Water Data Strategy

Recommendations for Access to Safe and Affordable Drinking Water in California

January 2021

theEARTH GENOME
REVEALING THE POSSIBLE

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List of Abbreviations and Acronyms

AB 1755	Open and Transparent Water Data Act
AB 685	Human Right to Water Act
CDPH	California Department of Public Health
DDW	Division of Drinking Water
DESC	Data Executive Steering Committee
DIET	Data Integration & Execution Team
DFA	Division of Financial Assistance
DMIT	Data Management and Innovation Team
DWR	Department of Water Resources
EPA	Environmental Protection Agency
GAMA	Groundwater Ambient Monitoring & Assessment
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HR2W	Human Right to Water
NA	Needs Assessment
OEHHA	Office of Environmental Health Hazard Assessment
OIMA	Office of Information Management and Analysis
PWS	Public Water System
SADW	Safe and Affordable Drinking Water
SAFER	Safe and Affordable Funding for Equity and Resilience
SB 200	Save and Affordable Drinking Water legislation
SDGs	Sustainable Development Goals
SDWIS	Safe Drinking Water Information System
SGMA	Sustainable Groundwater Management Act
SWRCB	State Water Resources Control Board
TMF	Technical, Managerial, Financial

Executive Summary

The final version of the California Water Resilience Portfolio (the Portfolio) was released by Governor Gavin Newsom in July 2020.[1] The Portfolio outlined a comprehensive, and sometimes aspirational, list of needed actions to help build climate-resilient water systems for the state. Importantly, the top 10 priorities started with a call to implement the Safe and Affordable Drinking Water (SADW) Act. Correspondingly, the Portfolio's list of 142 recommended actions began with stating the importance of helping local water systems to achieve reliable access to safe and affordable drinking water.

The discussion around these top 10 priorities concluded by stressing the importance of better leveraging information and data to improve water management. This is most fitting given that improved access and use of **water data is often cited as a critical enabler for water sustainability in California**. This document focuses on that intersection of drinking water and water data as it relates to access to safe and affordable drinking water.

Upon the July 2019 signing of Senate Bill 200 that passed the Safe and Affordable Drinking Water Fund, conversations emerged including discussions between the Water Foundation and senior leadership at the State Water Resources Control Board (the State Water Board or SWRCB). These discussions culminated around a central question:

> How can we utilize better water data to improve access to safe and affordable drinking water for all Californians?

The purpose of this strategy document and supplemental materials is to evaluate the current situation of water data at the State Water Board as it relates to drinking water and to provide recommendations towards the improving outcomes for access to safe and affordable drinking water for all Californians. Chiefly, the purpose of the document is to identify priority areas that would **most benefit from improved data** and outline a strategy of **tactical and strategic steps for the State Water Board to take to achieve better outcomes**.

First, the document identifies a multi-faceted and extraordinarily complex problem statement due to extensive structural factors within drinking water data. These factors include local differences in drinking water systems, wide variability in hydrology, diverse stakeholder groups, complicated relationships between stakeholders, as well as overlapping and sometimes limited regulatory responsibilities and mandates.

Leadership and Collaboration

The complexity found in **drinking water data challenges need to be addressed at multiple levels, both within Division of Drinking Water, and by increasing coordination across the multiple divisions of the State Water Board.** This includes distinct coordination with Division of Financial Assistance and the Division of Water Rights. Fostering collaboration externally with other state agencies and local stakeholders is also vital, with **particular emphasis on collaboration with the Department of Water Resources.** This recommendation is consistent with what Wade Crowfoot, Secretary of the California Natural Resource Agency calls a "water system of systems" approach referenced in the Portfolio. As such, the strategy emphasizes new ways to coordinate across stakeholders to achieve more significant progress on drinking water.

[1] California Water Resilience Portfolio, https://waterresilience.ca.gov/

Metrics and Focus Areas

The strategy urges **the use of desired drinking water metrics and outcomes to drive data collection and decisions**, as well as to formulate near-term actions and a multi-year roadmap. **Three focus areas arose out of the primary research comprising the three topics of TMF (technical, managerial, and financial) capacity, consolidations, and at-risk water systems.** The focus areas are codependent, where better water data in one area helps support efforts in another. That is, improving the evaluation of TMF capacity of local water systems would directly inform at-risk evaluations. Then understanding the drivers of risk thus help to prioritize solutions (such as consolidations) that are most appropriate for the local situation and sustainable over the long term.

It is this interdependence that necessitates data integration. **Without prioritizing water data integration, step-change improvement in drinking water outcomes is not possible.** The goal of this strategy document is to help improve data integration and decision making in a coordinated way across these focus areas.

Roadmap for action

Noteworthy efforts towards drinking water optimization are underway and outlined within a tool landscape to identify gaps and opportunities for innovation. Acknowledging these, the document proposes **additive pathways to achieve progress within the identified focus areas and done with a long-term perspective in mind**, listing needed steps required over a 5+ year time horizon. These future states were designed to guide work plans that avoid redundancy or once-off disconnected tools.

Many recommendations herein focus on informing State Water Board decisions that may have the greatest benefit to drinking water outcomes.[2] Fewer recommendations are made on collecting, processing, and reporting data back to the public, which are three earlier steps in the data lifecycle that the State Water Board does relatively well today. The document concludes with a recommended, practical list of next steps to implement a successful water data strategy.

A holistic and comprehensive approach to data and decision-making is essential to achieving sustainable access to safe and affordable drinking water for all Californians.

[2] This report does not intend to fully encompass all data and information systems needed to manage the drinking water program, per the report scope suggested by State Water Board executives. This document is meant to supplement other discussions around the significant modernization that is needed in all areas of DDW data systems.

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I. Introduction

The Human Right to Water (HR2W) is not recognized universally. California has the most progressive legislation in the US in working to provide safe, accessible and affordable drinking water to its residents. Yet legislation alone is not enough to address the complexity of drinking water in the State. An intentional collection of data, metrics, decisions and outcomes are all needed in the process to ensure every Californian can exercise their right to water. Thus, understanding one is necessary to understanding the other. This section introduces a brief history of California's road from lauded efforts to proactively creating a water data strategy.

The Human Right to Water

Discussions around the UN Sustainable Development Goals (SDGs) often focus on developing economies and are glossed over in national efforts to improve health, tackle climate change, reduce inequality and grow the economy. Nonetheless, the SDG 6 call for universal safe and affordable water should be of significant concern to the US. Between June 2016 and May 2019, an estimated 45,000,000 Americans served by water systems were exposed to the most severe health-based Safe Drinking Water Act violations, and nearly 40% of the US population during that time were served water from systems in violation of the law.[3] Yet, as the 2014 adversary complaint of *Lyda et al. v. City of Detroit et al.* dismissal showed the nation, "there is no constitutional or fundamental right either to affordable water service or to an affordable payment plan for account arrearages."[4] That is, SDG 6 is not a priority within the US; American citizens appear to not have a human right to safe and affordable drinking water.

Unless one resides in California. In 2012, California became the first state to declare that every human being has the right to accessible, safe and affordable drinking water through Assembly Bill 685. The state's efforts were lauded by the United Nations as an example of making steps towards reaching Global Goals.[5] Most recently, California's Water Resilience Portfolio (the Portfolio) added to the momentum of the state to achieve the human right to water by prioritizing, in part, the advancement of local water system capabilities and the leveraging of information and data for drinking water.

Division of Drinking Water and Other Efforts

In 2014, the Drinking Water Program transitioned from the California Department of Public Health to the State Water Resource Control Board (SWRCB or State Water Board) under the newly formed Division of Drinking Water (DDW), currently led by Deputy Director Darrin Polhemus. At the time, it was hoped that the consolidation of drinking water and water quality programs into a single entity would create synergies leading to "significant improvements in the administration of the state's drinking water programs, particularly regarding the effectiveness of financial assistance programs, the integration of drinking water with other water policy issues and the ability of the public to hold decision-makers accountable for drinking water outcomes."[6]

Nonetheless, the transfer also involved the inheritance of the structural factors that cause much of the challenges faced by DDW today. Principally, this includes multiple legacy IT systems and often disparate data along with unclear responsibilities and roles as it relates to coordinating data across the State Water Board as a

[3] NRDC, Watered Down Justice, 2019. https://www.nrdc.org/sites/default/files/watered-down-justice-report.pdf
[4] Murthy, S (2016). A New Constitutive Commitment to Water. Boston College Journal of Law and Social Justice, vol. 36., p.159. https://ssrn.com/abstract=2669380
[5] UN News, California law on human right to water sets examples for others – UN expert, 2010. https://news.un.org/en/story/2012/09/421852
[6] LAO, The 2014-15 Budget: Resources and Environmental Protection, February 2014. https://lao.ca.gov/reports/2014/budget/resources/resources-environmental-protection-022114.aspx

whole. Without vested authority to develop and implement solutions, local ad hoc workarounds become the only movement away from the status quo.

Two years later, in 2016, the State Water Board unanimously resolved "the human right to water as a core value and adopts the realization that the human right to water as a top priority for the Water Boards."[7] Although subsequent progress has been made, in 2020 there remained an estimated 1 million Californians that lack access to safe and affordable drinking water. Recently the effort received a boost by Senate Bill 200. Signed by Governor Newsom in July 2019, SB 200 created the Safe and Affordable Drinking Water (SADW) Fund to help support drinking water solutions in California.

In early 2020, the State Water Board launched the Safe and Affordable Funding for Equity and Resilience (SAFER) Program in cooperation with DDW, Division of Financial Assistance (DFA), Division of Water Quality, the Office of Public Participation (OPP) and the Division of Information Technology (DIT). Over the years, significant milestones and related data efforts have been achieved both internal and external to the State Water Board, including the following programs:

- The Needs Assessment (NA) of vulnerable and unsustainable water systems in need of funding or technical assistance, done in collaboration with external parties led by UCLA (SB 862)[8]
- The State Water Board's Human Right to Water portal, the first of its kind, making it easier for the public to see which public water systems are not in compliance
- The DWR Drought and Water Shortage Risk Explorer Tool, an online risk scoring and interactive tool to identify small suppliers and rural communities at risk of drought and water shortage vulnerability (AB 1668)
- The Community Water Center Drinking Water Tool, a public facing resource for communities to understand their groundwater vulnerability and management

These efforts show how the State Water Board works valiantly to improve the current situation. Through first-hand observation, there are many individuals within the State Water Board who are doing more with less. That is, even with resource and funding challenges, individuals have in some cases devised suitable means to access data to inform their daily actions. Advancements are in process through the recent actions of the SAFER Program. Notwithstanding this growth and improvements, **greater data and better decision-making coordination will be needed across all DDW program areas DDW program areas and the broader SWRCB to continue this progress** that tracks progress, prioritizes projects and intensifies focus on stakeholder benefits.

California Water Data Strategy for Drinking Water: An urgent need

While there has been progress in the eight years since California's pioneering dedication to HR2W, as anthropomorphic and climatic threats increasingly put pressure on the state's water resources, the need for focused action via water data strategy for achieving access to safe and affordable drinking water is increasingly urgent. This need is supported by California also pioneering efforts to drive the use of data for the betterment of society; The Open and Transparent Water Data Act (AB 1755) of 2016 requires state agencies, led by the DWR and the State Water Board, and together with the California Water Quality Monitoring Council and the California Department of Fish and Wildlife, to create an integrated data platform and devise a strategic plan for broad water data and decisions. In stride, in late 2020, the Office of the Chief Data Officer released California's Data Strategy, outlining the importance of quantitatively measuring how well the state government delivers on its public services.[9]

[7] SWRCB Resolution No. 2016-0010. https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf
[8] State Water Board, Drinking Water Needs Assessment, 2020. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html
[9] California Open Data Portal, 2020. https://data.ca.gov/

The following chapters outline recommendations for achieving access to safe and affordable drinking water in California with the objective of providing actionable recommendations to the State Water Board to improve key outcomes towards the HR2W.

This strategy document outlines a multi-year roadmap of prioritized decisions and outcomes identified by the State Water Board to accelerate and achieve access to safe and affordable drinking water for all Californians.

Methodology

The recommendations herein arose from a ten-month project that engaged the State Water Board on the topic of a water data improvements and strategy through interviews, surveys, presentations, and regular updates.

From December 2019 to October 2020, the Earth Genome undertook activities to identify focus areas to serve as the foundation of the water data strategy. This included interviews with 46 individuals, a survey of the district engineers and staff of the Field Operations Branch (n=64), a survey of the SAFER Engagement Units (n=14), a data survey presentation to the DDW Data Integration and Execution Team (DIET) (17 attendees), and attendance at seven public webinars hosted by the State Water Board all outlined in Appendix I.

Given the ongoing pandemic, only virtual meetings occurred after March 2020. Nonetheless, there was continued engagement from the State Water Board individuals despite the challenging situation. Research and recommendations took a tiered format (Figure 1) outlined in supplemental material 1-4. Interviews and discussions provided context to the current state and highlighted the need for water data metrics to measure progress, while also providing the opportunity to evaluate assumptions and ideas, while strategy was honed. Additionally, the findings suggested focus areas for water data that included both in-depth analysis and quick assessments. Underpinning that were six cross cutting recommendations.

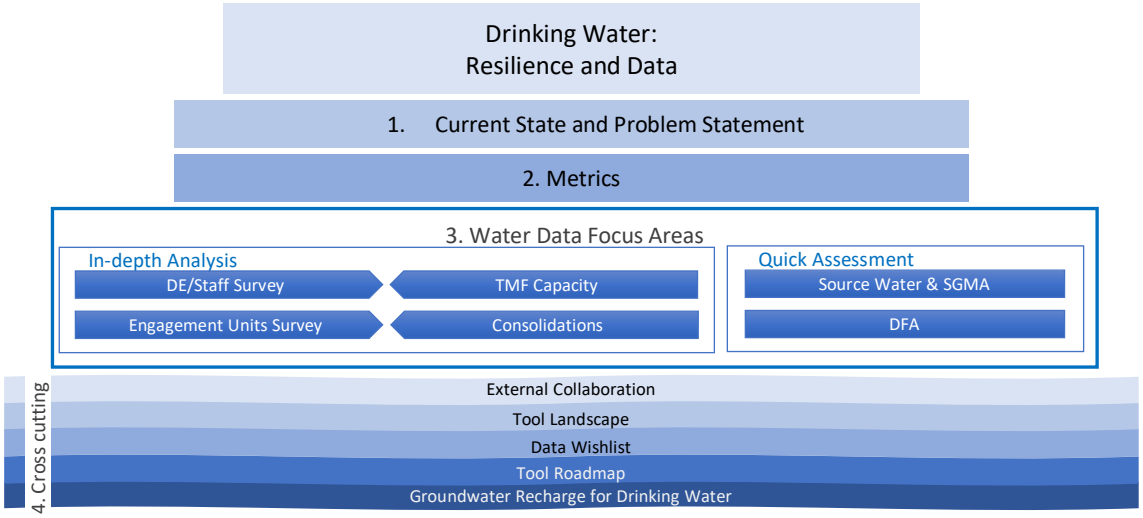


Figure 1 The strategy was created using a tiered format, with extensive details contained in supplemental materials 1-4.

When establishing potential focus areas, this strategy avoided specific topics deemed out of scope based on timeframe or overlap including the building of actual data tools, addressing legacy IT system issues related to improving data system architecture, any data solutions already addressed by the NA. A lack of evaluation of these areas does not infer that improvements are not also needed in these data areas.

II. Current State: Data Challenges

Today, the SAFER Program is tasked with ensuring access to safe and affordable drinking water in every California community, for every Californian.[10] Achieving this relies on a data strategy that pushes beyond the status quo. Unfortunately, today the current state is a system that is under resourced, faces massive complexity, needs greater clarity on roles and responsibilities and would benefit from a focused strategy on prioritized actions and solutions. Details on the problem statement are outlined in supplemental materials 1.

Within the State Water Board, data currently falls within a four-step lifecycle of collection, processing, communication to the public, and informing decisions. Limited by current resources, each of these four steps face explicit challenges (Figure 2). Resource limitations include both capital and time; it takes resources to solve challenges that stem from a legacy of limited funding and underinvestment in data and data infrastructure. Nonetheless, through interviews of the staff at the State Water Board it became clear that there is a mentality of maximizing resources to do more with less, and to make progress through a "do the best that we can" approach.

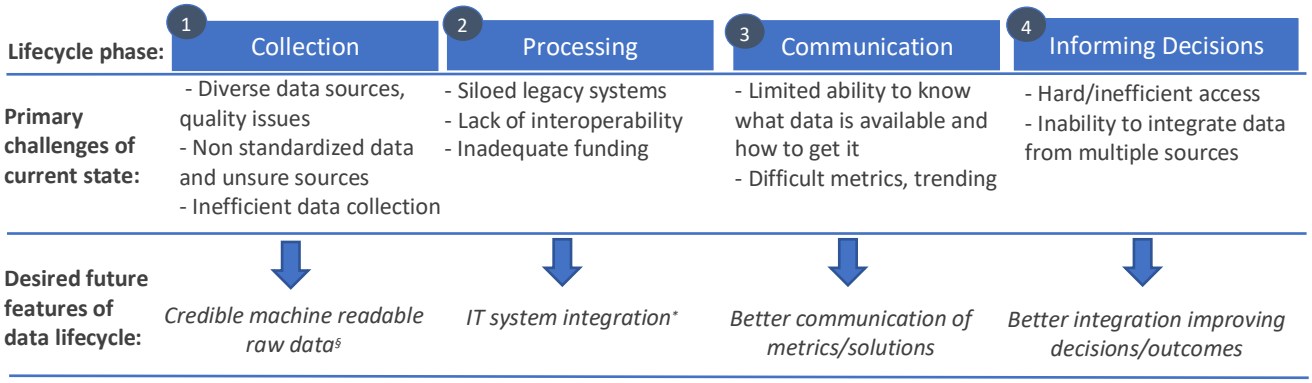


Figure 2 The four-part role of SWRCB managing water data includes collection, processing, communication and informing decisions.

