Bay Area Shared Water Access Program (SWAP) Strategy Report

FINAL REPORT // March 2023

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FINAL

BARR SWAP Strategy Report

Prepared for
East Bay Municipal Utility District (Lead Agency)
and Bay Area Regional Reliability Partners:
Alameda County Water District
Bay Area Water Supply and Conservation Agency
Contra Costa Water District
Marin Municipal Water District
Santa Clara Valley Water District
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- Bay Area Clean Water Agencies
- Bay Area Council
- Bay Planning Coalition
- Building Industry Association Bay Area
- California Building Industry Association
- California Sportfishing Protection Alliance
- City of Hayward
- East Bay Dischargers Authority
- Environmental Defense Fund
- Pacific Institute
- Public Policy Institute of California
- Sierra Club, Loma Prieta and San Francisco Bay Chapters
- Silicon Valley Leadership Group
- Stanford University, Water in the West
- ReNUWIt
- The Bay Institute
- UC Davis, Center for Watershed Sciences
- Wholly H2O

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ACWD	Alameda County Water District
AF	acre-foot/feet
AFY	acre-foot/feet per year
BARR	Bay Area Regional Reliability
BAWSCA	Bay Area Water Supply and Conservation Agency
BBID	Byron Bethany Irrigation District
BC	Brown and Caldwell
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CVO	Central Valley Operations
CVP	Central Valley Project
CWC	California Water Code
Delta	Sacramento-San Joaquin Delta
DWR	California Department of Water Resources
EA	Environmental Assessment
EBMUD	East Bay Municipal Utility District
FONSI	Finding of No Significant Impact
FRWA	Freeport Regional Water Authority
FSCC	Folsom South Canal Connection
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IRWMP	Integrated Regional Water Management Plan
ISG	individual supply guarantee (SFPUC)
JPA	joint powers authority
LV	Los Vaqueros Reservoir (CCWD)
LVE	Los Vaqueros Reservoir Expansion
M&I	municipal and industrial
Marin Water	Marin Municipal Water District
NEPA	National Environmental Policy Act
NOE	Notice of Exemption
O&M	operations & maintenance
Reclamation	U.S. Bureau of Reclamation
RWS	San Francisco Regional Water System (SFPUC)
SBA	South Bay Aqueduct (DWR)
SCCAO	South-Central California Area Office (Reclamation)
SFPUC	San Francisco Public Utilities Commission
SGMA	Sustainable Groundwater Management Act
SWAP	Shared Water Access Program
SWP	State Water Project (DWR)
State Water Board	State Water Resources Control Board
TAF	thousand acre-feet
TM	Technical Memorandum
UWMP	Urban Water Management Plan
Valley Water	Santa Clara Valley Water District
WSA	water supply agreement (SFPUC)
WSCP	Water Shortage Contingency Plan
WTP	water treatment plant
WTP1	ACWD Water Treatment Plant No. 1
WTP2	ACWD Water Treatment Plant No. 2
YWA	Yuba Water Agency
Zone 7	Zone 7 Water Agency

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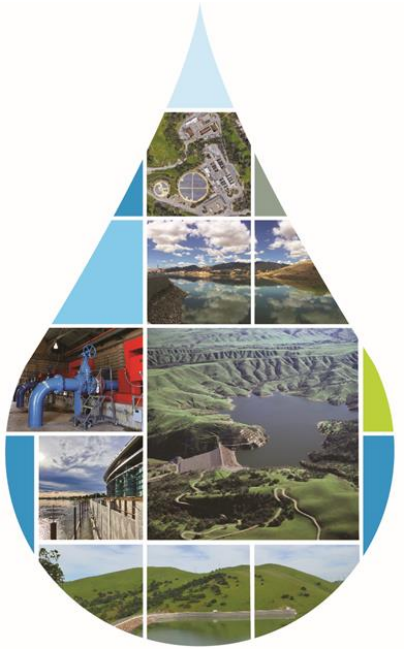
Executive Summary



