Water Company
	Kinneloa Irrigation District
	LA County Waterworks Districts 29 & 80- Malibu
	LA County Waterworks District 40 Region 39- Rock Creek
	LA County Waterworks District 21- Kagel Canyon
	Liberty Utilities- Compton
	Liberty Utilities- Bellflower- Norwalk
	Liberty Utilities- Lynwood
	Reesedale Mutual Water Company
	Rurban Homes Mutual Water Company
	San Gabriel Valley Water Company- El Monte
	Sleepy Valley Water Company Inc.
	So Cal Edison Co- Santa Catalina
	SPV Water Company Inc.
	Sterling Mutual Water Company
	West Valley County Water District
Minimal Cause for Performance Concern (No MCL, <3 monitoring violations, 1+ moderate risk factor)	Beverly Hills- City, Water Department
	California Water Service Company- Dominguez
	Colorado Mutual Water Company
	Compton- City, Water Department
	Golden State Water Company- Willowbrook
	Golden State Water Company- Florence/Graham
	Golden State Water Company- Hollydale
	Golden State Water Company- South Arcadia

Classification Category	Water Systems
Minimal Cause for Performance Concern (cont.) (No MCL, <3 monitoring violations, 1+ moderate risk factor)	La Canada Irrigation District
	LA County Waterworks District 36- Val Verde
	LA County Waterworks District 4 & 34- Lancaster
	LA County Waterworks District 37- Acton
	LA County Waterworks District 40 Region 38- Lake L.A.
	Landale Mutual Water Company
	Las Flores Water Company
	Leisure Lake Mobile Estates
	Lynwood- City, Water Dept
	Maywood Mutual Water Company #1
	Maywood Mutual Water Company #2
	Mesa Crest Water Company
	North Trails Mutual Water Company
	San Gabriel County Water District
	San Gabriel Valley Water Company- Montebello
	Santa Clarita Valley Water Authority- Imported Division
	Sierra Madre- City, Water Department
	Signal Hill- City, Water Department
	Sunnyside Farms Mutual Water Company
	Tierra Bonita Mutual Water Company
	Walnut Park Mutual Water Company
	Westside Park Mutual Water
	Wilsona Gardens Mutual
No apparent cause for performance concern (No violations or risk factors)	Amarillo Mutual Water Company
	Antelope Park Mutual Water Company
	Antelope Valley-East Kern Water Agency
	Averydale Mutual Water Company
	Azusa Light and Water
	Bell Gardens- City, Water Department
	Bellflower-Somerset Mutual Water Company
	Bellflower Home Gardens Water Company
	Bellflower Municipal Water System
	Blue Skies Trailer Park
	Burbank- City, Water Department
	Cal-American Water Company- Baldwin Hills
	Cal-American Water Company- Duarte
	Cal-American Water Company- San Marino
	California Domestic Water Company
	California Water Service Company- Hermosa/Redondo Beach
	California Water Service Company- Palos Verdes

Classification Category	Water Systems
No apparent cause for performance concern (cont.) (No violations or risk factors)	California Water Service Company- East LA
	Cerritos- City, Water Department
	City of Alhambra
	City of Industry Waterworks System
	City of South Pasadena
	Commerce- City, Water Department
	Covina Irrigating Company
	Covina- City, Water Department
	Downey- City, Water Department
	El Dorado Mutual Water Company
	El Monte- City, Water Department
	El Rancho Mobile Home Park
	El Segundo- City, Water Department
	Fenner Canyon Youth Conservation Camp
	Foothill Municipal Water District
	Glendale- City, Water Department
	Glendora- City, Water Department
	Golden State Water Company- Bell, Bell Gardens
	Golden State Water Company- Artesia
	Golden State Water Company Norwalk
	Golden State Water Company- Culver City
	Golden State Water Company- South San Gabriel
	Golden State Water Company- San Dimas
	Hawthorne- City, Water Department
	Huntington Park- City, Water Department
	Inglewood- City, Water Department
	Los Angeles County Waterworks District 40 Region 35-N.E. L.A.
	La Habra Heights County Water District
	La Puente Valley County Water District
	Lakewood- City, Water Department
	Las Virgenes Municipal Water District
	Lincoln Avenue Water Company
	Littlerock Creek Irrigation District
	Long Beach- City, Water Department
	Manhattan Beach- City, Water Department
	Maywood Mutual Water Company #3
	Monrovia- City, Water Department
	Montebello Land & Water Company
	Montebello- City, Water Department
	Monterey Park- City, Water Department

