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Technical Memorandum 2

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List of Abbreviations

ABAG	Association of Bay Area Governments
ACWD	Alameda County Water District
AF	acre-foot/feet
AFY	acre-foot/feet per year
AMI	advanced metering infrastructure
BARDP	Bay Area Regional Desalination Plant
BARR	Bay Area Regional Reliability
BAWSCA	Bay Area Water Supply and Conservation Agency
BiOp	Biological Opinion
CA	California
Cal Water	California Water Service Company
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
cfs	cubic foot/feet per second
CVP	Central Valley Project
CWC	California Water Code
DAC	disadvantaged community
DCP	Drought Contingency Plan
DDW	State Water Resources Control Board Division of Drinking Water
Delta	Sacramento-San Joaquin River Delta
DOT	Department of Transportation
DPR	direct potable reuse
DSRSD	Dublin San Ramon Services District
DWR	California Department of Water Resources
EA	Environmental Assessment
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
EDA	economically distressed area
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FIRO	Forecast Informed Reservoir Operation

FRWA	Freeport Regional Water Authority
FRWP	Freeport Regional Water Project
GHG	greenhouse gas
IFA	Infrastructure Finance Act
in.	inch(es)
IPR	indirect potable reuse
IRWM	Integrated Regional Water Management
ISD	Ironhouse Sanitary District
JPA	joint powers authority
LF	linear foot/feet
LV	Los Vaqueros
mgd	million gallons per day
MMWD	Marin Municipal Water District
MOA	Memorandum of Agreement
NDF	Newark Desalination Facility
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
P3	public-private partnership
PREP	Potable Reuse Exploratory Plan
psi	pound(s) per square inch
R&R	repair and replacement
RWF	Regional Wastewater Facility
RWQCB	Regional Water Quality Control Board
SBA	South Bay Aqueduct
SCADA	supervisory control and data acquisition
SCVWD	Santa Clara Valley Water District
SCWA	Sacramento County Water Agency
Semitropic	Water Storage District
SFPUC	San Francisco Public Utilities Commission
SGWP	Sustainable Groundwater Planning
SRA	Shortage Response Action
SRF	State Revolving Fund
State Board	State Water Resources Control Board
SVAWPC	Silicon Valley Advanced Water Purification Center
SVCW	Silicon Valley Clean Water
SWP	State Water Project
TBD	to be determined
TDS	total dissolved solids
TM	technical memorandum
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
UWMP	Urban Water Management Plan
WCWTP	Walnut Creek Water Treatment Plant
WSCP	Water Shortage Contingency Plan
Zone 7	Zone 7 Water Agency

Executive Summary

BARR and the DCP Background

Eight of the San Francisco Bay Area's largest public water agencies are working together through the Bay Area Regional Reliability (BARR) partnership toward regional solutions to improve water supply reliability for the more than six million residents and thousands of businesses and industries in the area. As a first step in this unprecedented partnership, the BARR agencies are developing a regional Drought Contingency Plan (DCP).

To support their efforts, the BARR agencies, including Alameda County Water District (ACWD), Bay Area Water Supply and Conservation Agency (BAWSCA), Contra Costa Water District (CCWD), East Bay Municipal Utility District (EBMUD), Marin Municipal Water District (MMWD), San Francisco Public Utilities Commission (SFPUC), Santa Clara Valley Water District (SCVWD), and Zone 7 Water Agency (Zone 7), secured a grant from the United States Bureau of Reclamation (USBR) to help develop the DCP.

The outcomes of the DCP development effort conducted by the BARR member agencies through much of 2016 are summarized in two technical memoranda — TM1 and TM2 — that, taken together, will compose the DCP. While TM1, distributed in August 2016, lays the foundation for the DCP with a comprehensive view of Bay Area water supply, demand, and potential vulnerabilities to drought conditions, TM2 outlines potential regional drought response actions and mitigation measures.

DCP Objectives

The motivation for BARR is for partner agencies to cooperatively develop regional projects to strengthen long-term water supply reliability and resilience, better leveraging water and infrastructure resources and exploring new operations strategies. The DCP specifically addresses potential drought-related impacts. Regional drought mitigation measures for sustained supply are augmented by near-term drought response actions to manage limited supply and meet immediate needs. Though planning for catastrophic events is also critical for ensuring the region's health, safety, and prosperity, emergency response staff from the BARR agencies and other agencies are working directly with the Association of Bay Area Governments (ABAG) to develop a complementary program that will identify emergency response procedures and actions (the Regional Lifelines Council).

TM2 Elements

TM2 focuses primarily strategies to improve regional reliability and resilience—drought response actions and drought mitigation measures—as well as an operational and administrative framework for implementation.

Drought Response Actions

Response actions are triggered during specific stages of drought to manage limited supplies and decrease the severity of immediate impacts over short durations. As described in detail in TM1, each BARR agency has its own unique set of drought response actions dictated by agency-specific conditions and documented in Water Shortage Contingency Plans (WSCPs). The BARR agencies submit WSCPs with their Urban Water Management Plans (UWMPs) every five years. Governor Brown's Executive Order (EO) in May 2016 and the subsequent Water Use Efficiency framework released in draft form by the California Department of Water Resources (DWR) and State Water Resources Control Board (State Board) in November 2016 would update WSCP requirements to include "adequate actions to respond to droughts lasting at least five years" and to remain "customized according to local conditions." Specifically, agencies would be required to submit drought planning/projection information annually as well as once every five years with their UWMP update.

Beyond individual BARR agency drought response actions already being taken, the following two joint drought response actions show promise for implementation in the future:

- **Regional drought response communications:** Consistent regional messaging is key to effectively reaching the public regarding the need for water savings. BARR agencies would benefit from economies of scale by coordinating regional outreach campaigns building on effective local programs and/or leveraging models from other regions.
- **Mobile water treatment facilities:** Short-term leases of mobile trailers with various treatment units could be used to treat saline surface water, groundwater, and/or recycled water in times of severe shortage. Significant logistical challenges would need to be explored, including mobilization and startup, as well as operation, maintenance, and any legal or environmental issues.

Drought Mitigation Measures

When collectively developing a list of drought mitigation measures to characterize and assess for the DCP, the BARR agencies focused on those that would benefit multiple agencies and are justifiably characterized as "regional in nature." More specifically, given the objective of the BARR effort—to jointly advance a suite of projects uniquely enabled by this regional partnership effort—all BARR drought mitigation measures must increase regional water supply reliability during drought and engage two or more BARR agencies, as summarized in Table ES-1. The BARR agencies provided the Drought Task Force, an advisory stakeholder group, a preview of the measures for their review and input.

Many of the measures involve leveraging/expanding existing assets and/or potentially constructing new facilities—such as interties, storage, and treatment—which typically require thoughtful and often lengthy planning and implementation. In addition, the BARR agencies are exploring a few early-action measures to further exercise the partnership and produce tangible joint outcomes that can be implemented relatively quickly, including a regional water market program to facilitate voluntary exchanges and transfers and maximize efficient use of existing assets and resources.

The measures are each at various stages of planning. The assessment of the potential measures in this TM is based on current knowledge and planning objectives, which will evolve over time.

Rather than rank or prioritize, the BARR agencies consider the entire list of 15 measures viable possibilities depending on need and timing. In assessing the measures, the BARR agencies are applying several factors including benefits (e.g., yield, flexibility/sustainability, and timing), costs, implementability (during non-emergency conditions), and social and environmental considerations.

Table ES-1. BARR Drought Mitigation Measures

No.	Drought Mitigation Measure	Engaged BARR Agencies
Interties		
1	Transfer-Bethany Pipeline	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7
2	Zone 7-EBMUD Intertie	Zone 7 and EBMUD
3a	ACWD-SFPUC Intertie and Local Supply	ACWD, BAWSCA, and SFPUC
3b	ACWD-SFPUC Intertie and IPR	ACWD, BAWSCA, and SFPUC
4	West Side SFPUC-SCVWD Intertie	SFPUC, BAWSCA, and SCVWD
5	SFPUC-Zone 7 Intertie	SFPUC, BAWSCA, and Zone 7
6	MMWD-EBMUD Intertie	MMWD and EBMUD
Storage		
7	LV Expansion	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7

Table ES-1. BARR Drought Mitigation Measures		
No.	Drought Mitigation Measure	Engaged BARR Agencies
Treatment/Supply		
8	Walnut Creek Water Treatment Plant Pretreatment Facility	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7 (to be confirmed)
9	Regional Desalination Plant	CCWD, EBMUD, SCVWD, SFPUC, and Zone 7
10	Silicon Valley Advanced Water Purification Center (SVAWPC) Expansion	SCVWD, SFPUC, and BAWSCA
11	Mid-Peninsula Potable Reuse Exploratory Plan (PREP)	SFPUC and BAWSCA
12	Joint Tri-Valley Potable Reuse Feasibility Study	Zone 7, EBMUD, and SFPUC
Operations		
13	Regional Advanced Metering Infrastructure (AMI) Feasibility Assessment	ACWD, CCWD, EBMUD, MMWD, and SCVWD
14	Del Valle Reservoir Water Supply Storage Expansion Project	ACWD, SCVWD, and Zone 7
15	Bay Area Regional Water Market (Exchanges/Transfers) Program	ACWD, BAWSCA, CCWD, EBMUD, SCVWD, SFPUC, and Zone 7

Operational and Administrative Framework

Sharing water resources and facilities across the region will require new operational and administrative mechanisms with a range of considerations, as listed below and detailed in this TM:

- **Institutional:** Transferring water and/or sharing infrastructure among users often requires new institutional agreements to specify roles, responsibilities, and key implementation steps.
- **Operational:** To achieve regional water solutions, the BARR agencies may need to modify current operations. For example, agencies may need to coordinate water quality monitoring and changes in water treatment operations to address the transfer and blending of supplies, including water quality effects such as taste and odor, treatability, or corrosion concerns.
- **Permitting and environmental documentation:** Implementation of drought mitigation measures would require obtaining regulatory approvals and permits; coordinating with relevant governmental agency(ies) issuing the needed permit(s) at federal, state, and/or local levels; and completing specific environmental analysis/documentation as mandated by federal and state regulations.
- **Water rights:** Supply transfers often trigger needed modifications to water-rights permits to address changes in points of diversion, place of use, and/or purpose of use. While specific operational and legal limitations apply, two potential areas of flexibility show promise:
  - Conjunctive use of transferred supplies (transferring water to storage in non-dry years for use during dry years) would improve water management.
  - Changes to points of diversion would allow exchanges of water between BARR agencies, especially those that have local storage capability.
- **Funding:** Viable funding sources can expedite and facilitate implementation of mitigation measures or drought response actions. Several state, federal, and local funding sources are currently available, including grant and loan opportunities. Funding eligibility and other requirements, such as local cost-share for grants and repayment terms for loans, are important considerations. In addition, grant funding is competitive (thus, less certain to materialize). Alternative funding mechanisms, such as public-private partnerships (P3s), are other pathways to consider.
- **Governance:** BARR agencies may further consider formation of a joint powers authority (JPA) in future phases of work to exercise their powers as a single agency to accomplish specific common goals.

Next Steps

The BARR partnership holds tremendous potential to forge new regional approaches for reliable water supply in the Bay Area. Together, the BARR agencies are pursuing measures and actions collaboratively that would use existing infrastructure and water resources more fully to produce greater efficiencies and improved water supply reliability for the area. Through this collaborative process, the BARR agencies now have a regional platform for water management, one that enables joint measures and actions to meet Bay Area water needs while also meeting individual agencies' site-specific needs.

Though the BARR agencies are not currently obligated to update the initial DCP, the agencies (or some variation/subset) may produce future updates, modified drought mitigation measures, and/or response actions.

In addition to this joint DCP, the BARR agencies also individually maintain UWMPs as living documents that reflect long-term planning to ensure reliable, adequate water supplies for existing and future water demands. UWMP data have traditionally been presented in various forms, to reflect agency-specific conditions. In the future, BARR agencies may consider integrating some aspects of the DCP into their UWMPs to enable greater consistency and to reflect the regional partnership.

As the State Board finalizes a new Water Use Efficiency framework, "Making Water Conservation a California Way of Life" (State Board 2016), future Bay Area water demands may remain constant or decline. At the same time, climate-change uncertainties and the potential for catastrophic events to threaten water supply require that Bay Area water agencies take further actions to guard against these challenges and improve reliability and resilience. The measures and actions laid out in this DCP better prepare BARR agencies for the future. The BARR agencies or some subset expect to further advance plans, explore funding options, and study feasibility for at least some of these measures in the near term. To facilitate exchanges/transfers during future droughts, the BARR agencies are pursuing funding for the Bay Area Water Market Program. In the coming years, the agencies may also update or expand this BARR DCP.

Beyond the measures considered here, BARR agencies are also currently pursuing other projects individually or with agencies outside of the BARR construct to further improve Bay Area supply reliability. Taken together, joint BARR and individual agency efforts are solidifying systems and resources to provide a sustainable, reliable, high-quality water supply for a healthy community and vibrant economy in the Bay Area.

Section 1: Introduction

California has been facing extraordinary drought from 2012 through 2016. In 2015, the Sierra Nevada Mountains had the lowest snowpack in recorded history and, as a result, the U.S. Drought Monitor classified the Bay Area and most of California as experiencing "exceptional" drought conditions. Most Bay Area water supply agencies rely on snowmelt in the Sierra Nevada Mountains for at least a portion of their supplies. Below-normal local rainfall also affected local supplies. While hydrologic and supply conditions improved significantly in most parts of the state during the 2016 water year, as of early March 2017, it remains to be seen whether this change signals the end of the recent (and potentially ongoing) drought or whether dry conditions will persist next year and beyond.

Regional planning context: The region's previous drought planning efforts may need to be expanded given potential climate-change impacts, uncertainty in future regulations, and projected increases in Bay Area population and water demands. As the first installment of the Bay Area Regional Reliability (BARR) Drought Contingency Plan (DCP), TM1—the work that preceded this document—provided a summary of the Bay Area water systems, the BARR agencies' current drought monitoring programs, and a vulnerability assessment. TM2—this document—presents an evaluation of potential cooperative drought mitigation and response actions identified by the BARR agencies with the overarching goal of improving water supply reliability for the Bay Area.

The BARR DCP differs from past planning efforts because it integrates information from eight individual water agencies and focuses on regional actions to benefit the Bay Area as a region. Specifically, the eight agencies include Alameda County Water District (ACWD), Bay Area Water Supply and Conservation Agency (BAWSCA), Contra Costa Water District (CCWD), East Bay Municipal Utility District (EBMUD), Marin Municipal Water District (MMWD), San Francisco Public Utilities Commission (SFPUC), Santa Clara Valley Water District (SCVWD), and Zone 7 Water Agency (Zone 7). Collectively, the BARR agencies serve more than six million people.

Drought mitigation measures must account for potential climate change impacts and other water supply uncertainties. While extensive scientific research has explored potential climate change impacts with findings published in peer-reviewed technical literature, existing climate models predict a wide range of potential water-resources effects. Nonetheless, given the potential for increased extreme climatic events such as the unprecedented recent/ongoing drought, as well as infrastructure and regulatory risks, the BARR agencies are evaluating several measures aimed at improving the region's collective drought resilience. Through this coordinated regional approach to drought contingency planning, the BARR agencies plan to improve water supply reliability, leverage existing infrastructure investments, facilitate water transfers during shortages, and improve climate-change resilience.