§Potentially accessed in data lake-type system
**Potentially the proposed DDW Enterprise system*

Interview findings noted that step four has received limited investment to date, mainly because step four inherently depends on optimizing steps one through three. In the current state, intense complexity of structural and technical factors compounds the challenges of the first three steps. For example, the disparity of size and sophistication across thousands of water systems in California negatively impacts step one. Step two faces the task of navigating dozens of existing IT systems without funding to update and modernize those systems going forward. Funding challenges are acutely felt in step three, where recent efforts to secure funding to improve the State Water Board website, a salient site for accessing water data, was not approved. Across all steps, the impact of COVID-19 on basic state funding to the State Water Board is an obvious obstacle to achieving HR2W.

Additionally, each of these four steps are impacted by a human factor. Addressing the complexity of human involvement requires significant leadership with both the authority and resources to integrate data towards the best decision making and bridge organizational silos. Today, there is no single individual assigned at an authority level across divisions to lead the State Water Board towards an integrated data vision. There is also a gap at the staff/implementation level. State Water Board staff skills are consistent with their regulatory roles. As such, many staff do not have IT expertise or extensive training in data science; data literacy is a salient obstacle today.

[10] Policy for Developing the Fund Expenditure Plan for The Safe and Affordable Drinking Water Fund, p.3: https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/docs/final_policy_for_dev_fep_sadwf_052020.pdf

SWOT Analysis

The SWOT analysis below provides a summary on where the State Water Board can capitalize (strengths), where to focus improvements (weaknesses), what to invest in (opportunities) and what to keep tuned in to (threats) to address the current problem statement (Figure 3).

Although each factor listed in the SWOT analysis represents interview and survey comments, this is not meant to be comprehensive and does not represent consensus across the State Water Board on each factor. This SWOT is intended to be used as a starting point for ongoing internal conversations around water data strategy.

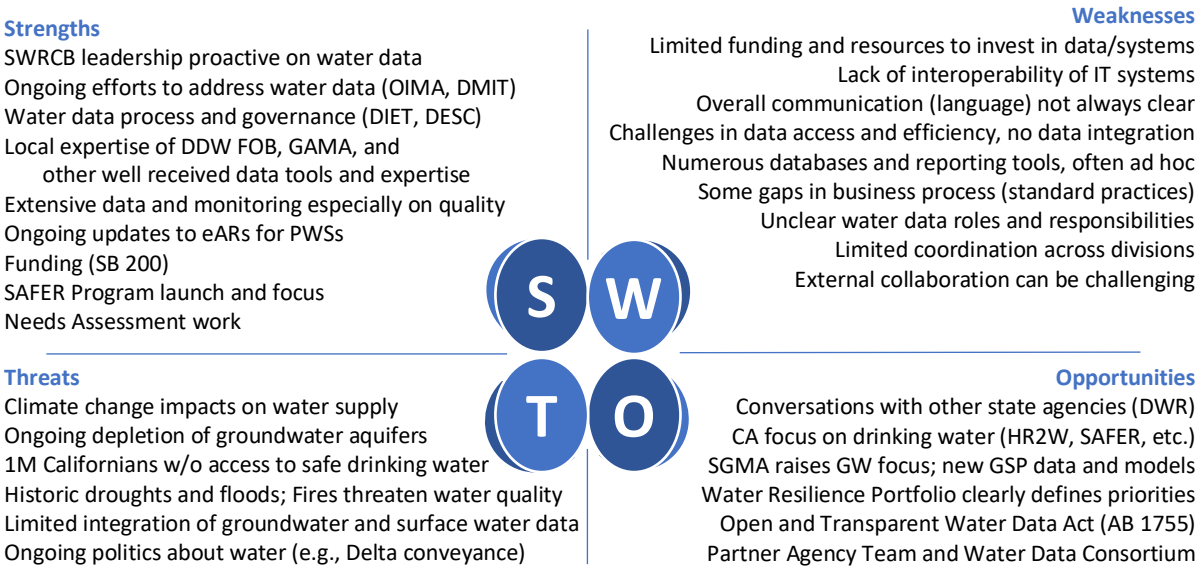


Figure 3 SWOT Analysis of the current state within SWRCB's drinking water efforts.

Many strengths and opportunities listed here are relatively recent developments, illustrating progress while also emphasizing the need to maintain momentum and act on these advantages. This strategy document provides a roadmap and recommendations towards this but building on the current state requires leveraging work underway such as the Needs Assessment, specifically at-risk evaluations and cost/solution estimates. It also includes continuation of DIET and Data Executive Steering Committee (DESC) efforts to improve water data collection and reporting systems. Additionally, action includes ensuring adequate resources for the ongoing work to launch a clearinghouse or other enterprise level efforts that dramatically improve data access.

III. Metrics & Outcomes

Success is measured by progress over time. One aspect of the desired future state for the State Water Board is achieving the HR2W, providing safe and affordable drinking water to all Californians. The California Data Strategy released in September 2020 stresses the need for longitudinal data to assess how well government provides services for the public.[11] Yet the only way to gauge the quality of services is to have established metrics and desired outcomes to begin with. As such, it's necessary to **develop a metric-based approach to answering today's key questions related to drinking water.** Through carefully defined metrics informed by high quality data, there are opportunities for improved outcomes that positively impact public health and build greater awareness around drinking water.

Given today's current situation, achieving the vision of HR2W is primarily aspirational in the near-term. Nonetheless, progress from the current state to the HR2W goal can be broken down into definite outcomes in the future state, achievable through drinking water and data and IT systems progress (Figure 4).

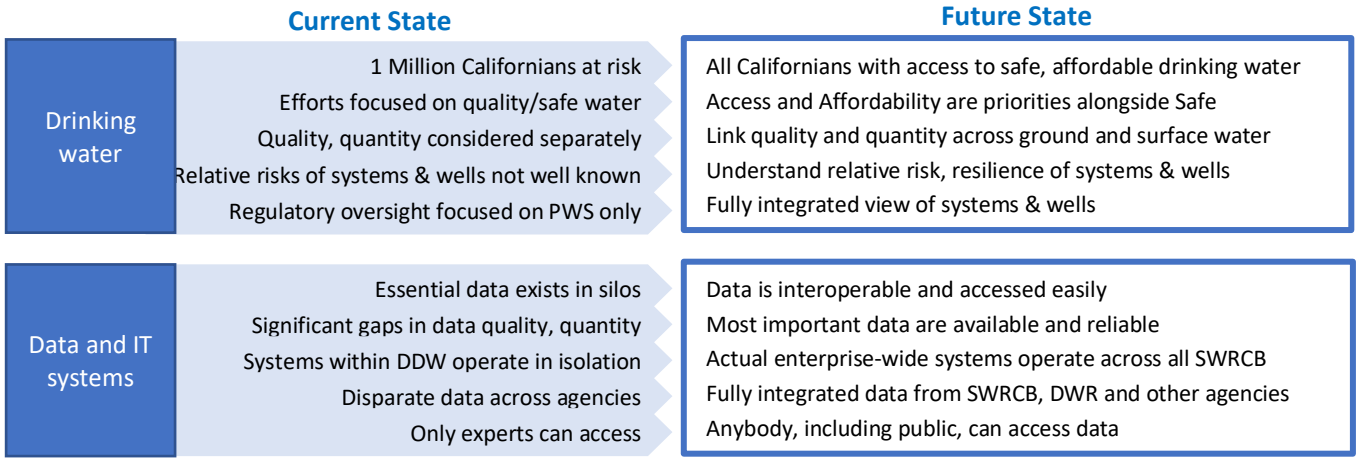


Figure 4 Comparison of current state and aspirational future state. Systems and wells refer to public, tribal and community water systems and domestic wells.

Achieving the outcomes of this aspirational future state requires integrating data to ensure we can answer fundamental management questions. As a starting point, there are ten questions for California drinking water that can be measured and answered through metrics (Figure 5).

Risks	Solutions
• Who and where are the **~1M Californians** without access to safe and affordable drinking water? • What water systems are at **greatest risk** (quantity, quality, affordability) right now? • How are **water systems trending** over time (risks and resilience)? • How is **water quality trending for key communities**? • How might **drought affect supply?**	• How can we most **cost effectively solve the ~1M** without safe and affordable drinking water? • What are the optimal **solutions** to the risk/problem? • What **water systems, using what objective criteria, should receive** that funding? • What systems should be **consolidated**? • Has **previous DFA funding** led to long-term resilience of water systems?

Figure 5 Ten key management questions essential to link risks and solutions to the future state discussion.

[11] California Open Data Portal, 2020. https://data.ca.gov/

These high-level questions dovetail with metrics identified by the Fund Expenditure Policy.[12] Also, the questions are complimentary to and build off the ongoing work the State Water Board with OEHHA, DWR and other stakeholders in developing and advancing indicators over time. All of this should align with the ongoing Clearinghouse effort within SAFER in the State Water Board, which is a key IT component to ensure accessibility of high-priority data.

Defining Drinking Water Metrics

In keeping with the metrics outlined by the Policy, this strategy document focuses on water metrics that are defined by three major distinctions (supplemental materials 2, Metrics).

1. Process vs outcomes. Quantifying number of projects provides a process metric but does not necessarily quantify specific improvement. Only outcome-based metrics can **accurately track how drinking water challenges are improving**.
2. Current vs future. Metrics can and should evolve over time. Current metrics are important, but new capabilities and functions can be added to measure more aspirational outcomes. **Future metrics are essential to achieving long-term resilience while building out current data collection and IT systems.**
3. Internal vs external. Stakeholder interest in drinking water metrics is diverse. External, public metrics understandably face concerns over appropriateness. **Distinct classification of metrics as external or internal ensures the State Water Board can confidently define metrics** to improve internal processes and outcomes while also developing metrics important to targeted external stakeholders.

Aspirational Monitoring and Awareness

With adequate metrics, an ideal outcome in the future state will see the State Water Board and public with seamless access to a full accounting of the number of Californians without appropriate drinking water, whether that be due to quality or quantity limitations, or affordability. For these Californians without access to safe and affordable drinking water, the public or State Water Board would be able to **pinpoint their own local situation and quickly know their current level of water service**. In the future state, the State Water Board will be able to place all California residents into quantified drinking water risk tiers, also searchable by individual residents. New functionalities and improved data will make it possible to **provide the types of timely public health alerts, such as for air quality given AQI measurements, and service interruption notifications** currently used by electric utilities for PSPS type situations (Appendix II). As California deals with a historic 2020 wildfire season exacerbated by recent droughts, these types of alert services are becoming more commonplace for many residents. Ultimately, metrics allow for near- and long-term transparency into how water system resilience is consistently improving for all Californians. Innovations in both costs and technology, plus investments are needed to achieve this type of tracking for drinking water.

[12] Policy for Developing the Fund Expenditure Plan for The Safe and Affordable Drinking Water Fund, section XI.I: https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/docs/final_policy_for_dev_fep_sadwf_052020.pdf

IV. Improving Water Data

Strategy Focus Areas

Recommendations herein focus on three select areas that were identified through interviews with State Water Board, section chiefs, district engineers and staff, and the DFA. Additional input came from survey results and in-depth discussions with executives. Across all groups, the topics of water system TMF (technical, managerial and financial) capacity, consolidations/regionalization, and source water capacity were consistent (Appendix III). **These are topics that will most benefit from improved water data and that will have the greatest impact on achieving safe and affordable drinking water for Californians and it is recommended that they are prioritized above other topics.** Insights from each of the focus areas are discussed in this section.

Water Data Strategy Framework

Understanding how best to tackle these focus areas rest on applying a four-part framework of data, tools, decisions, and outcomes (Figure 6). Central to applying this framework is understanding that it is an iterative cycle, **where the key is to establish more direct links along the process from improved water data to ideal drinking water outcomes**. However, optimizing these links depends on two essential considerations, the starting point of the framework and the central human element.

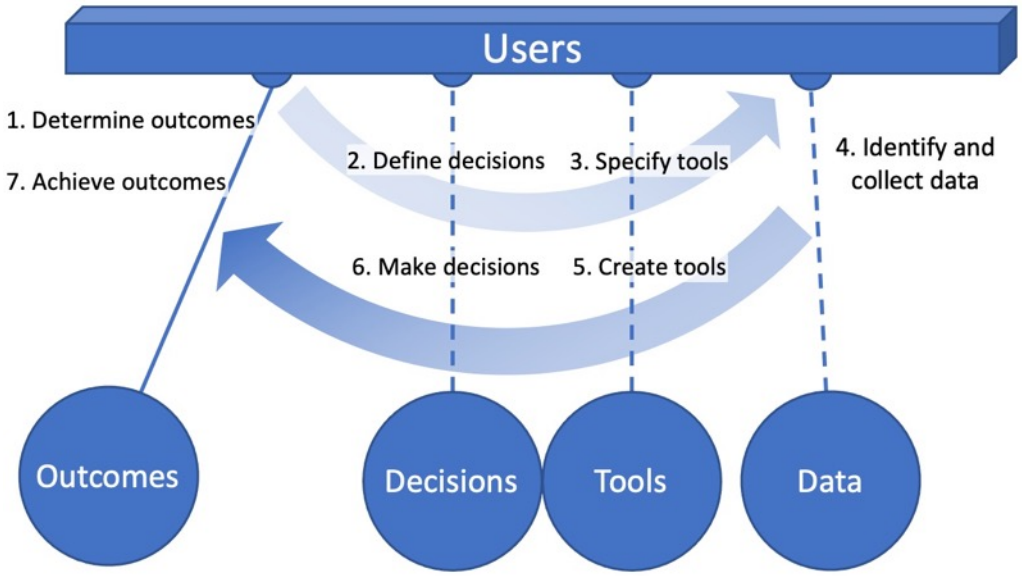


Figure 6 Four-part framework for drinking water data strategy is driven by outcomes, but data returns momentum for a continuous cycle under the user's control.

Outcomes, not data, are the starting and ending place of the cycle. **Data is the turning point** (point 4 in Figure 6)**.** Thus, determining desired outcomes, plus the necessary decisions and tools, drives the collection of defined data. Once that data is collected, it returns towards achieving the original outcomes. **The goal of improving water data is not simply better data, it is to achieve better outcomes**.

Second, users touch every part of this framework, interacting with outcomes, decisions, tools and data, in both directions. Acknowledging the **impact of human behavior** while moving through this framework encourages a more actionable mindset which may aid in identifying complications that come from human dynamics, rather

than technical details alone. This emphasizes why business process, which spans the four elements of the framework, is so critical for the State Water Board to define and be understood across the organization.

4C Data

Implementing this framework requires **high quality data.** We define this term to mean data that is 4C: comprehensive, comparable, credible and cost-effective (Figure 7). 4C data requires moving beyond the status quo, which entails not just centralizing data into one location, but also redefining how it is collected and monitored over time. Today, 4C data is limited given the problem statement discussed previously.

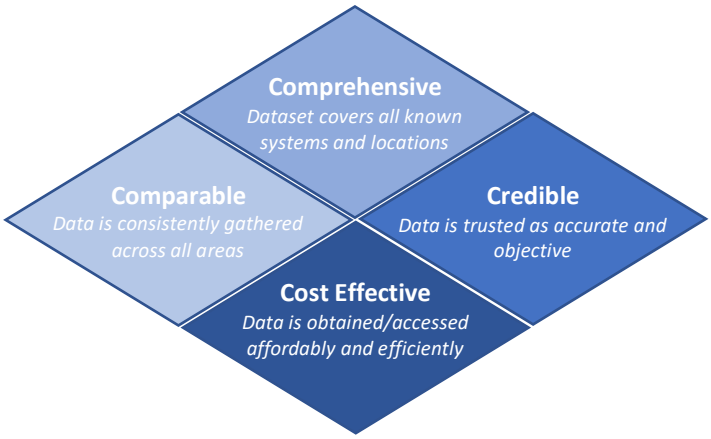


Figure 7 High quality data is defined by meeting the 4C criteria of comprehensive, comparable, credible and cost effective

TMF Capacity

In May 2020, an online survey was administered to the 24 District Offices of the DDW Field Operations Branch District Engineers (DEs) and their staff (supplemental materials 3). All but two districts responded with a total of 64 responses, including 19 of the 24 DEs. An understanding of data for TMF capacity was also drawn out of the SAFER Engagement Units survey (supplemental materials 3).

