DROUGHT CONTINGENCY PLANS

FOR RURAL DISADVANTAGED UNINCORPORATED COMMUNITIES IN CALIFORNIA

COMMUNITY WATER CENTER
EL CENTRO COMUNITARIO POR EL AGUA

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Executive Summary

In April of 2017, California's drought emergency was lifted in the entire state except for the counties of Fresno, Kings, Tulare, and Tuolumne. The continued effects of drought in these counties coupled with the planned termination of state drought relief funding speaks to the increased need for robust drought contingency and water shortage plans. This report covers key components of drought contingency and water shortage plans for small water systems and self-supplied water users in rural, disadvantaged, unincorporated communities. The analysis and recommendations of this report heavily focus on equity, gaps in existing water shortage and drought plans, and opportunities for integration into existing plans and resources.

Through a review of academic literature and 18 drought and water management plans, this report identifies best practices and presents innovative recommendations. The range of plans reviewed include the following: tribal drought contingency plans, urban water management plans, irrigation district water management plans, county water shortage plans, state drought contingency plans, and regional drought coordination plans. Six criteria were used for the analysis of plans:

1. Pre-assessment: the foundational background knowledge meant to aid the plan's success.
2. Integration: full or partial integration into existing plans; capitalization of existing resources and partnerships.
3. Communications: ability to communicate the plan effectively and efficiently across implementing agencies and different levels of government and to the general public.
4. Public Participation: enabling accessible and prolonged opportunities for public participation in plan development while prioritizing members of disadvantaged communities.
5. Review and Update: frequency with which plans are reviewed and updated; conducting troubleshooting exercises, such as performing run-throughs of the plan.
6. Funding: incorporating strategies for funding with a focus on drought preparedness and the unique needs of disadvantaged communities.

These criteria and the associated sub-criteria were created from a comprehensive literature review, attention to elements of particular relevance to environmental justice and equity, and consideration of strategic added value for this research.

Executive Order B-37-16, highlights the need for "Making Water Conservation a California Way of Life." In theme with this initiative, we advocate for shifting the focus of drought and water shortage planning to preparedness rather than emergency response. Emergency drought assistance for Tulare County alone has cost the state $4 million annually (Romero, 2017). Developing a new normal in which resources are shifted to drought preparedness can help reinforce water conservation as a way of life and save money in the long run.

In addition to moving away from a reactive approach, this report recommends higher levels of integration between drought plans, land use planning and zoning, public health initiatives, climate change initiatives, and other existing plans and resources. Combining drought contingency plans into a county or district water management plan holds the greatest opportunity for full integration. Agencies implementing water management plans have the appropriate expertise to help prevent severe water shortages to the extent possible, again shifting the focus to preparedness rather than reactionary measures. Climate change and public health challenges as they relate to drought and water shortage should be included in water management plans as well. Additional highlights from each of the six criteria are as follows:

Pre-assessment

Assessing climate change impacts on water supply, water demand, water infrastructure, and drought frequency can help a community better prepare for future drought and water shortage scenarios. Applying a drought risk factor to water uses and sources is another way to lay the foundation for understanding what challenges the drought or water shortage plan needs to address.

Integration

Proactive measures for integration include ensuring complementarity of drought contingency plans with existing general plans and non-emergency plans. Training health care professionals and educators to respond to drought-related health impacts can also promote better integration.

Communications

Roles and responsibilities of implementing agencies must be clearly outlined for each stage of drought. Contact information of implementing agencies should be included in the plan itself to increase efficiency and ease of use. Multimodal communication methods and accessible language are key for delivering messages to the public.

Public Participation

Timing, accessibility, and appropriateness of venues are essential for public participation. Providing services, such as childcare, that increase the comfort level of participants during public engagement events is one way to make public participation more feasible. Community members should have as much opportunity to shape the plan as possible.

Review and Update

Conducting "drills" of the plan for different drought and water shortage scenarios can help identify weak points and necessary adjustments before the plan is implemented. Review and updates to the plan on an annual or bi-annual basis help keep the plan abreast of changing environmental, political, and social climates.

Funding

Establishing a reserve water fund for disadvantaged communities and pursuing avenues for funding low-income water assistance can help ensure that disadvantaged communities are not left behind as groundwater becomes scarcer. Arranging for pre-established contracts with NGOs for drought response can help formalize critical partnerships that emerge during drought emergencies.

1. Introduction

1.1 Background

California has recently emerged from a five-year drought. On April 7, 2017, Governor Brown released Executive Order B-40-17, lifting California's drought emergency across the state except in four counties: Fresno, Kings, Tulare, and Tuolumne. The last five years of intense drought has had a multitude of impacts, including costing California ratepayers an estimated $2.45 billion dollars due to a decline in hydropower generation (Gleick, 2017). The Executive Order builds on Executive Order B-37-16, "Making Water Conservation a California Way of Life," which requires the Department of Water Resources to work with counties to facilitate improved drought planning for small water suppliers and rural communities.

Despite heavy rainfalls this year, water remains a critical issue and many communities, particularly those reliant on groundwater, are still dealing with water shortages in the San Joaquin Valley. The Sustainable Groundwater Management Act (SGMA) requires the Department of Water Resources (DWR) to identify groundwater basins and sub-basins in conditions of critical overdraft. Those designated as high or medium priority and critically overdrafted must then be managed under a groundwater sustainability plan by January 31, 2020. Among those basins designated as critically overdrafted, many are in the San Joaquin Valley – including the Kings, Tulare Lake, and Kern County basins (CA DWR, 2016). Groundwater overdraft – the use of groundwater in excess of levels at which an aquifer can recharge – has led to falling aquifers, land subsidence, and dry wells. Given the potential for increased severity and frequency of drought, climate change may exacerbate groundwater problems. This is particularly detrimental for private well and small water system users relying on groundwater who may have little to no alternatives. Moreover, as groundwater levels fall, agricultural water users with greater access to capital can afford to dig new or deeper wells. Private well users are unlikely to have the necessary financial resources for this, leaving many without water, while large-scale agriculture continues to exacerbate groundwater shortages.

In the San Joaquin Valley, small water systems and self-supplied domestic water users in rural, disadvantaged, unincorporated communities (hereafter referred to as DACs) face particular social and environmental vulnerabilities to drought. Disadvantaged water users often carry a disproportionate burden of water issues and lack robust infrastructural and financial safety nets. Self-supplied waters users must rely on the County for assistance during drought since public utilities are not responsible for supplying their water. The cumulative impacts of water quality issues on top of water shortage compounds the burden on DACs. A 2011 study found

that, for water systems with less than 200 connections in the San Joaquin Valley, systems serving higher percentages of Latinos had higher nitrate levels (Balazs et al, 2011). As climate change is expected to aggravate water quality problems (Ekstrom et al, 2017), this disparity in water quality impacts in small water systems – systems that are also more likely to face difficulties coping with drought – underscores the particular importance of applying an environmental justice framework to the water challenges facing the San Joaquin Valley.

California's Assembly Bill No. 685, also known as the Human Right to Water Bill, recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." Ensuring that some communities are not made to bear disproportionate burdens of drought and are able to affordably access water is an essential foundation of California's commitment to the right to water.

1.2 **Tulare County:** Demographic & Water Availability Context

Tulare County is representative of many counties in the San Joaquin valley, some of which are at greater risk than others from the effects of drought. The demographics of Tulare County made it a relevant area to use as a case study as we reviewed drought contingency and water management plans and developed innovative recommendations for future drought planning. By familiarizing ourselves with the characteristics of Tulare County, we were able to approach the concept of drought contingency planning for the region with an understanding of the unique needs that must be addressed in these communities. Importantly, we designed the recommendations that we present in this report to be implementable throughout the region and integrated into existing plans.

A report by the Pacific Institute & the Environmental Justice Coalition for Water, entitled *Drought and Equity in California*, found that "low-income households, people of color, and communities already burdened with environmental pollution suffered the most severe impacts" of the drought (Feinstein, 2017, p. 1). A majority of drought-impacted household outages reported in Tulare County were in Disadvantaged and Cumulatively Burdened Communities (Feinstein, 2017).

Tulare County is a rural agricultural community of 450,000 residents. Only four percent of the larger Tulare Basin, in which Tulare County sits, is urban (The Central Valley, 2017). The rest of the basin has been extensively developed for agriculture and petroleum extraction. These rural agricultural communities have been found to be more vulnerable to significant adverse economic impacts of drought and to the mental health impacts of drought (Drought, Climate

Change and Health, 2016). Croplands dying are a direct impact of drought conditions in the San Joaquin Valley and thousands of jobs have been lost as a result, which has led to serious mental health impacts for the men and women who have lost jobs and have been left with an uncertain future.

Tulare County has an overall poverty rate of 28 percent, while the southwest has an even more extreme and concentrated poverty rate – 40 percent of the population is 150 percent below the federal poverty level (Place Matters, 2012). Those with limited income or financial resources are especially vulnerable to food insecurity from rising food prices associated with drought and crop loss. Food insecurity is associated with higher risks of chronic illness such as diabetes and hypertension. The County is 63 percent Latino and as high as 90 percent Latino in many census tracts (Place Matters, 2012). Residents often do not contact authorities to report dry wells or to request emergency services in times of drought for fear of consequences from immigration or child services.

The area is almost entirely dependent on groundwater, which residents access through individual private domestic wells. These private wells are not monitored by the County. This system of accessing water through individual wells puts these communities at increased risk of water shortages and contaminated well water. About one-fifth of California's raw groundwater contains high levels of contaminants (Belitz, 2015). The water shortages in these rural communities are largely due to groundwater basin depletion over the last five years, caused by over-pumping of groundwater, which is especially drastic during times of drought.

Due to these issues, many counties, such as Tulare, are still unable to universally access safe drinking water. Tulare County residents face increased vulnerabilities to the physical and mental health effects of drought from complications, such as increased exposure to groundwater contaminants and higher potential for wildfires leading to the risk of smoke inhalation and increased exposure to particulate matter. The effects and complications of drought are compounded, which has created a complex and urgent problem for counties like Tulare.

Rural, unincorporated, disadvantaged communities, such as in Tulare County, do not have the same ability to respond to drought as larger cities. These communities must rely on the County for addressing water shortages. As the wells run dry in these communities, the County searches for ways to provide water and deal with the increasing resulting health concerns. With the help of the state, Tulare County has supported families dealing with water shortages at the cost of $500,000 a month since 2014. More than $19 million has been spent on drought assistance in Tulare County to date (Romero, 2017).

Although Governor Brown's Executive Order B-40-17 declared that the drought was not over in Tulare County, the state recently announced that drought disaster assistance will be cut off for the entire state in June 2017. Yet, in Tulare County there are still 90 homes with dry wells and 450 families depending on bottled drinking water and water tank programs, as well as hundreds of residents in Porterville relying on a drought food distribution program (Romero, 2017; Barker, 2018). To install a new well costs about $27,000 and the state spends about $600 each time it fills a large temporary water tank (Drought Assistance, 2017). Thus, to continue drought assistance in Tulare, it is estimated to cost the state $4 million annually. The County is working with the state on a possible extension to have more time to phase out existing drought assistance and work with local groups to get families the support they need before funding is cut.

Preparedness is increasingly discussed as a more economically sustainable way to deal with drought effects on local communities. This is especially relevant when considering the long-term health impacts of drought conditions. A professor at the University of California Riverside, Kurt Schwabe, is researching the long-term physical and economic costs of the drought on the health of communities in California. Dr. Schwabe's research will provide a more complete picture of the true cost of drought events, which will be essential for helping policymakers make informed decisions on future drought planning and policy (Weiser, 2016).

Tulare County is facing an urgent situation that has harmful implications for its residents' health and safety. The recommendations in this report have been designed for implementation in attempts to prevent future compounded health and safety crises resulting from drought conditions, such as those prevalent today in the San Joaquin Valley.

1.3 Defining Drought Planning and Water Systems

While there are a number of different forms of drought planning, including drought risk management, drought risk reduction, and drought cycle management, this research focuses on developing recommendations for drought contingency planning and drought contingency plans. As defined by a United Nations report, drought contingency planning is a systematic process of integrating drought risk management, while a drought contingency plan is a summary of impacts of a specific drought translated into stages of and triggering criteria for drought risk reduction (Lesukat, 2012). However, we recognize that at times these forms of planning are used differently or even interchangeably; therefore, drought and water management plans supplemented our analysis. In general, drought planning is oriented around managing drought with the assumption that it exists as a naturally recurring event. At the same time, water

conservation and sustainability measures that seek to reduce the likelihood and occurrence of drought events are areas that merit greater emphasis.