BARR is not a water supply master plan or a justification for growth or new supplies. Rather, the effort is focused on combining/integrating existing assets to improve resilience for droughts (i.e., not demand sensitive). A balance is needed in planning adequate supplies to meet demands without over-projecting and constructing stranded assets. Demand projections, as summarized in TM1, reflect the outcome of BARR agencies' other planning documents. The agencies continually update demand forecasts and will reflect lessons learned from the recent drought in updated projections.

The potential drought mitigation measures presented in this TM do not reflect all water supply reliability projects that the BARR agencies are developing or considering. As further described in Section 4, additional potential regional projects are being explored by BARR agencies as well as other Bay Area water and wastewater agencies, such as a suite of Western Recycled Water Coalition projects. Many are similar in nature to the BARR measures.

Though planning for catastrophic events is also critical for ensuring the region's health, safety, and prosperity, emergency response staff from the BARR agencies and other agencies are working directly with ABAG to develop a complementary program that will identify emergency response procedures and actions (the Regional Lifelines Council).

Role of water conservation/demand reductions: For the purpose of this DCP, the BARR agencies acknowledge the distinction between long-term water conservation (ongoing water use efficiency) and short-term emergency water use reductions (temporary cutbacks) and the difference between actions to appropriately support each. Water shortage conditions, such as the recent drought, can necessitate actions to support short-term emergency water use cutbacks. However, extraordinary cutbacks are unsustainable and can result in potential unintended consequences, such as long-term economic impacts (e.g., California business climate and residential property values), utility revenue instability, water affordability issues, disincentive for future capital investment to improve local reliability, compromised quality of life, as well as other potential long-term impacts.

Water use over the past several years has been significantly reduced because of the recent drought, based on policy changes and actions taken at both the state and local levels. Public awareness and actions during the drought have resulted in lasting efficiencies (cultural changes and passive savings) and temporary reductions (behavioral changes).

Long-term water use efficiency is a fundamental, core component of BARR agencies' water management. The BARR agencies remain committed and will continue ongoing water conservation efforts, regardless of hydrologic conditions. When properly designed and implemented, water use efficiency programs result in sustainable potable demand offsets that support the economy, environment, and communities.

As the State Board finalizes a new Water Use Efficiency framework, "Making Water Conservation a California Way of Life" (State Board 2016) and refines the framework over the next three to four years, future Bay Area water demands may remain constant or decline.

Section 2: Regional Reliability Assessment

The motivation for BARR is to enable Bay Area agencies to develop long-term regional projects cooperatively to mitigate potential drought-related impacts and build long-term water supply reliability and resilience. As a guiding principle, all BARR drought mitigation measures engage two or more BARR agencies and provide increased regional water supply reliability during droughts. The BARR agencies are applying several factors in assessing the measures.

For the purpose of this DCP, drought strategies are defined in the following two distinct ways:

- **Drought response actions** are specific actions triggered during specific drought stages to manage the limited supply and decrease the severity of immediate impacts (e.g., curtailing lawn watering). Drought response actions use temporary, short-term infrastructure and activities that agencies and the public can implement quickly and that provide expeditious benefits. Section 3 includes further discussion on the drought response actions considered for BARR.
- **Drought mitigation measures** are actions, programs, and strategies implemented before drought to address potential risks and reduce potential drought-related impacts when the event occurs. Many drought mitigation measures considered for BARR involve leveraging/expanding existing assets and/or potentially constructing new facilities—such as interties, storage, and treatment—which typically require thoughtful and often lengthy planning and implementation. In addition, the BARR agencies are exploring actions that can be implemented relatively quickly, including development of a regional water market program to facilitate water exchanges/transfers. Potential BARR drought mitigation measures are described in more detail in Section 4.

The framework for assessing potential drought mitigation measures is described further throughout this section.

2.1 Overview

The assessment and presentation of these drought mitigation measures is not intended to result in prioritization or ranking. Rather, the objective is to profile the measures being considered and assess them individually.

2.2 Assessment Factors

To characterize the drought mitigation measures, the BARR agencies and project team developed four categories of assessment factors—benefits, costs, implementability, and social and environmental considerations. Table 1 below summarizes the assessment factors by category. As stated above, these factors do not reflect a grading and ranking of the measures relative to each other; rather, these factors are used to characterize some of the key strengths and challenges of each potential measure.

Table 1. BARR Drought Mitigation Measure Assessment Factors

Assessment Factors	Definitions
Benefits:	The positive impacts and attributes of a measure with respect to the following factors:
• Water supply yield and availability	• The ability of the measure to address vulnerabilities (as identified in BARR TM1), and the amount of water made available under various hydrologic conditions (wet, normal, and dry years), supply storage for multi-year droughts, and emergency supply (AFY). Note that yield does not necessarily represent a new water supply source to the region.
• Regional resilience	• Improvement of supply reliability for two or more agencies through diversification of supply portfolios and/or expansion of local sources to improve regional self-reliance and prevent economic loss (from a qualitative perspective).
• Efficiency	• Increased efficiency in use of existing assets, facilities, and resources.
• Flexibility/sustainability	• Ease of adaptation to changes in physical or statutory conditions (e.g., climate change, catastrophic events, population or economic growth, regulatory changes).
• Water quality considerations	• Potential to change water quality, including improvements, degradation, treatment compatibility, and/or stability. • Fit-for-purpose water, as a function of water quality.
Costs:	The financial costs associated with a measure, including the following assessment factors:
• Capital costs	• Estimated total capital cost and unit cost of water supply developed ($/AF yield). Capital costs typically include planning, permitting, public outreach, engineering, legal and administrative, and construction costs, but as the BARR agencies developed the cited measure costs on a case-by-case basis, the exact details of the approach to each cost estimate varies somewhat.
• O&M costs	• Annual cost to operate and maintain a measure may be presented qualitatively as a range of costs, low (≤$300/AF), moderate ($300–$700/AF), or high (>$700/AF), to reflect uncertainty or changes in conditions. • Anticipated annualized rehabilitation and replacement costs, which may be presented qualitatively as a range of costs.
Implementability and timing	The ability to take a measure from concept to execution during non-emergency conditions. Implementability considers the following factors: local control, regulatory/permitting requirements, institutional needs, water rights, hydraulic constraints, water quality compatibility, constructability, and funding. The potential for a measure to be advanced in the near-term to address pending needs or longer-term efforts.
Social and environmental considerations	The effects of a measure on the community, economy, and environment, potential impacts (positive or negative) on disadvantaged communities (DACs), energy, instream flows, and the acceptability of the measure to customers/ratepayers and local interest groups.

AF = acre-foot.

O&M = operations and maintenance.

Section 3: Drought Response Actions

Drought response actions are near-term actions triggered during specific stages of drought to manage the limited supply and decrease the severity of immediate impacts from drought. As described in detail in TM1, each BARR agency has its own unique set of drought response actions.

State law requires retail and wholesale urban water suppliers to adopt and submit an Urban Water Management Plan (UWMP) every five years to the California Department of Water Resources (DWR). As part of UWMP development, urban water suppliers prepare Water Shortage Contingency Plans (WSCPs) that document the individual agency's drought response plan. While state law requires WSCPs to contain certain elements, agencies may tailor the plans as appropriate to their local characteristics.

In May 2016, Governor Brown issued an Executive Order (EO) that directed state agencies to "strengthen local drought resilience," among several other actions. The EO specifically calls for updating WSCP requirements to include "adequate actions to respond to droughts lasting at least five years" and to remain "customized according to local conditions." DWR and the State Board released a public draft report in November 2016 describing a proposed framework for implementing actions in response to the Governor's EO directives. The framework proposes new requirements for water agencies to submit specific drought planning/projection information at two different frequencies as follows:

- **Each year**, agencies will submit an Annual Water Budget Forecast (projecting supplies and demands based on current conditions and an additional dry year), Shortage Response Actions (SRAs) tied to specific water shortage levels, and protocols for implementing drought response actions (e.g., communication plan, customer compliance/enforcement, implementation authorities, financial plan for drought condition, and monitoring/reporting).
- **Every five years**, as part of their updated UWMPs, agencies will submit updated WSCPs that include a five-year drought risk assessment that examines shortage risks for the next five or more consecutive years, based on historical drought hydrology, plausible climate and regulatory changes, and demand projections.

In addition to the individual BARR agencies' drought response plans and water shortage response actions, the following two drought response actions show promise for potential regional implementation:

- **Regional drought response communications:** Consistent regional messaging is key to effectively reaching the public regarding the need for water savings. Given the Bay Area's dense population, conflicting, inconsistent messages from individual water agencies can confuse and mislead the public. BARR agencies can benefit from an economy of scale by coordinating an expanded regional outreach campaign (e.g., press releases; media; and public service announcements on television, radio, and billboards) across the Bay Area to provide consistent messaging to the public. Such a regional communications program could leverage successful large-scale outreach campaign examples from places such as Australia and/or build on effective local programs.
- **Mobile water treatment facility:** Use of mobile treatment units would enhance the BARR agencies' ability to provide drinking water during drought or other emergencies. This would protect health and safety and improve economic resilience and quality of life during emergency conditions. The concept involves leasing mobile trailers containing microfiltration pretreatment units and reverse osmosis filters to treat saline surface water, groundwater, and/or recycled water. BARR agencies would deploy the units in Bay Area locations experiencing severe water shortage (because of drought or a catastrophic event), as long as power and appropriate waste disposal are available.

  Mobile package water treatment plants are commonly used by the military and emergency relief organizations where access to a local high-quality potable water supply is limited or absent. Off-the-shelf packages are also available to provide water treatment in small developments isolated from centralized

water treatment and distribution systems. These package plants can offer both conventional treatment and advanced treatment systems, like reverse osmosis.

Significant logistical challenges would need to be addressed by participating agencies, and implementation is expected to be challenging. Studies to date have not identified potential sites well-suited for the units. Institutional, environmental, permitting, and engineering challenges will need to be overcome. Developing and permitting use scenarios, conducting environmental analysis, working with local agencies, designing and engineering built-in flexibility to operate under various use scenarios, construction, and startup will all pose challenges. Appropriate waste disposal would be needed to avoid environmental impacts. Energy needs of such units are anticipated to be high.

Though planning for catastrophic events is also critical for ensuring the region's health, safety, and prosperity, emergency response staff from the BARR agencies and other agencies are working directly with ABAG to develop a complementary program that will identify emergency response procedures and actions (the Regional Lifelines Council).

Section 4: Drought Mitigation Measures

When collectively developing a list of drought mitigation measures to characterize and assess for the DCP, the BARR agencies focused on those that would benefit multiple agencies and are justifiably characterized as "regional in nature." More specifically, given the objective of the BARR effort—to jointly advance a suite of projects uniquely enabled by this regional partnership effort—all BARR drought mitigation measures must increase regional water supply reliability during drought and engage two or more BARR agencies.

The measures are each at various stages of planning. The assessment of the potential measures in this TM is based on current knowledge and planning objectives, which will evolve over time.

4.1 Overview of Potential BARR Drought Mitigation Measures

For this TM, each of the 15 potential BARR drought mitigation measures falls into one of the following four categories:

- **Interties:** construction of new physical pipeline connections between agencies that would allow transfer of water supply between and among BARR agencies
- **Storage:** construction of new water storage capacity in existing reservoirs (i.e., no new surface water reservoirs)
- **Treatment/supply:** creation of access to additional water supplies that leverages existing water supply sources, create new sources of supply (e.g., through indirect potable reuse [IPR]), and/or improves treatment capacity in existing plants to treat new, more challenging local water supplies
- **Operations:** changes in water management practices that do not require new infrastructure (e.g., alternative storage locations)

Each of the potential measures feature shared benefits for multiple BARR agencies and, wherever possible, make use of existing resources, facilities, and infrastructure to reduce both the overall cost and the environmental footprint of the measure, as summarized in Table 2. The measures are each further described in individual profiles in Attachment A. The profiles characterize the measures in context of the assessment factors described in Section 2 and reflect currently available information from existing resources (e.g., technical studies/plans and funding applications).

Figure 1 presents the geographic coverage areas of the eight BARR agencies and highlights some key existing water infrastructure, as well as the general location of the potential measures.

4.2 Other Projects

The potential drought mitigation measures presented in this TM do not reflect all water supply reliability projects that the BARR agencies are developing or considering. Attachment B describes some additional potential regional projects including some being explored by BARR agencies as well as other Bay Area water and wastewater agencies, such as a suite of Western Recycled Water Coalition projects. Many are similar in nature to the BARR measures, as they involve expanding groundwater recharge (i.e., using IPR and/or surface water), adding wells to increase production capacity for use during drought and emergencies, expanding stormwater capture, expanding non-potable reuse, and implementing direct potable reuse (DPR). While each project described in Attachment B provides unique value, many benefit only one BARR agency or multiple agencies that are not members of the BARR partnership. As a result, the list of projects in Appendix B are considered complementary to BARR's efforts, as they collectively build increased regional reliability and water use efficiency within the Bay Area.