Across the State Water Board, data on TMF capacity arose as a consistent concern. While **TMF capacity data is imperative in solving the safe and affordable drinking water challenge**, it also has the **largest data gap** across all known datasets. The preeminent issue for small water systems is financial capacity, arguably more so than technical or managerial, given financial capacity is crucial for understanding financial sustainability.

Discussions on this focus area identified **three aspirational benefits of improved TMF capacity data**:

1. The ability to use quantifiable, numeric TMF capacity scores to create a **fact-based rating of water systems** to specifically benefit the State Water Board's ongoing evaluation of water systems.
2. The application of the fact-based ratings and use financial capacity data to **directly inform at-risk analysis and provide essential context into risk and resilience assessments**.
3. The ability to **compare relative TMF capacity data across multiple systems** to inform technical assistance and to prioritize funding (including consolidations) decisions; the ability to **determine whether to fund systems with consistently poor TMF capacity**.

Consolidations

In July 2020 an online survey was administered to the North and South Engagement Units (EUs) (supplemental materials 3). Full participation of the 14 individuals within the EUs provided insight to the challenges and successes of the relatively newly formed program. While the relatively small sample size increases the chances for bias, individual conversations with internal experts aided in interpretation of the results.

Primarily, the survey illustrated the current ways in which the EUs evaluate water systems for consolidations which depend on a unique human element as well as often challenging data, making the evaluation process both dynamic and complex. Accelerating the rate of consolidations is a key priority for the State Water Board so addressing these human elements and data gaps is essential.

While consolidations are recognized as a priority solution for providing safe and affordable drinking water, the rate at which consolidations now occur must be accelerated to achieve more significant HR2W progress. Identifying and implementing the most cost-effective **consolidation strategy revolves around regional and statewide collaboration and coordination**. This is especially of consequence as successive consolidations may increase in difficulty over time. One way to address both speed and difficulty of consolidations is to identify ways in which to increase water systems' willingness to consolidate. Understanding that consolidation depends on relationships, not just datasets and process-driven data, is fundamental to success. Discussions on this focus area identified **three aspirational benefits of improved data on consolidations**:

1. A **standardized checklist**, that allows for freedom within the framework, that uses 4C data **to prioritize and rank consolidation potential across PWSs, state smalls and domestic wells**.
2. When aggregating data, increasing **stakeholder interest in voluntary consolidations**.
3. **Standardized, best-practice stakeholder engagement models** that can be consistently scaled.

Source Water Capacity: Sustainable water quantity

Interviews with stakeholders, participation in webinars and secondary research raised the issue of sustainable water quantity supply (supplemental materials 3). While the focus of safe and affordable drinking water has historically been on water quality, greater emphasis on access to a sustainable supply of drinking water is needed for effective water data strategy. However, the focus is shifting, evident by the addition in the final version of the Water Resiliency Portfolio of the need to address water shortages.[13]

There is a growing urgency to address source water sustainability, expressly in linking the Sustainable Groundwater Management Act (SGMA) with drinking water priorities. In California, many disadvantaged communities rely on groundwater as their source of drinking water. Statewide SGMA compliance will create large amounts of data on groundwater levels and source supply sustainability fundamental to understanding and protecting groundwater for drinking water. There is an opportunity for the State Water Board to proactively leverage the 20-year time horizon models used by SGMA to create a forward-looking perspective on drinking water. However, creating a collaborative link of data sharing between the State Water Board and DWR is imperative in establishing a collective watershed view on water supply efforts that span both groundwater and surface water. The research on this focus area identified **three aspirational benefits of improved data on drinking water quantity**:

1. The ability to create a quantitative **assessment of individual source water capacity and stability**.
2. The ability to **link water source to water system** to understand water supply risk across the state.
3. The ability to spatially estimate the **number of Californians without access to drinking water**.

[13] California Water Resilience Portfolio, https://waterresilience.ca.gov/

Division of Financial Assistance

Interviews with the Division of Financial Assistance further substantiated the issues surrounding TMF capacity and consolidation and identified two primary focus areas where improved water data would best impact DFA outcomes. Conversations identified using comprehensive TMF capacity data, trended over time, **to solve underlying water system issues rather than the current short-term solutions that require continual financial assistance**. For consolidations, improved water data could **push decision making beyond the current project proposal focus to a more holistic and regional approach to consolidations**.

Beyond TMF and consolidations, DFA recommends focusing on the sustainability and resiliency of water systems to provide safe and affordable drinking water over the long term thus complementing current DDW focus on systems at greatest immediate risk. The tension between immediate and long-term is evident in some indicators such as affordability, which may adversely impact revenues decreasing the ability of a system to be self-sustaining. It is believed that a more comprehensive view of water systems may aid in distinguishing two seemingly similar water systems as sustainable or failing in a five-year time frame.

Defining leading indicators, as opposed to the lagging indicators used today, would shift decisions towards proactive, forward looking solutions by extrapolating for sustainability. **For DFA, improved data could reduce quick-fix, reactive funding by establishing a framework to evaluate and prioritize projects that address the underlying causes of system failure or sustainability.** This resiliency-focus of DFA data dovetails with recommendations for TMF included in this document, highlighting again the importance of dedicated efforts to improve TMF data (particularly managerial and financial) to the benefit of providing safe and affordable drinking water in the long term.

Within DFA, there is a belief that data collected today is sufficient to begin the process of defining leading indicators for system sustainability. For example, analyzing and quantifying the relative cost effectiveness of DFA funded projects to discern parameters that drive costs is largely possible today. This could expand to include the calculation of not just cost per connection but also the cost of access to safe and affordable drinking water service provided over a longer (±10 years) period per household. Better data could also include the leading indicators of capital costs, operating costs, longevity of solutions, and lifetime value of solutions. This would also require the incorporation of implicit knowledge of DDW district engineers and other field staff, which would further add considerable value to the definition of leading indicators, significantly improving any initial algorithm. The goal of building and improving an algorithm around leading indicators is to eventually have sufficient data to identify tipping points for water system sustainability.

Defining the parameters and leading indicators that drive self-sustaining water systems today would enable better screening and more effective funding decisions going forward.

Relationship to ongoing efforts

The above recommendations must acknowledge the ongoing efforts already in development in the State Water Board that address aspects of these focus areas. Most notably, the State Water Board Needs Assessment identification of at-risk public water systems, domestic wells and state small water systems and cost analysis for interim and long-term solutions is fundamental to advancing these focus areas. In particular, the July 2020 draft final white paper discussion on the identification of Risk Assessment 2.0 indicators[14] and corresponding SAFER webinar on at-risk public water systems highlights the prime components of risk indicators, risk thresholds and weighting and/or scoring of the indicators. Importantly, the 2.0 Risk Indicator categories focus on quality, affordability, TMF capacity and touches on water quantity with respect to a PWS delivering safe, sufficient, continuous water.

Finding and accessing data is a deep-rooted challenge across State Water Board efforts towards solutions. As such, certain efforts such as the Clearinghouse under development within the State Water Board, need further dedicated resources and support. This concept of a one-stop-shop where all relevant existing data is housed and accessible across the State Water Board was one of t**he leading requests across survey and interviews and has the potential to increase efficiency, efficacy in all the focus areas.** Ideally, it would serve as the single interface for many users. To this extent, the work of the SAFER Needs Analysis unit should be prioritized to integrate the Clearinghouse effort and the Needs Assessment work.

OIMA also plays an elemental, ongoing role including programs on data and data management, as well as quality assurance guidelines. This role will provide continuing support in broader water data improvements that addresses these focus areas. **In many ways, today OIMA is the most critical organizational body that is helping unite water data within the State Water Board.** In this way, it serves a human-connecting role while also advancing technical capabilities. Additionally, the multiple formats and interfaces of data management and use innovation efforts (like the Data Management and Innovation Team - DMIT) administered by OIMA leads the modernization of State Water Board water data. These efforts have the greatest potential in an environment where staff are empowered with a level of autonomy to innovate and explore solutions to improve data use, which is also an environment that attracts and retains young, skilled staff.

Quickly prototyping tool concepts like the Drinking Water Systems with Violations tool, is indispensable to progress within the State Water Board's water data strategy. Visualizing data in this way, where users access a public site, increases transparency, understanding, and engagement with external stakeholders. These efforts, and many others not mentioned here, should be supported in the future to ensure continued progress.

Finally, what's also needed is greater focus on the user experience and user interface development (UX/UI) to make tool designs more accessible to a broad set of users. This requires dedicating more resources towards in-house expertise on UX/UI which, in turn, requires the support to create accurate user stories to inform UX/UI development.

[14] SWRCB, Draft Final White Paper Discussion on: Identification of Risk Assessment 2.0 Indicators for Public Water Systems, 2020. https://www.waterboards.ca.gov/drinking_water/programs/safer_drinking_water/docs/draft_white_paper_indicators_for_risk_assessment_07_15_2020_final.pdf

Stakeholder Benefits

Overall, improved water data can perhaps be best summarized by listing the direct benefits to stakeholders and how that new information will improve water decision making (Figure 8). Principally, the benefits of better water data **center around people and the public**, where any Californian can see, in near real-time, whether their drinking water is safe, access is sustainable, and if it is affordable.

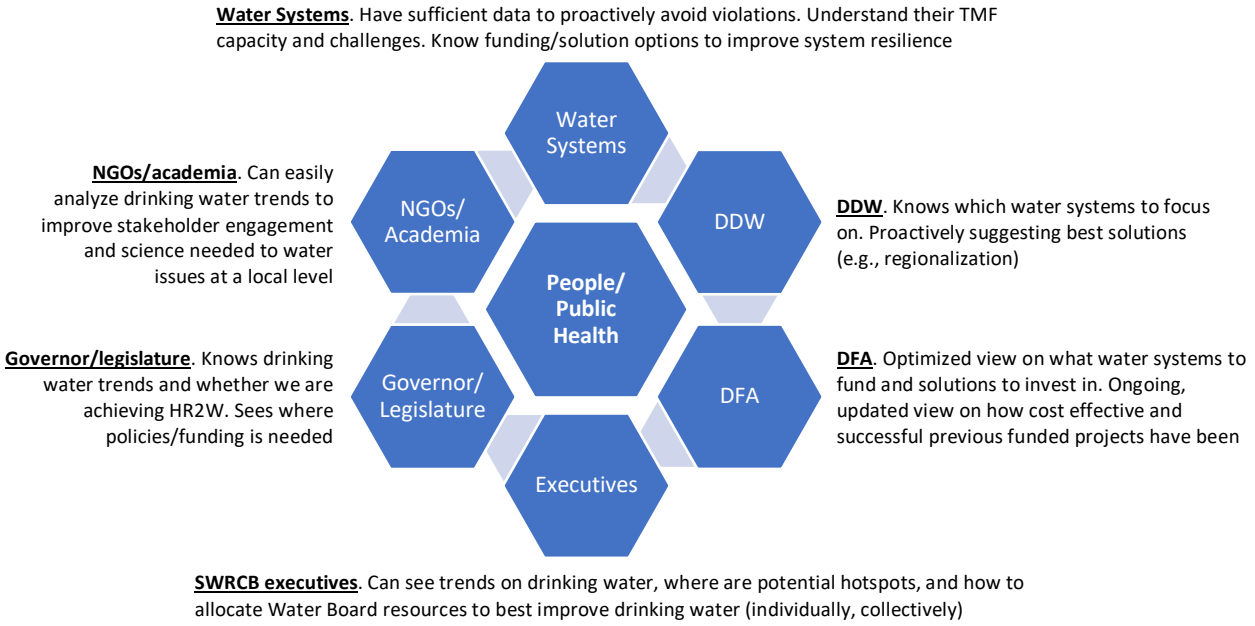


Figure 8 Better water data benefits many stakeholders, but optimization ultimately revolves around people and public health.

The identified benefits above are perhaps aspirational, and in some instances, it is realistic to assume they cannot be achieved in entirety for many years. However, these benefits serve to anchor a vision for the State Water Board that can guide near and interim steps toward that future state. It aspires to **simultaneously address public health, empower better tracking of safe drinking water, and enable improved decision making** essential to creating long-term sustainability of drinking water sources.

V. Cross Cutting Recommendations

Internal Leadership and External Collaboration

Globally and locally, from the United Nations *SDG 6 Synthesis Report* to PPIC's *Managing California's Water Report*, it is clear that implementing visionary change as it relates to water requires improved governance and strong institutions, "water crises are usually governance crises."[15] Specific to California water governance, strategic shifts in how both leadership and collaboration occur are critical to effective management of water going forward.[16] Additionally, the Portfolio outlines the necessity of building connections across the state in order to achieve sustainable stewardship of shared water resources and track outcomes toward regional water resilience.

In short, data alone is not sufficient. Even if perfect data were easily accessible and risk well documented, progress relies on key decision makers using information in a coordinated fashion. However, overall data interoperability and the procurement process in the state of California has not progressed with available technology. While this is an external hinderance, it directly impacts the State Water Board's internal efficiencies. Movements are underway within the State Water Board towards growing internal capacity, but it requires equivalent effort across external collaborators. Thus, success relies on addressing water data governance and collaboration both internal and external to the State Water Board.

Internal Leadership

Internally, the State Water Board must "lift the floor," and create new connective tissue across multiple divisions. Lifting the floor comes from improving the overall data literacy through the continuation of the Office of Information Management and Analysis's (OIMA) existing efforts and work related to the Data Management Innovation Team. It also entails cross-training efforts across the State Water Board for a shared language and understanding across divisions, for example training DIT staff on drinking water system concepts possibly through participation in field inspections, or training water executives on the latest IT advancements. The intention should not be to make every individual an expert at everything, but rather to achieve cross pollination between silos and to optimize individual potential through shared knowledge. Specific to DDW, the connective tissue should be a greater consistency of data driven decision making across all levels in the face of significant local variability in one water system to the next. The broader enterprise system in the DDW pipeline could be a source of achieving these goals.

In the broader State Water Board, connective tissue must be built through **clear organizational structures that guide strategy and implementation**. Encouraging and empowering staff to connect over innovative solutions is also essential in strengthening the internal structure of the State Water Board and improving retention of young, skilled staff. Building connective tissue may take the form of **a dedicated new group to help set priorities and solidify linkages between division efforts and business processes**. The role of such a group would be three-fold:

1. Create an inclusive integrated IT/data strategy
2. Identify prioritized use cases that span across divisions

[15] UN High Level Panel on Water, Action Plan, 2016. https://sustainabledevelopment.un.org/content/documents/11280HLPW_Action_Plan_DEF_11-1.pdf
[16] PPIC, Managing California's Water: From Conflict to Reconciliation, 2011. https://www.ppic.org/publication/managing-californias-water-from-conflict-to-reconciliation/

3. Provide technical resources and opportunities to ensure prioritized projects can be successful implemented. While these cross-training efforts and clarity of linkages are important between division efforts, action beyond SAFER and DDW is critical to reach the full potential of such efforts.

A steering committee, comprising high-level executives from each State Water Board division would oversee such a group and ensure coordination and engagement. Division of Drinking Water leadership, specifically the SAFER group must play a guiding role. Currently effective governance structures, such as DESC/DIET must also be incorporated into the broader organization.

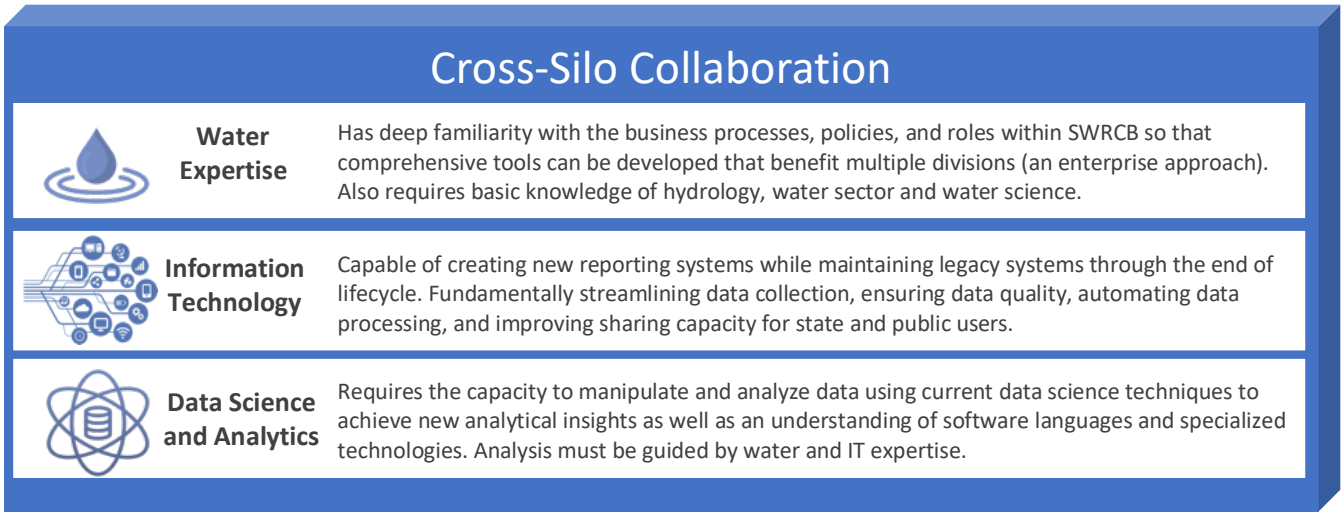


Figure 9 Three competencies essential in an individual to lead water data within the State Water Board. Excelling at human relations that foster collaboration to bridge organizational silos is paramount to all other competencies.