Water systems in California are classified based on the number of service connections and water users. Those systems with 15 or more service connections and 25 or more individual water users include public water systems, community water systems, and tribal water systems. Those systems with less than 15 service connections and less than 25 water users include non-public water systems, state small water systems, local water systems, and private wells or surface diversions. While this report's recommendations focus on smaller water systems with less than 15 service connections, our analysis also examined larger systems (Feinstein, 2017, p. 10).

2. Purpose

As defined by the Community Water Center (CWC), the central task of this research is to examine drought contingency planning and plans for drought preparedness, coordination, and effective response in small water systems and rural, disadvantaged, and unincorporated communities. This report includes an analysis of existing plans selected across local, regional, and state levels evaluated along six criteria that were chosen based on: 1) a comprehensive literature review, 2) attention to elements of particular relevance to environmental justice and equity, and 3) consideration of strategic added value for this research.

We provide recommendations along these key areas toward innovative drought contingency planning, taking into account best practices as identified within existing plans, as well as additional and novel elements drawn from literature, interviews with experts in the field, and from our analysis of gaps and opportunities. These recommendations build on Governor Brown's mandate to shift the paradigm toward water conservation and sustainability as a way of life. By examining drought contingency, preparedness, and response plans, this research demonstrates how the emphasis of drought preparedness must be reconsidered. We advocate a move away from the status quo of reacting to drought events through crisis management toward drought planning that integrates drought preparedness into all phases of the planning process across governmental and institutional silos, in order to make water consciousness truly a way of life.

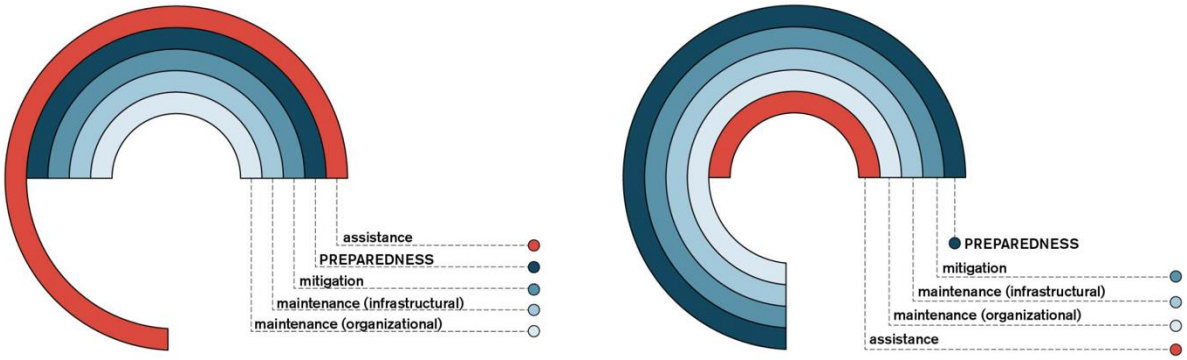

Figure 1. Graphic demonstrating a transition from reactive to preventative approaches taken with drought contingency planning. The drought management schematic with drought as the new normal was adapted from: *Drought Contingency Plans and Planning in the Greater Horn of Africa* (2012).

3. Methodology

A selection of 18 drought contingency and water management plans were assessed (see Table A1 – Appendix), keeping in mind our goal of achieving preventative, rather than reactive, strategies. These plans fit into the following six categories, which account for geographic and political diversity: county and community, urban, water district, tribal, regional, and state. Tribal plans, in particular, adhere to a unique governance model. However, these plans proved to be pertinent to the analysis because of their unmatched integration of community hardships experienced across arid regions with parallel water infrastructure challenges.

Analytical criteria were established upon a close reading of the 18 plans and a literature review. The criteria were developed in order to provide more granular best practices, thereby adding value to CWC's current recommendations around drought contingency planning for small water systems and self-supplied domestic water users. Notes gleaned from each plan were organized thematically, leading to the development of the following analytical criteria: (a) pre-assessment, (b) integration, (c) communications, (d) public participation, (e) review and update, and (f) funding.

The six primary criteria were further broken down into sub-criteria; each primary criterion contains three to four sub-criteria (see Table A2 – Appendix). Equity is treated as a cross-cutting issue and is therefore integrated across all criteria. For example, this assessment demonstrates

whether equity challenges were noted across regions in pre-assessments, local partnerships were maximized, accessible language and communication methods were employed, participatory methods addressed the needs of vulnerable communities, test run activities conducted during plan reviews assessed equity, and whether specific funding needs associated with implementing projects in disadvantaged communities were addressed.

An assessment matrix was created to evaluate the degree to which each of the 18 plans addressed the sub-criteria (see Tables A3-A8). These data were then aggregated to show how well each plan addressed the six primary criteria (see Table 1).

Table 1. Aggregated drought contingency plan assessment

	PRE-ASSESSMENT	INTEGRATION	COMMUNICATIONS	REVIEW & UPDATE	FUNDING	PUBLIC PARTICIPATION
1. East Niles (2015)						
2. Tulare County (2016)						
3. Hualapai Reservation (2003)						
4. Navajo Nation (2003)						
5. Northern Cheyenne Tribe (2007)						
6. Zuni Tribe (2001)						
7. Fresno, City of (2016)						
8. Houston, City of (2015)						
9. Porterville, City of (2015)						
10. Sacramento County (2016)						
11. Santa Cruz, City of (2009)						
12. Tulare, City of (2015)						
13. Visalia District (2016)						
14. Susquehanna River Basin (2000)						
15. South San Joaquin Irrigation District (2016)						
16. Yucaipa Valley Water District (2011)						
17. California (2010)						
18. Oklahoma (1997)						

Meets all sub criteria Meets 1-3 sub-criteria Does not meet sub-criteria

An aggregate assessment gives a broad, baseline understanding of elements considered present or absent in each plan. Plans with dark orange highlights indicate where criteria were explicitly met. These plans were looked upon for best practices. On the other hand, plans with grey highlights indicate areas where criteria were not met and provided a starting point for recommendations. In addition to providing a baseline for recommendations, this aggregate assessment revealed that, overall, tribal plans met all six primary criteria. This is likely due to the inclusion of equity and community values across tribal plans.

4. Analysis

An analysis of the 18 selected plans, in conjunction with the insights gained from interviews with experts in the field, shed light on the status quo of drought contingency planning. This analysis helped us determine the baseline for all evaluation criteria. Plans were rife with lost opportunities for local partnerships, unaligned language, funds allocated toward emergencies instead of preventative measures, long gaps between reviews, limited vulnerability assessments, and short-lived participatory approaches (see Figure 2). Therefore, ensuing recommendations, listed in the following sections, focus on solutions that could be integrated into existing efforts and plans (e.g., county or district level water management plans) in order to reduce the burden on community members, and to capitalize on available resources and the synergy between local, state, and regional actors. The remainder of this section offers more detailed descriptions of the baseline across criteria.

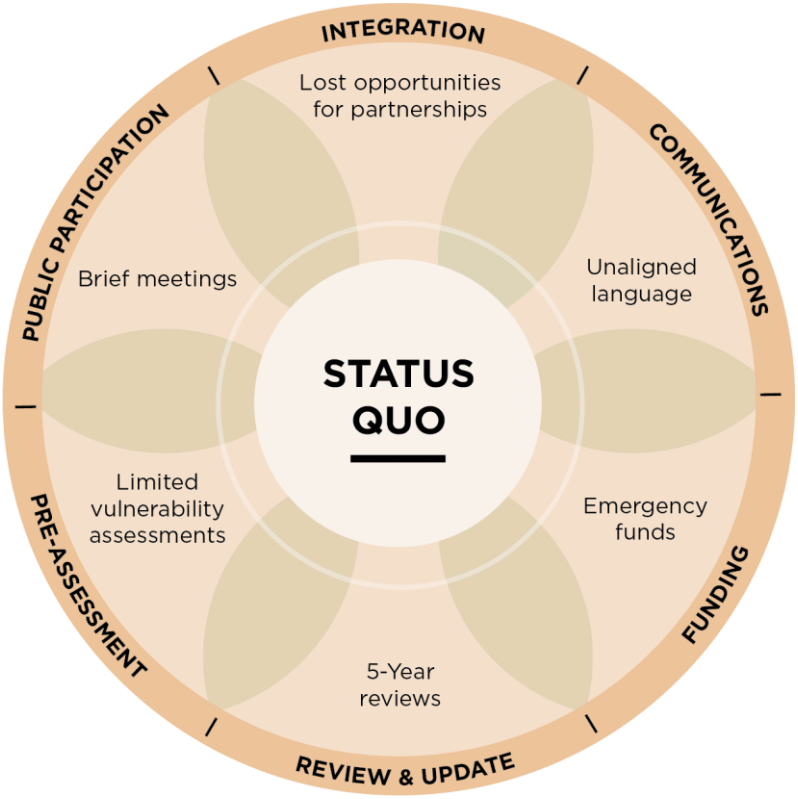

Figure 2. Overview of the status quo conditions based on the six criteria used for analysis and recommendations.

4.1 Pre-Assessment

The pre-assessment criteria measures if the plan has a strong foundation. This foundation includes factors that are important to the success of the plan but have the potential to be overlooked. Pre-assessment can be thought of as the background research or context that is important to consider before designing the contingency plan itself.

The following table shows what sub-criteria were used to analyze pre-assessment within drought contingency and water management plans and the rationale for the choice of each sub-criterion.

SUB-CRITERIA	RATIONALE
1. Notes equity challenges across the area	Plans often disregard the unequal impacts drought and water shortage have on different members of the community. Recognizing equity challenges within the jurisdiction of the plan and incorporating specific actions to address these challenges is crucial.
2. Considers short and long-term impacts of climate change	Climate change has the potential to exacerbate drought and water shortage impacts. As a result these impacts must be factored into drought and water shortage plans.
3. Acknowledges current state of water supply vs. demand	Outlining the current water demand and supply gives the community a baseline. From this baseline they can estimate current and future drought risk as compared to current and future demand and supply.

The equity component is especially important for our purposes. This sub-criteria evaluates if the plan identifies groups that may need more support during a drought or water shortage and explicitly addresses how to provide them with the appropriate support.

The status quo for pre-assessment shows that equity challenges are sometimes nominally mentioned, but rarely do plans explicitly discuss how they will address these challenges. Several plans did include the projected water demand of lower income single family and multifamily households as required by Section 10631.1 (a) of the California Water Code. A majority of the plans reviewed failed to include any discussion of climate change impacts on drought or water shortage. Two plans included a nominal reference to climate change and four plans included

climate change in a more meaningful way (see Discussion & Recommendations). Lastly, plans often, but not always, included an assessment of available water supply and demand.

4.2 Integration

This baseline integration criteria assesses if the plan has the potential to dovetail with other existing policy documents that guide planning processes, such as general plans, land use plans, hazard mitigation plans, water management plans, and climate change plans. Admittedly, streamlined integration of drought contingency and preparedness across a range of documents is often difficult because of the differing rates at which these plans are updated. Yet this integration grows increasingly more critical when considering how climate change-induced drought affects community health, an issue that must be addressed in almost all facets of planning management.

The following table shows what sub-criteria were used to analyze integration and the rationale for the choice of each sub-criterion.

SUB-CRITERIA	RATIONALE
1. Leverages data sources from existing plans	Plans, especially in rural, unincorporated DACs must leverage the wealth of data from both existing plans, government data sources (e.g., USGS), and data collected by NGOs (e.g., United Way), in order to most effectively and accurately gauge the current landscape of drought in a geographic area.
2. Maximizes local partnerships	If a plan does not maximize local partnerships beyond government agencies, it will inevitably lack community buy-in and fail to take root as an effective, implementable document.
3. Considers potential synergies with existing plans or fully integrates into existing plans	If a plan lacks the potential for synthesis with existing initiatives, it can often “sit on the shelf” and never be enacted. Similarly, if plan requirements are not flexible they are less likely to be enacted.