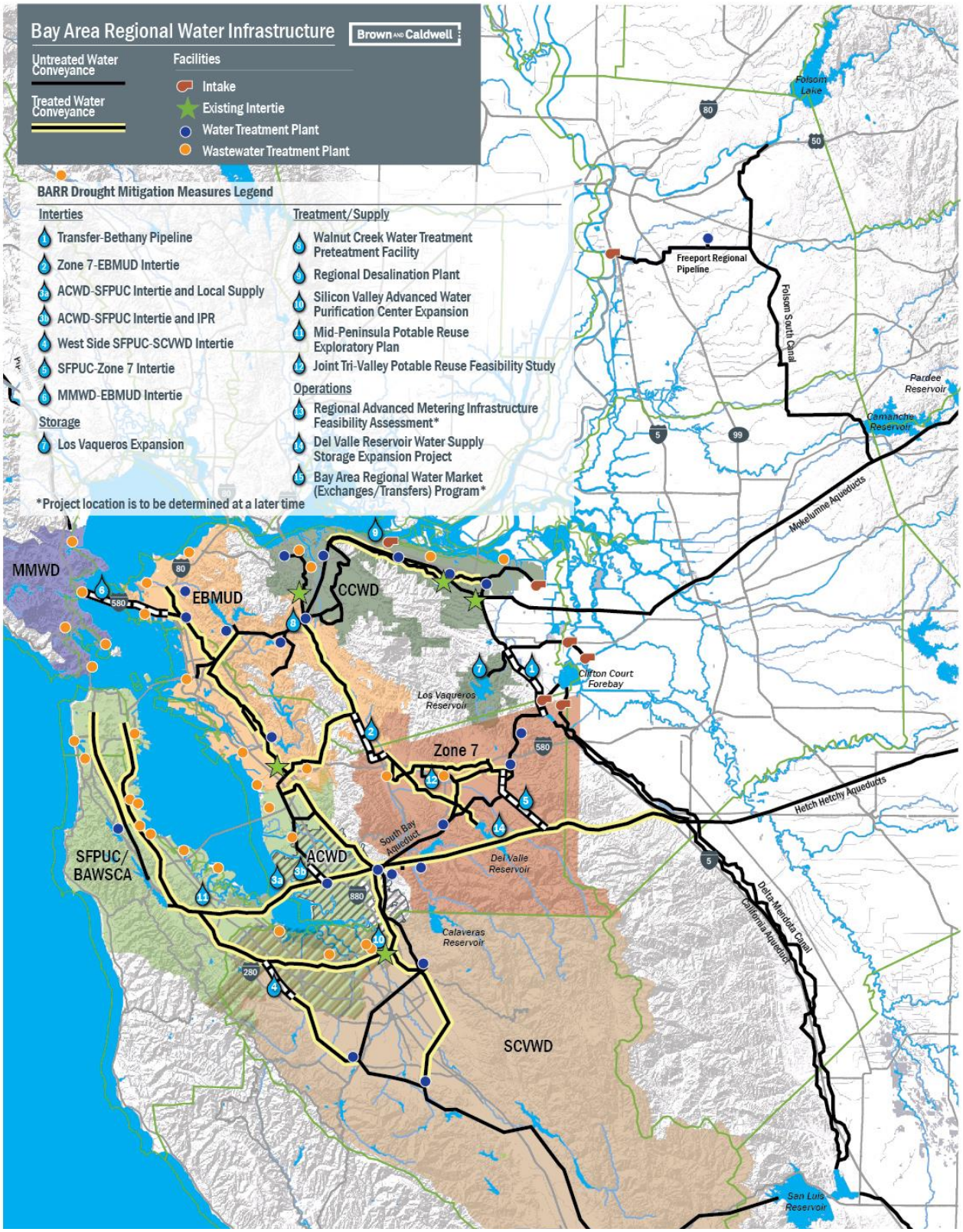

Figure 1. Existing Bay Area Regional Water Systems and Potential Drought Mitigation Measures

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Table 2. Overview of BARR Drought Mitigation Measure Characteristics

No.	Drought Mitigation Measure	Engaged BARR Agencies	Description	Cost [a]	Availability and Yield of Water (AFY)	Status	Implementability	Timing	Social & Environmental Considerations
Interties									
1	Transfer-Bethany Pipeline	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7	Connects LV Reservoir, CCWD's intakes, and EBMUD's intakes to the Bethany Reservoir and enable water conveyance to the South Bay Aqueduct (SBA) using a new pipeline around the east side of Mt. Diablo.	Capital: $200 million* O&M: TBD (likely moderate) *Not including costs of related measures (LV Expansion and WCWTP Pretreatment Facility)	217,000 AFY capacity in all water year types; actual yield would depend on system operations	Preliminary design	Draft supplemental EIR/EIS due in summer of 2017. Modification of water rights may be required to share water among potential partners. New easements are required for construction.	Construction could start as early as 2020	Benefits Delta fisheries through state-of-the-art fish screens and increased operational flexibility. Presents potential partnership opportunity with Central Valley wildlife refuges (south of the Delta), due to resulting ecosystem benefits.
2	Zone 7-EBMUD Intertie	Zone 7 and EBMUD	Connects EBMUD's water delivery system to Zone 7's, providing potential water sharing during emergencies and transfer/exchange opportunities.	Capital: $43 million O&M: TBD (likely low from EBMUD to Zone 7 and likely moderate from Zone 7 to EBMUD, because of pumping costs)	11,200 to 28,000 AFY (10 to 25 mgd), depending on the need and water availability Wet/normal year yield may be limited by EBMUD's wheeling transmission capacity of approximately 10 mgd. More transmission capacity may be available during dry years and emergencies.	Conceptual	Permits and traffic control plans would be needed to construct the intertie pipeline.	CEQA review could be completed in one year. Full implementation could be completed within four to five years.	Requires mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).
3a	ACWD-SFPUC Intertie and Local Supply	ACWD, BAWSCA, and SFPUC	Connects ACWD's Newark Brackish Groundwater Desalination Facility (NDF) with SFPUC's Bay Division Pipeline to provide emergency supplies and water transfer opportunities. NOTE: Measure 3b is a variation of Measure 3a. If Measure 3b were constructed, all elements of Measure 3a would be included.	Capital: $7.7 million O&M: TBD (likely moderate)	Up to 5,600 AFY (to be stored) in normal and wet years	Conceptual	Permits would be needed to construct the intertie pipeline. An operating plan and booster pump station would be needed to address the differential in the ACWD and SFPUC systems' operating pressures.	Implementable within two to five years	Provides environmental benefits by reducing demand on surface water supplies within ACWD's service area. Warrants outreach and communications with customers regarding modifying water supply.
3b	ACWD-SFPUC Intertie and IPR	ACWD, BAWSCA, and SFPUC	Produces purified local wastewater effluent to recharge the Niles Cone Groundwater Basin as a new source of supply. Measure 3b is a variation and extension of Measure 3a and includes all elements of Measure 3a, as well as IPR. IPR capacity could range from 4 mgd up to 15 mgd depending upon future demands, distribution system modifications, and facility sizing.	Capital: $93 million to $500 million O&M: TBD (likely high)	4,480 to 17,000 AFY in dry years 10,000 to 22,600 AFY in normal and wet years	Conceptual	Permits would be needed to construct the intertie pipeline. An operating plan and booster pump station would be needed to address the differential in the ACWD and SFPUC systems' operating pressures. Additional limnological studies would be needed to evaluate the effect of advanced treated water for IPR into Quarry Lakes, a park facility with recreational and human contact (e.g., swimming and fishing) beneficial uses.	Implementable within five to ten years	Provides environmental benefits by reducing demand on surface water supplies within ACWD's service area. Warrants outreach and communications with customers regarding modifying water supply and adding advanced treated water to Quarry Lakes.
4	West Side SFPUC-SCVWD Intertie	SFPUC, BAWSCA, and SCVWD	Adds a second intertie between SFPUC and SCVWD, providing potential water sharing during emergencies and transfer/exchange opportunities, including potable reuse opportunities.	Capital: $150 million O&M: TBD (likely moderate)	Up to 55,000 AFY capacity in normal and wet years	Conceptual	Permits would be needed to construct the intertie pipeline	Implementable within seven to nine years	Requires mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions). Any additions or modifications to water supply would involve outreach and communications with customers.

Table 2. Overview of BARR Drought Mitigation Measure Characteristics

No.	Drought Mitigation Measure	Engaged BARR Agencies	Description	Cost [a]	Availability and Yield of Water (AFY)	Status	Implementability	Timing	Social & Environmental Considerations
5	SFPUC-Zone 7 Intertie	SFPUC, BAWSCA, and Zone 7	Connects SFPUC's and Zone 7's water delivery systems, providing potential water sharing during emergencies and transfer/exchange opportunities.	Capital: $66 million O&M: TBD (low from SFPUC to Zone 7; medium from Zone 7 to SFPUC, because of pumping costs)	11,200 to 28,000 AFY (10 to 25 mgd), depending on the need and water availability, in all water year types	Conceptual	Permits would be needed to construct the intertie pipeline. Some construction in a highly urbanized area can be challenging and disruptive.	CEQA review could be completed in one year. Full implementation could be completed within four to five years.	Requires mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).
6	MMWD-EBMUD Intertie	MMWD and EBMUD	Connects EBMUD's and MMWD's water delivery systems either with a pipeline across the Richmond-San Rafael Bridge or across the Bay's bottom, providing potential water sharing and transfer opportunities.	Capital: $45 million O&M: $100/AF (low)	5,600 to 10,000 AFY capacity in all water year types	Conceptual	Pipeline construction in an urban area would necessitate CEQA compliance; coordination with many jurisdictions, property owners, and permitting agencies; permits; an agreement with Caltrans for access and use of to the Richmond-San Rafael Bridge; and traffic control plans. Water rights modifications may be needed. Construction across the bridge could be challenging and disruptive to traffic flow.	Implementable within three to five years	Requires mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).
Storage									
7	LV Expansion	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7	Expands reservoir capacity and connect to the Transfer-Bethany Pipeline. Measures 1 and 8 are companion measures to the LV Expansion.	Capital: $600 million* O&M: TBD (likely low) *Not including costs of related measures (Transfer-Bethany and WCWTP Pretreatment Facility)	115,000 AF (expansion of existing 160,000 AF capacity reservoir to 275,000 AF capacity) in all water year types	Preliminary design	Draft supplemental EIR/EIS due in summer of 2017. Modification of water rights may be required to share water among potential partners.	Initial CEQA review is complete; supplemental CEQA review is expected in 2017. Construction could start as early as 2022.	Benefits Delta fisheries with state-of-the-art fish screens and increased operational flexibility. Inundates additional areas in the watershed and may affect terrestrial habitat and cultural resources.
Treatment/Supply									
8	Walnut Creek Water Treatment Plant (WCWTP) Pretreatment Facility	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7 (to be confirmed)	Allows EBMUD to treat water from the Sacramento River, LV Reservoir, and other sources, enabling EBMUD to deliver supplies to neighboring water agencies. Measures 1 and 7 are companion measures to the WCWTP Pretreatment Facility.	Capital: $35-60 million* (depending on scale of capacity) O&M: TBD (likely moderate) *Not including costs of related measures (Transfer-Bethany and LV Expansion)	128,800 AFY in normal and dry years WCWTP capacity: 115 mgd. Pretreatment facility must match treatment plant, aqueduct, and wheeling capacity.	Preliminary design	The pretreatment facility is feasible from a constructability standpoint. However, community involvement and outreach for the project would be required.	Conceptual plans, CEQA, land acquisition are done; detailed design and construction may take up to three years	Improves EBMUD's ability to provide high-quality drinking water during droughts, emergencies, and planned and unplanned shortages. Reduces energy use and greenhouse gases produced to treat supplemental drought supply. No significant environmental effects are anticipated.
9	Regional Desalination Plant	CCWD, EBMUD, SCVWD, SFPUC, and Zone 7	Provides a new water supply source for the region; install a 20 mgd brackish water treatment plant at CCWD's Mallard Slough Pump Station.	Capital: $175 million O&M: $300–$390/AF (moderate)	22,400 AFY treated water in all water year types (28,000 AFY diverted to the intake; ~80% recovery)	Preliminary design	Environmental review has not been completed. In the past, similar desalination projects in the region have lacked public support or received strong public opposition. Conveying new supplies and transferring/exchanging supplies may be challenging and require new agreements and additional infrastructure. Water rights modifications would be required to share water among partner agencies. During critically dry water years, operations would need to be coordinated with CVP/SWP and the City of Antioch to avoid potential impacts.	Feasibility study, pilot testing, and Delta modeling have been conducted. Environmental review is needed. The plant could be constructed by 2030.	Lacks public support/faces public opposition regarding potential impacts to fisheries, increased energy consumption, increased greenhouse gas emissions. Potential impacts on fisheries could be reduced or avoided through operational best practices and facility design. Recent advances in treatment technologies may also decrease energy usage.
10	Silicon Valley Advanced Water Purification Center (SVAWPC) Expansion	SCVWD, SFPUC, and BAWSCA	Expands the existing SVAWPC to provide purified water directly to regional partners or indirectly through banking/exchanges/transfers.	Capital: $600 million O&M: $700/AF (high)	Up to 25,000 AFY in all water year types	Preliminary design – SVAWPC Expansion); Planning – regional partnerships	Challenges include managing reverse osmosis concentrate; fully utilizing purified water during low-demand periods; and determining the allocation of wastewater flows between potable reuse, non-potable reuse, and outflows to the Bay. Close coordination and collaboration with the City of San Jose on securing source water and managing reverse osmosis concentrate management/disposal.	Implementable within five to ten years (estimated)	Improves supply reliability which protects and benefits health and safety, customers' quality of life local agriculture, and many Silicon Valley businesses that contribute significantly to the economic health of the Bay Area. Requires CEQA review and engineering controls to mitigate increased salinity concentrate disposal that could increase receiving water salinity.

Table 2. Overview of BARR Drought Mitigation Measure Characteristics

No.	Drought Mitigation Measure	Engaged BARR Agencies	Description	Cost [a]	Availability and Yield of Water (AFY)	Status	Implementability	Timing	Social & Environmental Considerations
11	Mid-Peninsula Potable Reuse Exploratory Plan (PREP)	SFPUC and BAWSCA	Develops an IPR partnership for the mid-peninsula region.	Capital: TBD O&M: TBD (likely high)	Up to 6,720 AFY (6 mgd) in all water year types	Planning	The initial feasibility study will identify implementation challenges. Interagency agreements would be required to share water among partner agencies. The project may require a wastewater change petition, as well as significant permitting and CEQA review.	An initial feasibility study is currently underway and will be complete in mid-2017.	Improves supply reliability which protects and benefits health and safety, customers' quality of life, and many Silicon Valley businesses that contribute significantly to the economic health of the Bay Area. Concentrate disposal could increase salinity in receiving waters and would have an environmental impact (which may be positive). Rigorous analysis would be needed to select the best disposal option(s).
12	Joint Tri-Valley Potable Reuse Feasibility Study	Zone 7, EBMUD, and SFPUC	Explores a potential potable reuse partnership for the Tri-Valley (Amador Valley, Livermore Valley and San Ramon Valley) region.	Capital: $76M - $152M O&M: $3M to $6M/year (high)	4,800 to 7,700 AFY in all water year types	Planning	The initial feasibility study will identify implementation challenges. Interagency agreements would be required to share water among partner agencies. The project may require a wastewater change petition, as well as significant permitting and CEQA review. Local control of this water supply would likely be a motivating factor and implementation driver.	An initial feasibility study is currently underway and will be complete in mid-2017.	Improves supply reliability which protects and benefits health and safety, customers' quality of life, local agriculture, and many Silicon Valley businesses that contribute significantly to the economic health of the Bay Area. Concentrate disposal could increase salinity in receiving waters and would have an environmental impact (which may be positive). Rigorous analysis would be needed to select the best disposal option(s). Effective public communication and education will be needed to address any public concerns over the safety of potable reuse.
Operations									
13	Regional Advanced Metering Infrastructure (AMI) Feasibility Assessment	ACWD, CCWD, EBMUD, MMWD, and SCVWD	Assesses the feasibility for potential regional AMI expansion.	Capital: $250/meter installed ($250 million for 1 million meters) O&M: moderate	0.07 AFY/meter installed, in all water year types (70,000 AF for one million meters)	Planning	Based on the results of existing AMI programs, the most significant concern of AMI implementation is related to cost. AMI meter installation may be phased over time.	The regional feasibility assessment is currently conceptual, though some agencies are further along in planning or implementing AMI.	Requires significant customer outreach to garner support for implementation. Increased accuracy of water use data can improve billing equity among ratepayers and support collection of fees for all water used, eventually providing dividends that delay the need for water rate increases. Improves customer understanding of where and how they can use water more efficiently to reduce demand on surface water and groundwater supplies.
14	Del Valle Reservoir Water Supply Storage Expansion Project	ACWD, SCVWD, and Zone 7	Modernizes the flood management rules to use a greater portion of existing reservoir capacity to capture additional local supply and store additional emergency water supply while maintaining necessary flood protection. Implements Forecast Informed Reservoir Operation (FIRO) and uses modeling, forecasting tools, and improved information to improve flood-control and water supply operations.	Capital: $150 million (Study under way) O&M: TBD (likely low, studies under way)	Up to 35,000 AFY (additional storage) in normal and dry years	Conceptual	The SBA Contractors are currently seeking state funding for this project, as well as evaluating the feasibility of modernizing flood rules, expanding emergency storage, and replacing/relocating EBRPD facilities (which may be costly). Federal, state, and local review and permits would be required, and additional project constraints may be identified during that process that could affect implementation feasibility.	The project could be implemented within five years.	Benefits the environment by improving the operational flexibility of the SWP in managing pumping from the south Delta to minimize fish entrainment and meet water quality and flow objectives. Increases the area available for enhanced recreational opportunities, replaces EBRPD facilities, and improves water quality. Requires public support and cooperation from EBRPD to update recreational facilities.
15	Bay Area Regional Water Market (Exchanges/ Transfers) Program	ACWD, BAWSCA, CCWD, EBMUD, SCVWD, SFPUC, and Zone 7	Establishes a program for short-term interagency exchanges/transfers (specific TBD) to enable long-term resilience and flexibility for emergency conditions or events. Develops a tool (a "roadmap document") to enable future water exchanges and transfers by leveraging best practices based on the short-term interagency transactions completed as part of this effort.	TBD (depends on exchange/transfer scenario; at least $1.6 million to convey and store 3,000 AF of transferred supply in LV)	One-time exchange of water (at least 3,000 AF)	Planning	Implementation challenges would be specific to the agencies, facilities, and water sources involved in the transfer/exchange. Most would involve filing for a short-term transfer with the State Board, modifying water rights, securing additional permits, determining restrictions, and seeking approvals by agencies at federal, state, and/or local levels. Participating agencies would resolve technical challenges (water quality, treatment, intertie operations) before conducting this one-time demonstration test.	Depends on exchange/transfer scenario. Anticipated to be short-term and implementable between one to three years.	Leverages existing resources, supplies, and assets, thereby lowering their environmental burden. Facilitates development of a regional exchange project to improve dry-year supply resilience, which improves economic security and quality of life for the Bay Area.