Coinciding with lifting the floor, the State Water Board must take a "raise the ceiling" approach. Interviews aided in the identification of three leadership competencies, nested within the paramount ability to foster collaborative relationships (Figure 9). These competencies, expertise in the business and science of water, informational technology, and data science and analytic abilities, are necessary to both champion the internal work described above and raise the ceiling of potential within the State Water Board.

While interviews uncovered evidence of deep knowledge and expertise in these areas across the State Water Board, there appears to be a lack of individuals that hold all competencies in full and some competencies are completely siloed within individual divisions. A strategic combination of multiple individuals currently scattered across the State Water Board holds the possibility of a strong representation of the three competencies to raise the ceiling. However, interviews also suggested significant benefit of **a new senior position**, filled by an individual residing in the State Water Board, that requires all competencies in a single applicant tasked with leadership of these recommendations and strategy.

External Collaboration

External collaboration includes engagement with state agencies and other stakeholders. Success rests on these groups being complementary and coordinated (see supplemental materials).

The need for **effective collaboration with other state agencies across both senior executive and staff level cannot be overstated**, particularly with other state agencies deeply involved in water such as DWR. There is growing urgency for greater coordination; connecting across groundwater and surface water, water quality and water quantity can only occur through central coordination between these agencies. At the most basic level, agreement on definitions, water boundaries and supplier information is needed. This is already being

acknowledged by senior leaders of both organizations and discussions are now occurring across SWRCB and DWR, including exploring how DWR may play a complementary, non-regulatory role in drinking water, working together to collect domestic well data and on well completion reports.

Specific to drinking water, the roles and responsibilities of each state institution must be comprehensively mapped, discussed, and optimized for the agreed upon desired benefits for local communities. To that end, Figure 10 lists relevant high-level drinking water datasets, studies, plans and other relevant information where improved water data integration between the State Water Board and the DWR would lead to better drinking water outcomes surrounding the distinct aspect of source water supply.

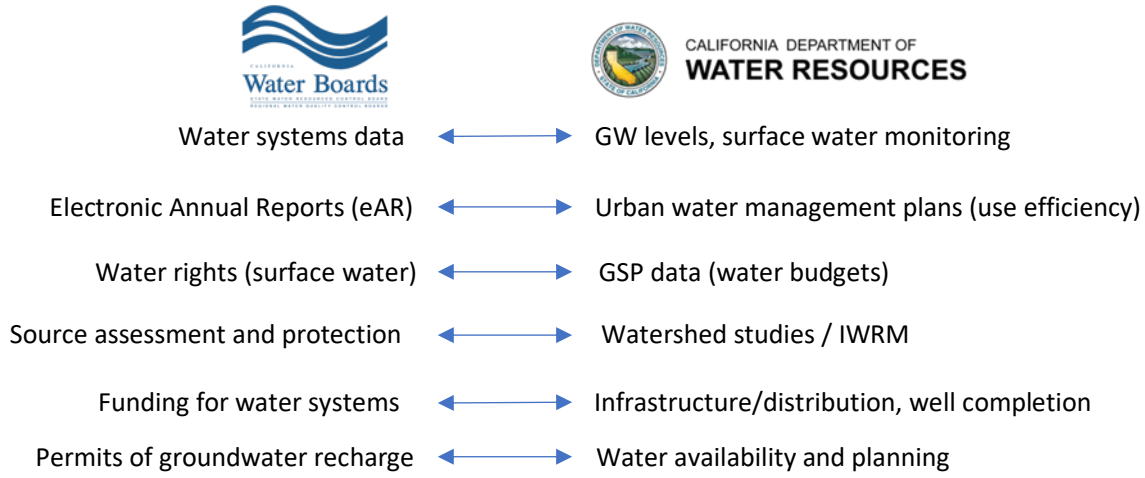


Figure 10 Examples of how integrating source water quantity across SWRCB and DWR would lead to better water outcomes and ensure a more sustainable supply and access to safe and affordable drinking water.

Establishing the fundamentals of how to better integrate analytics and modeling of groundwater data generated by the Sustainable Groundwater Management Act (SGMA) is a pressing issue for state agencies, especially as more groundwater sustainability plans (GSPs) are submitted in the coming years. Although this requires significant coordination between the DWR Sustainable Groundwater Management Office and the State Water Board, it is imperative in the response to the water access and source water quantity issues in California. This sort of external collaboration may take the form of an interagency task force, specifically built around SGMA.

Beyond the collaboration with other state agencies, State Water Board needs also to coordinate with other external stakeholders including water systems, community organizations, NGOs, and external water data groups such as the California Water Data Consortium, California Data Collaborative, and the Internet of Water. Such collaboration is central to ensuring that future tools are built in collaboration to avoid redundancy and encourage building upon previous efforts. How the State Water Board can collaborate with these other groups is explored in later sections of this water data strategy document, mainly on how it relates to a future roadmap of water data tools.

Tool Landscape

This type of successful collaboration and improved water data toward principal focus areas requires both understanding the current data tool status quo and leveraging that work where possible. California may have some of the best drinking water tools in the US. Most of these tools focus on collecting and publishing data for greater accessibility by the public, often driven by legislative action. A timeline of noteworthy drinking water efforts since 2017 illustrates some existing and future drinking water tools. (supplemental material 4, Tool Landscape and Figure 11). Additionally, other upcoming data tools such as GEARS (Groundwater Extraction Annual Reporting System) will be a critical complement to drinking water tools.

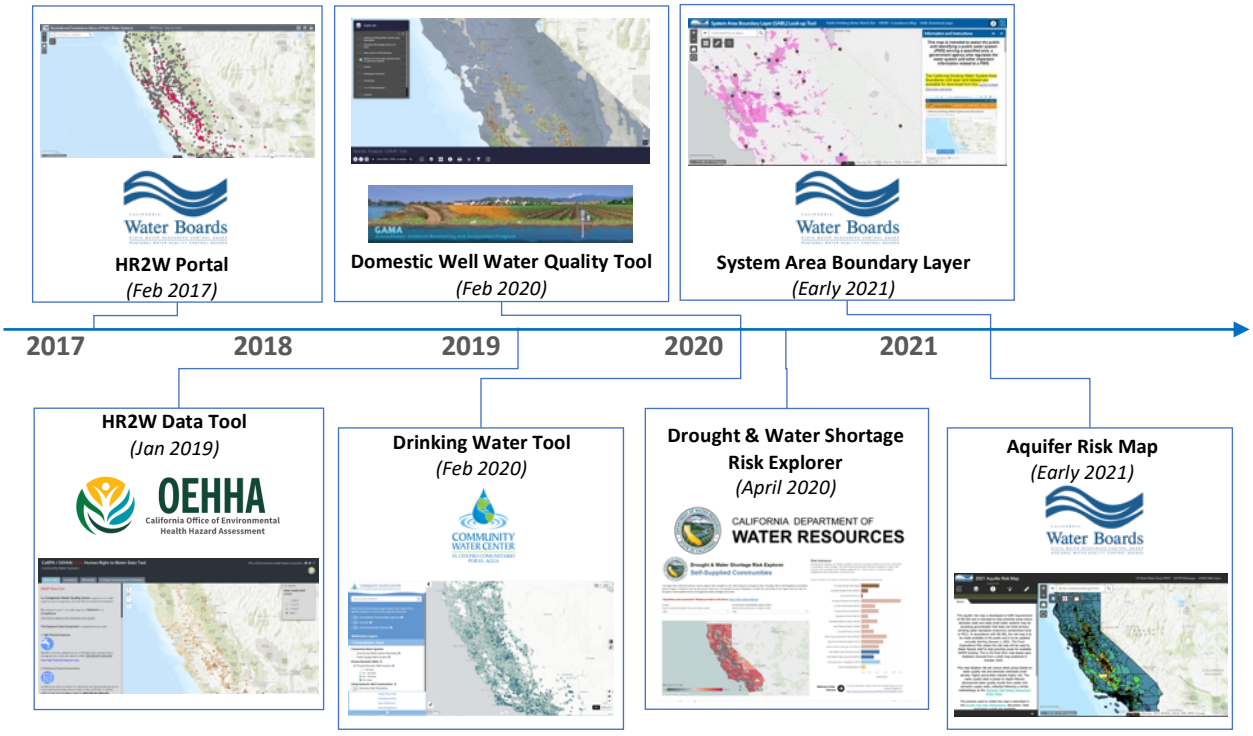
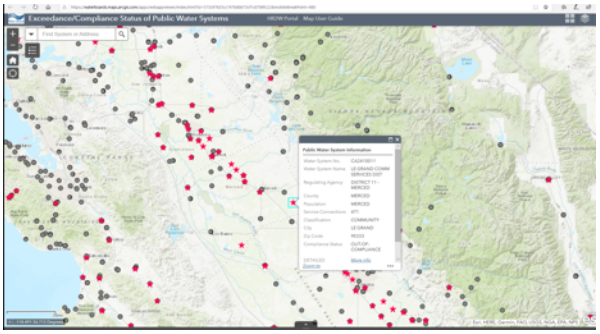


Figure 11 Current water tool landscape from 2017 to early 2021.

Each tool is respectively considered groundbreaking. Yet despite the varying levels of collaboration that went into these tools' development, in some ways the tools are overlapping rather than additive. A reoccurring challenge with these tools is the use of inconsistent frameworks and methodologies. Even when similar or shared data is used, the data is often interpreted in disparate ways. For example, Figure 12 presents water data for the Le Grand Community Services District, located near Merced CA, in four different ways.

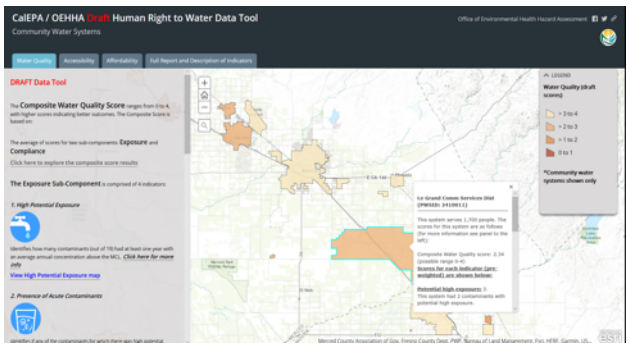
There is consensus amongst these tool makers on **the need for greater coordination and advancements in water data as the approach today is seen as both fragmented and constrained.** It is also acknowledged there are some clear gaps in tools today, predominantly as it relates to smaller water systems (e.g., state smalls and domestic wells), and water quantity related to source water supply. Ideally these gaps would be strategically addressed via support across state agencies, from agency leaders and the CA Department of Technology.

HR2W Portal



Out of Compliance
Associated file indicates 123-TCP violation in 1Q 2019

HR2W Data Tool

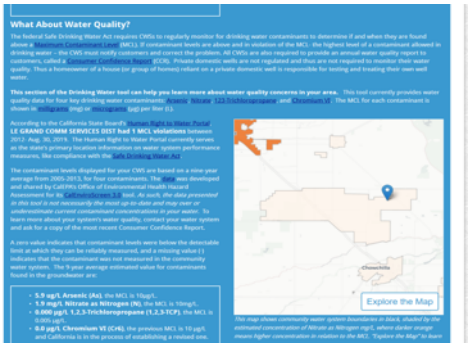


Composite Scores (out of 4)
Water Quality = 2.34 Accessibility = 2.75 Affordability = 1

Drought & Water Shortage Risk Explorer Tool

Risk score of 79 (out of 100)
Water Quality in Surrounding Basin: Red

Drinking Water Tool



Lists 2005-2013 averages for contaminants
Also lists one MCL violation (per HR2W portal)

Figure 12 Overlapping drinking water tools show how data for an individual district may appear in multiple formats.

Data Wishlist

To address the gaps in tools today, improvements and advancements in water data are needed. Initial interviews highlighted the challenge in what data could be collected as well as the opportunity to inform decision makers and promote the integration of data. Further surveys and interviews established a foundational data wishlist. This wishlist was supplemented by secondary research into TMF capacity data collected by other state and national agencies,[17] creating a picture of prospective datasets. This wishlist is not meant to be exhaustive and is intended to complement the risk indicator data efforts underway by the Needs Assessment Unit.

As a requirement of the SADW Fund the Needs Assessment Unit in the DDW has developed a comprehensive list of 129 potential risk indicators for "identifying public water systems, tribal water systems, state small water systems, and regions where domestic wells consistently fail or are at-risk of failing to provide adequate safe

[17] Additional references included policy documents from Colorado (TMF Capacity for Drinking Water Revolving Fund Project User Guide. https://www.colorado.gov/pacific/cdphe/drinking-water), Alaska (State of Alaska's Strategy for Improving the TMF Capacity of Class A Public Drinking Water Systems, 2000. http://dec.alaska.gov/media/5324/strategy.pdf), South Dakota (Capacity Assessment Worksheets for Public Water Systems, 2016. https://denr.sd.gov/des/dw/PDF/E0427LDV3-CapacityAssWorkSht.pdf), Australia (Australian Drinking Water Guidelines, 2011. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines).

drinking water."[18] As part of the Needs Assessment, a novel data fitness evaluation was also carried out which identified data gaps where desired metrics for evaluating systems risk of failure are not currently available.

This water data wishlist (supplemental material 4) contains 21 water data categories each of which contain multiple datasets linked not only to tool development but also to metrics and outcomes for drinking water. Some of the datasets in the wishlist exist today, however, many have data quality issues categorized into three tiers of spatial, temporal and other (Figure 13).

Spatial	Temporal	Other
S1. Coverage: Data for only select areas or systems. Data is not comprehensive S2. Comparable: Data available but varies across multiple sources so data can't be compared across disparate systems	T1. Outdated: Lack most recent and relevant data T2. Frequency: Insufficient sampling of data over definite period T3. Latency: Data exists but results are not timely	O1. Qualitative: Data is only available in qualitative, likely subjective form; lack of not quantitative objective data O2. Hardcopies: Data is available but in hard to access formats like hardcopy, use requires extensive manual effort

Figure 13 Three types of data quality issues found in water datasets today.

All data categories listed in this wishlist are used in a recommended tool, often at a discrete phase, ensuring that every dataset is informing a decision or process and is fit for purpose. The list constitutes an ideal set that would inform each phase and it is worth noting that tool phases may not necessarily require all the specified datasets. These phases are covered in the tool roadmap section below.

[18] This list was developed thorough consultations with internal and external stakeholders, feedback from public webinar workshops and surveys of DDW engineers, as well as consideration of existing tools and frameworks. https://www.waterboards.ca.gov/drinking_water/programs/safer_drinking_water/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

Tool Roadmap

To complement ongoing tool development, first and foremost the Aquifer Risk Map and NA Risk Assessment 2.0, there is an opportunity to address the gaps in tools for TMF capacity and consolidations through phased tool development. The phased tool development outlined below provides an example of a general approach for solving data challenges and can serve as a model for use by the State Water Board for other SAFER efforts and beyond. It is also important to consider this development in the context of the proposed DDW enterprise concept and roadmap. For both topics, a four-phase pathway towards solutions and improved decision making were developed with feedback from the State Water Board. These pathways are summarized in this section and can be found in depth in supplemental material 3, TMF Capacity and Consolidations.

TMF capacity tool

This work identified the need for a TMF capacity tool built into Clearinghouse, internal to the State Water Board. The tool would quantify and track TMF capacity by individual water system over time. To be effective, **this tool must inform decisions across the State Water Board, leveraging shared and consistent data** (Figure 14). Effectiveness also relies on clear definitions of regulations that define TMF capacity for example, managerial requirements with regards to training.

The TMF capacity tool would aid in decision making across the hierarchy of SWRCB, outlined below.

- SWRCB executives → Informs trends and impact on HR2W goals. Inform funding and policy decisions
- DDW executives → Decide on TMF Capacity program, emphasizing efficiency across all PWS in CA
- Section Chiefs → Inform regional TMF trends and local capacity building
- District Engineers/Staff → Decisions on PWS-specific TMF. Decisions on permits, actions, Administrators
- DFA → Inform which PWS should receive funding, based on TMF trends

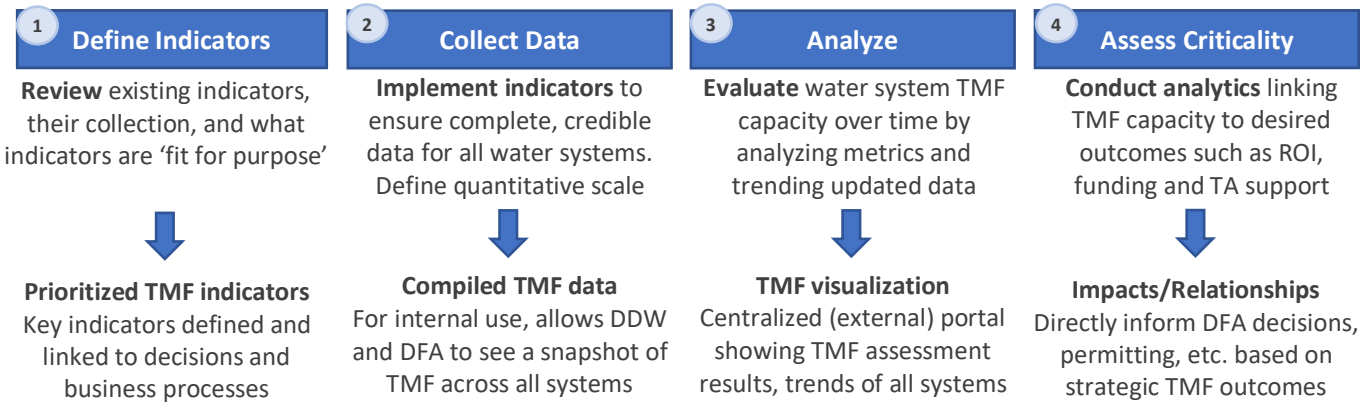


Figure 14 TMF Capacity tool potential pathway.