Classification Category	Water Systems
No apparent cause for performance concern (cont.) (No violations or risk factors)	Norwalk- City, Water Department
	Orchard Dale Water District
	Palm Ranch Irrigation District
	Palmdale Water District
	Paradise Ranch Mobile Home Park
	Paramount- City, Water Department
	Pasadena- City, Water Department
	Pico Rivera- City, Water Department
	Pico Water District
	Pomona- City, Water Department
	Quartz Hill Water District
	Rowland Water District
	Rubio Canon Land & Water Association
	San Fernando- City, Water Department
	Santa Clarita Valley Water Authority- Pinetree
	Santa Clarita Valley Water Authority- Castaic
	Santa Clarita Valley Water Authority- Santa Clarita
	Santa Clarita Valley Water Authority- Tesoro Del Valle
	Santa Clarita Valley Water Authority- Valencia
	Santa Clarita Valley Water Authority- Newhall
	Santa Fe Springs- City, Water Department
	Santa Monica- City, Water Department
	South Montebello Irrigation Dist
	Suburban Water Systems- Covina Knolls
	Suburban Water Systems- Glendora
	Suburban Water Systems- La Mirada
	Suburban Water Systems- San Jose
	Suburban Water Systems- Whittier
	Sunny Slope Water Company
	Terra Nova Mobile Home Park
	Torrance- City, Water Department
	Tract 349 Mutual Water Company
	Valencia Heights Water Company
	Valley County Water District
	Valley View Mutual Water Company
	Valley Water Company
	Vernon- City, Water Department
	Walnut Valley Water District
	Western Skies Mobile Home Park
	White Fence Farms Mutual Water Co No. 3
	Whittier- City, Water Department

Classification Category	Water Systems
Insufficient Data	Camp Williams- Resort
	Desert Palms Mobile Home Park
	Green Valley County Water District
	LA County WW District 40, Regions 24, 27, 33- PEAR-BLOSSOM
	Lily of the Valley Mobile Village
	Little Baldy
	Llano Del Rio Water Company
	Llano Mutual Water Company
	Peter Pitchess Honor Rancho. LAFCO Sheriff
	Shadow Acres Mutual Water Company
	Sherwood Mobile Home Park
	Sundale Mutual Water Company A, B
	White Fence Farms Mutual Water Co

Appendix 2: Systems in Proximity to Failing and Severe Performance Concern Systems

System Name	Intersecting Systems[31] 1 mile	Intersecting Systems 3 miles	Intersecting Systems 5 miles
Alpine Springs Mobile Home Park	Palmdale Water District	Palmdale Water District LACO Waterworks (District 37- Acton, District 4 & 34- Lancaster)	Palmdale Water District LACO Waterworks (District 37- Acton, District 4 & 34- Lancaster) Littlerock Creek Irrigation
Bleich Flats Mutual	None	None	California Water Service Co. Lake Hughes*
Clear Skies Mobile Home Ranch	LACO Waterworks District 4 & 34- Lancaster Golden Sands MHP*	LACO Waterworks District 4 & 34- Lancaster El Rancho MHP Averydale MWC Landale MWC	LACO Waterworks District 4 & 34- Lancaster Tierra Bonita MWC White Fence Farms MWC No. 3 Landale MWC Quartz Hill WD California Water Service Co. Lancaster*
Lancaster Park Mobile Home Park	LA Co Waterworks District 4&34- Lancaster	LA Co Waterworks District 4&34- Lancaster Leisure Lake Estates	LA Co Waterworks District 4&34- Lancaster Averydale MWC Golden Sands MHP*

[31] This table lists only intersecting systems which were given a given scores of: no apparent concern, minimal concern, or limited concern in the system performance review conducted for this report (see Appendix 1 for scores of systems). Intersecting systems with scores of limited concern are noted in this table with an *.