In spite of these seemingly intuitive measures, a survey of the current landscape of a range of policy plans showed that drought contingency planning could be better integrated at most stages of the planning process. Within the plans surveyed, eight out of eighteen plans consider potential synergies with existing plans, but almost none of them fully integrate into existing

plans. Almost none of the plans clearly mention Senate Bill 1000 (addressing environmental justice in general plans), Assembly Bill 685 (made California the first state in the nation to legislatively recognize the human right to water) or Senate Bill 379 (addressing the inclusion of safety elements against natural disasters in general plans) as drivers for how they have integrated drought into their policy process. Within the plans surveyed, there are several missed opportunities, including the following gaps: a) Many display a lack of cohesion with existing emergency response plans and land use plans; b) Many plans hint at informal examples of collaboration between local and state levels but require more formalized coordination reflected within plans; c) Many plans display lost opportunities for partnerships with universities.

Out of all plans surveyed, the tribal plans and the City of Tulare Urban Water Management Plan do the most effective job of coordinating between state and local levels of government, as well as integrating drought contingency planning into strategic partnerships with institutions (e.g., schools, hospitals, community centers, and universities). At one point, the Tulare UWMP specifically mentions its commitment to working with "General Plans, Water Master Plans, Recycled Water Master Plans, Integrated Resource Plans, Integrated Regional Water Management Plans, Groundwater Management Plans, and others" while also calling out its desire to actively involve "diverse social, cultural, and economic elements" (City of Tulare, 2015, p. 14). Despite these successes, all of the plans surveyed could more actively incorporate preventative health care and advocacy measures into their drought preparedness work. This would tackle the physical and emotional stressors associated with drought in a more thoughtful and comprehensive way.

4.3 Communications

The main objective of the communications criteria is to assess if the plan can be picked up and navigated quickly to enable streamlined implementation.

The following table shows what sub-criteria were used to analyze communications within drought contingency and water management plans and the rationale for the choice of each sub-criterion.

SUB-CRITERIA	RATIONALE
1. Clear outline of roles and responsibilities among stakeholders	All parties involved in implementing the drought or water shortage plan must have a clear understanding of their assigned actions for each stage of drought. Ambiguity in the state of crisis can lead to inefficiencies that cannot be afforded. A clear articulation of roles and responsibilities can also make the plan easier to implement for new hires or employees filling in for other colleagues.
2. Uses accessible language and communication methods (e.g., clarity, translated into Spanish)	Outreach materials, such as public notifications of drought must be accessible and must accommodate for varying levels of education, access to internet, and languages spoken. The plan itself should aim to be as accessible as possible in order to increase transparency, enable understanding, and foster trust between the community and the implementing agencies.
3. Streamlined communication processes	Communications materials and resources for communicating (e.g., contact information of implementing agencies) can be prepared ahead of time to increase the plan's efficiency. Using the same terminology for drought stages across levels of government can also streamline communication.

Majority of the plans include information on roles and responsibilities but with varying levels of clarity and detail. Some plans spread the roles and responsibilities throughout the plan in a narrative format. Others fail to breakdown roles and responsibilities any more than tasking the municipality at large with implementing all components of the drought plan. The result is an unclear outline of what agency or organization is responsible for each task. A few plans also did not consider new roles and responsibilities for each stage of increased drought or water shortage severity. Contact information for the various parties involved in implementing the plan is also usually not included in the plan itself.

Accessibility of the plan is another key sub-criteria under communications. Providing outreach materials and public notices related to the drought plan is underemphasized. There is also no mention of including the plan itself in more than one language. Lastly, pre-written public messages tend to be included in a select few plans. Many of the gaps mentioned here are discussed further in the Discussion & Recommendation section.

4.4 Public Participation

The criteria for public participation focuses on the extent to which community stakeholders are involved in planning processes. Moreover, the criteria emphasize the efficacy of participation methods included in plans, such as public workshops. The degree of attention given to vulnerable and marginalized communities was prioritized in the design of the sub-criteria.

The following table shows what sub-criteria were used to analyze public participation methods within drought contingency planning processes and the rationale for the choice of each sub-criterion.

SUB-CRITERIA	RATIONALE
1. Addresses participation needs of marginalized, vulnerable communities (e.g., time, location)	Drought contingency plans typically address the public in general terms, without considering whether or not proposed participation options are accessible to marginalized, vulnerable communities, where people are already pressed for time and resources. A broader and more representative public base will appear at events if appropriate considerations are taken to encourage the presence and garner the support of communities who have historically and disproportionately been left out of planning processes.
2. Provides avenues for prolonged participation	Effective participation is reciprocal and ensures that continual avenues for conversation are provided. With prolonged participation, a wider array of perspectives can be shared and incorporated into plans.
3. Prioritizes participants' expertise throughout planning process	Community members are primary stakeholders with expert knowledge of local needs. Valuing their expertise will contribute to more nuanced assessments and recommendations. Furthermore, the widespread acceptance of plans is more likely when local expertise is integrated.

While many drought contingency and water management plans underscore the need for public participation, descriptions of the approaches taken to achieve public participation are vague. For example, calls to consult the public are visible across plans; however, descriptions regarding what these consultations entail are minimal.

Furthermore, public participation activities are short-lived. Public hearings, for example, accompanied the release of three of eighteen plans. Yet, these hearings only allowed for one week to two months of public commentary. Community members often miss this window of time and, as a result, are unable to provide feedback. Similarly, one-time workshops hardly provide opportunities for sustained involvement in planning processes.

Public participation is often included in the education and outreach sections of plans. When these categories are conflated, community-oriented public participation becomes overshadowed by top-down prescriptive actions assigned to the public instead. Informational campaigns take center stage. In these circumstances, meetings with community members are only called when conflict resolution is needed.

Finally, two of eighteen plans nod to legal requirement CWC §10642, which states that urban water suppliers must consider the diverse social and cultural elements of a population. While this legal requirement is often cited, plans seldom outline the methods that will account for these considerations.

4.5 Review and Update

The review criteria assess whether a plan has been tested for functionality in the community it is designed to serve and if it is updated consistently. This section also checks if equity is being addressed in the review and updating of these plans.

The following table shows what sub-criteria were used to analyze review and update arrangements within drought contingency and water management plans and the rationale for the choice of each sub-criterion.

SUB-CRITERIA	RATIONALE
1. Carries out “drill” of the contingency plan before implementation phase to identify weak points	By testing the plan, authorities can identify any weaknesses in the implementation and make adjustments as needed. This test run will ensure that the plan will be successfully carried out in a real drought event.

2. Test run activities, if integrated, assess equity	Reviewing plans with a focus on equity will ensure that the plan is inclusive and that it addresses the needs of the most vulnerable residents in these communities.
3. Sets timeline for consistent review and update of plan	Including a requirement on how often to review and update plans establishes a precedent to keep plans up-to-date with the most recent data available.

The status quo for review shows that communities do not include standard requirements to carry out a "drill" of the plan, which means that the plans are not tested for functionality in a real-time scenario. This leaves communities vulnerable to any weaknesses in plans, which will not be identified until the community is in a real drought situation and must depend on the plan. In this situation, it is too late to make adjustments to improve the process for community members and, as a result, the residents will bear the burden of any issues that are raised at the time of implementation.

The other sub-criteria in this section, the frequency of reviewing and updating plans, was also identified to be substandard in most plans. Often, plans are only updated after a drought-related event. In California, water plans are updated once every five years. By relying on plans to be updated only after drought-related events or once every five years, the communities are left with plans that do not consider the most relevant, up-to-date climate data and larger social and political context. It is important for plans to be updated on a frequent basis to ensure that they are considering the latest information available.

4.6 Funding

The criteria for analyzing funding were developed to assess the extent to which resource planning around drought preparedness and response take into account equity considerations, specifically the needs and circumstances of DACs. Additionally, the criteria were designed to reflect how funding was balanced between emergency response and drought preparedness.

The following table shows what sub-criteria were used to analyze funding arrangements within drought contingency and water management plans and the rationale for the choice of each sub-criterion.

SUB-CRITERIA	RATIONALE
1. Incorporates funding strategies within staged responses for drought	Drought contingency plans typically translate planning actions into drought response stages. Reflecting strategies for funding within these stages can reduce the need for ad hoc planning after drought is triggered and can help ensure appropriate funding for water conservation measures to reduce drought impacts.
2. Addresses specific funding needs associated with implementing projects in DACs	The specific needs of DACs should be considered since effective drought response in these communities may demand the use of different mechanisms and actions.
3. Establishes pathways for partnering with and funding NGOs to implement actions to reach DACs	NGOs and community-based organizations can play key roles in reaching DACs. Acknowledging this role in resource planning and formalizing these partnerships can be an important step in considering equity.
4. Goes beyond funding emergency response to incorporate drought preparedness and resilience actions	As part of the shift away from the current overwhelming focus on emergency response, appropriately reflecting funding needs and sources for drought preparedness can help minimize the need for costly emergency measures.

Overall, our analysis suggests that plans still vastly underemphasize equity considerations in relation to water users and funding, both in planning for the unique needs and challenges of DACs and in establishing mechanisms to reach them. Additionally, general funding strategies – even those unrelated to the issue of equity – are not well incorporated into drought contingency and water management plans. This indicates that planning agencies can make significant improvements by preparing for funding drought preparedness and response.

First, we found that six of eighteen plans acknowledge funding in drought stages but this acknowledgment is often nominal and undefined, suggesting that concrete funding sources and strategies are still under-reflected in drought response stages.

Second, in assessing the incorporation of funding for disadvantaged water users, we found that while there is some acknowledgment of specific funding challenges for DACs, they are again limited in specificity. Two tribal plans include recognition of the special burden of drought on water haulers and private wells (Navajo Nation Drought Plan; Northern Cheyenne Tribe Drought Plan), which parallels some of the challenges of rural, disadvantaged, and unincorporated households in the San Joaquin Valley.

Third, regarding the extent to which contingency plans acknowledged the role of and funding for NGOs in drought management and response, we found that only three of eighteen plans reference a potential role for civil society. Specifically, the California and Oklahoma State Plans and the Tulare County Draft Plan for Self-Supplied Domestic Water Users, to varying extents, acknowledge a potential role for NGOs and CBOs. In the state plans, however, there are no concrete funding strategies in place for partnering with NGOs or CBOs.

Finally, we examined the extent to which plans incorporated funding for drought preparedness and water conservation, rather than focusing primarily on emergency response. We found that ten of eighteen plans include water conservation measures, although many of these are in other areas of Urban Water Management Plans. Yet, there is limited discussion of how to specifically fund these measures, as well as limited emphasis on pre-drought actions. Instead, many water conservation measures are triggered in the first stage of drought rather than before drought starts. We acknowledge that normal water conservation measures may be reflected in other plans due to the fact that drought contingency planning in some areas may consist only of staged responses when a drought event is first triggered.

5. Discussion & Recommendations

We identified best practices across the reviewed sub-criteria and developed new recommendations based on the best practices and the gaps identified.

5.1 Pre-Assessment

Key recommendations for the pre-assessment criteria are outlined and described below.

- Prioritize projects that provide subsidized water services to low-income community members

- Consider cultural norms in the language and actions of the plan
- Include climate change impacts on water supply, demand, and drought frequency
- Assign drought risk factors to major water sources and water use sectors
- Prioritize water uses
- Conduct water supply and demand projections for normal and dry year(s)
- Conduct aquifer yield potential studies before permitting new water uses to reduce the risk of adding demand that cannot be met; Require developers to identify water sources that meet their demand without inhibiting existing water needs

We identified best-practices across the three sub-criteria for the pre-assessment category. Under the equity sub-criteria, the Navajo Nation Drought Contingency Plan (2003) acknowledges that one primary goal of the plan is to streamline the administration of funds across Navajo Nation chapters while also recognizing some community members are more vulnerable to drought than others. The Oklahoma Drought Management Plan (1997) acknowledges the needs of lower income, older individuals by prioritizing projects that provide utility services at a lower cost. Lastly, the Zuni Drought Contingency Plan (2001) acknowledges important cultural norms that need to be addressed for the success of the plan. The authors of the plan were sensitive to the fact that natural disaster planning used to be considered taboo. They also aligned with the traditional way of dealing with by focusing the plan around *actions.*

There are four plans that included the climate change sub-criteria in a meaningful way. Sacramento's Urban Water Management Plan (2016) includes a climate change vulnerability assessment in the appendix. The assessment address potential climate change impacts on water supply, water demand, and water quality. A snapshot is included below.