a. *Capital costs are listed in millions of dollars. Operations and maintenance (O&M) costs are estimated as low (≤$300/AF), moderate ($300–$700/AF), or high (>$700/AF).*

Section 5: Operational and Administrative Framework

Given that most BARR drought mitigation measures involve using BARR agencies' collective assets and resources, an operational and administrative framework is critical for supporting implementation. Numerous implementation steps are needed to progress implementation of a drought mitigation measure from planning/design to construction during non-emergency conditions, including actions related to permits, environmental evaluation/ documentation, partnerships (interagency agreements/cost sharing), state/federal approvals, funding, and public outreach.

As shown in Figure 2, key implementation steps are interrelated. Timely and successful implementation requires deliberate, thoughtful planning and ongoing coordination among project partners and with regulating agencies.

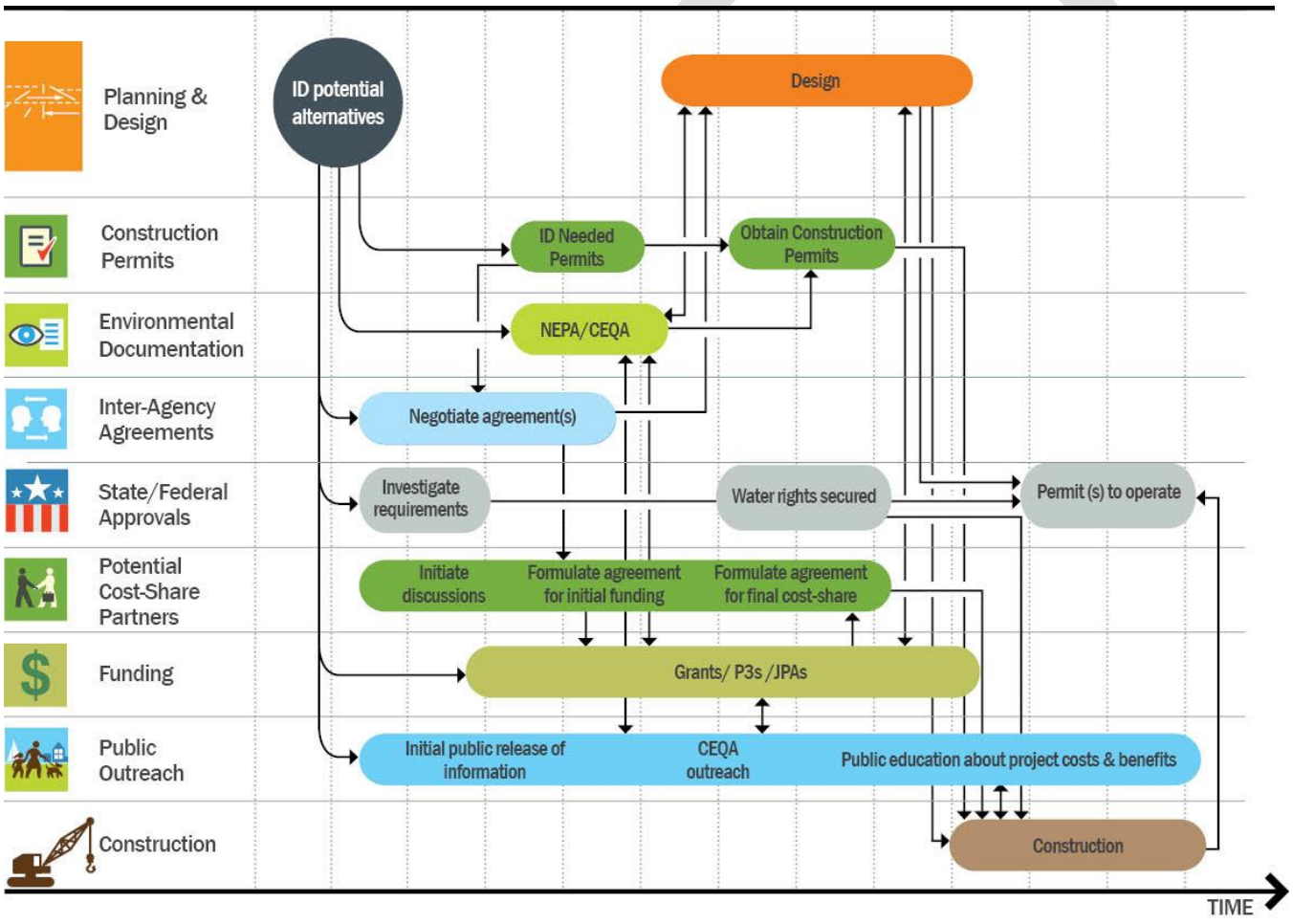

Figure 2. Critical-Path Actions for Potential BARR Drought Mitigation Measures Implementation

Components of the operational and administrative framework that support implementing drought mitigation measures and sharing BARR agencies' collective assets and resources involve a range of considerations, including institutional, governance, operations, water rights, and funding.

5.1 Institutional Considerations

Similar to most projects involving water transfer and/or shared infrastructure, the BARR agencies executed a Memorandum of Agreement (MOA) in September 2015 to specify roles, responsibilities, and key implementation steps for their partnership. The MOA acknowledges that each BARR agency owns and operates independent water systems, and that integrated use of capacity in existing infrastructure and new interconnections or facilities may provide water supply reliability and/or water quality benefits to multiple BARR agencies or other regional partners.

The BARR agencies approved a set of principles related to their partnership, including:

- The BARR agencies will participate in the evaluation of near- and long-term joint water supply reliability projects including, but not limited to, use of capacity of existing facilities; changes to infrastructure including new interconnections, recycled water, water conservation, expanded treatment, regional desalination, and water transfers and exchanges; and development of other projects or institutional arrangements that encourage a regional approach to achieving water supply reliability in the Bay Area.
- The BARR agencies will conduct BARR activities in an inclusive manner that encourages voluntary participation by BARR agencies as well as other interested persons or organizations.
- A specific project or activity does not have to involve all BARR agencies, but it is expected that each agency will endeavor to communicate planning efforts initiated by two or more BARR agencies to improve water supply reliability including water transfers, wheeling agreements, interties, and additional water supply infrastructure improvements.
- Partnerships are expected to result in betterment for the public served by the agencies involved and to be conducted in a manner that does not adversely affect any of the BARR agencies. The BARR agencies will not undertake Bay Area regional projects or activities that may impact the conditions within the service area of another agency without first obtaining that agency's approval.
- The BARR agencies will strive to achieve equitable cost and risk sharing for future projects or concepts commensurate with the benefits to be received.
- The BARR agencies agree to provide transparency with regard to costs and the expectation is that actual costs will be used in determining reimbursements unless another acceptable arrangement is determined by the participants.
- To the extent to which a partnership relies on regional, state, or federal grant money to evaluate regional reliability, the grant recipients will work with the BARR agencies to balance priorities for regional reliability against other individual agency priorities.
- The BARR agencies agree to coordinate prior to characterization and evaluation of facilities, water rights, or water contracts owned by another agency.
- The BARR agencies undertaking specific projects identified through the BARR partnership will cooperate in and, to the extent applicable, facilitate, efforts to obtain regulatory approvals necessary to conduct demonstration and full-scale projects.

The MOA specifies the following general responsibilities of all BARR agencies:

- Continue working cooperatively to develop the BARR studies (i.e., the DCP and Feasibility Study).
- Work with the BARR team in conducting the BARR studies.
- Share relevant engineering, permitting, regulatory, and operational information regarding their own facilities and permits with other BARR agencies for the benefit of the studies.

- Provide access to facilities and operational data that may be needed for the BARR studies (such as intakes, aqueducts and pumping plants, treatment plants, interties, etc.). If needed, conduct necessary analysis of their own facilities, permits, operational data, procedures or requirements, or any other data that are needed by the BARR studies and share the information with other BARR agencies. Access to facilities will be consistent with, and will follow, the facility owner's standard safety and notification requirements.
- Provide engineering oversight and review of BARR studies' work products.
- Conduct general work that is needed to advance the BARR studies. These efforts may include state and federal grant applications, website update, and outreach.

The MOA is an ongoing, long-term agreement among the agencies. However, as described in the MOA, a subset of agencies may advance some BARR measures through a separate, parallel process (particularly if a measure does not directly benefit all BARR agencies). Taken together, joint BARR partnership and individual agency efforts are connecting systems and resources to provide sustainable, reliable, high-quality water supply for a healthy community and vibrant economy in the Bay Area.

5.2 Operational Considerations

In addition to institutional agreements that establish roles and responsibilities, BARR agencies must consider the effects of regional drought mitigation measures on system operations, such as water quality, conveyance, and distribution. The BARR agencies will need to develop coordinated operations plans for individual measures that are implemented among two or more partners. Elements of operations plans may include:

- Water quality monitoring and evaluation
- Public notification of changes in water blends (particularly to address taste and odor concerns)
- Pressure differentials between interconnected systems
- Water delivery timing
- Guidelines regarding how systems can, and cannot, be operated

BARR agencies will also coordinate with relevant federal/state agencies (e.g., Reclamation, State Board, DWR) and local agencies whose facilities are involved in potential BARR measures to ensure their respective operations are not affected.

5.3 Permitting and Environmental Documentation

Implementation of projects like most BARR drought mitigation measures requires obtaining regulatory approvals and permits and coordinating with relevant governmental agency(ies) issuing the needed permit(s) at federal, state, and/or local levels. In addition, specific environmental analysis/documentation are required, as mandated by federal and state regulations.

The specific permits and environmental analysis required vary depending on the nature and details of individual projects. Because the measures are each at various stages of planning, permitting and environmental requirements are more clearly defined for some measures than others. Based on currently available information, potential permitting and environmental requirements are summarized in Table 3.

Table 3. Initial Assessment of Potential Permitting and Environmental Documentation Needs for BARR Drought Mitigation Measures [a]

No.	Drought Mitigation Measures	Federal					Federal/ State	State											Local
		NMFS (ESA)	USACE (Section 404)	US Coast Guard (fisheries)	USFWS (EA compliance)	Western Power Administration (transmission and open access)	NEPA [a]/CEQA	CA DOT (encroachment)	CA Reclamations Board (encroachment)	CDFW (CA ESA)	Division of Safety of Dams	DDW (groundwater injection permit)	DWR (encroachment)	RWQCB (dewatering)	RWQCB (construction NPDES stormwater)	RWQCB (Section 401)	State Board (water right)	State Lands Commission	State Historic Preservation Office (Section 106)	Encroachment permits
Interties																				
1	Transfer-Bethany Pipeline	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	Contra Costa County and/or Alameda County, cities
2	Zone 7-EBMUD Intertie		✓		✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	Contra Costa County and/or Alameda County, San Ramon, Dublin and San Leandro
3a	ACWD-SFPUC Intertie and Local Supply		✓		✓		✓	✓	✓	✓			✓			✓	✓			Alameda County, Newark
3b	ACWD-SFPUC Intertie and IPR		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	Alameda County, Newark
4	West Side SFPUC-SCVWD Intertie		✓		✓		✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	Santa Clara County, Los Gatos, Saratoga, Cupertino, Los Altos, Palo Alto
5	SFPUC-Zone 7 Intertie		✓		✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	Alameda and/or San Joaquin County, Tracy, Livermore
6	MMWD-EBMUD Intertie		✓		✓		✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	Contra Costa County and Marin County, San Rafael, Richmond
Storage																				
7	LV Expansion	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	Contra Costa County and/or Alameda County, cities
Treatment/Supply																				
8	WCWTP Pretreatment Facility		✓				✓							✓	✓	✓	✓			Contra Costa County, Walnut Creek
9	Regional Desalination Plant	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	Contra Costa County, Antioch, Pittsburg
10	SVAWPC Expansion		✓		✓			✓		✓		✓		✓	✓	✓	✓	✓	✓	Santa Clara County, San José
11	Mid-Peninsula PREP [b]	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	Local county/ies, city/ies
12	Joint Tri-Valley Potable Reuse Feasibility Study		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	Local county/ies, city/ies
Operations																				
13	Regional AMI Feasibility Assessment [c]																			
14	Del Valle Reservoir Water Supply Storage Expansion Project		✓		✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	Local county/ies, city/ies
15	Regional Exchange Demonstration Project [d]		✓		✓		✓			✓										Local county/ies, city/ies

a. *NEPA may be required if federal agencies are involved.*
b. *Potential permits listed, unknown which permits required until site(s) is/are selected.*
c. *Minimal permitting requirements anticipated.*
d. *Federal Warren-Act contract may be needed. Potential refill or conveyance agreements needed from CVP/SWP.*

CA = California
CDFW = California Department of Fish and Wildlife
CEQA = California Environmental Quality Act
DDW = State Water Resources Control Board Division of Drinking Water
DOT = Department of Transportation
DWR = California Department of Water Resources
EA = Environmental Assessment
ESA = Endangered Species Act
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
NPDES = National Pollutant Discharge Elimination System
RWQCB = Regional Water Quality Control Board
USACE = United States Army Corps of Engineers
USBR = United States Bureau of Reclamation
USFWS = United States Fish and Wildlife Service

5.4 Water Rights

The BARR agencies developed the list of potential drought mitigation measures with a primary focus on sharing and exchanging water among the BARR agencies. The BARR agencies collectively have a diverse portfolio of water supplies and water rights (DWR 2016). For example, SFPUC has pre-1914 water rights for its Hetch Hetchy Project on the Tuolumne River. EBMUD has post-1914 water rights for its Pardee Project on the Mokelumne River. MMWD has local area both pre- and post-1914 water rights and receives approximately 25 percent of its water supply from the Sonoma County Water Agency. In addition, SCVWD has contracts for water supply from both the SWP and CVP and local water rights, while CCWD has both CVP contracts and local water rights for LV.