System Name	Intersecting Systems[31] 1 mile	Intersecting Systems 3 miles	Intersecting Systems 5 miles
Lancaster Water Company	LA Co Waterworks District 4&34- Lancaster	LA Co Waterworks District 4&34- Lancaster White Fence Farms MWC No. 3 Quartz Hill WD Antelope Park MWC CA Water Service Co Lancaster*	LA Co Waterworks District 4&34- Lancaster Leisure Lake Mobile Estates El Rancho MHP Averydale MWC Landale MWC El Dorado MWC White Fence Farms MWC No. 3 Sunnyside Farms
Lancaster Water Company (cont.)			Quartz Hill WD Palm Ranch Irrigation CA Water Service Co Lancaster*
Land Projects Mutual Water Co.	LA Co Waterworks District 4&34- Lancaster	LA Co Waterworks District 4&34- Lancaster	LA Co Waterworks District 4&34- Lancaster
LA Residential Community Foundation	Santa Clarita Valley WA (Tesoro, Imported)	Santa Clarita Valley WA (Tesoro, Imported, Santa Clarita)	Santa Clarita Valley WA (Tesoro, Imported, Santa Clarita, Valencia, Pinetree)
La Verne (City)	GSWC San Dimas Three Valleys MWD Pomona- City	GSWC San Dimas Three Valleys MWD Pomona- City Glendora- City Walnut Valley Water District Suburban Covina Knolls Covina- City	GSWC San Dimas Three Valleys MWD Pomona- City Glendora- City Walnut Valley Water District Suburban Covina Knolls Covina- City Valencia Heights Water Co.

System Name	Intersecting Systems[31] 1 mile	Intersecting Systems 3 miles	Intersecting Systems 5 miles
Lynwood Park Mutual Water Co.	Compton-City Central Basin MWD GSWC Willowbrook LADWP Liberty Utilities Compton*	Compton-City Paramount- City GSWC (Southwest, Florence/Graham) LADWP Long Beach- City California Water Service Co. Dominguez Liberty Utilities (Compton*, Lynwood*)	Paramount- City Downey- City Huntington Park- City GSWC (Southwest, Bell/ Bell Gardens) LADWP Long Beach- City California Water Service Co. Dominguez Liberty Utilities (Bellflower/ Norwalk*, Lynwood*)
Mettler Valley Mutual	None	West Valley County Water District*	West Valley County Water District*
Mitchell's Avenue E Mobile Home Park	None	Leisure Lake Estates LACO Waterworks District 4 & 34- Lancaster	LACO Waterworks District 4 & 34- Lancaster Averydale MWC Golden Sands MHP*
Oak Grove Trailer Park	Sleepy Valley Water Company*	North Trails Mutual SPV Water Company* Santa Clarita Valley WA Imported	SPV Water Company* Santa Clarita Valley WA (Imported, Tesoro, Pinetree) LACO Waterworks District 37 Acton
Rivers End Trailer Park	Santa Clarita Valley WA (Pinetree, Imported)	Santa Clarita Valley WA (Pinetree, Imported, Santa Clarita)	Santa Clarita Valley WA (Pinetree, Imported, Santa Clarita,Tesoro) North Trails MWC

System Name	Intersecting Systems[31] 1 mile	Intersecting Systems 3 miles	Intersecting Systems 5 miles
Sativa-LA County Water District	GSWC (Willowbrook, Southwest*) Central Basin MWD Liberty Utilities Compton* Compton- City Lynwood- City	GSWC (Southwest*, Florence/Graham) Central Basin MWD Liberty Utilities Compton* Compton- City Lynwood- City LADWP Long Beach- City CA Water Service Dominguez Paramount- City	GSWC Southwest*, Florence/Graham, Bell/Bell Gardens, Hollydale) Central Basin MWD Compton- City Lynwood- City LADWP Long Beach- City CA Water Service Dominguez Paramount- City Torrance City Liberty Utilities Bellflower/ Norwalk* Tract 349 MWC Huntington Park- City Hawthorne- City
The Oaks	California Water Service Co. Lake Hughes*	None	None
The Village Mobile Home Park	LACO Waterworks District 4 & 34 Lancaster	LACO Waterworks District 4 & 34 Lancaster Leisure Lake Estates Golden Sands MHP*	LACO Waterworks District 4 & 34 Lancaster Leisure Lake Estates Averydale MWC Western Skies MHP Antelope Park MWC El Rancho MHP Golden Sands MHP* California Water Service Co Lancaster*

System Name	Intersecting Systems[31] 1 mile	Intersecting Systems 3 miles	Intersecting Systems 5 miles
Valhalla Water Association	LADWP	LADWP Glendale- City Foothill Municipal Water District Crescenta Valley Water District*	LADWP Glendale- City Foothill Municipal Water District Crescenta Valley Water District* La Canada Irrigation District Mesa Crest Water Co*
White Rock Lake RV Park	None	Santa Clarita Valley WA (Pinetree, Imported)	Santa Clarita Valley WA (Pinetree, Imported, Tesoro, Santa Clarita) North Trails MWC LACO Waterworks District 37- Acton Casa Dulce Estates*
Winterhaven Mobile Estates	None	None	None

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