Table C-1. Climate Change Vulnerability Checklist and Prioritization

Question	Response	Priority	Justification	Vulnerability
I. Water Demand				
Are there major industries that require cooling/process water in your planning region?	Yes	Low	The largest water-intensive industry in the Region is agriculture.	Increased potential for summer water shortage.
Does water use vary by more than 50% seasonally in parts of your region?	Yes	High	Summer months are as much as 50% higher than the average month and winter months are as much as 50% lower than the average month. Warming temperatures and increased extreme events will likely exacerbate summer demand.	Increased potential for summer water shortage.
Are crops grown in your region climate sensitive? Would shifts in daily heat patterns, such as how long heat lingers before nighttime cooling, be prohibitive for some crops?	Yes	High	A variety of crop types are grown in the Region, including row crops, tree crops, and irrigated grains. Agricultural production in Sacramento County has a value of approximately $300 million dollars (Sacramento County Department of Agriculture 2002). Many of these crops are sensitive to climate change (Sacramento County Climate Action Plan 2011).	Increased potential for summer water shortage.
Do groundwater supplies in your region lack resiliency after drought events?	No	Low	Groundwater supplies in the Region have proved resilient after past drought events.	N/A
Are water use curtailment measures effective in your region?	Yes	Low	Water conservation BMPs are used effectively throughout the Region, as detailed in various UWMPs.	Potential for demand hardening and limited opportunities for further conservation.
Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?	No	Low	Minimum in-stream flow requirements are generally met in both the American River and the Sacramento River. However, climate change is expected to place additional stress on summer low flows.	Reduced summer low flows.
II. Water Supply				
Does a portion of the water supply in your region come from snowmelt?	Yes	Medium	American River runoff from April through July is dominated by snowmelt. This provides water supply throughout the dry summer and fall.	Reduced water supply reliability.
Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?	No	N/A	Currently, there is no use of imported water in the Region, and use of this supply is not anticipated in the future.	N/A
Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?	No	N/A	There are no coastal aquifers within the Region.	N/A
Would your region have difficulty in storing carryover supply surpluses from year to year?	Yes	Medium	Current regional reservoir operating conditions limit storage opportunities during winter runoff season; increased winter runoff would not necessarily translate into increased storage of water leading into the spring season. In the ARB Region, the ratio of storage to annual runoff is approximately 0.64, indicating that this is likely to be the case (Roos 2005). In addition, less spring snowmelt could make it more difficult to refill winter reservoir flood control space during late spring and early summer of many years, which could potentially reduce the amount of surface water available during the dry season (Roos 2005). Conversely, storage capture of snowmelt runoff has traditionally occurred during the late spring and early summer seasons. Reductions in runoff during these seasons likely would translate into reductions in storage capture and, likewise, reductions in water supply for warm season delivery.	Reduced water supply reliability.
Has your region faced a drought in the past during which it failed to meet local water demands?	No	High	The Region has not failed to meet local water demands during drought years. However, the potential effects of climate change make this a possibility. The Region is projected to have more frequent, longer, and more-extreme heat waves and longer periods of drought (Sacramento County 2011).	Reduced water supply reliability.
Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?	Yes	Medium	Invasive species, including various nonnative fish and plant species, are an ongoing issue within the Region (**Appendix B**).	Invasive species impacts on infrastructure.

Figure 3. A snapshot of the climate change vulnerability assessment in the Sacramento Urban Water Management Plan (2016).

The Visalia District Urban Water Management Plan, the Porterville Urban Water Management Plan, and the California Drought Contingency Plan also include discussion of climate change impacts on distribution systems, supply, suppliers, demand, and drought frequency.

Including a baseline analysis of water supply and demand is common amongst drought contingency and water management plans, but there are few complementary components to consider. For example, the Zuni Drought Contingency Plan (2001) provides a general prioritization scheme of water uses (e.g., drinking water, water for health, fire suppression). The Zuni plan also includes a drought risk factor for major water use sectors. The Navajo Nation plan (2003) assigns a drought risk factor to each public system. The system is given a drought risk rating based on the percent of residents relying on water haulers, the percent of the supply that comes from alluvial sources, and the inadequacy of storage. The Fresno Urban Water Management Plan (2016) includes projected water supply and demand for normal conditions, a single dry year, and multiple dry years (2007). Lastly, the Northern Cheyenne Drought Mitigation Plan outlines how to avoid adding water demand that cannot be met. The plan suggests using aquifer yield potential studies to permit new uses and require developers to identify water sources that meet their demand without inhibiting other existing water needs.

5.2 Integration

Key recommendations for integration are outlined and described below.

- Coordinate drought contingency plans with existing general plans and non-emergency plans to encourage prevention instead of reaction
- Incorporate drought contingency planning into water management plans
- Ensure that county health departments are involved in the process of drought contingency planning
- Build capacity with educational measures and advocacy measures for members of rural communities and DACs
- Integrate data from NGOs and governmental agencies
- Coordinate drought contingency plans with existing emergency and hazard mitigation plans
- Train care professionals and educators for emergency response specific to drought and include this action in county health planning

Best practices of integration can be clearly gleaned from tribal drought contingency plans, as well as plans from larger cities, such as Santa Cruz and Fresno, that include entire chapters on

how their plans aim to coordinate with outside agencies and the larger community. Tribal drought contingency plans are especially effective at leveraging existing data for drought prevention measures, such as the Northern Cheyenne tribe, which works in tandem with USGS and the Montana Ground Water Information Center Database to monitor and map springs, water levels, and water quality.

Beyond best practices, these recommendations about how to better incorporate drought contingency into existing plans have been broken up by time scale, into what we have termed "preventative" and "reactive" term integration strategies in order to best illustrate how this synthesis should be approached on multiple fronts and at every stage of the policy making process.

As illustrated in the quote below, spoken by one Tulare County Resident in the Pacific Institute's *Drought and Equity in California* Report, there is an extreme urgency to focus on prevention for drought contingency planning. "I've lived without water for two years, seven months. It's important to point out the urgency to get long term solutions more rapidly than we're getting them now." (Feinstein, 2017, p. 9)

Preventative Integration

Thinking on a long term scale, policymakers should coordinate and ensure complementarity of drought contingency plans with existing general plans and non-emergency plans (e.g., sustainability plans, water utility plans, agricultural plans, climate action plans) to ensure prevention instead of reaction by incorporating drought contingency into land use regulations. As an example of this, zoning, agricultural, and land use plans can incorporate financial assistance, water pricing, and water market policies. Furthermore, water utility plans can place caps on drought charges and do yearly assessments of future supply problems. Water utility plans seem to have the most potential to be combined with a drought contingency plan due to their natural potential for synthesis and the frequency of water utility plan updates. Agencies implementing water management plans have the appropriate expertise to help prevent severe water shortages to the extent possible, again shifting the focus to preparedness rather than reactionary measures.

In addition, policymakers and organizers must ensure that county health departments are involved in the process of drought contingency planning. Actions that health departments can take include publishing guides and conducting advocacy campaigns to inform the public about drought's compounded effects on health. Educational measures can build capacity for vulnerable homeowners and small water suppliers through technological, institutional, and financial support, through partnerships with institutions like NGOs, schools, hospitals, and

community organizations. These measures can also better inform community members about how to best protect their physical health against vector-borne diseases that are more prevalent during drought. In the example of Valley Fever, professionals can counsel community members about staying indoors with windows closed on windy and dusty days and wearing a respirator when necessary. Additionally, professionals can counsel residents on how to tend to their emotional health in the wake of drought related stress.

To educate communities on issues relevant to them, advocacy measures can focus on unemployment assistance and sustainable economic opportunities for DACs. This can be done by advocating for the creation of policies to provide unemployment assistance and sustainable economic opportunities for disadvantaged workers, such as farm workers.

Finally, policymakers and organizers can easily integrate data from NGOs, such as United Way and the Household Water Supply Shortage Reporting System, including maps of who has called to report water outages and detailed watershed maps that can help manage water transfers during times of crisis.

Reactive Integration

By pre-planning and preparing materials ahead of time, counties can save money, more effectively deliver emergency assistance, and better mitigate health problems when reactive measures are necessary. Policymakers should coordinate and ensure complementarity of drought contingency plans with existing emergency and hazard mitigation plans to give specific advice about how homeowners and small water suppliers can react and keep people better informed about the specific measures that need to be taken at each phase of drought. In addition, health care professionals and educators should be trained for emergency response specific to drought, which must be included in county health planning.

5.3 Communications

Key recommendations for the communications criteria are outlined and described below.

- Outline roles and responsibilities in a table explaining what agency is responsible for each action at every stage of drought
- Include contact information for all agencies involved in carrying out the plan
- Provide examples of drought monitoring reports, drought declaration letters, and pre-written messages for the public
- Use multiple modes to communicate with the public

- Ensure that communication methods account for varying levels of education, access to internet, and language needs
- Use consistent naming of drought stages across agencies and amongst levels of government

The plans that were the easiest to navigate included a table outlining what agency was responsible for each action at every stage of drought. Organizing roles and responsibilities into a table rather than a narrative format increases efficiency and ease of use by rotating leadership, new employees, or people who have not yet implemented the drought contingency plan. The Navajo Drought Contingency Plan provides a good example of a table of roles and responsibilities by drought stage (Figure 4). The Oklahoma Drought Management Plan and the Cooperative Drought Contingency Plan for the Hualapai Reservation provide additional good examples.

Table 6.2
Recommended Responses During Drought Alert
(Mild Drought Conditions, SPI between 0.0 and -0.99)

Agency	Recommended Responses
Department of Water Resources (NDWR)	Water Management Branch will: - Prepare the Monthly Drought Status Report - Distribute the Monthly Drought Status Report to: 1. the Director of Dept. of Emergency Management 2. the Executive Director of Natural Resources Division 3. the Emergency Management Commissioners 4. Drought Task Force (Navajo Nation Division Directors) 5. Reclamation and FSA - Post the Monthly Drought Status Report on the Navajo Nation web site
Department of Emergency Management (NDEM)	Convene drought status meetings with the Emergency Management Commission and Drought Task Force every other month, or as needed, to review recently completed and planned work, evaluate current monitoring data and assess drought triggers Assist and review Chapter drought Contingency Plans, and evaluate drought impacts Monitor vacancies on the Emergency Management Commissioners, and seek IGR approval for nominees Identify federal, state and county assistance
Department of Agriculture (NNDA)	Encourage voluntary livestock reduction Encourage sale barns Proved market information to affected districts
Navajo Nation President	Makes appointments to the Navajo Nation Drought Task Force. Direct each Tribal Division will designate a drought coordinator
Drought Task Force (Division Directors)	Divisions Executive Directors may use programmatic funds if available to mitigate drought impacts

Figure 4. Table of Recommended Responses During Drought Alert Conditions (Navajo Nation Drought Contingency Plan, 2003).

The implementation process can be further streamlined by including contact information for all parties identified to carry out the plan. This information tends to be included as an appendix. Including examples of reports, letters, or pre-written messages for the public can also speed up implementation. The Navajo Nation Drought Contingency Plan (2003) includes an example of a monthly drought status report, as well as sample drought declaration and determination letters. The Santa Cruz Water Shortage Contingency Plan (2009) also includes example reports for monthly monitoring of supply and demand as well as public messages for each stage of water shortage. The Yucaipa Valley Plan (2011) provides pre-written public messages for each stage of drought and suggests developing anticipated questions and answers for each customer group.

Ensuring that these public messages and other related outreach materials are accessible for all members of the community is key. The Indian Health Services Template for Drought Contingency Plans stresses the need for timely, straight-forward messages, which are available through many modes (2014). Multi-modal approaches may include internet, newsletters, newspapers, radio, television, public meetings, and special events (Santa Cruz Water Shortage Contingency Plan, 2009). Communication methods should aim to address varying levels of education, access to internet, and language needs.

Lastly, it is important for the names of each drought stage to be the same across agencies and amongst different levels of government. Using the same terminology for each stage of drought allows local municipalities to clearly communicate their needs to higher levels of government. It also creates a shared sense of understanding of potential impacts (Runkle, 2000). The terms used in the California Drought Contingency Plan (2010) include abnormally dry, first stage drought, severe drought, extreme drought, and exceptional drought.

5.4 Public Participation

For public participation, we propose several key recommendations, which are outlined and described below.