The Bay Area Regional Reliability (BARR) partnership was developed as a framework for eight San Francisco Bay Area water agencies to strengthen drought resilience and preparedness and address water supply reliability concerns on a mutually beneficial and regionally focused basis. BARR Partners work together to play several different roles in water management across the San Francisco Bay Area, serving as retail and/or wholesale suppliers, groundwater sustainability agencies, watershed stewards, and flood protection managers. The BARR Partners 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 (Marin Water)
- ✓ San Francisco Public Utilities Commission (SFPUC)
- ✓ Santa Clara Valley Water District (Valley Water)
- ✓ Zone 7 Water Agency (Zone 7)

After each of the BARR Partners adopted a set of principles for the Partnership in 2014, the Partners executed a Memorandum of Agreement in 2015 to guide collaboration. In that same year, the Partners were awarded a U.S. Bureau of Reclamation (Reclamation) grant, and each partner contributed individual funds to collectively develop a regional Drought Contingency Plan—the first of its kind. Completed in 2017, the BARR Drought Contingency Plan differs from planning efforts in the past because it focuses on the Bay Area as a region as opposed to individual partners and integrates disparate elements into one cohesive document.

In developing the Drought Contingency Plan, the BARR Partners performed a comprehensive review of Bay Area water supplies, demands, and potential vulnerabilities to drought conditions and identified potential regional drought mitigation measures to reduce vulnerability to future water shortage. These measures focus on enhancing water supply reliability, which in the context of the Drought Contingency Plan refers to the ability to consistently meet water demands across a full range of climatic conditions and during catastrophic events.

Overall reliability can be enhanced by ongoing demand management; a diverse portfolio of water supplies; and regionally connected and resilient conveyance, storage, and treatment facilities able to adapt to future uncertainties, while also providing for aging infrastructure replacement.

Building Resilience through Shared Water Access: Bay Area "SWAP"

As a continuing effort to build regional resilience and support overall water supply reliability in the San Francisco Bay Area, BARR initiated development of the Bay Area Shared Water Access Program (SWAP) with the objective of establishing a roadmap to guide future water supply transfers and exchanges in the area.[1]

Funded in part by Reclamation under a Title XVI WaterSMART grant awarded in 2017, BARR SWAP is one of many BARR Drought Contingency Plan drought mitigation measures. It is not a "one-stop shop" to solve all water supply reliability challenges across the region. It does, however, complement the separate and ongoing planning efforts of the BARR Partners to balance future water supplies and demands.

The purpose of BARR SWAP is to help guide future transfers and exchanges to address urgent supply shortfalls in times of need. This BARR SWAP Strategy Report provides guidance and serves as a resource to assist BARR Partners and other water managers when planning future water transfers and exchanges. The report also highlights stakeholder input as an important component of this planning process.

Collaborative Approach, including External Stakeholder Task Force

Critical to the success of BARR SWAP is consideration of broad perspectives and stakeholder feedback throughout development of this Strategy Report. Considering the regional nature of BARR SWAP, implementation of this program requires coordination and collaboration across BARR Partners' internal organizations, among the BARR Partners (Bay Area water suppliers), and with owners/operators of statewide water supply and conveyance projects, namely the California Department of Water Resources (DWR) and Reclamation (i.e., owners/operators of the State Water Project and Central Valley Project, respectively).

At the start of developing BARR SWAP, the BARR Partners collectively identified potential water transfer and exchange concepts that showed promise for improving regional water supply reliability but had not yet been tested or proven. Through a collaborative process, the BARR Partners selected pilots and established term sheets to identify roles/responsibilities, operational considerations, and cost share. The process required coordination across planners, engineers, operators, legal counsel, and financial departments from within and across the BARR Partners, along with coordination with approval agencies (e.g., DWR and Reclamation).