Additional resources are requisite to complete this pathway, particularly in phases 3 and 4. These two phases require sufficient data analytics capabilities, which is a known priority for the Needs Analysis unit. Further rationale and extensive background on the development of this TMF capacity tool pathway can be found in supplemental resources 4.3.

Consolidation tool

This work identified the need for a GIS map-based tool for consolidations. Key features include the analysis of consolidation potential for both receiving systems and at-risk systems based on clearly defined priority factors. Additionally, the tool would track the progress of systems during the consolidation process which, by identifying possible bottlenecks, could allow for **addressing barriers and accelerating consolidations over time** (Figure 15).

The consolidations tool would aid in decision making across the hierarchy of SWRCB, outlined below.

SWRCB executives → Informs impact of consolidations on HR2W goals. Inform funding and policy
DDW executives → Decide on consolidation strategy, goal setting and mix of mandatory/voluntary
Section Chiefs → Optimize mix of consolidation and other solutions, for their regions
District Engineers/Staff → Decide which systems should be consolidated (and type of consolidation)
DFA → Inform which PWS should receive funding, based on consolidation/regionalization potential

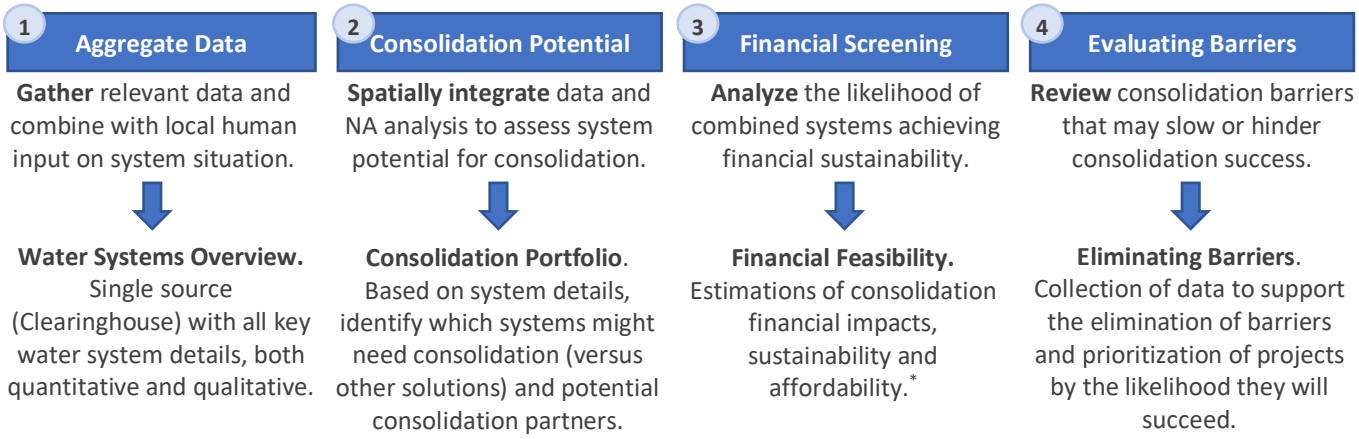


Figure 15 Water System Consolidations tool potential pathway.

*Note: Tool estimates are high-level screening only. Detailed financial calculations still required

For both TMF capacity and consolidations, the pathways are consistent and in alignment with work underway. The four phases of TMF capacity tool compliment and build on the current NA work now in the SAFER Program. Alignment on the consolidation pathway took place through multiple discussions and co-creation to ensure that the recommendations match the emerging strategy for consolidation within the Engagement Units.

Relationships between pathway phases

Pursuing the TMF capacity pathway and consolidation pathway must be done in a connected and parallel fashion as phases feed into each other and enable subsequent phases. Hence, the role of SAFER Program is critical to ensure close coordination. Furthermore, the inherent relationships between the pathways extend out to other decision-making opportunities. The successful implementation of these tools could provide valuable data into other parts of the State Water Board that in turn help to grow data driven decision-making throughout the organization.

Given the complexity and nuances in these tool pathways, a detailed review of supplemental material 4, which includes an aspirational four phase approach for source water supply solutions and its linkages to TMF capacity and consolidation, are essential to successful improvements. By building out these tools, and a third tool discussed below, the State Water Board will directly address the priority challenges facing threats to smaller

water systems based on poor TMF capacity, while correspondingly accelerating consolidation capabilities, primary solution for long-term resilience of drinking water.

Groundwater Recharge for Drinking Water

A novel opportunity exists for groundwater recharge for drinking water (supplemental material 4, Groundwater Recharge for Drinking Water) tool. Such a tool is especially relevant today for two reasons. First, the integration of SGMA related groundwater recharge and HR2W is difficult today (Figure 16). That said, linking recharge with water systems and communities is possible today if done in a coordinated way.

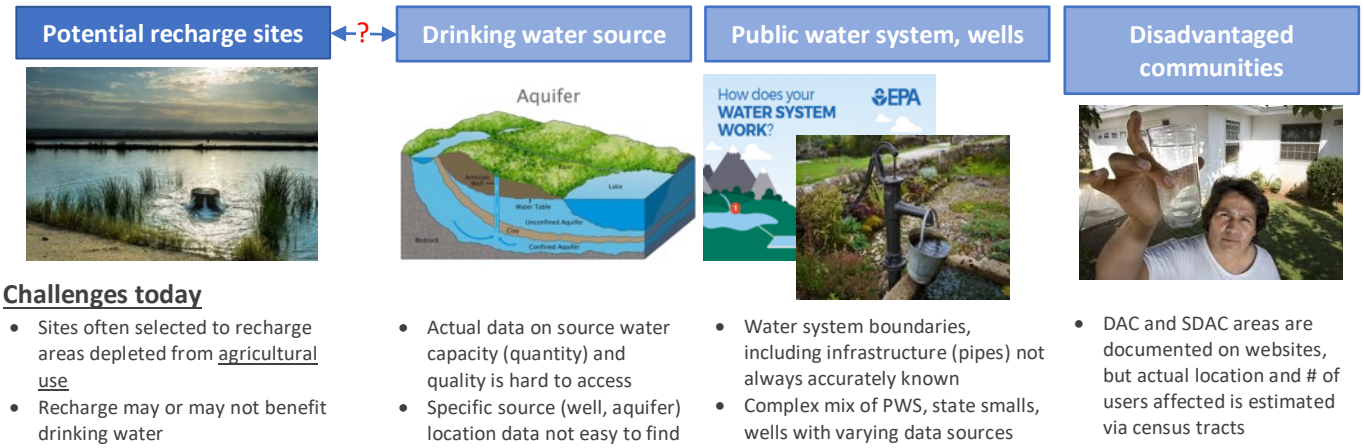


Figure 16 Groundwater Recharge for Drinking Water: Data integration is a significant challenge.

Second, there is a significant volume of water proposed as recharge by GSAs soon. To this extent, water data from SGMA compliance could directly inform approved projects in the coming years. Although there are still significant policy challenges related to groundwater recharge, this approach may form the foundation for solutions to offsetting the demand side reductions to groundwater that will be needed.

This tool would take the form of a **simple GIS map highlighting suitable recharge aquifer locations that would most benefit water systems and disadvantaged communities**. This concept focuses on recharge impacts for both quantity and quality while helping address well dewatering and aquifer overdraft affecting the most vulnerable DACs, outlined in Figure 17.

In this concept, the information and end users extend beyond SWRCB. Here are the decisions by end user:

GSAs → Informs project site selection for recharge projects specified in GSPs
DWR → Provide information to GSAs who are in process of submitting GSPs
SWRCB DDW → Helps inform Field staff and Engagement Units on how GSPs impact local water systems
SWRCB Div. of Water Rights → Information that can be considered in recharge permitting

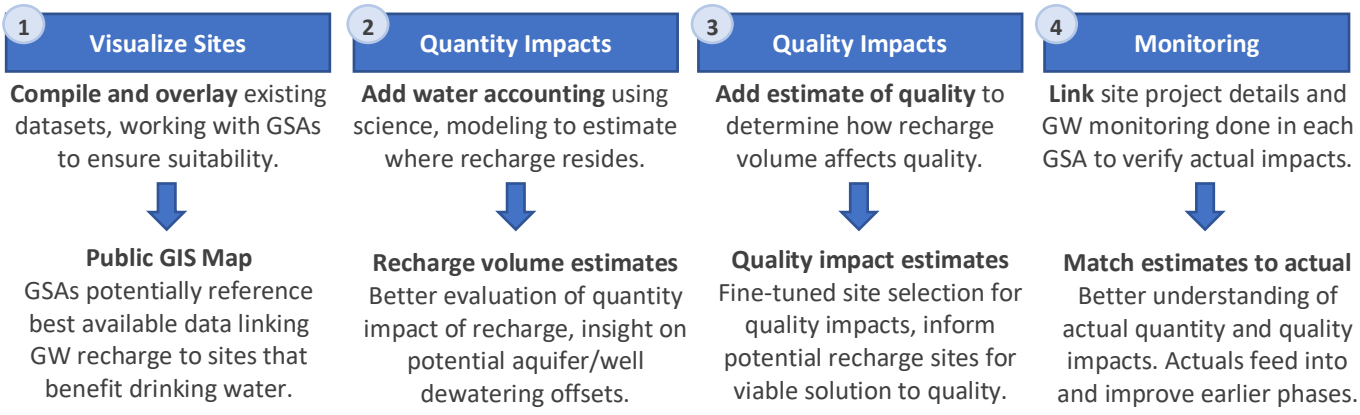


Figure 17 Groundwater Recharge for Drinking Water: Tool potential pathway.

The groundwater recharge mapping concept is distinct in that implementation would inherently require cross agency coordination between the State Water Board and DWR. To ensure connections to existing State Water Board programs, primary responsibility for groundwater recharge mapping should reside within the State Water Board. The first of these roles is that of DDW to identify communities and public water systems in greatest need. Second, the role of the Division of Water Rights to approve groundwater recharge permits and evaluate for water availability for recharge. Third, the Division of Water Quality which must ensure that groundwater recharge does not impact underlying water quality challenges for drinking water.

For ideas like the groundwater recharge concept, broad based engagement should be high priority. The State Water Board would presumably engage with DWR to convene a larger group of interested parties such as local GSAs, public water systems, disadvantaged communities, and NGOs and incorporate their views. Likewise, academia and other water data organizations could contribute data methodologies and science to these types of efforts. Further recommendations and considerations for growing engagement are outlined in supplemental materials 4.

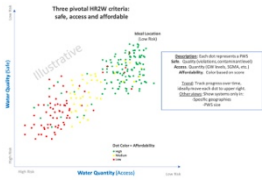
Potential Visualizations

The tool roadmap above is designed and recommended so that all facets are mutually reinforcing. Reinforcement across all facets is imperative since individual phases feed into each other and enable unified movement towards achieving the desired future state. This is perhaps most tangibly seen by integrating across the recommended datasets and tools to produce visualizations that lead to meaningful insights and thus improved decision making. Six visualizations are outlined in Figure 18 with large versions of the illustrative maps and graphs in

Graphs (by PWS)

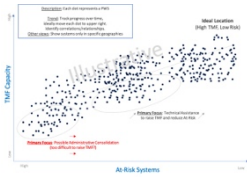
1 HR2W: Access, Safe, Affordable

Data: Water quality (violations, contaminants), water quantity (source supply), and affordability
Insight: Which PWS's do not meet all 3 of the HR2W criteria?



3 TMF and At-Risk: Trends

Data: TMF scores, At-Risk scores by PWS (and system size)
Insight: What is correlation between poor TMF Capacity and At-Risk?



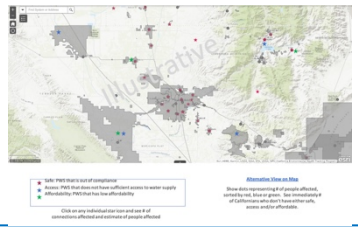
5 Financials and Funding

Data: F sustainability, PWS size (connections), DFA funding
Insight: What is correlation between PWS size and F? Which should be funded and how, through loan or grant?

GIS Maps (by People)

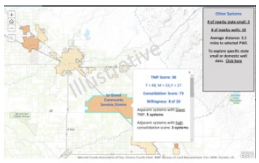
2 HR2W: Access, Safe, Affordable

Data: Number of users in PWS (or state smalls or wells) without HR2W
Insight: Who and where are the Californians without access, safe and/or affordable?



4 TMF and Consolidations

Data: Willingness to consolidate, score, TMF capacity, population
Insight: Where are adjacent systems with suitable consolidation and TMF scores? Population impacted?



6 DAC / Affordability

Data: DAC/population by location, relative affordability, DFA funding
Insight: Which DACs have the worst financials? What funding has the PWS received from SAFER? $/connection and results?

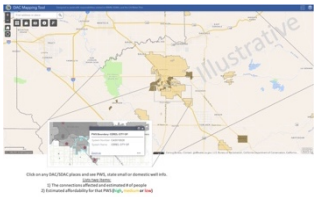


Figure 18 Recommended visualizations through the integration of multiple datasets.

Appendix IV.

These examples are offered to illustrate a few key principles that should underlie any future visualizations. Specifically, all graphs should be based on need: they should be done in direct response to known decisions that need to be better informed. They need to communicate progress and allow for interrogation of underlying data and assumptions reliably and transparently. They should go beyond being single moment in time "snapshots" and instead focus on trending of vital metrics and drinking water outcomes. They should also connect across disparate datasets, since it is often the bridging of individual datasets that will lead to new insights being surfaced. This is particularly true for more fully integrating water data with corresponding financial and social/ community-based data.

VI. Resourcing & Costing

Resourcing

As the main recommendations on TMF capacity, consolidations, and source quantity fit within the mandates of the SAFER Program, the Program should decide on whether existing team resources are sufficient for carrying them out. Presumably, additional resources will be required to hire or add to the SAFER team. Drawing on other resources (e.g., Division of IT, OIMA, or external consultants) may need to be considered for this work. The GAMA unit could also play an indispensable integration role, given their ongoing work on the Aquifer Risk Map. It is consequential to **maintain resources for the vital work developing Clearinghouse and potential future development of a DDW Enterprise system**, which could serve as the data infrastructure necessary to enable these water data strategy recommendations.

Potential costs

Creating an exact cost estimate for these strategy recommendations is challenging given uncertain timing, resourcing and exact scope to be implemented. However, it is likely that implementing all aspects of this suggested work would require several million dollars, especially if the State Water Board were to pursue and develop the more aspirational vision and metric recommendations.

Ideally, directional estimates at the individual tool level are useful. Comparing the resources and IT costs required for other recent water data tools, such as those cited in the Tool Landscape section of this report, may provide the best comparisons to estimate costs, as would focused conversations with future tool builders.

External comparisons suggest an estimated range for potential costs that may be two staff full time equivalents engaged on each tool development for 1-2 years. In this sense, it can be expected that any individual tool might cost in the range of $400,000-$600,000 if development costs are also included. It is pertinent to note that these numbers are directional only, given that tool development costs vary on exact scope, functionality, and level of stakeholder engagement required. A bite-sized, piecemeal approach is recommended to begin building out essential tool functionality. This can be done though phased development with an eye toward adding on greater functionality over time.

VII. Implementation: Next 12 Months

Implementing the strategy for data improvements for drinking water hinges on sequencing and prioritization, given current resource constraints at the SWRCB and other ongoing efforts. This includes the progress and continued prioritization of the Needs Assessment, priorities identified via DIET/DESC, Human Right to Water Portal, and Clearinghouse. External SWRCB efforts are critical too for ensuring scale and coordination, such as the Drought and Water Shortage Risk Explorer Tool. Building on these items, acting on these strategy recommendations will help accelerate current progress and ensure movement toward a shared, future state vision. Urgent action is needed as alignment with the Portfolio provides extra focus and impetus to build climate-resilient water systems for the state. The leading question is, **where do new recommended efforts fit into current priorities and what resources should be used for implementation?**

This section outlines the sequencing towards creating the TMF capacity tool and consolidations tools. Notably, the phases and full realization of all recommended tools are contingent on resources. Even so, it is still possible that actions listed here are achievable in some part over the next 12 months.