Water rights issues must be considered and addressed for each drought mitigation measure. The BARR measures span a range of supplies with various water rights requirements, including some that may require water rights modifications.

Several general categories of water rights modifications may apply to the measures, including:

- **Place of use modifications:** Allows use transferred supply in an area outside the place of use specified in the original water rights. Place of use modifications may be required to individual agencies' water rights permits for local/other surface water supplies and/or SWP/CVP contract supplies.
- **Point of diversion modifications:** Allows for diversion of supply at a location other than the point specified in the original water rights.
- **Pre-1914 water rights "no injury" rule:** Allows pre-1914 water rights holders to change their place/purpose of use or point of diversion provided that the change causes "no injury" to other legal users of water (both junior and senior water right holders), per the California Water Code (CWC).
- **No Unreasonable Effects on Fish and Wildlife:** Allows changes to water rights in an expedited fashion to enable water transfers provided that the transfers do not result in "unreasonable effect of fish, wildlife or other instream beneficial uses."
  - CWC Section 1725: For short-term transfers (occurring in 1 year or less). Transfers approved by the State Board under CWC Section 1725 are exempt from CEQA.
  - CWC Section 1735: For long-term water transfers (occurring over more than 1 year).
- **New water rights:** Enables use or storage of a water supply not previously permitted.
- **Wastewater change petition:** Allows for diversion of wastewater flow for reuse/recycling.

Table 4 summarizes potential water rights modifications that may be needed to implement the BARR drought mitigation measures. When further evaluating implementation feasibility beyond the DCP, the BARR agencies may use this table as a guide to identify water-rights issues that require further assessment and warrant specific permit changes.

The BARR agencies evaluated several different potential approaches for transferring SWP/CVP water supplies considering water rights and operational factors. (See Attachment C for more detail.) Two showed promise, including:

- **Conjunctive use of transferred supplies:** BARR agencies could purchase supplies from willing sellers during non-dry (normal/wet) years to transfer for local storage and for use during dry years. Factors directly affecting the viability of this approach include water availability, conveyance capacity, and storage availability.
- **Changes to points of diversion changes:** Changes to points of diversion for BARR agencies' existing CVP/SWP water rights could increase access to the agencies' storage facilities. Increased supply in storage could provide a mechanism for long-term regional exchanges. The BARR agencies could also

take advantage of the currently permitted CVP/SWP joint point of diversion in their water-right permits when the conditions allowing its use are met.

Table 4. Water Rights Assessment for Specific Proposed Drought Mitigation Measures

No.	Drought Mitigation Measure	Summary	Potential Water Rights Modifications Needed									State/ Federal Approvals Needed
			Place of Use for Local/Other	Place of Use for SWP	Place of Use for CVP	Point of Diversionr	Pre-1914 Rights ("No Injury")	CWC Section 1725 (if ≤1 year)	CWC Section 1735 (if >1 year)	New Water Rights	Wastewater Change Petition	
Interties												
1	Transfer-Bethany Pipeline	This intertie would likely require permit changes for both CCWD and EBMUD to include areas to be served outside existing permitted places of use. The permit changes could be accomplished in any one year through CWC Section 1725 or, if longer than one year, CWC Section 1735. If CCWD uses CVP water, USBR would need to file the petition.	✓					✓	✓			USBR, State Board
2	Zone 7-EBMUD Intertie	For transfers from EBMUD to Zone 7, an EBMUD permit change would likely be needed to include Zone 7's service area as a place of use. For transfers from Zone 7 to EBMUD, EBMUD should review its permit and determine whether the existing SWP place of use covers all of EBMUD. If not, then EBMUD should seek a change in the SWP place of use or use local ACWD water rights and change the place of use for those water rights. These changes could be accomplished in any one year through CWC Section 1725 or, if longer than one year, CWC Section 1735. If using water supplied by SWP contracts, this transaction will need to be an exchange of water with EBMUD and not a sale. DWR would need to file the petition with the State Board.	✓	✓				✓	✓			State Board
3a	ACWD-SFPUC Intertie and Local Supply	ACWD's NDF does not have a water-right permit because it does not divert from a "usable" water source. Thus, the expansion of use to SFPUC does not pose a water-right issue. However, if ACWD water-right water is moved to the SFPUC service area, ACWD should seek appropriate water-right changes to the places of use in those water rights. For SFPUC's pre-1914 water rights, SFPUC should check for "no injury" and notify the State Board of the change through its Report of Water Diversion and Use. ACWD may want to use CWC Section 1725 for a short-term transfer in any given year. If ACWD is using water supplied by SWP contracts, this transaction will need to be an exchange of water with SFPUC and not a sale. DWR would need to file the petition with the State Board.	✓	✓			✓	✓				State Board
3b	ACWD-SFPUC Intertie and IPR	Same as above except that a Wastewater Change Petition will likely be needed.	✓	✓			✓	✓			✓	State Board
4	West Side SFPUC-SCVWD Intertie	Because this is a second connection, how the water rights for the first connection were handled will dictate how this second connection must be permitted. A place of use change may be needed for both SFPUC and SWP/CVP water rights. It is recommended that SFPUC and SCVWD avoid a CVP place of use change if possible. If SCVWD wants to use water supplied by SWP contracts, this transaction will need to be an exchange of water with SFPUC and not a sale. DWR would need to file the petition with the State Board.	✓	✓	✓							State Board
5	SFPUC-Zone 7 Intertie	This intertie would likely require permit changes for both SFPUC and Zone 7 for place of use of local water rights and/or SWP water rights, depending on which water rights are used. For SFPUC pre-1914 water rights, SFPUC should check for "no injury" and notify the State Board of the change through its Report of Water Diversion and Use. If Zone 7 wants to transfer SWP water, this transaction will need to be an exchange of water with SFPUC and not a sale. DWR would need to file the petition with the State Board.	✓	✓			✓					State Board
6	MMWD-EBMUD Intertie	This intertie would likely require permit changes for both MMWD and EBMUD to include areas to be served outside existing permitted places of use. These could be accomplished by a petition to the State Board for any one year through CWC Section 1725 or, if longer than one year, through CWC Section 1735.	✓					✓	✓			State Board
Storage												
7	LV Expansion	CCWD would need permit changes to include new areas outside CCWD's existing permitted place of use. A new water right may be needed depending on the operation and other agencies participating in the project.	✓							✓		USBR, State Board
Treatment/Supply												
8	WCWTP Pretreatment Facility	Depending on whose water is diverted for treatment and delivery, EBMUD will likely need either place of use or point of diversion permit changes. These could be accomplished in any one year through CWC Section 1725 or, if longer than one year, CWC Section 1735.	✓			✓		✓	✓			State Board
9	Regional Desalination Plant	Assuming the intake would be located at Mallard Slough, CCWD's existing water right permit and license would be used.	✓									USBR, State Board
10	SVAWPC Expansion	A new Wastewater Change Petition would likely be needed to allow for additional wastewater to be treated and recycled. The change petition should also include any new places of use.									✓	State Board
11	Mid-Peninsula PREP	Changes to the existing Wastewater Change Order may be needed to include new places of use.									✓	State Board
12	Joint Tri-Valley Potable Reuse Feasibility Study	Changes to the existing Wastewater Change Order may be needed to include new places of use.									✓	State Board
Operations												
13	Regional AMI Pilot Project	No water-right issues apply to implementing AMI.										None
14	Lake Del Valle Re-Operation	Currently planned to stay within existing water rights permits.										State Board
15	Regional Exchange Demonstration Project	Depending on whose water rights are used to pump water for exchange, either a change in point of diversion or place of use would be needed.	✓			✓						USBR, State Board

1 *Note: Where CVP Contract water is used, USBR will need to file the petition to modify place of use. Where SWP Contract water is used, DWR will need to file the petition to modify place of use or water exchange.*

5.5 Funding

Identifying viable funding sources can often be the primary constraint in implementing any project, including the potential drought mitigation measures and response actions being contemplated by the BARR agencies. Several state, federal, and local funding sources are potentially available (i.e., current grants and loan opportunities). Funding eligibility and other requirements, such as local cost-share for grants and repayment terms for loans, are important considerations. In addition, grant funding is competitive (thus, less certain to materialize). In addition, alternative funding mechanisms, such as public-private partnerships (P3s), are additional pathways to consider.

Like other water projects, costs associated with the BARR drought mitigation measures have three components—capital costs for initial construction and operations and maintenance (O&M) costs, and repair and replacement (R&R) costs for ongoing implementation once initial construction is complete. Some funding sources can be used only for capital expenditures, while others are more broadly applicable.

5.5.1 Grants and Loans

Agencies can use grant and loan programs to finance capital projects. Table 5 provides a summary of currently available federal and state funding sources. Such programs evolve with time, and current information is typically most efficiently found on websites (refer to the embedded hyperlinks in Table 5).

When pursuing grant funding, the following general guidelines typically apply:

- Grant applications require demonstration of the ability to construct, operate, and maintain the project without grant funding.
- Grant award or funding authorization is not a promise of grant reimbursement.
  - Most grants are reimbursements and not up-front cash, which means a funding source must be available for project construction.
  - Grant reimbursements are subject to annual budget and appropriations processes. As such, disbursement of grant funds is not guaranteed to follow an established schedule.
  - It may take several years after project completion to receive reimbursements, especially in difficult economic times.
  - Most grants require a minimum cost share by the project sponsor.
  - Federal grants typically require investment of additional resources.

Despite the competitive nature of grants, securing external funding can help to minimize ratepayer impacts and the rising cost of water services, which is particularly important to the BARR agencies concerning affordability issues in low-income disadvantaged communities (DACs).

5.5.2 Public-Private Partnerships

In recent years, public agencies have explored P3s and other forms of private-sector financial involvement as possible ways to improve service, quality, and efficiency. P3s involve private financing and the sharing of a project's risks and rewards beyond the construction phase between public and private partners. In P3 projects, the private partner is typically responsible for the financing, design, construction, and O&M of the facility. In return, the private partner will typically receive a fee for the water from the public partner(s).

California's Infrastructure Finance Act (IFA) (IFA; published in California Government Code Section 5956) authorizes local governments to use private-sector investment capital for developing "fee-producing infrastructure facilities." It must be paid for by those benefiting from the facility. Among others, the IFA applies to cities (general law and charter), counties (general law and charter), public districts, JPAs, and any

other public or municipal corporations. The government agency may grant ownership or leasing rights to the facility for up to 35-year terms.

Projects built under a P3 approach can offer some unique benefits. P3s provide a new source of funding for projects with costly infrastructure and/or operational costs. This approach can make otherwise unaffordable capital projects economically feasible. Private partners are often incentivized to complete the project as soon as possible because the private partner is usually not paid until after the project has been successfully constructed and is operating to predetermined performance requirements.

While P3s can offer many direct and indirect benefits, they also present challenges. P3 arrangements tend to be fairly complex, and each agreement is unique and requires significant legal and technical input by both the public and private partners. Also, by forming a P3, an agency must concede some of the control of its water system to a private entity. Further, the public may perceive issues with respect to privatizing public infrastructure assets and the loss of public control over such assets. While these concerns can be mitigated by the terms of most agreements, they can pose challenges for a public agency to pursue projects on a P3 basis.

5.6 Governance

A joint powers authority (JPA) is an entity formed between two or more public agencies that allows them to join together and exercise their powers as a single agency for the purpose of accomplishing specific common goals. JPAs typically outline the ownership, governance, and financing of joint projects. California Government Code Sections 6500–6538 provide the authority for public agencies to enter into JPAs. JPAs may form between local entities to acquire land, construct regional infrastructure, share maintenance, or operate shared facilities. Regional water districts, energy agencies, cities, counties, or any other entity described in California Government Code Section 6500 can be voting members of a JPA. Private businesses, individuals, and privately owned/investor-owned utilities are not allowed by law to be a voting member of a JPA. JPAs have the ability to arrange capital financing by selling bonds. These bonds create the capital needed to finance the design and construction of JPA projects. Bonds issued by the JPA are reimbursed over time by the JPA and from the revenue generated by the projects. By sharing resources and combining services, the member agencies (and their taxpayers) can use a JPA to leverage their combined resources to more effectively distribute the costs and benefits of new joint projects.

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Table 5. Federal and State Grant and Loan Funding Opportunities

Program	Agency	Type	Description	Funding Ceiling	Minimum Cost-Share Requirement
Federal					
Basin Studies Program	USBR	Grants: Planning	Basin studies are basin-wide efforts, cost-shared with non-federal partners, to evaluate and address the impacts of climate change. Funding is available for comprehensive water studies that define options for meeting future water demands in Western river basins where imbalances in water supply and demands exist or are projected. (http://www.usbr.gov/watersmart/bsp/index.html)	TBD	50% (non-federal cash or in-kind services)
Drought Response Program	USBR		The Drought Response Program is administered by the USBR. It supports a proactive approach for addressing drought by providing assistance to water users to conduct drought contingency planning and to take actions that build long-term resilience to drought. The program includes two funding areas described below. (http://www.usbr.gov/drought/)		
		Grants: Planning	• Drought Contingency Planning: Financial assistance will be made available on a competitive basis to non-federal entities to develop a new DCP or update an existing plan.	$200,000	50% (non-federal)
		Grants: Construction	• Drought Resiliency Project: Financial assistance will be made available to implement small-scale projects to increase the reliability of water supplies; improve water management; implement systems to facilitate the voluntary sale, transfer, or exchange of water; and benefit fish and wildlife and the environment.	$750,000	50% (non-federal)
Title XVI	USBR	Grants: Construction	USBR administers funds for recycled water feasibility, demonstration, and construction projects through the Water Reclamation and Reuse Program authorized by the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992 (Title XVI) and its amendments. To meet eligibility requirements, a project must have a feasibility study, comply with environmental regulations, and demonstrate the ability to pay the remainder of the construction costs. Programs/projects that provide regional benefits are more likely to be funded under this program. Projects successful in the application process are authorized by Congress and included in USBR's annual budget request to the president. Congress then appropriates funds, and USBR ranks and prioritizes projects and disburses the money on a competitive grant basis each year. Prioritized projects are those that postpone the development of new water supplies, reduce diversions from natural watercourses, and reduce demand on federal water supply facilities, or that have a regional or watershed perspective. (http://www.usbr.gov/watersmart/title/)	Up to 25% of construction costs, with a maximum of $20 million	75% of construction costs
WaterSMART Water and Energy Efficiency Grants	USBR	Grants: Implementation	WaterSMART Water and Energy Efficiency Grants provide cost-shared funding for projects that save water, increase energy efficiency and the use of renewable energy in water management, support environmental benefits (i.e., make conserved water available instream or otherwise address endangered species issues), mitigate conflict risk in areas at a high risk of future water conflict, and accomplish other benefits that contribute to water supply sustainability in the western United States. Projects are selected through a competitive process and the focus is on projects that can be completed within 24 months that will help sustainable water supplies in the western United States. (http://www.usbr.gov/watersmart/weeg/index.html)	Up to 50%, with a maximum of $1 million	50% (non-federal)
Water Infrastructure Finance and Innovation Act (WIFIA)	EPA	Loans	The WIFIA program accelerates investment in the nation's water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects. The WIFIA program was established by the Water Infrastructure Finance and Innovation Act of 2014. EPA estimates that current budget authority may provide more than $1 billion in credit assistance and may finance over $2 billion in water infrastructure investment. (https://www.epa.gov/wifia).	Up to 49% of eligible project costs. Minimum project size: • $20 million for large communities (population greater than 25,000) $5 million for small communities (population of 25,000 or less)	Not applicable to loans.