In addition to the intra- and inter-agency collaboration among the water suppliers' organizations, the BARR Partners also convened an advisory group of external representation, referred to as the Stakeholder Task Force, to provide interested parties and BARR Partners an opportunity for meaningful engagement in the BARR SWAP's development. Task force members represent 18 organizations spanning a range of interests, including environmental, regional planning, disadvantaged communities, business, recycled water, and more. Stakeholder Task Force members include the following organizations:

1. Association of Bay Area Governments
2. Bay Area Clean Water Agencies
3. Bay Area Council
4. Bay Planning Coalition

[1] In context of BARR SWAP, the term "transfer" refers to the movement of water from an alternative or new supply to a BARR Partner. The term "exchange" refers to the substitution of one water supply use for another (i.e., two transfers taking place either simultaneously or at different times, allowing Partners to reallocate or make use of each other's sources of supply). The term "water transactions" is used in BARR SWAP to convey both transfers and exchanges.

5. Building Industry Association Bay Area
6. California Building Industry Association
7. California Sportfishing Protection Alliance
8. City of Hayward
9. Environmental Defense Fund
10. Pacific Institute
11. Public Policy Institute of California
12. ReNUWIt
13. Sierra Club, Loma Prieta and San Francisco Bay Chapters
14. Silicon Valley Leadership Group
15. Stanford University, Water in the West
16. The Bay Institute
17. UC Davis, Center for Watershed Sciences
18. Wholly H2O

Input from Stakeholder Task Force members helped shape and refine aspects of the BARR SWAP Strategy Report through workshops and written comments submitted at key milestones. Figure ES-1 identifies the focus of this input across different key content for the Strategy Report.

Figure ES-1. BARR SWAP input themes from Stakeholder Task Force

Stakeholder discussion included feedback and recommendations on the BARR SWAP goal and vision, critical success factors for a regional water sharing program, and suggestions for evaluation and selection criteria for transfers and exchanges. Stakeholder Task Force members also provided recommended references for further consideration.

Throughout this Strategy Report, this icon is used to identify key areas where Stakeholder Task Force input is incorporated.

Developing the BARR SWAP Strategy

This report introduces the general context for water transfers and exchanges in the Bay Area and considers lessons learned from past transfers and exchanges. The underlying regional approach is guided by the following cooperating principles among the BARR Partners:

- We are working together to enhance regional reliability.
- We have assets, infrastructure, and water rights that can be leveraged.
- We can build from what has happened before.
- We can test and have tested new concepts to explore and inform opportunities.
- We can navigate future opportunities by building from our partnership and existing resources, what we have accomplished before, and concepts we explore.

By taking a regional approach, the Partners can enhance water supply reliability, leverage existing infrastructure investments (Figure ES-2), facilitate water transfers during critical shortages, and improve climate change resilience.

The regional perspective of BARR SWAP bridges both institutional and physical barriers that would enable more efficient sharing of water resources, especially when rapid responses are needed to address emergency conditions. Leveraging existing infrastructure and institutional agreements, understanding lessons learned from past transfer/exchanges, and exploring new concepts enables the BARR SWAP to further develop regional water reliability strategies.

BARR SWAP aligns and supports other relevant regional and local planning efforts and policies, including long-term water supply planning on a regional scale, Integrated Regional Water Management Plans, Urban Water Management Plans, Water Shortage Contingency Plans, and Groundwater Sustainability Plans. At the state level, these efforts also support strategies identified by the California Water Plan Update (2018 and current 2023 update) and the California Climate Adaptation Strategy, among others.