- Consider the following when working with marginalized communities:
    - Timing of events
    - Accessibility and appropriateness of setting
    - Family friendliness
    - Participants' control over information
    - Participants' comfort handling uncertainty

    - Participants' assessment of all major actions prior to dissemination of plans
- Consider the following targeted participatory approaches when time and resources are limited:
    - Group model building (e.g., closed-loop diagramming, see Figure 5)
    - Study circles, citizen juries, round tables, and collaborative watershed management for multi-phased efforts
    - Two-way communication (e.g., door-to-door interactions)

Taking the baseline for public participation into account, specific recommendations were developed for inclusive public events. Where plans lack institutionalized approaches for working with marginalized and vulnerable communities, several key considerations are encouraged. Timing of participatory events is crucial. For example, community members who rely on public transit should be given ample time to reach venues. Considering the accessibility and appropriateness of venues where events occur is also critical. For example, moderate settings like public schools are less intimidating than upper class hotels and set a more appropriate tone for public participation. By the same token, participants might be required to bring the family members they care for to public events, including young children. Creating a family friendly atmosphere and, if resources permit, offering childcare services could increase community involvement. Acknowledging inherent power dynamics could also help build trust among facilitators and participants alike.

Furthermore, scientific data surrounding water resources is rapidly evolving and involves levels of uncertainty. Therefore, facilitators of public events should strive to gauge participants' comfort level in the midst of handling such uncertainty. Transparency is encouraged, and any fluctuating or inconsistent information should be clarified. Participants should be given as much control as possible in handling information and shaping plans. Moreover, a community assessment of all major actions is recommended prior to the dissemination of plans (Butler and Adamowski, 2015; von Korff et al., 2012).

When funding and time are limited, however, targeted participatory approaches are recommended. For example, researchers have aggregated case studies of participatory water resource management from around the world. These researchers point to group model building as an effective strategy to engage marginalized communities. Participatory modeling, such as causal-loop diagramming (Figure 5), provides participants with a better understanding of the different elements of a given system and their interrelations. For example, creating a community-generated model of local agencies and the services they provide would, over the course of model making, put participants in alignment about the interrelationships between various actors and the services they offer. Participatory models are compatible with addressing

water-related challenges because they inherently account for economic and social concerns. The results of the modeling process, however, should be made publicly available through online platforms where possible (Butler and Adamowski, 2015; Voinoy and Brown Gaddis, 2008).

Study circles, citizen juries, round tables, and collaborative watershed management have been shown to support multi-phased participatory efforts and the work of local agencies and organizations (Konisky and Beierle, 2001). Scenario workshops are well suited for problem solving and identifying goals and alternatives, while social multicriteria evaluation proved best in addressing long-term conflicts, weighing trade-offs, and reconciling stakeholders' divergent views, though relied heavily on experts. Hybrid approaches that bring together elements of different participatory processes are suggested for this reason (Kallis et al., 2006). Finally, two-way communication methods, such as door-to-door contact, are costlier and timelier, yet solicit the most participation (Duram and Brown, 1999).

While examples of specific participation strategies offered in current plans are sparse, ideas for future public involvement appear in a few plans. Among these, the California Drought Contingency Plan (2010) lists potential actions to be taken by community members from the onset of planning processes. These potential actions serve to maximize local expertise. Community members are called upon to help develop indicators and determine risks. The Zuni Tribe Drought Contingency Plan (2001, p. 9), for example, requires the approval of all major actions by the Tribal Council prior to the implementation of the plan. The plan states the following: "Any policies dictating mandatory measures to be taken by the community will be implemented only with the approval of the Tribal Council." The Santa Cruz Water Shortage Contingency Plan (2009, p.3-36) suggests acknowledging any public participation and explicitly expressing appreciation. The plan suggests that governments and agencies should "publicize gratitude for the community's cooperation."

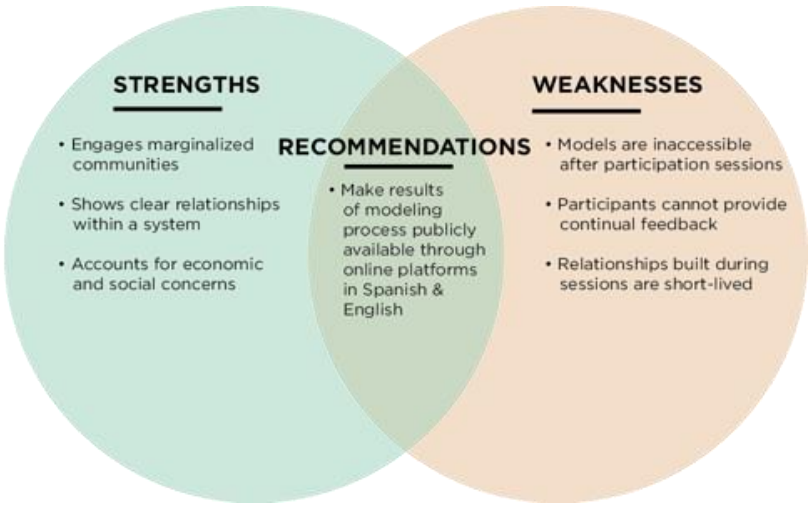

Figure 5. Example of causal-loop diagram and assessment. Causal-loop diagramming involves community members getting together to map the relationships between any given entities. The strengths and weaknesses of this approach were evaluated and served as a basis for recommendations (Konisky and Beierle, 2001; Duram and Brown, 1999).

5.5 Review and Update

For Review and Update, we propose the following recommendations:

- Carry out a "drill" of the contingency plan
- Update plans annually
- Address equity in review of plans

In times of drought, there are urgent needs of the community that need to be met and there is little time to analyze whether or not the drought contingency plan is working as designed. Thus, it is necessary to review these issues beforehand to be as prepared as possible for future drought events. The Cooperative Drought Contingency Plan of the Hualapai Reservation includes a requirement to carry out a "test" of the contingency plan using different scenarios and drought stages. After the plan is approved, it must be announced publicly to its Tribe Members and to the Hualapai Tribal Council. As explained in the plan: "Following announcement, a test of the plan will be implemented as coordinated by the Hualapai Tribe and coordinating agencies" (Christensen, 2003, p.2). By running through the plan as it has been designed, in a controlled situation, the Hualapai Reservation identifies any weaknesses in the plan and allows time to make adjustments.

The Navajo Nation Drought Contingency Plan requires drought status meetings with the Emergency Management Commission twice a year, or as needed, to review recently completed and planned work, evaluate current monitoring data and assess drought triggers and assist and review drought contingency plans. The scale of counties in California and the number of communities under their jurisdiction make once a year review the most feasible timeline for review of contingency plans. The timely reviewing of these plans should be a priority for communities because the more prepared a County is for a drought event the less emergency funding will be spent, the more streamlined the process will be overall, and the less likely it may be to fail to account for vulnerable community members. Community members will receive information and aid in a timely manner and roles and responsibilities will be clearly defined. Data quality must also be taken into account when reviewing these plans and if plans are only

updated every five years, data, such as water table levels and precipitation predictions, will not be up-to-date.

Another important aspect to the reviewing of plans is addressing equity in these reviews. This was a sub-criteria that was not found to be carried out in any of the plans we reviewed. To be sure that the plan is inclusive and is addressing the needs of the most vulnerable residents in these communities, equity must be addressed in the annual review of these plans.

5.6 Funding

For Funding, we propose the following recommendations:

- Establish a reserve water fund for disadvantaged communities
- Pursue avenues for funding low-income water assistance, such as the Low-Income Water Rate Assistance Program or the State Water Board's Household & Small Water System Drought Assistance Program
- Consider equity in designing and implementing water shortage fees
- Shift funding toward drought preparedness and water conservation (e.g., reducing the upfront costs of efficiency upgrades for low-income households)
- Arrange for pre-established contracts with NGOs to formalize critical partnerships

Appropriate planning around funding can lay the groundwork for effective drought management. The following funding recommendations are organized around equity, water conservation, and supporting communities.

Ensuring that equity considerations are taken into account across funding strategies is critical, particularly in light of California's Human Right to Water Policy, which requires that water access be *affordable*. Establishing a reserve water fund for disadvantaged communities for drought response can provide an important safety net for vulnerable water users. However, Proposition 218, which protects users from inequitable water rate increases, also limits the ability of public utilities to subsidize low-income customers or provide financial assistance. Thus, turning to alternative funding sources to create reserve funds or financial assistance must also be considered. Additionally, private well and non-public water system users are not positioned to benefit from financial assistance from public utility companies. One important avenue may be the Low-Income Water Rate Assistance Act (from AB 401) which requires the preparation of a plan (to be submitted by January 1, 2018) that covers funding and implementation of a Low-Income Water Rate Assistance Program. As a currently ongoing

process, it may provide new ways of funding low-income water assistance. Similarly, advocating for the expansion of programs like the State Water Board's Household & Small Water System Drought Assistance Program, which provides financial assistance for drought-related drinking water emergencies, including new well construction, and permit and connection fees, may also help to bring about greater awareness of particular funding considerations for DACs.

Additional equity recommendations relate to prioritization of funding needs, water fees, and federal funding. While water shortage fees can provide important signals to use water efficiently, they must take equity into account. Certain types of fees can be regressive, disproportionately affecting low-income households. While private well users are not affected by water fees, small public systems may experience this. Finally, opportunities like utilizing certain types of cost-share for federal funding which includes the waiving or reduction of non-federal cost-share based on financial hardship could help guarantee that areas with a high proportion of low-income water users are not left behind. The U.S. Department of Interior's WaterSMART program supports drought contingency planning and has included these models of cost-share arrangements in distributing funds.

The emphasis of drought planning is often on response, rather than pre-drought water conservation actions. Shifting funding toward drought preparedness and water conservation is therefore a key strategy for comprehensive resource planning around drought. This could be done by embedding contingency plans within larger water management plans so that the proactive and reactive sides are in sync and appropriately emphasized. We also recommend that as part of creating opportunities for greater synergy between drought planning and water conservation, there should be an effort to reduce the upfront costs of efficiency upgrades for low-income households (Feinstein 2017), which can help guarantee that vulnerable communities are considered in drought preparedness. In the case of private well users, this may also help regulate the use of water if or when groundwater becomes available.

Finally, in rural and unincorporated areas, strong partnerships between state or local agencies and NGOs or CBOs can aid in conducting outreach, building trust, and providing much-needed services. Arrangements for pre-established contracts with NGOs as is included in the Tulare County Draft Water Shortage Contingency Plan for Self-Supplied Domestic Water Users can formalize critical partnerships and alliances that have emerged in drought emergencies.

California recently announced that it intends to cut off all disaster assistance to assist families suffering from the effects of drought in Tulare County by the end of June 2017. Sustainable and comprehensive funding for drought management beyond emergency response is critical to avoid similarly dire situations in the future.

6. A Path Forward

As counties in the San Joaquin Valley look toward a future in which drought is the "new normal," issues of equity and feasibility in enacting drought contingency plans become even more crucial. This report acknowledges the need for flexibility and underscores that drought contingency requirements for rural areas and DACs must be specifically tailored to the needs of those communities. Similarly, we emphasize that while integration of drought contingency planning into existing documents is crucial, the way in which these drought contingency measures become enforced and enacted is also essential. Many well-intentioned planning documents are drafted and then left fallow due to the difficulty of implementation. Incorporating drought contingency planning comprehensively across all planning documents and making it a requirement for county or district water management plans must be the next step toward moving from a reactive to a preventative paradigm.

7. References

Key References

1. *Drought Contingency Plan Public Water System*. Template. Indian Health Services. 2014. http://www.water.ca.gov/tribal/docs/May_30_14/DroughtContingencyPlanTemplate%20on%20IHS%20CA%20website.pdf.
2. *National Drought Mitigation Center at the University of Nebraska Lincoln.* http://drought.unl.edu/.
3. Feinstein, Laura, Rapichan Phurisamban, Amanda Ford, Christine Tyler, and Ayana Crawford. "Drought and Equity in California." *The Pacific Institute; The Environmental Justice Coalition for Water*, January 2017.
4. *Place Matters for Health in the San Joaquin Valley: Ensuring Opportunities for Good Health for All.* Report. Joint Center for Political and Economic Studies. March 2012. https://www.fresnostate.edu/chhs/cvhpi/documents/cvhpi-jointcenter-sanjoaquin.pdf
5. von Korff, Yorck, Katherine A. Daniell, Sabine Moellenkamp, Pieter Bots, and Rianne M. Bijlsma. "Implementing Participatory Water Management: Recent Advances in Theory, Practice, and Evaluation." Ecology and Society 17, no. 1 (2012). doi:10.5751/es-04733-170130.