Table 5. Federal and State Grant and Loan Funding Opportunities

Program	Agency	Type	Description	Funding Ceiling	Minimum Cost-Share Requirement
State					
Proposition 1	State Board		The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) authorizes $7.545 billion in general obligation bonds to fund ecosystems and watershed protection and restoration, water supply infrastructure projects, including surface water and groundwater storage, and drinking water protection. The State Board is administering funds for five programs, described below. (http://www.waterboardsa.gov/water_issues/programs/grants_loans/proposition1.shtml)		
		Grants: Planning and Construction	• Drinking Water (total funding: $260 million)	• Planning: $500,000 • Construction: $5 million	Variable, depending on inclusion of DACs and/or economically distressed areas (EDAs)

		Grants: Planning and Implementation	• Groundwater Sustainability (total funding: $800 million)	• Planning: $100,000 to $1 million
				• Implementation: Two types
				  • 1st type – Offers funding starting at $500,000 with no maximum funding limit
				  • 2nd type - Provides funding opportunities for drinking water treatment projects that only benefit a DAC/EDA. Applicants are eligible to receive up to $5 million. No minimum funding amount is set.
					Variable, depending on inclusion of DACs and/or EDAs. Non-DAC/EDA projects require a 50% match.

		Grants: Planning and Construction	• Small Community Wastewater (total funding: $260 million)	• Planning: $500,000 • Construction: $6 million	Variable, depending on inclusion of DACs and/or EDAs
		Grants: Planning and Implementation	• Stormwater (total funding: $200 million)	• Planning: $50,000 to $500,000 • Implementation: $250,000 to $10 million	50% (local)
		Loans	• Water Recycling (total funding: $625 million): Grant funds have been committed. However, loans currently remain available.	• TBD	Not applicable to loans.
	CWC	Grants: Implementation	• Water Storage Investment Program: Funding for storage projects. State funds can only be spent on the public benefits.	• $2.7B • ~$250M will be available for implementation in 2018.	50% cost share.
	CNRA	Grants: Planning and Implementation	• Central Valley Project Improvement Act Grant Program (total funding: $475 million; 2016/17 budget: $89.15 million)	• No maximum or minimum amounts have been set for 2016/17 budget	
Integrated Regional Water Management (IRWM) Implementation Grant Program	DWR	Grants: Planning and Implementation	The IRWM Grant Program provides funding for projects that help meet the long-term water needs of the state, including: • Assisting water infrastructure systems adapt to climate change • Providing incentives through each watershed to collaborate in managing the region's water resources and setting regional priorities for water infrastructure • Improving regional water self-reliance, while reducing reliance on the Delta Proposition 1 authorized a total of $510 million in IRWM funding. (http://www.water.ca.gov/irwm/)	• Updating an existing IRWM plan: $250,000 (minimum request of $50,000) • New IRWM plan: $1 million	50%
Sustainable Groundwater Planning (SGWP) Grant Program	DWR	Grants: Planning and Implementation	The SGWP Grant Program provides funds for projects that develop and implement sustainable groundwater planning and projects consistent with groundwater planning requirements outlined in CWC Division 6. Proposition 1 appropriated a total of $100 million for this program. (http://www.water.ca.gov/irwm/grants/sgwp/index.cfm)	• DACs/EDAs and critically over drafted: $500,000 • All other grant applicants: $250,000	50% (local)
Water Energy Grant Program	DWR	Grants: Implementation	The Water Energy Grant Program provides funds to implement water efficiency programs or projects that reduce greenhouse gas (GHG) emissions and reduce water and energy use, including: • Commercial water efficiency or institutional water efficiency programs • Residential water efficiency programs that benefit DACs • Projects that reduce GHG, water use, and energy use • Projects with water conservation measures that also save energy DWR was appropriated $19 million of GHG Reduction Funds by Senate Bill 101 to administer the program. (http://www.water.ca.gov/waterenergygrant/index.cfm)	$3 million	None required. However, projects proposing a cost share may be prioritized for funding (i.e., a "tie-breaker advantage").

Table 5. Federal and State Grant and Loan Funding Opportunities

Program	Agency	Type	Description	Funding Ceiling	Minimum Cost-Share Requirement
Water Desalination Grant Program	DWR		DWR provides grants to local agencies for planning, design, and construction of desalination facilities (including pilot, demonstration, and research projects) for both brackish and ocean water. DWR has conducted three funding rounds since 2005 using Proposition 50 funds. The rules and procedures for funding vary depending on funding source/availability and DWR priorities at the time of funding. A fourth funding round is planned and will use primarily Proposition 1 funds (total funding of $100 million for desalination projects). The five relevant project categories follow below. (http://www.water.ca.gov/desalination/Water_Desal_Fund_Prog_OV.cfm)		
		Grants: Construction	• Construction projects	$3 million	50%
		Grants: Construction	• Pilot and demonstration projects	$1 million	50%
		Grants: Planning	• Feasibility studies	$250,000	50%
		Grants: Planning	• Environmental documents	$250,000	50%
		Grants: Research	• Research projects	$500,000	50%
Clean Water State Revolving Fund (SRF)	State Board	Loans	The Clean Water SRF program offers low-interest (below-market) financing for a wide variety of water quality projects, such as construction of wastewater treatment and water recycling facilities, implementation of nonpoint source and storm drainage pollution control solutions, and development and implementation of estuary plans to protect and promote the health, safety, and welfare of all Californians. Repayment periods are usually the lesser of 30 years or the expected useful life of the financed asset. (http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/)	No maximum funding limit.	Not applicable to loans.
Drinking Water SRF	State Board	Loans	Established by an amendment to the federal Safe Drinking Water Act in 1996, the Drinking Water SRF provides low-interest loans, additional subsidy (principal forgiveness), and technical assistance to public water systems for infrastructure improvements to correct system deficiencies and improve drinking water quality for the health, safety, and welfare of all Californians. (http://www.waterboards.ca.gov/drinking_water/services/funding/SRF.shtml)	No maximum funding limit.	Not applicable to loans.

a. *Though the IRWM Implementation Grant Program includes funding options for new IRWM Plans, the BARR agencies already participate in existing IRWM Plans. Thus, this funding option is not a viable option for BARR and is included only to provide a complete description of the grant program.*

Section 6: Summary and Next Steps

BARR represents an unprecedented partnership among Bay Area water agencies—a partnership with tremendous potential to forge new regional approaches and more fully optimize use of existing assets and resources to collectively strengthen reliability and resilience. Together, the BARR agencies are collaboratively pursuing measures and actions that would use existing infrastructure and water resources to produce greater efficiencies and improve water supply reliability for the area. Through a collaborative process, the BARR agencies have created a new regional water management platform that enables joint drought mitigation measures and response actions to meet the region's water needs while also meeting individual agencies' site-specific needs.

Although the potential BARR drought mitigation measures reflect a wide range of project types, all will require substantial changes in how agencies work together to manage water supplies both at the institutional and operational levels and in the agreements for water use (i.e., water rights and operational agreements). In addition, implementing joint measures may pose challenges related to financial, logistical, legal, social, and financial considerations. While more work remains to establish pathways for overcoming such challenges, the BARR DCP is a significant initial milestone for enabling the further advancement of the regional drought mitigation measures.

Beyond development of this DCP, the BARR agencies or some subset expect to further advance plans, explore funding options, and study feasibility for at least some of these measures in the near term, followed by developing an implementation and operations plan once measures are more fully developed. In addition, the agencies may pursue funding for a BARR pilot transfer effort to prepare for future exchanges as needed during drought conditions.

Though the BARR agencies are not currently obligated to update the initial DCP, the agencies (or some variation/subset) may produce future updates, modified drought mitigation measures, and/or response actions based on changed conditions. However, in addition to this joint DCP, the BARR agencies also individually maintain UWMPs as living documents that reflect long-term planning to ensure reliable, adequate water supplies for existing and future water demands. UWMP data have traditionally been presented in various forms, to reflect agency-specific conditions. In the future, BARR agencies may consider integrating some aspects of the DCP into their UWMPs to enable greater consistency and to reflect the regional partnership.

As the State Board finalizes a new Water Use Efficiency framework, "Making Water Conservation a California Way of Life" (State Board 2016), future Bay Area water demands may remain constant or decline. At the same time, climate-change uncertainties and the potential for catastrophic events to threaten water supply require that the BARR water agencies take further actions to guard against these challenges and improve reliability and resilience. The measures and actions laid out in this DCP better prepare BARR agencies for the future.

Beyond the measures considered here, BARR agencies are also currently pursuing other projects individually or with agencies outside of the BARR construct to further improve Bay Area supply reliability. Taken together, joint BARR and individual agency efforts are solidifying systems and resources to provide a sustainable, reliable, high-quality water supply for a healthy community and vibrant economy in the Bay Area.

Section 7: References

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Attachment A: Complete BARR Drought Mitigation Measure Profiles

Drought Mitigation Measure 1: Transfer-Bethany Pipeline

Drought Mitigation Measure 2: Zone 7-EBMUD Intertie

Drought Mitigation Measure 3a: ACWD-SFPUC Intertie and Local Supply

Drought Mitigation Measure 3b: ACWD-SFPUC Intertie and IPR

Drought Mitigation Measure 4: West Side SFPUC-SCVWD Intertie

Drought Mitigation Measure 5: SFPUC-Zone 7 Intertie

Drought Mitigation Measure 6: MMWD-EBMUD Intertie

Drought Mitigation Measure 7: Los Vaqueros Expansion

Drought Mitigation Measure 8: Walnut Creek Water Treatment Plant Pretreatment Facility

Drought Mitigation Measure 9: Regional Desalination Plant

Drought Mitigation Measure 10: Silicon Valley Advanced Water Purification Center Expansion

Drought Mitigation Measure 11: Mid-Peninsula Potable Reuse Exploratory Plan

Drought Mitigation Measure 12: Joint Tri-Valley Potable Reuse Feasibility Study

Drought Mitigation Measure 13: Regional Advanced Metering Infrastructure Feasibility Assessment

Drought Mitigation Measure 14: Del Valle Reservoir Water Supply Storage Expansion Project

Drought Mitigation Measure 15: Regional Exchange Demonstration Project

(Note – Attached as a separate PDF file.)

Attachment B: Other Bay Area Drought Projects (outside the BARR Drought Contingency Plan scope)

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Table B-1. Other Bay Area Drought Mitigation Projects (outside the scope of the BARR Drought Contingency Plan)

No.	Project Sponsor or Partners	Project Name	Type (conveyance, storage, treatment/supply, operations)	Brief Description and Implementability (i.e., time frame to produce supply)	Yield and Availability of Water (AFY)	Status	Estimated Capital Costs	Estimated O&M Costs (high, moderate, low)	Other Comments
List of Western Recycled Water Coalition Member Projects in Bay Area (2016)									
1	Central Contra Costa Sanitary District (Central San)	Contra Costa County Refinery Recycled Water Project, Phase 1	Conveyance	Phased project to deliver recycled water for Shell and Tesoro refineries (for cooling towers and boiler feed water)	5,600	USBR Feasibility complete	$25M	High	
2	City of Benicia	Benicia Water Reuse Project	Conveyance	Pipeline, pump station, and additional filtration and ammonia removal for cooling tower use	2,200	Planning	$27M	TBD (likely low)	
3	City of Brentwood	Brentwood Recycled Water Project	Conveyance	Pipelines, pump stations, and storage to extend recycled water for irrigation users	1,406	Phases in construction	$21	TBD (likely low)	
4	City of Hayward	Hayward Recycled Water Project	Treatment/conveyance	New treatment facility and pipeline to serve new customers for irrigation and for cooling	290	USBR Feasibility complete	$12M	TBD (likely low)	
5	City of Mountain View	Mountain View Recycled Water System Expansion	Conveyance	Storage, pumping, pipelines to expand system and serve large customers in Mountain View and Moffett Field	2,750	Planning	$20M	TBD (likely low)	
6	City of Palo Alto	Palo Alto Recycled Water Pipeline	Conveyance	Pipelines and pump stations for residential, commercial, and municipal uses	916	USBR Feasibility complete	$33M	TBD (likely low)	
7	City of Pleasanton	Pleasanton Recycled Water Project	Conveyance	Pipelines expanding recycled water for irrigation users	1,720	In construction	$20M	TBD (likely low)	
8	City of Redwood City	Central Redwood City Recycled Water Project	Conveyance	Pipelines, pump stations, and storage to expand system to central Redwood City	507	USBR Feasibility complete	$32M	TBD (likely low)	
9	Delta Diablo Sanitation District	High Purity Treatment	Treatment/supply	Treatment to improve recycled water quality for industrial uses and urban landscape projects	5,600	USBR Feasibility complete	$50M	TBD (likely low)	
10	Delta Diablo Sanitation District	Delta Diablo Recycled Water Project	Conveyance	Phased storage and pipeline/expansion to serve new users	4,380	USBR Feasibility complete	$34M	TBD (likely low)	
11	Dublin San Ramon Services District (DSRSD)	Dublin and San Ramon Recycled Water Expansion	Treatment/conveyance/ storage	Treatment, pipelines, pump stations, and reservoirs for irrigation customers	6,460	USBR Feasibility complete	$22M	TBD (likely low)	Possible Wastewater Change Petition needed
12	Ironhouse Sanitary District (ISD)	ISD Cypress Recycled Water	Conveyance	Pipelines and pump station to serve recycled water to Cypress corridor	173	USBR Feasibility complete	$5M	TBD (likely low)	
13	ISD	ISD Industrial Recycled Water Project	Conveyance	Pipelines, pump station, and storage for various users	2,350	USBR Feasibility complete	$29M	TBD (likely low)	
14	ISD and CCWD	ISD Direct Potable Reuse Project	Treatment/supply	Recycled water to Contra Costa Canal DPR; implementability TBD, pending DPR regulations	4,350	USBR Feasibility complete	$40M	High	
15	San Jose Water Company	SJWC Recycled Water Project	Conveyance	Pipelines to expand system for irrigation and industrial users	1,203	USBR Feasibility complete; phases under way	$24M	TBD (likely low)	
16	SCVWD	Various IPR and DPR projects	Treatment/supply/conveyance	Long-term potable reuse projects	~80,000	Planning	>$800M	TBD (likely moderate to high)	
17	SCVWD	South Santa Clara County Recycled Water Project	Conveyance	Pipelines, pumping, and storage to expand service for agriculture and other irrigators	30,000	Phases in construction	$72M	TBD (likely low)	
18	SCVWD	Wolfe Road Recycled Water Project	Conveyance	Pipeline and pump station to expand service to Sunnyvale and Apple Campus 2	903	Under construction	$18M	TBD (likely low)	
19	Sunnyvale	Sunnyvale Continuous Recycled Water Production	Conveyance	Pump station to serve recycled water expansion	500	Under construction	$2M	TBD (likely low)	
20	West Bay Sanitary District	WBSD Recycled Water Project	Treatment/conveyance	Satellite treatment facility, pump station, and pipelines for irrigation	152	Planning	$19M	TBD (likely low)	