TMF Capacity

The recommended sequence for implementing the TMF capacity tool are summarized in Figure 19 and detailed in Appendix V. Immediate steps include addressing the broad landscape of **TMF capacity goals and definitions**. That means alignment on information flow and ensuring TMF is efficiently shared across and within all levels of SWRCB. TMF capacity progress relies on **redefining TMF monitoring** by defining and incorporating quantitative scales and indicators that guide data collection and monitoring over time. These first steps feed into the next set of actions that center on 4C data (Figure 7) input into Clearinghouse. Comprehensive data entails TMF capacity data for all water systems, including the crucial financial capacity data. Identifying missing data, then determining sources of and methods for collecting that data, aids in the development of fact-based rankings that are actionable. Along with aggregating data into Clearinghouse, dedicated resources are needed for in-house **IT systems development** that prioritizes UX/UI to address data issues.

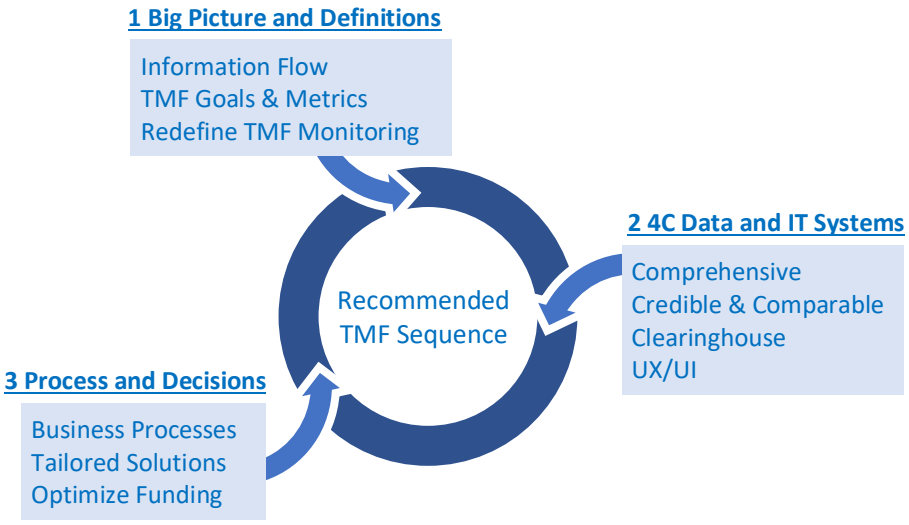


Figure 19 Recommended sequencing over coming 12 months to implement TMF capacity tool.

Finally, addressing processes and decisions based around TMF capacity, bolstered by the two sequences outlined above, will feed into the progressive loop of TMF capacity improvements. This third set of actions includes establishing a **stronger business process** with more data-centric, use-based practices. Then, creating **tailored solutions** based on identified trends and correlations that stem from 4C data. Finally, the opportunity to **optimize funding** through analysis of underlying issues and understanding of the future financial sustainability of a system will again feed back into the broader landscape of TMF capacity goals, repeating the cycle to increasingly efficient effect.

Consolidations

The summary of recommended actions for consolidations (Appendix V, Figure 20) follows a similar three step sequence as TMF capacity. Starting with the big picture and decisions surrounding consolidation, the need to **align decisions** at each level within SWRCB is an essential first step, as is clarifying precise roles and responsibilities at those levels. Also necessary is alignment on a **statewide strategy** where parallel and reinforcing efforts optimize consolidation activities. Additionally, the need for **further defining goals and metrics** remains a priority. Understanding proven strategies (e.g., regionalization) from other states as well as current consolidation efforts is needed as is defining long term, holistic goals with DFA for mandatory, voluntary and regionalization consolidation projects.

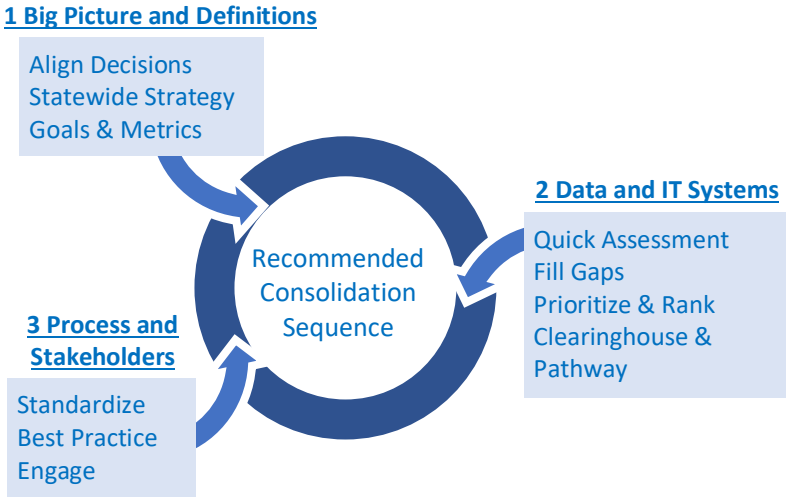


Figure 20 Recommended sequencing over coming 12 months to implement TMF capacity

Like TMF capacity, immediate action for consolidations should then be focused on data and IT systems. This includes a **quick assessment** of process flow and alignment on an evaluation checklist that then drives action on **filling data gaps**. A distinct focus must be made on improving system spatial data, incorporate state smalls and domestic wells, and capture willingness to consolidate data. **Prioritizing and ranking** systems for consolidation and ensuring that it also is viewable in the **central Clearinghouse** is essential at this sequencing step.

The third step in sequencing, and what will ultimately feed back into big picture and decision-making discussions, is acting on process and stakeholder efforts. Instituting consistent and clear frameworks to **standardize the evaluation of consolidations** while still allowing a degree of freedom feeds back into a statewide strategy of parallel and reinforcing efforts. Codifying, measuring and sharing **best practice** within the Engagement Units will further add to the consolidation process but as identified through interviews and surveys within SWRCB, devising **stakeholder engagement plans** is principal at this point in sequencing. This includes increasing voluntary interest in consolidations as well as collaborations with other entities and agencies outside of SWRCB.

VIII. Conclusion

California is the most progressive state when it comes to access to safe and affordable drinking water as a human right and has legislated and earmarked funding to achieve **some of the most advanced drinking water goals in the US**. In the past, funding and data infrastructure were unreliable which directly led to the slow progress of achieving the Human Right to Water. The Safe and Affordable Drinking Water Fund and Governor Newsom's Water Resiliency Portfolio highlight **the will and resources available to help further the goals of the HR2W**. These water data strategy recommendations provide guidance for meaningful progress in the near-term as it relates to the underlying data and decision making to improve drinking water outcomes. Given the current strengths and opportunities, contrasted by some notable threats to groundwater supply, **achieving the goals of the HR2W requires timely and initiative-taking action on the part of the State Water Board**.

This strategy urges focused effort towards TMF capacity, consolidations, source water capacity and groundwater recharge for drinking water data and tools. Significant complementary efforts are already underway, but this work identified the need for **increased clarity, unified direction and greater momentum for water data within the State Water Board**. Addressing this need necessitates taking focused, near-term steps outlined in this strategy document while also defining a long-term vision that builds towards achieving aspirational goals and outcomes.

The tool roadmap and pathways provide both aspirational and actionable recommendations for accelerating California's safe and affordable drinking water goals. Particular attention towards the groundwater recharge for drinking water concept is recommended as **a novel solution that encourages direct on-the-ground benefit to local communities** as GSPs are implemented in the coming months and years.

While technical and data quality challenges exist, **successful water data actions rest on the hard work and dedication of people.** Collaboration across divisions and hierarchical levels with the State Water Board is crucial. All decision makers, regardless of level, would ideally have access to shared data and insights that can be tailored to each role with clear responsibilities on decision making. Equally important is engagement and collaboration with external agencies and relevant stakeholders. We need to integrate groundwater and surface water, also water quality and quantity. This requires increased partnerships and collaboration. This will empower watershed stakeholders to make the best decisions for their local communities, using the best available data and science. It is people and users who link data, tools, decisions and outcomes.

Thus, it is the engagement of users, not just data, that is the central prerequisite to improved water data governance and the achievement of the human right to water for all Californians.

Appendix I: Interviews and activities

Summary of sources informing focus areas and strategy. Interviews and activities, December 2019 to November 2020.

SWRCB Board, Directors

Joaquin Esquivel, Chair
Elieen Sobeck, Executive Director
Laurel Firestone, Board Member

Division of Drinking Water

Darrin Polhemus, Deputy Director

SAFER Branch

Andrew Altevogt
Michelle Frederick
Karen Nishimoto
Caitlin Juarez
Kristyn Abhold

Quality Assurance Section

Betsy Lichti

Field Operations Branch

Stefan Cajina
Tricia Wathen
Chad Fischer
Bryan Potter

Division of Water Rights

Erik Ekdahl, Deputy Director
Brent Vanderburgh
Natalie Stork

Office of Information Management & Analysis

Greg Gearheart, Deputy Director
Rafa Maestu

Division of Water Quality (GAMA)

Scott Seyfried
Emily Houlihan
Carolyn Cantwell

Division of Information Technology

Russell Hernandez
Kiranmai Kesireddy
Mark Chan
Cheryl Holden

Division of Financial Assistance

Joe Karkoski
Jasmine Oaxaca
Lucio Orellana

Surveys

Field Office Branch, District Engineer/Staff, Water Data Survey **(n=64)**
SAFER Engagement Units Consolidations Data Survey **(n=14)**
DIET Water Data Survey Presentation (17 attendees):

Safer Branch
Michelle Frederick - SAFER
Kristyn Abhold - Needs Analysis Unit
Karen Nishimoto - Engagement Unit
Field Office Branch
Stefan Cajina – Chief, North Coastal
Zachary Rounds – Northern FOB
Tricia Wathen – Chief, South Central
Bryan Potter - Southern FOB
Eric Zuniga - Southern ROB
Hung Bui - Southern FOB
Sean McCarthy – Chief, South Coast

Program Management Branch
Betsy Lichti - Quality Assurance
Paul Williams –Data Management
Payman Alemi - Data Mgmt.
Montie Easter - Data Mgmt.
Joseph Emond – Data Mgmt.
Rassam Zarghami – Data Mgmt.
Eugene Leung – Treatment Tech

Workshops/Webinars

SAFER At-Risk Webinar 1, 2 & 3
CWC Tool Launch
SAFER Advisory Group Meeting 3
DMIT Public Forum

Needs Assessment

UCLA, Greg Pierce & Peter Roquemore
Corona Environmental Consulting, Tarrah Henrie
Pacific Institute, Laura Feinstein
Sacramento State, Maureen Kerner and Erik Porse
UNC Environmental Finance Center, Shadi Eskaf

Department of Water Resources

Deputy Director, Kris Tjernell
Water Use Efficiency Implementation Branch, Julie Ekstrom
Division of Planning, Kamyar Guivetchi
Sustainable Integrated Water Management, Jenny Marr
Statewide Infrastructure Investigations Branch, Ajay Goyal

Other External Stakeholders

OEHHA, Carolina Balazs
Community Water Center, Jonathan Nelson
WESS, Clare Pace
Fresno State, Sarge Green

Appendix II: Example aspirational goals and metrics

Example aspirational goals and metrics, electric utilities example

Aspirational goal: eliminate days without SADW.

Aspirational metric: Measure SADW disruptions by the minute, by individual, by system and over time

Electrical industry tracks similar metrics today (outage frequency/duration)

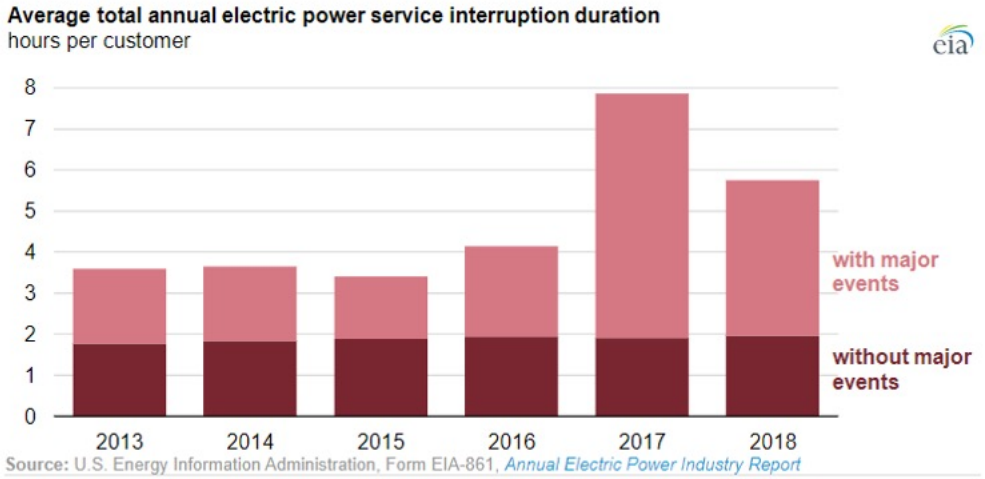
The reliability of electricity supply systems is generally measured using two metrics:

- System Average Interruption Duration Index (SAIDI)
- System Average Interruption Frequency Index (SAIFI)

JUNE 1, 2020

https://www.eia.gov/todayinenergy/detail.php?id=43915

U.S. customers experienced an average of nearly six hours of power interruptions in 2018



Source: U.S. Energy Information Administration, Form EIA-861, *Annual Electric Power Industry Report*

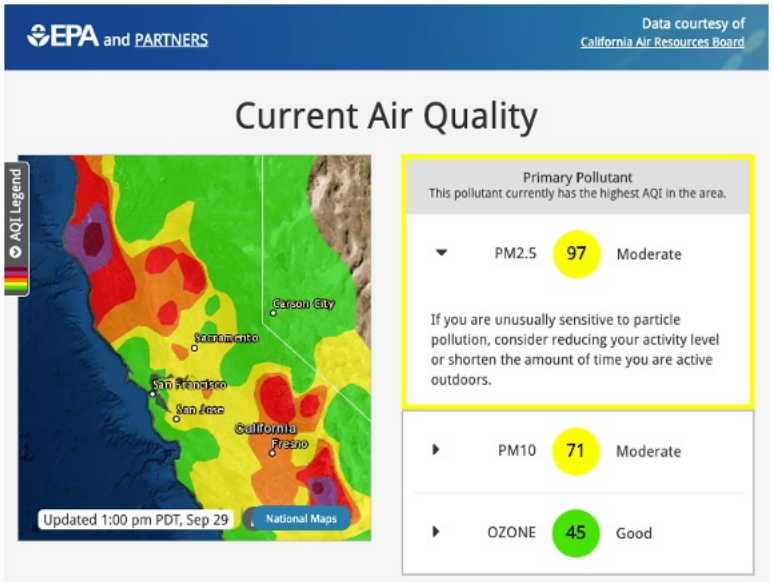
Interruptions in electricity service vary in frequency and duration across the nearly 3,000 electric distribution systems in the United States. Power interruptions are caused by many factors, including weather, vegetation patterns, and utility practices. In 2018, power outage durations for U.S. electricity customers averaged 5.8 hours per customer.

Example aspirational goals and metrics, EPA's AirNow.gov example.

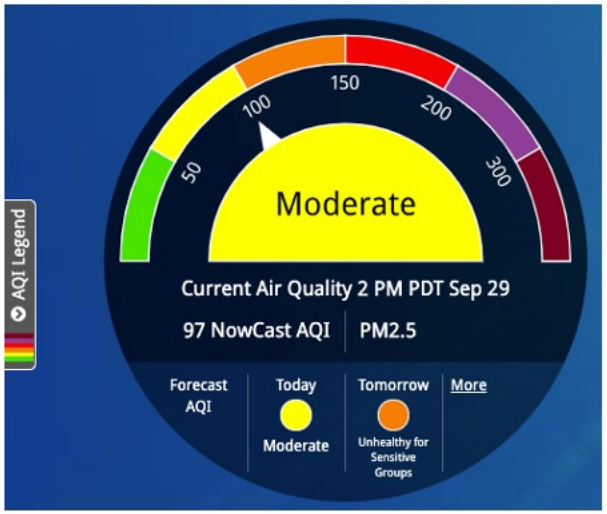
Aspirational goal: Public health alerts for drinking water

Aspirational metric: Real-time updates and monitoring of threats to drinking water

EPA, NOAA, National Park Service, NASA, CDC, and tribal, state, and local air quality agencies partnership to **provide real-time, localized air quality and health updates** to the public online and app based.



https://www.airnow.gov/



AirNow.gov uses a **centralized data system** in order to provide **quality control,** national **reporting consistency**, and the ability to **distribute data** to the public, researchers, businesses, educators, and to other data systems.

Appendix III: Six topics to explore on how water data can improve outcomes.

Six topics to explore on how water data can improve outcomes. Section Chiefs (Field Operations Branch).

Response to the question: *If you could get better drinking water data and tools, what would you want?*

1. Staff Resources

What. Way to track and understand task resources and needed staff

Why. Key operational decision they make is allocating staff resources. Need data to substantiate resource requests

"People often ask us about water quality or violation data. **But if you are trying to manage those outcomes, you need to be able to manage staff resources first.**"

2. Trends Dashboard

What. Way to trend key metrics and outcomes across all districts

Why. Would allow better management and communication to public and key communities

"We need dashboards. That's the first thing I thought of when you asked about data. **Dashboards would allow us all to be on the same page.**"

3. TMF Metrics

What. Metrics to compare TMF across multiple systems, statewide

Why. Better compare and drive improvements in TMF capacity. Inform needed solutions to address issues

"Section Chiefs would **ideally have ability to draw relationships correlated to TMF.** Leading indicators is exactly what we are looking for."