Full References

2015 Urban Water Management Plan. Report. Visalia District, CA: California Water Service, 2016. https://www.calwater.com/docs/uwmp2015/vis/2015_Urban_Water_Management_Plan_Final_(VIS).pdf

Barker, Myles. "Drought food program ending." The Porterville Recorder. April 28, 2017. http://www.recorderonline.com/news/drought-food-program-ending/article_ecb759ee-2bbd-11e7-b2ff-2b26822d77ad.html. Accessed May 7, 2017.

Balazs, Carolina, Rachel Morello-Frosch, Alan Hubbard, and Isha Ray. “Social Disparities in Nitrate-Contaminated Drinking Water in California’s San Joaquin Valley. Environmental Health Perspectives 119 (2011): 1271-1278. doi.:10.1289/ehp.1002878.

Belitz, Kenneth, Miranda S. Fram, and Tyler D. Johnson. "Metrics for Assessing the Quality of Groundwater Used for Public Supply, CA, USA: Equivalent-Population and Area." *U.S. Geological Survey, Environmental Science and Technology* 49 (June 26, 2015): 8330-8338. doi:10.1021/acs.est.5b00265.

Butler, Cameron, and Jan Adamowski. "Empowering marginalized communities in water resources management: Addressing inequitable practices in Participatory Model Building." Journal of Environmental Management 153 (2015): 153-62. doi:10.1016/j.jenvman.2015.02.010.

CA DWR (California Department of Water Resources). Last updated March 1, 2016. *Critically Overdrafted Basins*. http://www.water.ca.gov/groundwater/sgm/cod.cfm. Accessed May 7, 2017.

California Water Code Division 6 Part 2.6 Urban Water Management Planning Section 10631.1 (a). http://www.water.ca.gov/urbanwatermanagement/docs/water_code-10610-10656.pdf.

Christensen, Kerry . *Cooperative Drought Contingency Plan.* Report. Hualapai Tribe Department of Natural Resources . December 2003. http://www.hualapai.org/resources/drought/2007_BOR_Drought_Plan_2003.pdf.

City of Fresno 2015 Urban Water Management Plan. Report. Fresno, CA: Provost & Pritchard Consulting Group, 2016. https://www.calwater.com/docs/uwmp2015/sel/2015_Urban_Water_Management_Plan_Final_(SEL).pdf

Draft 2015 Urban Water Management Plan. Report. CA: City of Tulare, 2015. http://www.tulare.ca.gov/home/showdocument?id=2287

Drought Contingency Plans and Planning in the Greater Horn of Africa. Report. UN Office for Disaster Risk Reduction Regional Office for Africa. 2012. https://www.unisdr.org/we/inform/publications/26436.

"Drought assistance may end." *The Porterville Recorder*, April 19, 2017. Accessed May 7, 2017. http://www.recorderonline.com/news/drought-assistance-may-end/article_d780b0fe-24b3-11e7-ba19-ab6cccf79bb1.html.

Drought, Climate Change and Health. Report. Center for Climate Change and Health/Public Health Institute. 2016.

Drought Contingency Plan for the City of Houston. Report. City of Houston. Houston, TX, 2015. https://edocs.publicworks.houstontx.gov/documents/divisions/utilities/coh_drought_contingency_plan_2015.pdf

Duram, Leslie A., and Katharin G. Brown. “Insights and Applications Assessing Public Participation in U.S. Watershed Planning Initiatives.” Society & Natural Resources 12, no. 5 (June 1999): 455–67. doi:10.1080/089419299279533.

Ekstrom, Julia A., Louise Bedsworth, and Amanda Fencl. 2017. *Gauging climate preparedness to inform adaptation needs: local level adaptation in drinking water quality in CA, USA*. Climate Change 140: 467–481.

EPA (US Environmental Protection Agency). Building the Capacity of Drinking Water Systems. Last updated Sept. 30, 2016. https://www.epa.gov/dwcapacity/learn-about-small-drinking-water-systems.

Feinstein, Laura, Rapichan Phurisamban, Amanda Ford, Christine Tyler, and Ayana Crawford. "Drought and Equity in California." *The Pacific Institute; The Environmental Justice Coalition for Water*, January 2017.

Gleick, Peter. *Impacts of California's Five-Year (2012-2016) Drought on Hydroelectricity Generation*. Report. Pacific Institute. 2017. http://pacinst.org/app/uploads/2017/04/Embargoed_PI_Impacts_of_Californias_Five-Year_2012-2016_Drought_on_Hydroelectricity_Generation.pdf

Goddard, Toby, and Aerin Martin. *Water Shortage Contingency Plan*. Report. CA: City of Santa Cruz Water Department, 2009. http://www.cityofsantacruz.com/home/showdocument?id=14601

Kallis, Giorgos, Nuno Videira, Paula Antunes, Ângela Guimarães Pereira, Clive L Spash, Harry Coccossis, Serafin Corral Quintana, et al. "Participatory Methods for Water Resources Planning." Environment and Planning C: Government and Policy 24, no. 2 (April 2006): 215–34. doi:10.1068/c04102s.

Konisky, David M., and Thomas C. Beierle. "Innovations in Public Participation and Environmental Decision Making: Examples from the Great Lakes Region." Society & Natural Resources 14, no. 9 (October 2001): 815–26. doi:10.1080/089419201753210620.

Lesukat, Marko. February 2016. Drought Contingency Plans and Planning in the Greater Horn of Africa: A desktop review of the effectiveness of drought contingency plans and planning in Kenya, Uganda and Ethiopia. UNISDR (United Nations International Strategy for Disaster Reduction).

Navajo Nation Drought Contingency Plan. Report. Navajo Nation Department of Water Resources. 2003. http://drought.unl.edu/archive/plans/drought/tribal/NavajoNation_2003.pdf.

Nguyen, Thang and Lewis Moeller. *California Drought Contingency Plan*. Report. 2010. http://drought.unl.edu/archive/plans/drought/state/CA_2010.pdf.

Northern Cheyenne Tribe Drought Mitigation Plan. Report. June 2007. http://cheyennenation.com/executive/drought_plan_june2007.pdf.

Oklahoma Drought Management Plan. Report. Oklahoma Drought Management Team. 1997. https://www.owrb.ok.gov/supply/drought/reports/drought_plan.pdf.

Place Matters for Health in the San Joaquin Valley: Ensuring Opportunities for Good Health for All. Report. Joint Center for Political and Economic Studies. March 2012. https://www.fresnostate.edu/chhs/cvhpi/documents/cvhpi-jointcenter-sanjoaquin.pdf

Romero, Ezra David. "With Drought Assistance Forecast To End Tulare County's Looking For Solutions." *Valley Public Radio*, April 20, 2017. Accessed May 7, 2017. http://kvpr.org/post/drought-assistance-forecast-end-tulare-countys-looking-solutions#stream/0.

Runkle, Stephen A et al. *Susquehanna River Basin Drought Coordination Plan*. Report. Susquehanna River Basin Commission. 2000. http://www.srbc.net/hydrologic/docs/dm212.pdf.

"The Central Valley: Tulare Basin." U.S. Geological Survey. March 20, 2017. Accessed May 7, 2017. https://ca.water.usgs.gov/projects/central-valley/tulare-basin.html.

Urban Water Management Plan. Report. City of Porterville. Porterville, CA, 2015. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Porterville,%20City%20of/Porterville%202010%20Urban%20Water%20Management%20Plan.pdf

Urban Water Management Plan. Report. South San Joaquin Irrigation District. Manteca, CA: Provost & Pritchard Consulting Group, 2016. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/South%20San%20Joaquin%20Irrigation%20District/SSJID%20Final%20UWMP.pdf

Voinov, Alexey, and Erica J. Brown Gaddis. "Lessons for successful participatory watershed modeling: A perspective from modeling practitioners." Ecological Modelling 216, no. 2 (2008): 197-207. doi:10.1016/j.ecolmodel.2008.03.010.

Water Shortage Contingency Plan. Report. East Niles Community Services District. Bakersfield, CA, 2015. http://www.eastnilescsd.org/information/doc/Final%20Water%20Shortage%20Contingency%20Plan%204-30-2015.pdf

Water Shortage Contingency Plan. Report. CA: Sacramento County Water Agency, 2014. http://www.waterresources.saccounty.net/scwa/Pages/Water%20Supply%20Contingency%20Plan%20-%202014.pdf

Water Shortage Contingency Plan for Self-supplied Domestic Water Users. Report. California Department of Water Resources for Tulare County. Sacramento, CA: Tully & Young, 2016.

Yucaipa Valley Water District Authority Water Shortage Contingency Plan. Report. June 2011. http://documents.yvwd.dst.ca.us/publications/drought/watershortagecontingencyplan.pdf.

Zuni Drought Contingency Plan. Report. The Zuni Tribe Water Resources Section Conservation Program. December 2001. http://drought.unl.edu/archive/plans/drought/tribal/ZuniTribe_2001.pdf.

8. Appendix A: Assessment of drought contingency and water management plans

This part of the appendix will include a detailed spreadsheet, noting all insights drawn from the plans evaluated.

Table A1. Selected drought contingency and water management plans

County/Community	1. East Niles Community Services District (2015)
	2. Tulare County (2016)
Tribal	3. Hualapai Reservation (2003)
	4. Navajo Nation (2003)
	5. Northern Cheyenne Tribe (2007)

	6. Zuni Tribe (2001)
Urban	7. Fresno, City of (2016)
	8. Houston, City of (2015)
	9. Porterville, City of (2015)
	10. Sacramento County (2016)
	11. Santa Cruz, City of (2009)
	12. Tulare, City of (2015)
	13. Visalia District (2016)
Regional	14. Susquehanna River Basin (2000)
Water District	15. South San Joaquin Irrigation District (2016)
	16. Yucaipa Valley Water District (2011)
State	17. California (2010)
	18. Oklahoma (1997)

Table A2. Assessment criteria and sub-criteria

Pre-Assessment	• Notes equity challenges across the area • Considers short- and long-term impacts of climate change • Acknowledges current state of water supply vs. demand
Integration	• Leverages data sources from existing plans • Maximizes local partnerships • Considers potential synergies with existing plans or fully integrates into existing plans
Communications	• Clearly outlines roles and responsibilities among stakeholders • Uses accessible language & communication methods (e.g. clarity, translated into Spanish, etc.) • Streamlines communications processes

Public Participation	• Addresses participation needs of marginalized, vulnerable communities (e.g. time, location) • Provides avenues for prolonged participation • Prioritizes participants' expertise throughout planning process
Review & Update	• Integrates pilot programs, for example, prototypes, scenario modeling, role-playing etc., to test aspects of plan before implementation • Test run activities, if integrated, assess equity • Sets timeline for reviewing and updating plan
Funding	• Incorporates funding strategies within staged responses for drought • Addresses specific funding needs associated with implementing projects in DACs • Establishes pathways for partnering with and funding NGOs to implement actions to reach DACs • Goes beyond funding emergency response to incorporate drought preparedness and resilience actions

Table A3. Pre-Assessment Evaluation

PRE-ASSESSMENT CRITERIA	Notes equity challenges across the area	Considers short- and long-term impacts of climate change	Acknowledges current state of water supply vs. demand
East Niles Community Services District (2015)			Includes Water Availability and Estimate of Water Supply.
Tulare County (2016)	Yes.		
Hualapai Reservation (2003)		Does not address climate change per se, but does have mitigation plans in place to prevent future drought events or mitigate the effects as much as possible.	Section 2.11: Thus, among all the sectors, 2,627,025 gallons of water are needed per day during drought emergencies.

Navajo Nation (2003)	Plan is meant to streamline process for determining which chapter should receive assistance to reduce time between administering funds; recognition of sustained poverty amongst community and severity of potential drought impacts; discussion of vulnerability of domestic water haulers; discussion of vulnerability challenges of farmers and ranchers.		Table with drought risk rating for public water supply sources based on type of risk (p. 27); lists current reservoir levels compared to total capacity for each reservoir.
Northern Cheyenne Tribe (2007)			Discussion of water sources (including yield) and water uses; includes suggestions for how to avoid adding water demand that can't be met.
Zuni Tribe (2001)	Acknowledges that discussion of natural disasters used to be taboo within the community and the plan has carefully considered Zuni culture and religion; acknowledges historical impacts on the tribe and loss of traditional drought coping mechanisms.		Discussion of drought risks associated with different use types and their sources.
Fresno, City of (2016)	Section on projected lower income water demands.		Includes historical, current, and future demands, historical water production from surface water and groundwater; Provides dry year supply for next three years between different sources and whether they are sufficient to meet estimated demands.
Houston, City of (2015)			
Porterville, City of (2015)	Includes low income projected water demands (no direct mention of equity).	Includes a section on climate impacts.	Includes water demand and supply
Sacramento County (2016)	The Act requires that the water demand projections include the projected water use for lower income households (4-5) (no direct mention of equity).	Includes climate change vulnerability assessment.	Includes supply and demand assessment.