Table B-1. Other Bay Area Drought Mitigation Projects (outside the scope of the BARR Drought Contingency Plan)

No.	Project Sponsor or Partners	Project Name	Type (conveyance, storage, treatment/supply, operations)	Brief Description and Implementability (i.e., time frame to produce supply)	Yield and Availability of Water (AFY)	Status	Estimated Capital Costs	Estimated O&M Costs (high, moderate, low)	Other Comments
Other Projects Involving BARR Agencies [a]									
21	Zone 7	Additional Wells in the Livermore Valley Groundwater Basin	Treatment/supply	Constructing several new wells in the Livermore Valley Groundwater Basin to increase total production capacity for use particularly during droughts and emergencies while also increasing potential exchange opportunities with other agencies	7,300	Planning	$54M	Low	Chain of Lakes 3 and 4 planned to be constructed by 2030, Busch Valley Well by 2020, and Bernal Wells by 2025
22	Zone 7	Chain of Lakes Pipeline	Treatment/supply	A 36-inch-diameter pipeline from Cope Lake to Del Valle Water Treatment Plant (~6 miles) and a 12 mgd pumping station, allowing Zone 7 the ability to better manage local water supplies, recharge the local groundwater basin, help perfect local water rights, and meet demands with stored water in the Chain of Lakes during catastrophic events (e.g., loss of the Delta)	TBD	Planning	$57M	Low	Planned for construction by 2020
23	Central San, EBMUD, and CCWD	Canal Loop Recycled Water Project	Treatment/supply	Central San would provide recycled water to existing irrigation customers currently served by EBMUD and CCWD on the loop portion of the Contra Costa Canal	6,700	Planning	TBD	High	Possible Wastewater Change Petition needed
24	All BARR Agencies	Regional Stormwater Capture	Treatment/supply	Develop centralized and decentralized stormwater capture projects to enhance local storm runoff capture for recharge or potable use offset	TBD	Conceptual	TBD	Low to high (would vary project to project	Possible Wastewater Change Petition needed for some projects
25	Central San and CCWD	Central San Direct Potable Reuse	Treatment/supply	Central San would provide CCWD with DPR supplies	26,800	Conceptual	$535M	High	Implementation pending regulations on DPR Possible Wastewater Change Petition needed
26	Central San, EBMUD, and DSRSD	Raw wastewater from Central San to DSRSD	Treatment/supply	New trunk sewer to increase supply to DSRSD's recycled water plant, 2.7 mgd	TBD	Conceptual	TBD	Moderate	Possible Wastewater Change Petition needed

a. *The agencies are considering many projects beyond those listed below as part of their long-term planning efforts.*

Attachment C: Water Rights Background and Water Transfer Mechanisms

Water Rights Background

Water rights in California have a complex history. Three different classes of rules—pre-1914, post-1914, and recycled water—come into play among the potential BARR drought mitigation measures.

Pre-1914 Water Rights

Prior to 1914, appropriative water rights were established by posting a notice near the point of diversion or filing a plan with the county and beginning work. After 1914, appropriative water rights were obtained by filing an application with the State Water Resources Control Board (State Board) to receive a permit for the water supply development project. These permits specify:

- The amount of water that can be appropriated by direct diversion to use, store, or both.
- The season of diversion, points of diversion, places of use, purposes of use, conditions to protect prior rights, public trust resources and the public interest, and a timeframe to put the water to reasonable use.

The California Water Code[1] (CWC) allows pre-1914 water-rights holders to change their points of diversion, place of use, or purpose of use provided that the change causes "no injury" to any legal user of water (see CWC 1706). The CWC does not allow expansion of the pre-1914 water right in terms of the amount of water diverted or the season of diversion. There is no formal process for changing the point of diversion, place of use, or purpose of use of pre-1914 water rights. Typically, the pre-1914 water-right holder reports such changes in its Statements of Water Diversion and Use filed annually with the State Board. The State Board does not have permitting authority over pre-1914 water rights and does not typically review such changes.

Post-1914 Water Rights

Changes in post-1914 water rights points of diversion, places of use, or purpose of use are allowed under the CWC (Sections 1701–1705), but the process is more complicated. While the "no injury" rule also applies to post-1914 rights, a change petition needs to be filed with the State Board. The petition is publicly noticed and specifically noticed to water right holders downstream. Protests can be filed. If protests cannot be resolved by the parties, the State Board holds a water right hearing on the change petition and issues an order either approving or denying the change petition.

Water Reuse

Early on, the State Legislature recognized the benefits of reusing wastewater discharges for beneficial use. It also recognized that some of these discharges to natural stream courses provided benefits to public trust resources, especially in areas and at times when natural flows are low. In 1980 and 2001, the legislature changed the California Water Code (adding Sections 1210 to 1211) to provide a process for the State Board to review changes in the point of discharge and place of use of wastewater discharges. The process calls for the discharger to file a wastewater change petition with the State Board, describing the amount of water to be removed from the receiving waterbody for reuse and the place of use for the treated reuse supply. The State Board publicly notices wastewater change petitions, and protests can be submitted. If protests cannot be resolved by the parties, the State Board holds a water right hearing on the change petition and issues an order either approving or denying the change petition.

[1] The California Water Code can be accessed as follows: http://leginfo.legislature.ca.gov/faces/codes.xhtml

Modifying Water Rights

As described throughout TM2, the BARR drought mitigation measures focus primarily on sharing supplies through exchanges and transfers. Some measures involve potentially using water outside originally permitted conditions, requiring water rights permit modifications for points of diversion, place of use, and/or purpose of use. To enable exchanges and transfers, water rights changes can be accomplished in many ways, as summarized below and described in detail in the State's Board's "Guide to Water Transfers" (State Board, 1999).

1. No Injury Rule

   For pre-1914 and post-1914 appropriative water rights, a change to an existing water right must not injure any legal user of water. This principle, referred to as the "no injury rule," prohibits injury to other legal users of water (both junior and senior water rights holders), caused by a change in place or purpose of use or point of diversion for any reason, including changes necessary to facilitate a water transfer. For example, a water transfer could cause injury to other legal users of water by reducing the net downstream flow, or attempting to transfer previously abandoned flows that otherwise would have been available to other water users absent the transfer. The "no injury rule" is rooted in historical court doctrine dating back to the early days of California statehood and was codified in 1914.

2. No Unreasonable Effects on Fish and Wildlife

   The legislature changed the CWC after the 1976–77 drought to help expedite water transfers. CWC Sections 1725 and 1735 were added to allow water rights changes for both short-term (one year or less, CWC Section 1725) and long-term (longer than one year, CWC Section 1735) water transfers in an expedited fashion. Transfers conducted under CWC Section 1725 are exempt from CEQA. However, both CWC Sections 1725 and 1735 require that the water transfers not have an "unreasonable effect on fish, wildlife or other instream beneficial uses." This test is different from the "significant effect" test under CEQA and is generally considered a higher bar. The water right holder that petitions for a change under these CWC sections needs to provide the State Board an analysis that shows that the fish and wildlife effects of the water transfer are not "unreasonable."

3. CWC 1810 and Economic Effects

   In 1986 the legislature added CWC Section 1810, which requires state, local, and regional agencies to make excess conveyance capacity available to others (for a reasonable fee) for water transfers, provided that the action: (1) causes no injury to any legal user of water, (2) has no unreasonable effects on fish and wildlife, and (3) has no "unreasonable effects on the overall economy or environment of the county" from which the water was transferred. The economic effects evaluation required by CWC Section 1810 is a countywide assessment (not a person-by-person or a "third-party" evaluation).

Water Transfer Mechanisms

Short-term water transfers have been an effective tool for addressing water rights changes needed to move water from one water supplier to another. DWR's Background and Recent History of Water Transfers in California (DWR and State Board, 2015) includes a detailed review of water transfers from 1995 through 2015 from areas north of the Delta to areas south and west of the Delta.

BARR drought mitigation measures involving transfers of SWP water supplies will need to be part of a water exchange, where water is returned to the SWP contractor in a subsequent year. According to the SWP contracts, SWP water cannot be sold for use by another SWP contractor except through the turn-back pool or a long-term reallocation of the Table A Entitlements (a complicated process). Furthermore, SWP water cannot be sold to a non-SWP contractor. However, in the cases of both SWP and non-SWP buyers, water can be exchanged for water that is returned to the original SWP contractor in a future year. These exchanges are

still processed as water transfers with specific terms that call for the water to be "paid back" with a like amount of water in a future year on a 1:1, or perhaps 2:1 or better, basis, depending on what the parties negotiate.

Use of CVP or SWP water supply contracts in a flexible manner is a key consideration for Bay Area exchanges and transfers but must not result in changes to the operational rules of the CVP or SWP. Modifying those operational rules would require either re-consultation under the existing CVP/SWP Biological Opinions and/or changes to water-right permit conditions (NMFS 2009 and USBR 2008).

The BARR agencies considered five potential approaches for flexible use of SWP and CVP water supplies and facilities to support water transfers, including:

- Conjunctive use of transferred supplies
- Changes in points of diversion
- Changes in demand
- "Backing up" water in CVP or SWP reservoirs
- Water quality benefits

Conjunctive Use of Transferred Supplies

BARR agencies could purchase supplies from willing sellers during non-dry (normal/wet) years to transfer for local storage and for use during dry years. Factors directly affecting the viability of this approach include water availability, conveyance capacity, and storage availability.

Water transfers have been common in California for decades, particularly in dry years. In the past, DWR assembled water banks or dry-year programs that purchased water from willing sellers and sold it to willing buyers. During the last DWR Dry Year Program (in 2009), about three times the amount of water developed by the program was obtained by parties outside the program between willing sellers and buyers. In effect, the water market has matured to the point that DWR's facilitation is no longer needed. Over the years, interested parties have developed their own expertise in securing water transfers that meet the requirements of the CWC. Willing buyers and willing sellers are able to find each other without DWR involvement, bringing "new water" to systems through transfers. The roles of DWR and USBR have become focused solely on conveying water, including transfers, to areas south and west of the Delta.

Water Transfer Constraints. Two constraints limit the amount of water that can be transferred to BARR agencies—water availability and conveyance capacity to move water from north of the Delta to BARR partners' service areas. In terms of water availability for transfers, the price that potential buyers are willing to pay and water supply in the potential sellers' watersheds are critical factors. Higher prices typically bring more sellers into the water market.

Water availability in the sellers' watersheds can have a substantial effect on water transfers, as in 2015. In 2014, more than 400,000 AF of water was transferred from north of the Delta to areas south and west of the Delta. However, the low rainfall and historically low snowmelt in 2015 led the State Board to initiate curtailments to all post-1914 water rights in the Sacramento Valley watershed and curtailments to many pre-1914 water rights. Also, both the SWP and CVP curtailed deliveries to their water-right settlement contractors in the Sacramento Valley. Therefore, the water users in the Sacramento Valley needed almost all of their water to meet local demands and simply did not have very much water available for transfer to others regardless of price. As a result, in 2015 only a little more than 250,000 AF of water was transferred, even though demand for water both south and west of the Delta was greater than in 2014.

The other factor that constrains water transfers to areas south and west of the Delta is excess capacity at the SWP or CVP pumping facilities in the southern Delta to convey water transfers for others. The priorities for pumping water by the SWP and CVP are: (1) water to meet the water allocations to their contractors and

other firm commitments (like refuge water under CVP Improvement Act), (2) contractual access to excess conveyance capacity by the CVP and SWP water supply contractors, and (3) access to excess capacity by others.

The SWP operates two diversion systems in the Delta for conveying water to users south and west of the Delta—the North Bay Aqueduct, which draws water from Barker Slough, and the Harvey O. Banks Pumping Plant in the southern Delta, which diverts water from Clifton Court Forebay into the California Aqueduct. The long-term SWP contractors are required contractually to pay all SWP costs associated with the SWP water service; non-SWP contractors proposing to use SWP conveyance capacity are required to pay reasonable fees including power for this use. The Banks Pumping Plant often has excess capacity for conveyance of water transfers purchased by others in drier years but does not have capacity in average or wetter years. During the very dry years of 2013, 2014, and 2015, DWR had conveyance capacity for all requested water transfers. However, in 2016, a below-normal year in the Sacramento Valley, the Banks Pumping Plant had no excess capacity because all of the available pumping capacity was used to deliver SWP water to agencies with long-term contracts. The CVP has diversion facilities at the Jones Pumping Plant near Tracy. The maximum capacity at the CVP Jones Pumping Plant is less than that of the SWP Banks Pumping Plant. Typically, the CVP does not have excess conveyance capacity for water transfers except in the driest years.

A major factor that affects excess conveyance capacity of both the CVP and SWP is the 2008 and 2009 BiOps. These BiOps restrict the amount of water that can be diverted in the southern Delta in the winter and spring and result in forcing water diversions for CVP and SWP contractors into the summer. In addition, the BiOps limit the water transfers by others at the SWP and CVP facilities in the southern Delta to three months; July, August, and September. Therefore, excess CVP and SWP pumping capacity for water transfers exists in about one-third of the years (dry and extremely dry years and below normal years).

In normal and wetter years, available pumping capacity for water transfers will not be known until as late as April. This late of a "call" date for water for a prospective seller is often not acceptable, especially for crop idling water transfers. However, it can work for groundwater substitution transfers and reservoir re-operation transfers. Therefore, one way to increase water transfers in normal and wet years would be to pursue such late call date transfers. Wetter years also have more potential sellers, which often reduces price. While 1-year water transfers are more common currently, the BARR agencies should consider negotiating long-term water transfer agreements with willing sellers. These long-term agreements should contain flexible call dates to ensure that the water can be pumped in the Delta and a process to adjust price that is acceptable to all parties.