4. At Risk Systems

What. Way to proactively identify systems that may be future violations

Why. Need to be more proactive on identifying systems. Proactive, not reactive will allow us to get ahead

"I admit At Risk is pretty subjective. But there are some obvious red flags that can be identified. **We haven't done this fully yet, but it would be really beneficial.**"

5. Consolidation

What. Data to better inform when/ where consolidations should occur

Why. Real chance to improve how consolidations are identified and prioritized to "stop the bleeding"

"**Consolidation, although not the answer for everything, is the key for long term-sustainability** of the drinking water supply."

6. SW and GW Levels

What. Ability to know how surface/ groundwater is trending for each district

Why. Data available today in pieces, but hard to put together an integrated picture (e.g. learn from past droughts!)

"**We know source issues are critical for resilience. But today, there is no easy way to look that up.** How can we all systematically get all that data together?"

Six topics to explore on how water data can improve outcomes. District Engineers and Staff (Field Operations Branch).

Insights from survey: *What improvements that can most empower DE/staff to drive greater public benefit?*

1. One-stop-shop

What. Full incorporation of all data and tools into single system

Why. A single system consolidates the evaluation, prioritization, and management of at-risk systems

"One platform for everything! No multiple databases, no excel spreadsheets. **A one stop shop.**"

2. Quantified TMF

What. Complete, credible, comparable and cost-effective TMF data

Why. TMF Capacity data is perceived to be the biggest data gap today by topic area. Rating systems, including F viability, do not exist today

"Our ability to rate or state a water system's TMF capacity. **It would be great to give the water system a fact-based rating.**"

3. Consolidation

What. A system of prioritizing consolidations based on factors beyond water quality

Why. Ideally lay out feasible options for consolidations via individual system analysis on an easily visualized map

"Consolidations should be done case-by-case. **Forcing systems to consolidate can rub people the wrong way.**"

4. Compliance Metrics

What. Standardized, automated tracking of water systems on HR2W list and progress towards compliance

Why. Current manual tracking is custom and difficult to see milestones progress towards RTC of at-risk systems

"Enforcement water system response tracking…we currently [do this]…**but is not as efficient as it could be.**"

5. Business Process

What. Identify necessary decisions then create more data-centric and streamlined approach to daily practices

Why. Data converting (e.g., PDF to digital), and cleaning is lengthy. Need to prioritize what is most needed to improve decisions

"**We need to identify a specific use for all data we collect.** Data without a specific use should not be collected."

6. Efficiency and tools training

What. Training and reporting/visualization tools to generate greater efficiencies for both Staff and DE in their daily work

Why. DE/Staff see data best practice today still has significant gaps

"**Annual data training -** this is where our data is stored, this is how you access it, this is where you go for questions and additional resources."

Six topics to explore on how water data can improve outcomes. Division of Financial Assistance.

Response to the question: *Where do you think better drinking water data and tools might be beneficial to DFA?*

1. Project Funding

What. Analysis of past DFA projects for relative cost effectiveness and impacts

Why. Analysis can inform DFA funding decisions. Despite unique, what are "typical costs" and what are cost drivers

"This is a really important issue, but info is not in a usable form. **If we can determine the key parameters that drive costs, we could do better screening for funding.**"

2. Process Efficiency

What. Analyze process to see where DFA can drive administrative efficiency

Why. Opportunity to improve resource decisions in DFA. Shift work as needed to get more done

"This could help resource flexibility (helping solve backlogs). **We sometimes do this kind of efficiency work, but usually after stuff starts breaking.**"

3. TMF Capacity

What. Better understand TMF capacity of each system to optimize funding

Why. TMF is not tracked well today. Need to make assessments more robust and available when evaluating funding

"If we can effectively trend TMF over time, we will likely make different decisions. **Poor TMF means we need to stop putting on a Band-Aid and address underlying issues.**"

4. At Risk Systems

What. Proactively identify systems to direct $ to where it is most needed

Why. Opportunity to be more strategic on who gets funding (not just who gets to DFA first). Must build on NA work

"We need to get funding out the door quickly. Having said that, **we can improve targeting to ensure systems who <u>most</u> need the money actually get it.**"

5. Regionalization

What. Inform where regional solutions are best (not just single system action)

Why. DFA has seen many instances where water districts can be more strategic and "holistic"

"It would really benefit if we could look in a more holistic way (across multiple organizations), **going beyond planning in just a narrow project proposal way.**"

6. Data Structure

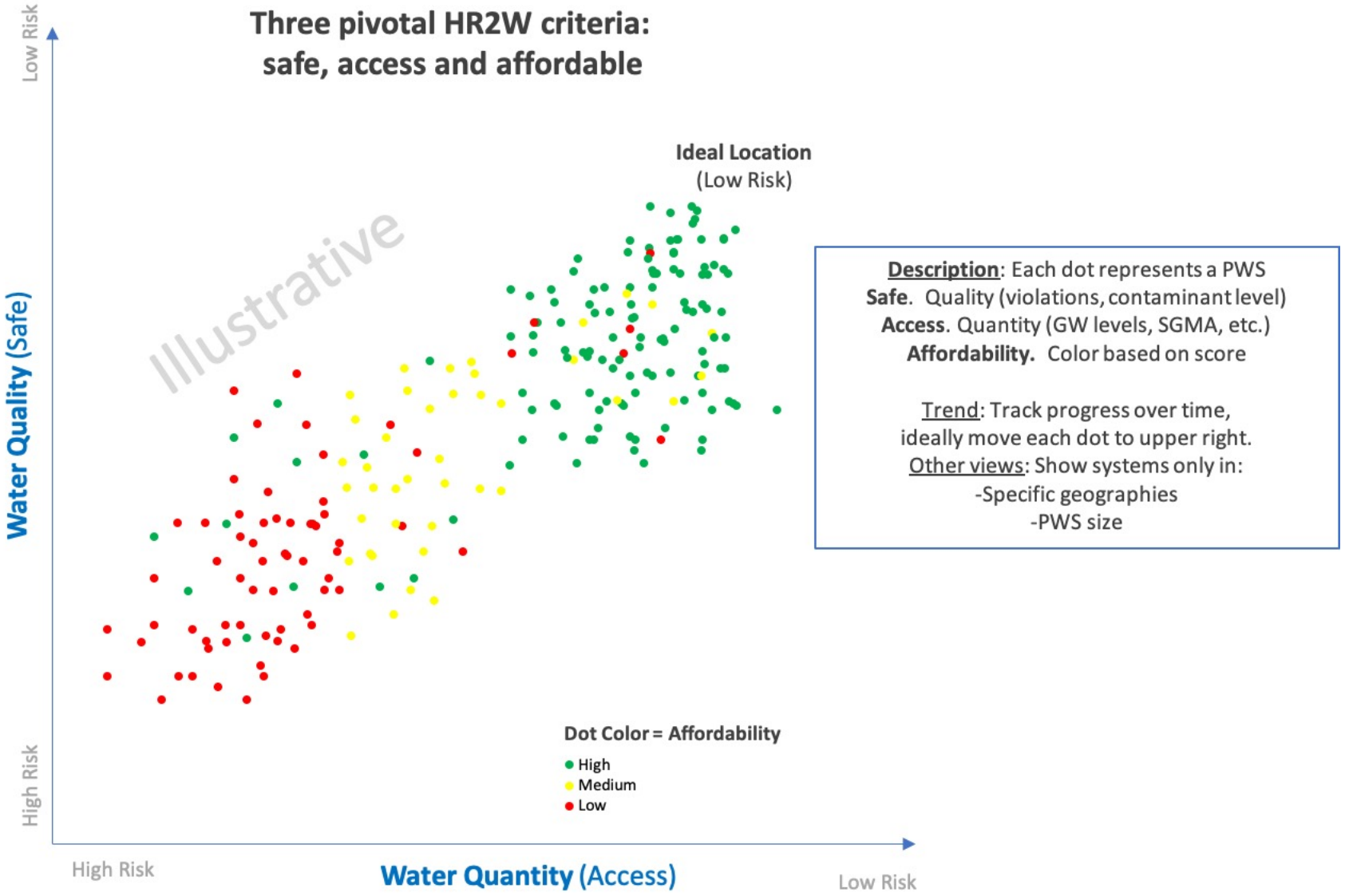
What. Improve DFA access to "data", since parts not really usable today

Why. Make better use of current data. Also improve data management so the data is in more usable form.

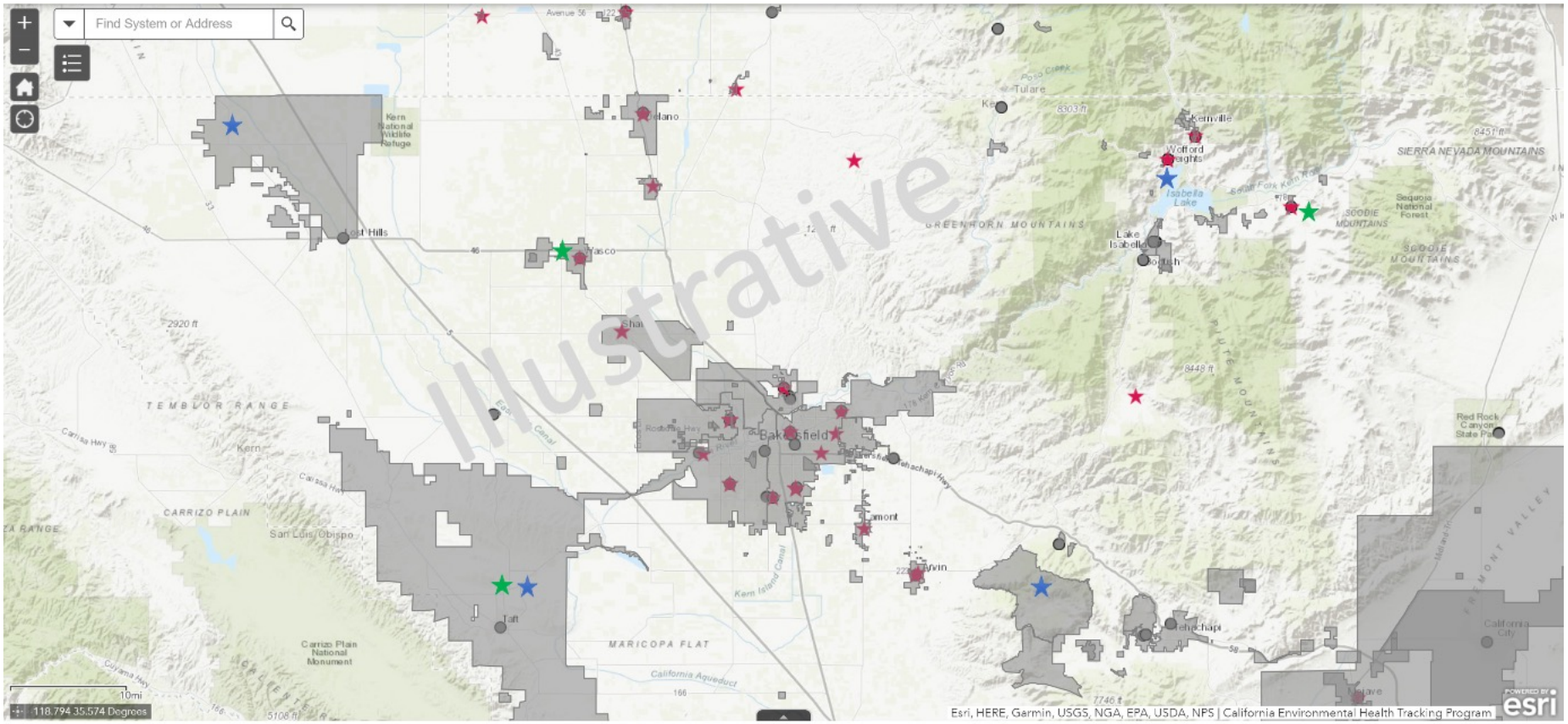
"There are a lot of forms, but that doesn't get into databases. Data lives in paper that is not easily accessible. **Fixing this could help us focus on the most important questions.**"

Appendix IV: Drinking water dataset visualizations

Drinking water dataset visualizations. Graph 1. Safe, Access and Affordable: PWS view.



Drinking water dataset visualizations. Graph 2. Safe, Access and Affordable: People view.



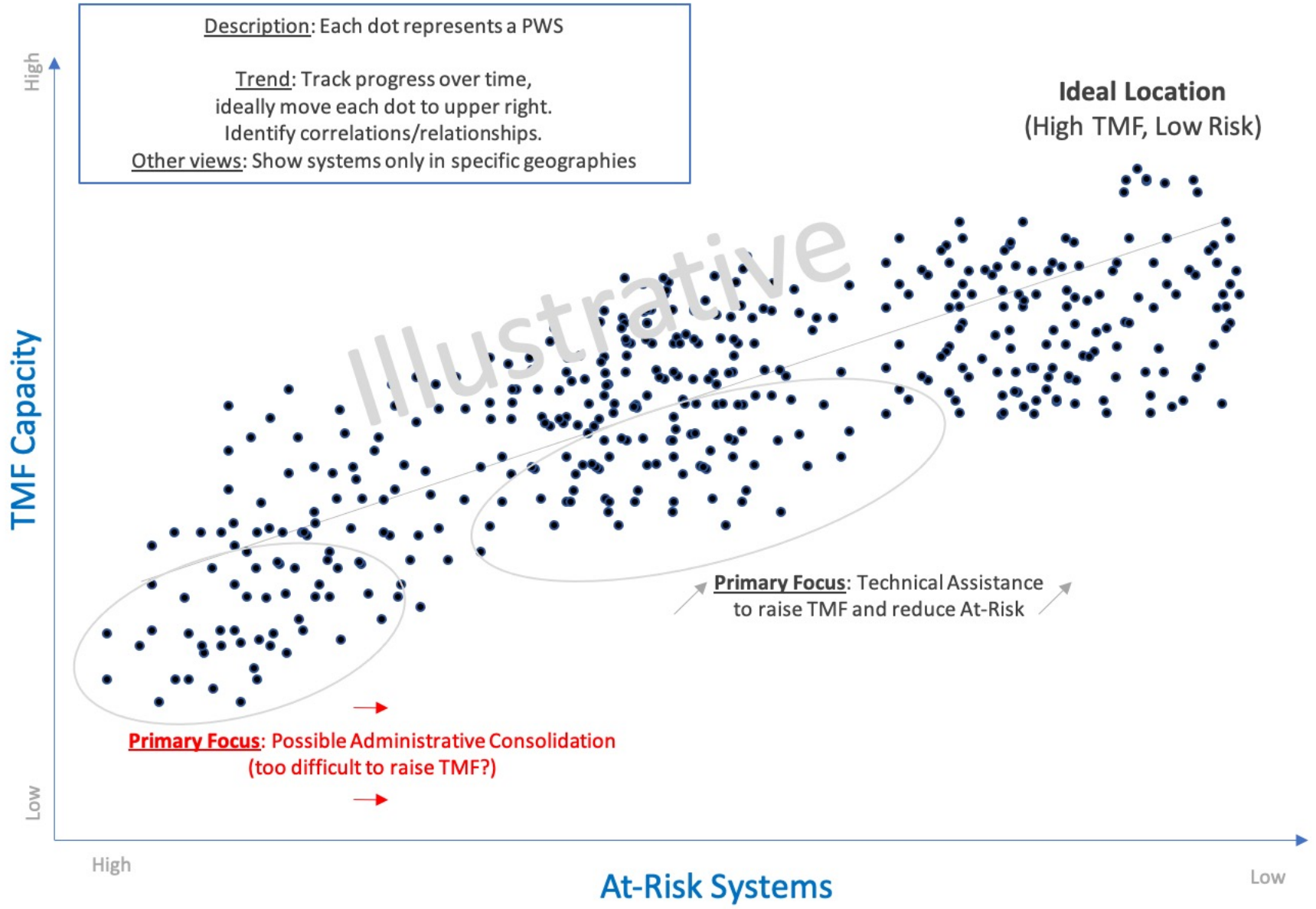
Safe: PWS that is out of compliance
Access: PWS that does not have sufficient access to water supply
Affordability: PWS that has low affordability

Click on any individual star icon and see # of connections affected and estimate of people affected