Santa Cruz, City of (2009)	Explicit mention of equity with regard to fee models but not of equity across the area.	Nominal reference to climate change: “No one can predict how the future will unfold, especially in light of the emerging science of global climate change, which some predict could bring more frequent, longer, or more intense water shortages across the state, and which compounds the uncertainty and risk going forward at the local government level" (p. 1-3).	Includes water supply and demand assessment.
Tulare, City of (2015)	Mentions disadvantaged and low-income families. Also, "Section 10631.1 (a) of the California Water Code requires that retail urban water suppliers include projected water use for lower income single family and multifamily households" (no direct mention of equity).	[Climate change] analysis is presently optional for water suppliers and the City has elected not to comment extensively on these impacts (p. 50).	Includes water supply and demand assessment.
Visalia District (2016)	Plan notes water use for low income households and that "the District serves several unincorporated portions of Tulare County, most notably the community of Goshen" (p. 23) (no direct mention of equity).	Includes climate change impacts.	Includes water supply and demand assessment.
Susquehanna River Basin (2000)			
South San Joaquin Irrigation District (2016)			Includes supply and demand assessment.
Yucaipa Valley Water District (2011)			

California (2010)	Declines in crop yields and fisheries may contribute to substantial increase in food prices, which would disproportionately impact low income communities... Reduced agricultural employment will impact low income farm workers and their families.	Potential climate change impacts mentioned throughout.	Discussed from higher level. No real baseline, likely because it is at a state level.
Oklahoma (1997)	The Older American Act authorizes the federal government to assume a portion or all of the costs associated with developing model projects that relieve older individuals of burdens related to costly utility service, frequently experienced during hot drought episodes. Special consideration is given to projects under which a business provides utility services to low-income, older individuals at a cost substantially lower than that afforded to other individuals.		

Note. Fields highlighted in orange indicate that sub-criteria were met. Fields highlighted in grey indicate that sub-criteria were not met.

Table A4. Integration Evaluation

INTEGRATION CRITERIA	**Leverages data sources from existing plans**	**Maximizes local partnerships**	**Considers potential synergies with existing plans or fully integrates into existing plans**
East Niles Community Services District (2015)			
Tulare County (2016)		Yes.	Begins to consider potential synergies.
Hualapai Reservation (2003)		Monitors other government programs' response to drought (p. 13).	Considers communication and cooperation with other public and private institutions (beginning on p. 27).

Navajo Nation (2003)	Only within the Navajo Nation.	Considers partnerships within the organization of the Navajo Nation.	
Northern Cheyenne Tribe (2007)		Partnerships are mentioned to map and monitor springs, water levels, water quality etc. in conjunction with USGS and Montana Ground Water Information Center database.	
Zuni Tribe (2001)		Determines drought indicators in conjunction with National Weather Service Stations.	Doesn't mention plans specifically, but mentions prioritizing water uses within sectors like farming, ranching, construction etc. that could be incorporated into plans (p. 9).
Fresno, City of (2016)	Yes.	Specifically examines coordination with other agencies and the community.	Yes.
Houston, City of (2015)			
Porterville, City of (2015)	Yes.	Mentions a school education program.	Yes.
Sacramento County (2016)			
Santa Cruz, City of (2009)	Yes.	Considers active public information campaign.	
Tulare, City of (2015)	The UWMP works with General Plans, Water Master Plans, Recycled Water Master Plans, Integrated Resource Plans, Integrated Regional Water Management Plans, Groundwater Management Plans, and others. Notes that the City is also a participant in the Kaweah River Basin Integrated Regional Water Management Plan Authority (p. 8).	Works across multiple city water agencies and notes that it wants to commit to "active involvement of diverse social, cultural, and economic elements" (p.14).	Yes.
Visalia District (2016)	Yes.	Yes.	
Susquehanna River Basin (2000)		Works with national agencies to monitor drought.	

South San Joaquin Irrigation District (2016)	Yes.	Coordinates with Emergency Notification Plans.	Yes.
Yucaipa Valley Water District (2011)		The District's management team works closely with members of other local, state, and federal agencies including the City of Yucaipa, City of Calimesa, County of San Bernardino, and the County of Riverside. The local municipalities meet once a month to discuss several issues related to the Yucaipa Valley, including hydrologic conditions, facility and system operations, and other subjects as may be beneficial in managing our water supplies (p. 2).	Yes.
California (2010)	Yes.	Yes.	Yes.
Oklahoma (1997)	Yes.	Yes.	Coordinates with county governments, irrigation districts, rural fire protection departments, USDA Emergency Boards etc., but does not integrate plans.

Note. Fields highlighted in orange indicate that sub-criteria were met. Fields highlighted in grey indicate that sub-criteria were not met.

Table A5. Communications Evaluation

COMMUNICATIONS CRITERIA	**Clearly outlines roles and responsibilities among stakeholders**	**Uses accessible language & communication methods (e.g. clarity, translated into Spanish, etc.)**	**Streamlines communications processes**
East Niles Community Services District (2015)			
Tulare County (2016)			

Hualapai Reservation (2003)		Plan states that special consideration should be given to the community's demographics. This includes language barriers, education level, and limited or no internet access.	
Navajo Nation (2003)	Table of agency/entity and their designated actions for each stage of drought including normal conditions as well as actions during routine operations and maintenance.	Notice of drought condition in local newsletter fliers and public meetings.	Includes contact names, addresses, and phone numbers for all responsible parties.
Northern Cheyenne Tribe (2007)	Shown in table, diagram, and narrative formats.		Includes example monthly drought status report to be distributed to pre-determined agencies and committees, as well as example drought declaration letters; contact names, addresses, phone numbers for all responsible parties included in plan, as well as contact information for media resources (radio, newspaper, TV).
Zuni Tribe (2001)			
Fresno, City of (2016)	Organized by agency/partner agency and their duties for monitoring, impact assessment, and mitigation and response.		
Houston, City of (2015)		Two of the water conservation positions with the city require Hmong and Spanish; plans provide water conservation information through multiple outlets (social media, webpage, newsletter, event booths, school events, workshops).	
Porterville, City of (2015)			
Sacramento County (2016)		Water conservation radio commercials in English and Spanish.	

Santa Cruz, City of (2009)		Stress the importance of timely, straight-forward messages which are available through many modes (radio, newsletter, meetings, internet) (same wording as Indian Health Services Template); will translate all public notices, regulations, and outreach materials into Spanish and other appropriate languages.	Provides example of monthly water supply and demand monitoring report; provides contact information for major agencies, media, large users, and landscape interests; provides pre-written public messages for stages of water shortage; recommends preparing mailing list ahead of time.
Tulare, City of (2015)			
Visalia District (2016)			
Susquehanna River Basin (2000)			
South San Joaquin Irrigation District (2016)			
Yucaipa Valley Water District (2011)			Monthly meetings between municipalities provide regular check-points for water supply challenges; Includes pre-written public messages for each stage of drought and anticipated Q&A's.
California (2010)	Includes table of agency and their associated actions for monitoring, communication/coordination and planning, local assistance, conservation, other actions organized by drought stages.	Public information strategy includes multiple modes of communication: newspaper, mail, radio, website.	
Oklahoma (1997)	Includes table for roles of state level agencies for each stage of drought, but roles for local stakeholders not as clearly outlined.		

Note. Fields highlighted in orange indicate that sub-criteria were met. Fields highlighted in grey indicate that sub-criteria were not met.

Table A6. Public Participation Evaluation

PUBLIC PARTICIPATION	Addresses participation needs of marginalized, vulnerable communities (e.g. time, location)	Provides avenues for prolonged participation	Prioritizes participants' expertise throughout planning process
East Niles Community Services District (2015)			
Tulare County (2016)	Suggested public outreach: Family friendly community events on water conservation and county resources and local school outreach. Special consideration should be given to the community's demographics including possible language barriers, education level, and limited or no internet access. Outreach should be bilingual to address non-English speaking residents. Outreach can also be coordinated through local churches, schools and non-government organizations (NGOs), especially for boundary areas with high concentrations of disadvantaged community residents. Internet access is also a consideration.		

Hualapai Reservation (2003)		The Hualapai Tribe attempts to minimize the vulnerability of the reservation to drought through frequent meetings with the public.	Regular publications in the community newsletter. Plan states that many tribal members are cattle owners and are therefore intimately knowledgeable of the range and water conditions across the reservation. The Hualapai Department of Natural Resources and the Hualapai Department of Public Works will take the lead in disseminating information regarding drought conditions to the Tribal Government and the Hualapai Community, including Cattle Districts. The Hualapai Tribal Council will have final authority for making all decisions regarding drought declaration and response to drought.

Navajo Nation (2003)		Affected Chapters will receive the monthly drought status report. Since the Chapters are closer to the local problems, they should be actively involved. The fire prevention teams at the federal, state and tribal levels should assist each other in publicizing restrictions using the radio, newspaper, and Chapter meetings.	To prepare the drought response strategy, the NDWR reviewed several state drought responses and conducted meetings with the Navajo Tribal programs. The plan incorporates the responses of: 1) the four Navajo departments that have explicit drought response responsibilities, 2) the Navajo Nation's Office of the President and Vice President, 3) the Emergency Management Commission and legislative oversight committees, 4) the Chapters, 5) NTUA, and 6) the grazing districts, farm boards, and soil and water conservation districts. Range managers conduct workshops on improving the quality of the cattle, vaccinations, increasing body weight, and decreasing diseases. The range managers also improve communication between the livestock producers and buyers. With this information, the ranchers will be better prepared to respond to drought and, if need be, reduce the number of livestock. The Chapter officials may know which wells and springs are dry, which windmills are broken, and which families need help. Other responses include recruiting volunteers for local action, assisting with public service announcements, and assisting with feed and water distribution, and working with the national guard.

Northern Cheyenne Tribe (2007)	Sixteen copies of the draft plan were mailed directly to various tribal departments, organizations, individuals, and state and federal agencies. The draft plan was also posted on the tribe's website. In drought conditions, the Board may order permit holders to reduce or cease water use. Prior to any such order, the Board shall give notice of its intent to require reductions through publication in a Reservation newspaper of general circulation and posting in at least four places on the Reservation. A public hearing shall be held at which public comment may be given. Decisions to require water use reductions may be appealed in accordance with Chapter IV.	The tribe's drought policy was drafted by the contractor and reviewed by the participants at the meeting held in Lame Deer on December 6, 2006. Goals and mitigation projects were also developed by the group at this meeting, then organized and formatted by the contractor. A 30-day comment period was provided from December 15, 2006 to January 15, 2007. A small number of primarily editorial comments were received and were incorporated into the draft plan. Mitigation goals and measures have been identified that will help the tribe realize its Drought Policy. Recommendation is made to appoint a Northern Cheyenne Drought Advisory Committee (NCDAC). • The NCDAC will meet at a minimum every spring (March) and fall (October) or more frequently if necessary to review indices (Percent of Normal, SPI, and PSDI) and anecdotal information, determine drought severity, and address drought issues.	Anecdotal evidence is incorporated from PDM steering committee members and other persons interviewed for information for the PDM and Drought Management Plan. Anecdotal evidence will also be reviewed by the NCDAC. NCDAC membership was recommended by participants in the June 5, 2007 tribal departments meeting: Director, Natural Resources Department (Chair), tribal public health, tribal forestry, tribal housing, tribal utilities, tribal council, Environmental Protection Agency, NRCS, Natural Resources Conservation Service, BIA Range Management and BIA Forestry/Fire, Indian Health Service (environmental engineer).

Zuni Tribe (2001)	When a drought declaration is made, appropriate agencies and the community will be notified, and impact assessment activities will be activated to determine the appropriate response actions. Information will be distributed to the community using the local radio station, KSHI, and local newspaper, The Shiwi Messenger, and if necessary, through flyers and/or meetings.		All official communications to entities outside the Zuni government regarding drought declarations will be made through the Tribal Administrator and Tribal Council. Any policies dictating mandatory measures to be taken by the community will be implemented only with the approval of the Tribal Council. The Plan has been prepared with careful consideration of Zuni culture and religion.
Fresno, City of (2016)	Followed legal requirement CWC §10642: Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.	The City conducted outreach to the community in some form over nearly 3,100 times between 2010 and 2015. The City has an online tool as well as a telephone hotline available for the public to report water leaks, either on their property or within the public rights-of-way. This helps reduce detection time and limits the water loss from leaks. Online forms and contact information for staff are also provided for community members year round. Additional staff are hired on when call volumes are higher.	