Points of Delta Diversions Farther Upstream. Use of southern Delta facilities, other than those of the SWP and CVP, is another consideration and includes the Freeport Regional Water Authority (FRWA) facilities near the town of Freeport on the Sacramento River. In February 2002, the JPA of the Sacramento County Water Agency (SCWA) and EBMUD created the FRWA. FRWA guides the financing, ownership, development, construction, and operation of the Freeport Regional Water Project (FRWP).

The FRWP diversion capacity is 286 cfs (185 mgd), which is a maximum possible annual diversion of 207,000 AF. The 2003 Draft EIR/EIS evaluated diversions at this location at "full build-out" with the maximum combined diversions of 155,000 AF. SCWA and EBMUD share the FRWP diversions. SCWA is allowed up to 131 cfs (85 mgd) and EBMUD gets 155 cfs (100 mgd). Therefore, the maximum quantity EBMUD can divert in any year is 112,000 AF.

Assumptions in the 2003 Draft EIR/EIS for FRWP are contained in Technical Appendix 3, Modeling Appendix (starting on page 3-84). This appendix cites the constraints of EBMUD's use of FRWP for CVP water, which limit EBMUD to using FRWP facilities only in dry years (an assumption consistent with the EIR/EIS evaluation). The modeling studies were conducted for the historical hydrologic conditions experienced from 1922 to 1993. During this modeling sequence, only 22 years of the 72 years studied showed EBMUD water

diversion. The average amount of water was 23,000 AF with a maximum of 112,000 AF, with the maximum occurring in only three years. Therefore, a significant amount of EBMUD FRWP unused capacity currently exists and could be used in the future.

The National Oceanic and Atmospheric Administration (NOAA) fisheries and USFWS BiOps for the FRWP do not contain operational restrictions on the Freeport diversions. They both conclude that the expected "take" of listed species (i.e., fish that are attracted by flows at the screen and are subsequently injured or become easy prey because of disorientation) is low, and not likely to harm the species. This finding is significant because FRWP, like the CCWD diversions at Rock Slough, Old River, and Victoria Canal intakes, is not constrained from pumping water transfers to just three months like the SWP and CVP facilities in the southern Delta. Also, FRWP diversions of transferred water could be accomplished in wetter years when the SWP and CVP excess pumping capacity in the southern Delta is unavailable.

While EBMUD has pumping capacity at FRWP, the following constraints exist on its use:

- CEQA evaluations would be needed unless the use was for water transfers under CWC Section 1725, which are exempted from CEQA but must go through the State Board expedited approval process.
- Because the FRWP water is moved through the Folsom South Canal, BARR agencies would need a Warren Act agreement with USBR for moving non-CVP water and this transfer would have NEPA implications that BARR agencies will need to address.
- EBMUD does not currently use the conveyance facilities from FRWP to the Mokelumne Aqueducts (including the Folsom South Canal) regularly and needs up to three months of advanced notice to prepare for facilities startup.
- Putting water into the Mokelumne Aqueduct 2, which is under pressure (head) from Pardee, comes with substantial pumping costs.
- Treatment concerns related to Delta water from FRWP are more restrictive than water from Pardee; therefore, EBMUD would need to plan to have the right treatment plants and associated operational facilities available for this water, and that can take time and include logistical considerations.
- Because of the way EBMUD's system is currently plumbed, both Aqueducts 1 and 2 are dedicated to FRWP operations, and thus use of Freeport needs to be scheduled when EBMUD's demands can be met using only Aqueduct 3 and its allotment of FRWP water (if available).
- Costs including startup and shutdown costs, O&M (including the aforementioned power costs), capital recovery, Sacramento Municipal Utility District fees, etc. can be significant; while this fee is a negotiated value, it could be about $400/AF, or perhaps higher.

EBMUD has agreements in place with CCWD and SCVWD for the use of the FRWP that have a small impact on capacity. EBMUD also has developed Principles for the Use of Unassigned Capacity and is in process of updating the Principles. Further, EBMUD has developed, internally, wheeling principles. Generally, EBMUD is open to the Freeport Diversions for use by others and is actively working with other water districts to expand the use of the Freeport Diversion facility.

Points of Diversion Changes

Changes to points of diversion for BARR agencies' existing CVP/SWP water rights could increase access to the agencies' storage facilities. Increased supply in storage could provide a mechanism for long-term regional exchanges. The BARR agencies could also take advantage of the currently permitted CVP/SWP joint point of diversion in their water-right permits when the conditions allowing its use are met.

The changes in points of diversion have the largest potential expand Bay Area water supplies. Classic water transfers are basically a change in the point of diversion and the place of use of the seller water rights to

those of the buyer. For water exchanges between or among BARR agencies, the agencies may need to change only the points of diversion.

The water exchange between CCWD (CVP contractor) and ACWD (SWP contractor) in the dry year of 2014 is a good example of applying a change in a point of diversion for a water exchange. ACWD purchased CCWD water held in storage in LV Reservoir. Because the CCWD system does not connect physically to ACWD, CCWD's CVP point of diversion was changed to the SWP Banks Pumping Plant. The State Board approved this change petition under CWC Section 1725, allowing CCWD CVP water to be pumped at the SWP Banks Pumping Plant for delivery to ACWD, and ACWD water held in LV was released to serve CCWD demand that would have been met if it had pumped the CVP water at its own facilities. In essence, ACWD indirectly leveraged another BARR agency's existing storage.

Use of SWP Allocations to "Store" Water by Exchange. In 2015, ACWD and Zone 7 attempted to place a small portion of their SWP allocations into virtual storage in LV. The storage was virtual because the CCWD would use the diverted water by allowing CCWD to provide ACWD and Zone 7 a virtual storage credit in LV. Though DWR did not support using an SWP allocation, they allowed ACWD and Zone 7 (through exchange within the SWP) to move ACWD and Zone 7 supplies stored in Semitropic to CCWD. This action required a point of diversion change petition to the State Board to allow CCWD to divert SWP water at its Delta facilities. The water would then return to the ACWD and Zone 7 in the same manner as in 2014 (i.e., move water from LV storage to ACWD). The State Board approved the petition but time ran out before the water could be physically diverted.

The BARR agencies could consider resolving the DWR concerns about use of SWP allocations for exchanges like the type ACWD used. Exchanges between CVP and SWP contractor water allocations south of the Delta occur regularly under the Consolidated Place of Use petition filed almost each year by DWR.

Comparing actual storage to virtual storage can be complicated. Storage from a water rights perspective is carrying water over from one season to another. The water rights regulations state that for licensing purposes, water held for less than 30 days is considered regulation and water held for more than 30 days is considered storage. When one gets a water right, it typically states, among many other things, the amount that can be diverted directly to use and the amount of water that can be stored by the water right holder. The past practice by the Division of Water Rights at the State Board has been to consider storage by the water right holder in its facilities. Once water is delivered to a contractor for use within the permitted place of use, the Division does not track if the water was subsequently stored by the contractor in its own facilities or those of other water users farther down the water delivery chain. The concern has been that taken to the extreme, the Division could be responsible for tracking storage in every swimming pool in Southern California. In the case of the Kern Water Bank and Diamond Valley, these local storage programs by contractors of the SWP are not considered storage by DWR under the DWR water right permits for the SWP. However, DWR water storage in San Luis Reservoir is covered in the water-rights permits of DWR for the SWP. Conversations with the current Division Chief of the Division of Water Rights confirms that this past practice still applies (Division of Water Rights on Storage 2016). Therefore, contractors of SWP water like ACWD should be able to take their SWP allocation and store it into LV without the need for the virtual storage in the future once an agency resolves this issue with DWR.

Changes in Water Deliveries

Another consideration is the concept of changing BARR agencies' water deliveries to allow for new storage opportunities of CVP or SWP water locally in wetter years for use in drier years. BARR agencies with CVP or SWP water supply contracts have access to water that is in excess of that needed by SWP or CVP. While the SWP/CVP facilities may not have storage capacity available during these excess conditions, the SWP and CVP water supply contractors can store water in their own facilities or in facilities owned by others under contract arrangements.

For SWP water supply contractors, the use of excess water and SWP facilities to capture such supply is allowed under their SWP long-term water supply contracts in Article 21 or 56. Article 21 allows a contractor to use or store excess SWP water, while Article 56 allows a contractor to use SWP facilities for either conveyance or storage of water south or west of the Delta, provided that conveyance or storage is not needed by the SWP. The CVP water supply contracts in Articles 3 and 215 contain similar contract provisions.

BARR agencies with CVP or SWP water supply contracts have made arrangements to use these surplus flows to the extent possible considering available storage capacity (i.e., either locally or under contract for storage otherwise). Most arrangements for surplus flows were made before the federal fishery agencies adopted the current set of BiOps in 2008 and 2009. The BiOps required SWP/CVP to change their operations such that about one million AF (about 20 percent) goes towards protection of endangered species), as well as the reduced frequency of SWP/CVP excess water (i.e., beyond that capable of being used by the SWP or CVP). For example, before the BiOps were adopted, San Luis Reservoir (the major off-stream reservoir south of the Delta operated jointly for the SWP and CVP) filled during about four of five years and, once filled, typically held excess water available to CVP or SWP contractors. However, after the BiOps were adopted, San Luis Reservoir now fills only during about one of five years. Therefore, availability of excess water has been greatly reduced and now occurs rarely.

CVP and SWP contractors often struggle to meet demands when water allocations are reduced, as in recent years. When annual water allocations exceed the supply needed to meet that year's demands, agencies typically store the excess water if storage capacity is available in existing local reservoirs, local groundwater basins, or out-of-basin groundwater storage like that of Semitropic Water Storage District (Semitropic) or Cawelo Water District. Therefore, demand reduction could provide for more storage opportunities, especially in higher water allocation years. When the opportunity to acquire excess water presents itself, storing in local reservoirs or groundwater basins would be beneficial. While out-of-basin groundwater storage is another option, it is much more difficult, and in some years, virtually impossible, to bring water stored farther south back to the BARR agencies.

"Backing Up" Water in CVP or SWP Reservoirs

In the Delta, the SWP and CVP typically divert water for transfers based on the pattern in which the water is made available by the seller. As new water becomes available (by actions taken by the seller to reduce the consumptive use of surface-applied water or released from reservoirs beyond that which would otherwise accrue to the system), the water is pumped for the buyer at the SWP or CVP facilities, provided that excess capacity exists for pumping and the Delta is in balanced conditions. At times, water is made available by the seller, but the water cannot be pumped. This situation results in a water loss for the buyer.

The term "backing up" water into CVP or SWP reservoirs refers to the ability of the SWP and CVP to take advantage of the "new" water in the system made available by the water transfer to meet Delta outflow or water quality standards. This action reduces reservoir releases that would have been made if that "new" transfer water was not in the system. In this manner, the transfer water is not exported on the pattern that it is made available, but is in effect "backed up" into a CVP or SWP reservoir. This water is then released later and pumped in the Delta when the water transfer window opens, typically that same year.

Physical and Policy Issues. Both physical and policy issues exist with "backing up" water by the CVP or SWP. Physically, the new water made available by the water transfer activities must enter the system at a time and location that allows the reservoir releases from the SWP of CVP to meet Delta standards to be reduced. Such events occur only infrequently. Reservoir releases are often dictated by instream flow, temperature, or navigation requirements downstream of the reservoir. When these flows enter the Delta, they may be higher than that needed to meet Delta outflow or water quality requirements and instead of going out the Delta, the CVP or SWP pumps such water for its own purposes. Under these conditions, adding more water to the

system in the form of a water transfer if that water accrues outside the water transfer window (July to September) does not provide a benefit to the reservoir storage and cannot be backed up. These conditions happen often.

However, in the past, the CVP and SWP have backed up water. The SWP does back up water when it can as part of its agreement under the Yuba Accord because the Accord has the potential to benefit all its contractors. Also, during the recent drought, the CVP did back up transfer water into Shasta for the CVP contractors to keep Shasta higher than it would have been otherwise in the summer to assist in meeting temperature requirements in the Sacramento River below Shasta. CVP then released this water for transfer later in the summer and early fall during an expanded water transfer window.

However, both the SWP and CVP hold to a policy position that these events are exceptions and cannot be relied upon in other circumstances. For the SWP, DWR does not interpret Article 56 (which allows contractors use of underutilized SWP facilities) to apply to water stored in Lake Oroville. DWR does not want to keep track of individual contractor water supplies in Lake Oroville. While DWR carries out such storage in San Luis Reservoir, it does so after it has allocated the water to individual contractors. The CVP has a similar policy opposition to backing up water into Shasta or Folsom Reservoirs for individual contractors. Therefore, BARR agencies should not rely on the ability to "back up" water without a change in the policy positions of both USBR and DWR.

Water Quality Benefits

Water quality benefits of operational flexibility by the BARR agencies is possible depending on where the water can be diverted. For example, water quality benefits could accrue if water can be diverted at the FRWP on the Sacramento River under the EBMUD diversion capability instead of diverting water in the southern Delta. This same but more extensive water quality benefit would accrue if the California WaterFix is implemented.

Summary

Currently water transfers pumped at the SWP or CVP facilities in the southern Delta are restricted to three summer months. Capacity to move water through transfers is now physically limited to the driest one-third of the water years. Using EBMUD's dedicated capacity at the FRWP could allow more water transfers rather than be limited only to use in dry years. More transfers may be enabled if the State approves and builds the California WaterFix.

Changes in points of diversion between BARR agencies can allow for the access to storage capabilities of some BARR agencies without the need to construct new facilities. However, BARR agencies would need to build new physical connections to make such exchanges easier in the long term. Also, the BARR agencies should take advantage of the currently permitted joint point of diversion between the SWP and CVP in their water-right permits when the conditions that allow the use of the joint point of diversion are being met. The BARR agencies need to evaluate the place of use boundaries of the SWP and CVP to ensure that for any specific exchange, those places of use overlap; if they do not, then the BARR agencies should seek permit changes to the places of use sufficient to allow such exchanges.

In addition, the SWP contracts do not allow SWP water to be sold except through very complex processes set forth in the SWP contracts. The contracts do allow SWP water to be exchanged with others in one year so long as it is returned in a future year. The return rate can vary from 1:1 to 1:2 or greater depending on the agreement between the parties. The contracts do not limit the year in which the water is returned but the contractors must convince DWR that the water will be returned for DWR to allow the exchange to commence.

The other possible flexibilities evaluated, changes in demand and "backing up water," do not hold much promise. Reductions in demand could allow for more storage opportunities in higher water allocation years.

However, with the water supply reductions to both the SWP and CVP resulting from the 2008 and 2009 BiOps, the BARR agencies with SWP and CVP water supply contracts may need to reduce demand just to match this reduced water supply.

The potential to back water up into SWP and CVP reservoirs has two burdens. First, the physical ability to back water up does not occur very often and can vary from week to week during the times when needed. Second, both DWR and USBR have policies against backing up water for individual contractors into upstream storage reservoirs except in limited circumstances that benefit either the ability to meet temperature requirements downstream or the benefit accrues to all their contractors.

Water quality benefits of changing the point of diversion for water supplies to BARR agencies can accrue if the revised point of diversion is farther from the influence of saltwater intrusion. A good example is the use of excess FRWP capacity of EBMUD. Also, if approved and constructed, California WaterFix may benefit water quality of CVP/SWP water supplies.