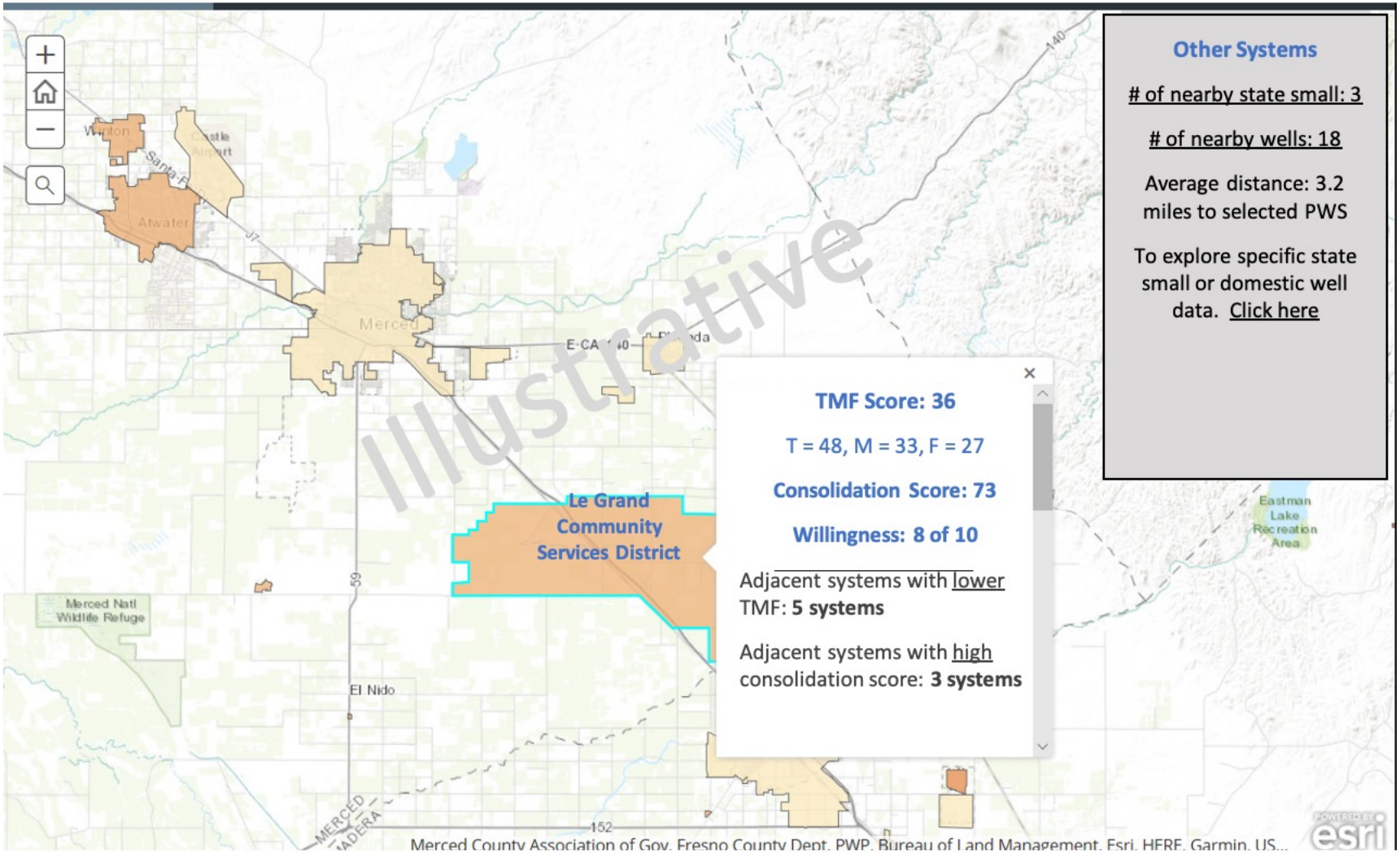
Alternative View on Map

Show dots representing # of people affected, sorted by red, blue or green. See immediately # of Californians who don't have either safe, access and/or affordable.

Drinking water dataset visualizations. Graph 3. TMF Capacity and At-Risk Systems: Trending over time.



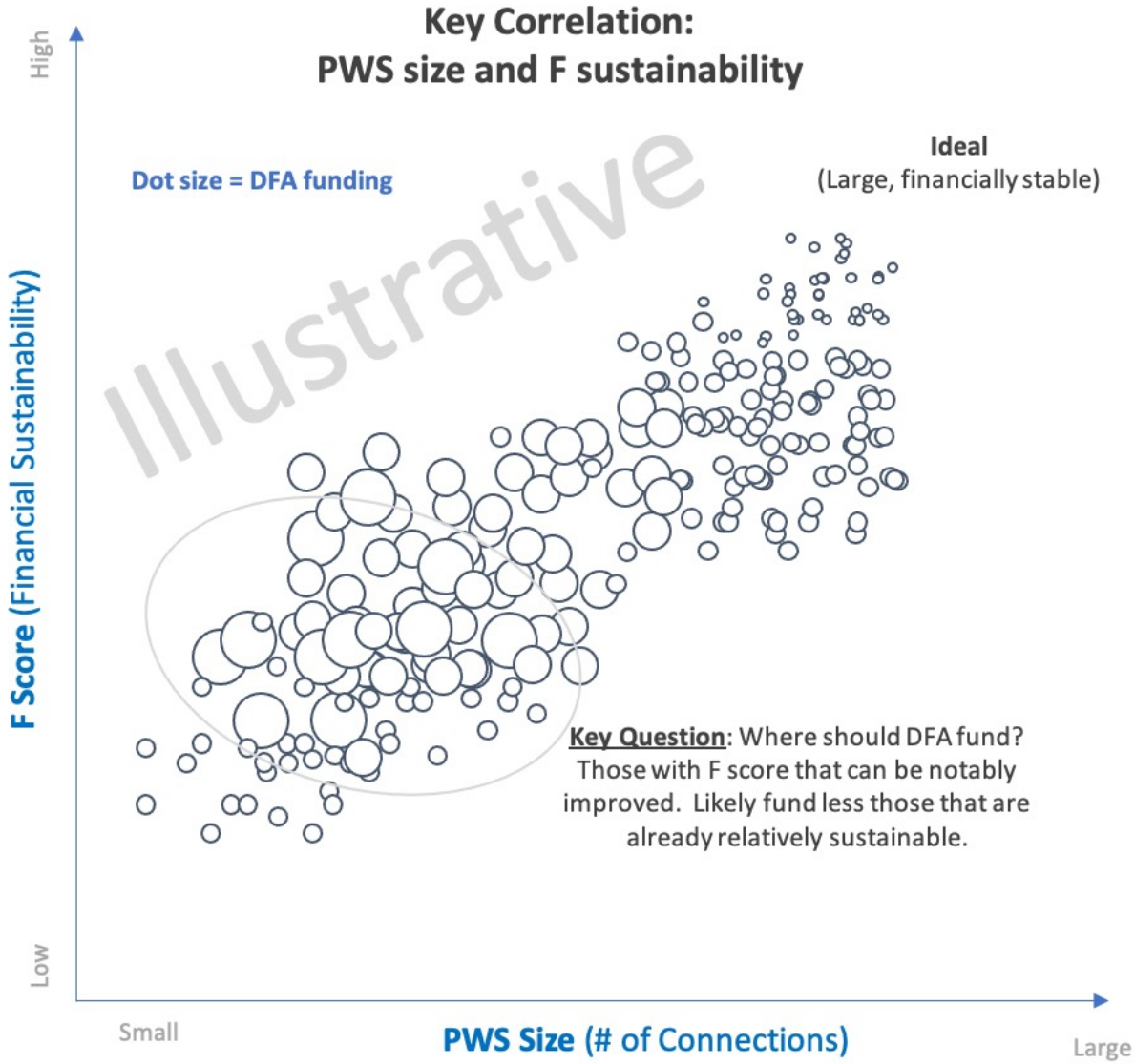
Drinking water dataset visualizations. Graph 4. TMF Capacity Consolidations.



Click on any individual PWS and see details on TMF capacity, consolidation score, and willingness to consolidate.

See additional details on neighboring PWS, state smalls and domestic wells.

Drinking water dataset visualizations. Graph 5. Financials: PWS size, financial sustainability and DFA funding.



Description: Each dot represents a PWS

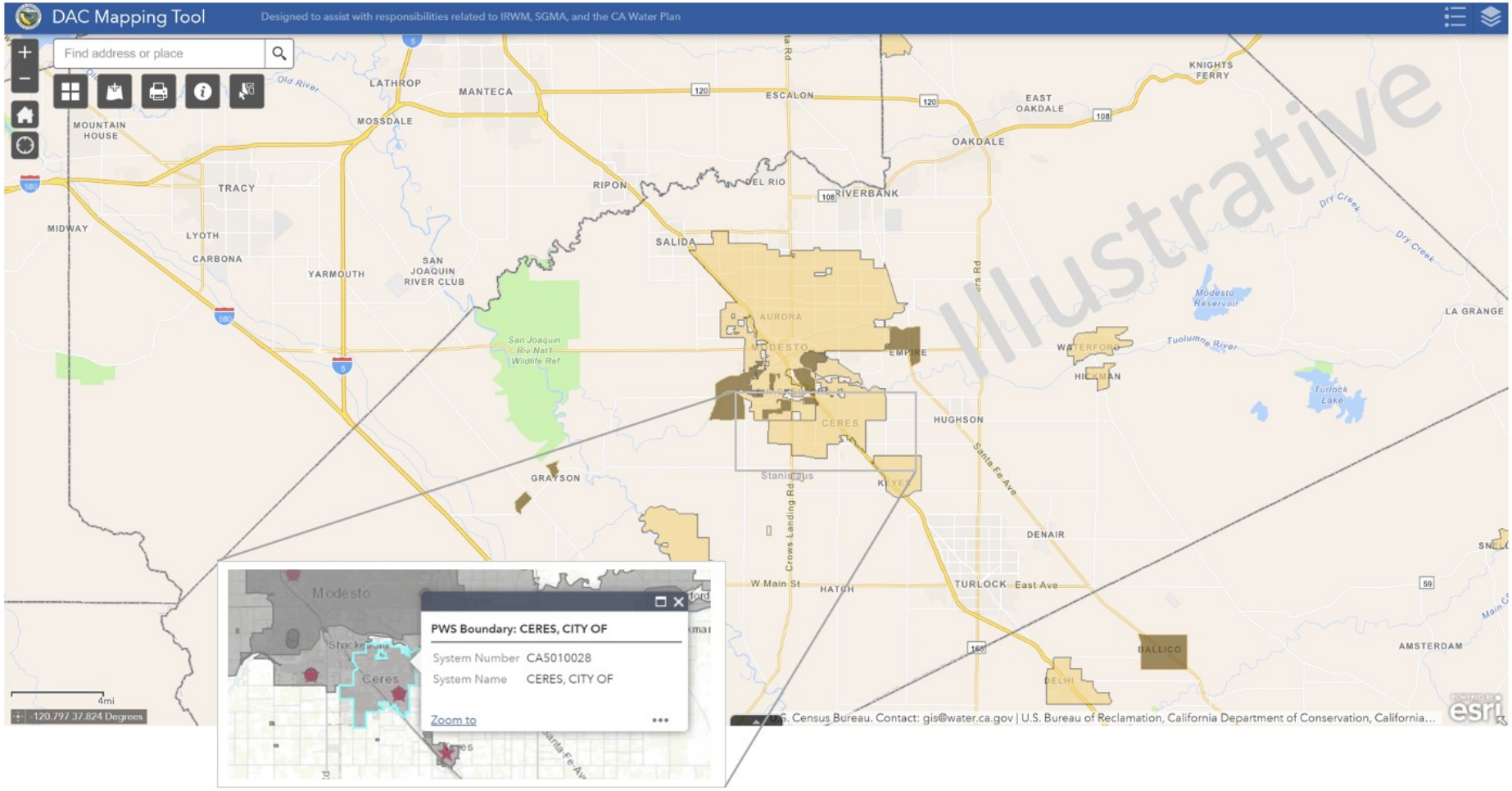
PWS Size. Number of connections

F Score. TMF score, specifically F

DFA Funding. Current and previous $ funding

Trend: Track progress over time, ideally move each dot higher.

Drinking water dataset visualizations. Graph 6. DAC and Affordability.



Click on any DAC/SDAC places and see PWS, state small or domestic well info.

Lists two items:

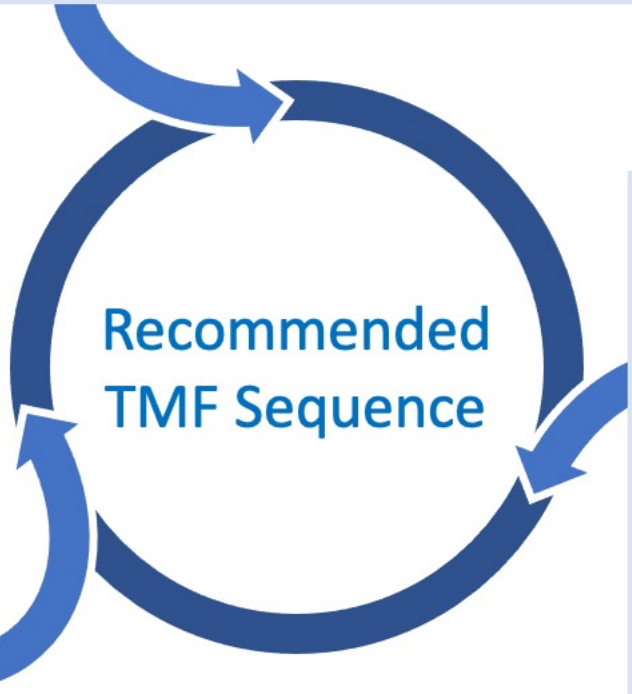
1) The connections affected and estimated # of people
2) Estimated affordability for that PWS (high, medium or low)

Appendix V: Sequencing for implementation

Sequencing for the implementation of the TMF capacity tool. Summary of recommended next steps.

Big Picture and Definitions

Information Flow: Ensure directives and data are efficiently shared across and within all levels of SWRCB
TMF Goals & Metrics: Agree upon objective, consistent outcome-based metrics and clear vision
Redefine TMF Monitoring: Define /incorporate quantitative scale and TMF indicators to guide data collection and monitoring over time



4C Data and IT Systems

Comprehensive: Prioritize TMF capacity data for *all water systems*, particularly small water systems. Improve financial capacity data
Credible & Comparable: For poor or missing data, determine sources and methods for *comparable and credible* collection. Develop quantitative *fact-based TMF ranking* across any state system
Clearinghouse: Ensure all data is aggregated and accessible in a central, single *cost-effective* source that can incorporate increasing functionality over time
User Experience and User Interface: Dedicate in-house resources and prioritize development of UX/UI to address data issues

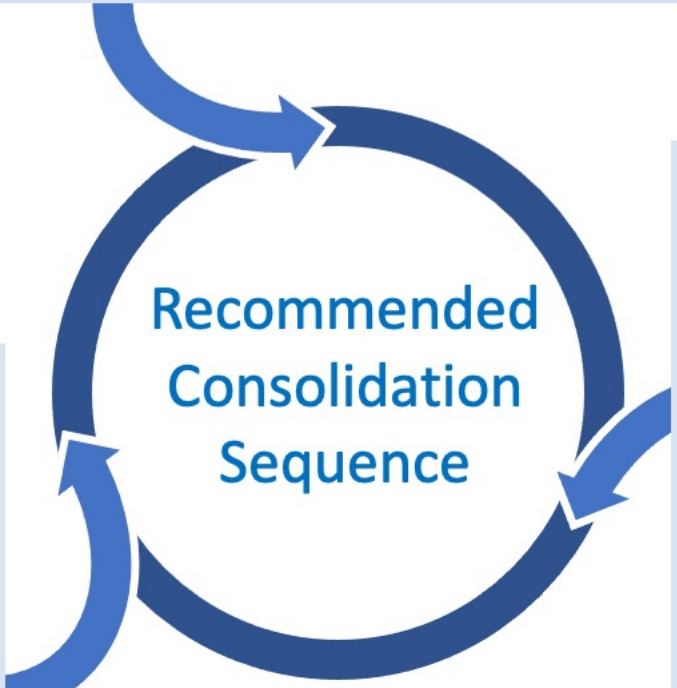
Process and Decisions

Business Processes: Establish more data centric, use-based business practices
Tailored Solutions: Identify trends and correlations based on TMF to create efficient solutions
Optimize Funding: Evaluate funding decisions to address underlying issues and potential for sustainable operation

Sequencing for the implementation of the Consolidations tool. Summary of recommended next steps.

Big Picture and Decisions

Align Decisions: At each level of SWRCB, align on consolidation decisions. Clarify roles and responsibilities
Statewide Strategy: Apply parallel and reinforcing efforts for identification and implementation of projects
Goals & Metrics: Incorporate proven strategies from other states. With DFA, define long term, holistic goals for mandatory, voluntary consolidation and regionalization



Data and IT Systems

Quick Assessment: Aggregate and assess key factors for process flow along 4c criteria for use in checklist
Fill Gaps: For missing data, determine sources and methods for collection. Improve system spatial data. Incorporate state smalls, domestic wells. Capture willingness to consolidate and social capital data
Prioritize & Rank: Develop prioritization and ranking system that includes datasets beyond water quality
Clearinghouse & Pathway: Ensure all data is aggregated and viewable in a central, single source that can incorporate increasing functionality over time

Process and Stakeholders

Standardize: Institute consistent and clear framework/checklist for consolidation process that allows degree of local modifications by Engagement Unit sections
Best Practice: Codify, measure and share best practices for consolidation acceleration
Engage: Devise stakeholder engagement framework using best practices and success stories, increase voluntary interest. Collaborate with other entities/agencies outside of SWRCB