Houston, City of (2015)		Avenues for public participation included: Posts on-line to receive comments and input from 6/5/12 to 8/17/12. Presented to the Oversight Committee and the Transportation, Technology and Infrastructure Committee 9/12/12. Public comments were received at this meeting and subsequent council meetings. Water Conservation Task Force established by Mayor's Office to continue review of water shortage and emergency options and opportunities for their application and implementation in Houston. The public is able to address the City Council Weekly.	
Porterville, City of (2015)			

Sacramento County (2016)		SCWA also participates in a regional public education and outreach program through the RWA. In collaboration with 22 water provider members and other wastewater, stormwater and energy partners, RWA formed the Water Efficiency Program (WEP) in 2001 to bring cost effectiveness through economies of scale to public education and outreach activities. Every year the WEP selects three to five public events to attend and to have a booth for the public to interact with local water conservation staff. This provides an opportunity for the region to communicate its messages. The adopted plan is available for public review during normal business hours at the SCWA administration building and on-line. The WEP is also very active in communicating to local media outlets such as the Sacramento Bee.	

Santa Cruz, City of (2009)	A multimodal approach to outreach is suggested, which maximizes reach and includes public meetings and forums, as well as presentations at community meetings and neighborhood and homeowners associations. Building trust and community support is called out as important. Suggests Publicizing gratitude for community's cooperation.	Monthly water commission meetings serve as a public forum for discussing water conditions and hearing issues regarding implementation of the water shortage ordinance throughout the entire duration of the water shortage event. But, regular meetings, e-mail group updates and presentations should precede water shortage events. Public participation is encouraged in the development and implementation of the plan. The final tasks in updating the plan include soliciting public review and input.	
Tulare, City of (2015)	There is no substitute for water planning at the local water supplier level. Only a local supplier has the knowledge, ability to consider the unique circumstances of the individual agency, can provide for participation by the community, and tailor the planning to local conditions. The City is committed to encouraging the active involvement of diverse social, cultural, and economic elements of its citizenry.	The City has also begun to implement a semi-annual town hall meeting open to the public to address water and conservation related issues and concerns.	

Visalia District (2016)	Cal Water's public outreach program provides assistance to residential customers through home water surveys and monthly water use reports; public Information and school education are also provided.	The City has started the planning and design of the East Side Regional Park and Groundwater Recharge Project with a series of workshops to establish user needs and define plan alternatives. Cal Water provided notice to these entities and the communities it serves 60 days prior to the public hearing it held on May 11, 2016, to present the draft of the UWMP, address questions, and receive comments. Cities and counties are receiving the public hearing notification from Visalia District as required per CWC §10621. The deadline for public comments was May 18, 2016, one week after the public hearing.	
Susquehanna River Basin (2000)			
South San Joaquin Irrigation District (2016)	Followed legal requirement CWC §10642: Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan. Plan addresses the outreach needs of different sized communities. Plan addresses barriers to entry, such as language.	SSJID encouraged active involvement and participation of others in the preparation of this plan. SSJID outreached to contracted agencies, farmers, city residents, rural county residents, and people in surrounding areas through letters, newspaper notices, public hearings, and by sending draft copies of the UWMP to nearby cities. Mentions CWC 10608.26: an urban retail water supplier shall conduct at least one public hearing to allow community input regarding the urban retail water supplier's implementation plan. The plan was made available for public review.	

Yucaipa Valley Water District (2011)		The public is informed during the Advisory Stage, as early as meaningful data are available. During the Voluntary Stage, specific actions are suggested.	

California (2010)		The Drought Coordinator would be assigned by DWR to coordinate drought activities among federal, State, local and tribal governments, stakeholders, and the public. The key duties may include: Enhance public awareness and drought education by providing workshops and incorporating conservation campaigns into statewide events. DWR and U.S. Bureau of Reclamation coordinate on water transfers activities and hold workshops to help urban water suppliers plan for drought conditions. Cal EMA will assist DWR in coordinating the activities of the Task Force. Their duties will include: Collaborate with State, regional, local, and tribal agencies on providing workshops on drought preparedness, social services and other assistance. Current Actions: In 2009, DWR, Cal EMA, and Department of Public Health hosted a series of workshops throughout California to share updates on drought impacts and response activities, and to discuss local groundwater conditions and planning for Integrated Regional Water. Management (IRWM) grants. Suggests developing an internet site for California Drought Contingency Plan Potential Actions: Educate water users & agencies on how to use climate information to plan for mitigation and drought response; provide public general information on drought as it relates to wildfire issues and recreation. Potential Actions: Provide ranchers and farmers with workshops on coping with drought. Potential Actions: Publish community and State facility water use information through	Potential Actions: Conduct drought preparedness regional workshops for the purpose of: Developing proper indicators for each region; assessing potential needs for regional assistance; determining relative risk of regions; and capturing drought component of Urban Water Management Plans.

		website, media, and other public outreach. Potential Actions: Conduct workshops or other methods of communication in drought stricken areas to provide information on assistance available.	

Oklahoma (1997)		The primary form of delivery for information and data, especially to the media and public, will be the Oklahoma Water Resources Bulletin, issued through the Oklahoma Water Resources Board. Drought-related public education materials are available from most of the state agencies and organizations.	The Oklahoma Department of Agriculture works closely with the state's agricultural community in assessing and responding to associated drought impacts, including those involving forestry and wildfire problems. The agency may also assist the Oklahoma State University Agricultural Extension Service in providing estimates of the impact of the drought on agriculture.

Note. Fields highlighted in orange indicate that sub-criteria were met. Fields highlighted in grey indicate that sub-criteria were not met.

Table A7. Review and Update Evaluation

REVIEW & UPDATE CRITERIA	Integrates pilot programs, for example, prototypes, scenario modeling, role-playing etc. to test aspects of plan before implementation	Test run activities, if integrated, assess equity	Sets timeline for reviewing and updating plan
East Niles Community Services District (2015)			
Tulare County (2016)			Mentions the need to update the Plan, but does not offer timeline to do so (p. 25).
Hualapai Reservation (2003)		"Following announcement, a test of the plan will be implemented as coordinated by the Hualapai Tribe and coordinating agencies" (p. 2).	This Plan will be reviewed and amended as needed every two years (Intro).
Navajo Nation (2003)			Convene drought status meetings with the Emergency Management Commission twice a year, or as needed, to review recently completed and planned work, evaluate current monitoring data and assess drought triggers. Assist and review Chapter drought Contingency Plans (p. 79).
Northern Cheyenne Tribe (2007)			Committee will meet twice a year, or more as necessary, to review indices (p. 25).

Zuni Tribe (2001)			The Plan will be reviewed and updated at a minimum of every five years. It will also be evaluated and revised following the occurrence of drought events. Appendix B, Section 5.3 describes items to consider when revising the Plan (p. 13).
Fresno, City of (2016)			Required to review and update Urban Water Management Plan every five years.
Houston, City of (2015)			
Porterville, City of (2015)			The City of Porterville expects to update their Water System Master Plan in 2015-2016.
Sacramento County (2016)			
Santa Cruz, City of (2009)			Includes Section 3.6, Water Shortage Recovery and Plan Termination, which details the steps for the city to take once the water shortage has ended. It includes debriefing with staff, information collection, evaluation to prepare an "after action" report, amongst other actions, as well as a final item: "Update the water shortage contingency plan as needed." Thus, no timeline is set out, but because this step will be taken after every water shortage event, it should be sufficient (p. 3-36).
Tulare, City of (2015)			Updated every five years.
Visalia District (2016)			Updated every five years.
Susquehanna River Basin (2000)			Local agencies are urged to review and update drought contingency plans (p. 19). When drought emergency is declared, PEMA requires the update of drought contingency plans (p. 22).
South San Joaquin Irrigation District (2016)			Updated every five years.

Yucaipa Valley Water District (2011)			
California (2010)			This plan may be reviewed and updated with each California Water Plan Update or as necessary to provide current information, technology, and strategies (p. 1).
Oklahoma (1997)			

Note. Fields highlighted in orange indicate that sub-criteria were met. Fields highlighted in grey indicate that sub-criteria were not met.

Table A8. Funding Evaluation

FUNDING	**Incorporates funding strategies within staged responses for drought**	**Addresses specific funding needs associated with implementing projects in DACs**	**Establishes pathways for partnering with and funding NGOs to implement actions to reach DACs**	**Goes beyond funding emergency response to incorporate drought preparedness and resilience actions**
East Niles Community Services District (2015)				
Tulare County (2016)	Acknowledges funding areas for each drought stage.	Staged response strategies recognize the need for outreach to disadvantaged communities but does not identify specific funding sources: "Alert County management regarding necessary personnel and budget requirements to implement outreach and education efforts" (p. 22).	"Trigger pre-established relationships with NGOs to expand outreach, implement actions, and direct available funding from state or federal resources (e.g. through annually executed "standby contracts"). These contracts would enable 100% reimbursement of any funds provided through State emergency response mechanisms" (p. 23).	Suggests the implementation of water conservation measures in Stage 1 Response but focus on pre-drought actions in this plan is not explicit.

Hualapai Reservation (2003)	Acknowledgement of need for funding from outside agencies but unclear what are viable sources; "the Hualapai Tribe has, and will, provide matching funds to assist in drought relief and mitigation efforts through Public Law 93-638 contracts with the U.S. Bureau of Indian Affairs" for capital mitigation projects (p. 23).			Responsibilities and activities during normal and alert conditions include need for drought mitigation funding (p. 18).
Navajo Nation (2003)	Brief acknowledgment.	Clear reference to water haulers and their vulnerability to drought: "Between 25 and 40 percent of the population does not have direct access to public drinking water systems, and must haul domestic water to their homes" (p. 4).		Plan recommends mitigation measures to be implemented before the next drought occurs and brings associated costs.
Northern Cheyenne Tribe (2007)		Mitigation goals include: "Establish a fund for assisting individuals in replacing wells that go dry" (p. 26).		Plan proposes drought mitigation in the form of goals and mitigation measures or projects.
Zuni Tribe (2001)		Acknowledgment of private well use but no mention of specific needs.		Plan includes a mitigation strategy with associated funding needs.
Fresno, City of (2016)				City funds methods to increase water conservation but only once stage 1 drought has been initiated.
Houston, City of (2015)				
Porterville, City of (2015)	Stage IV water reduction measures include: "A 20% rate increase on all residential and landscape water accounts will go into effect" (p. 53). Does not take equity into account.			Water conservation measures include past and future expenditures.

Sacramento County (2016)				Demands management measures, implemented for retail and wholesale customers, as part of the UWMP.
Santa Cruz, City of (2009)	Incorporates cost estimates and funding options.	Acknowledges the problem of equity in certain water fee models.		Year-round water conservation measures acknowledged, but discussion of funding is limited.
Tulare, City of (2015)		Acknowledges that the city is considered a "disadvantaged community."		Acknowledges funding needs and sources for water reduction measures.
Visalia District (2016)		Cal Water offers a Low Income Rate Assistance Program.		Includes estimated costs, savings, etc. for demand management measures.
Susquehanna River Basin (2000)				
South San Joaquin Irrigation District (2016)				Water conservation program is discussed, though specific funding is not.
Yucaipa Valley Water District (2011)				
California (2010)	Acknowledges funding in stages.	For extreme drought, acknowledges need to "Facilitate the provision of water hauling assistance/relief to communities" (p. 36).	Identifies Community Food Banks as having potential role in drought management or emergency assistance: "Obtain and distribute food donations to those who have lost jobs or income due to the drought and water shortages" (p. 45). Also includes NGOs such as United Way.	Identifies specific conservation funding efforts (p. 32).

Oklahoma (1997)	Acknowledges funding in stages.	Acknowledges that rural communities are especially vulnerable during drought (p. 7).	Identifies the potential role of volunteer relief organizations (p. 26).	Water conservation mainly discussed in relation to drought when it occurs; funding is not clearly specified.

Note. Fields highlighted in orange indicate that sub-criteria were met. Fields highlighted in grey indicate that sub-criteria were not met.