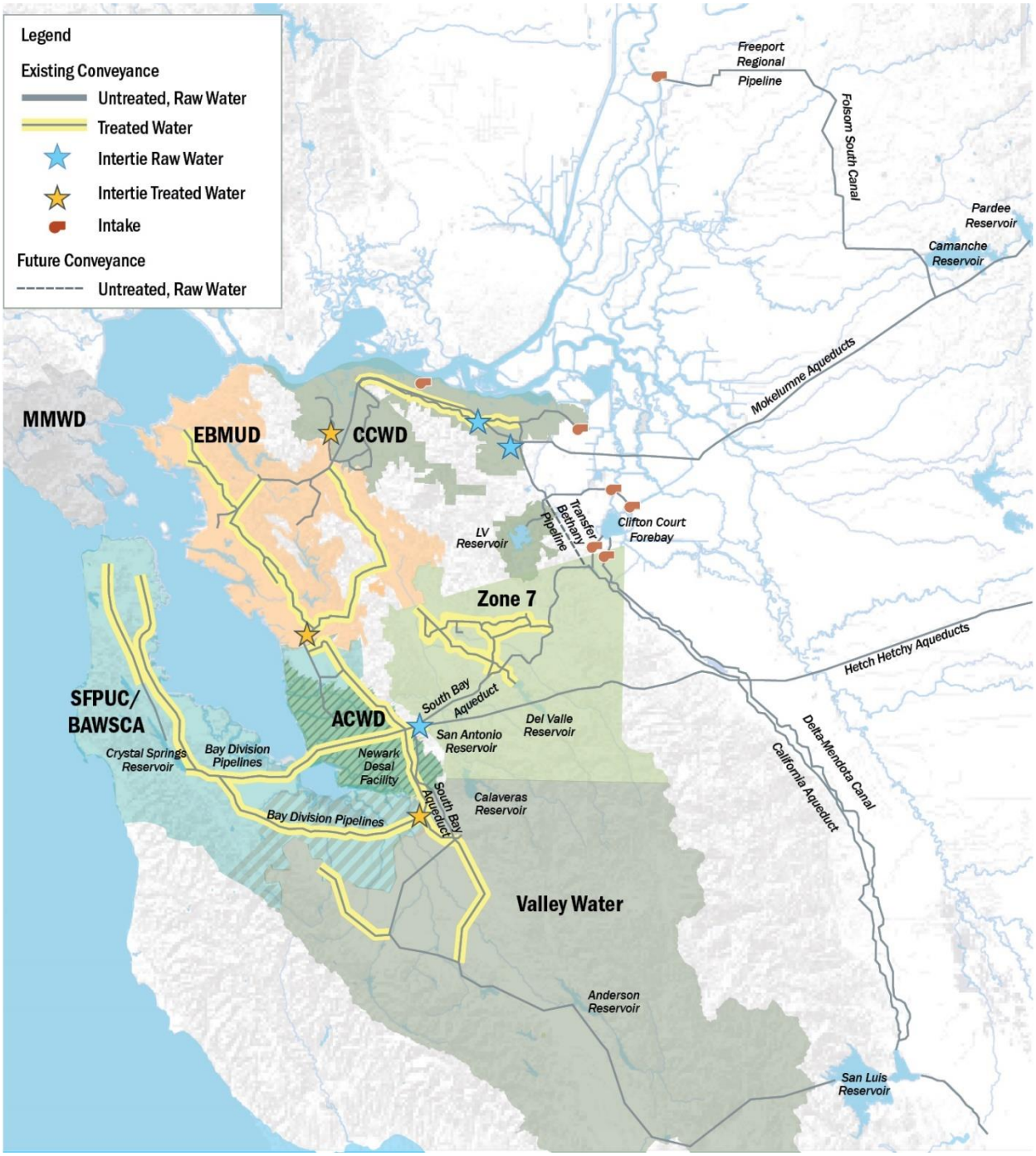


Figure ES-2. General map of BARR Partners' service areas and existing water infrastructure

(Hatched areas indicate areas that are served by more than one Partner Agency.)

A Roadmap to Guide Future Transfers and Exchanges

This Strategy Report provides brief background information on the BARR partnership, BARR SWAP, and other relevant information for water transfers and exchanges for the Bay Area. This information is presented in the form of a "roadmap" containing a series of steps water managers can take when considering and working toward implementing a transfer or exchange. Considerations include water supply and water rights, relevant state and federal agencies, and existing assets (e.g., infrastructure).

Overview of the BARR SWAP Roadmap

The roadmap summarizes important information and best practices for institutional and legal agreements, operations, and physical considerations for water transfers and exchanges. This content includes a list of Bay Area water suppliers that have shared access (overlapping rights) to potential sources of transfer water and the existing institutional agreements and past transfers they have pursued or completed. The roadmap also includes key questions to engage and integrate stakeholder input for practical guidance in conducting future Bay Area transfers and exchanges. Figure ES-3 provides a simplified overview of the steps and key questions outlining the BARR SWAP Roadmap.

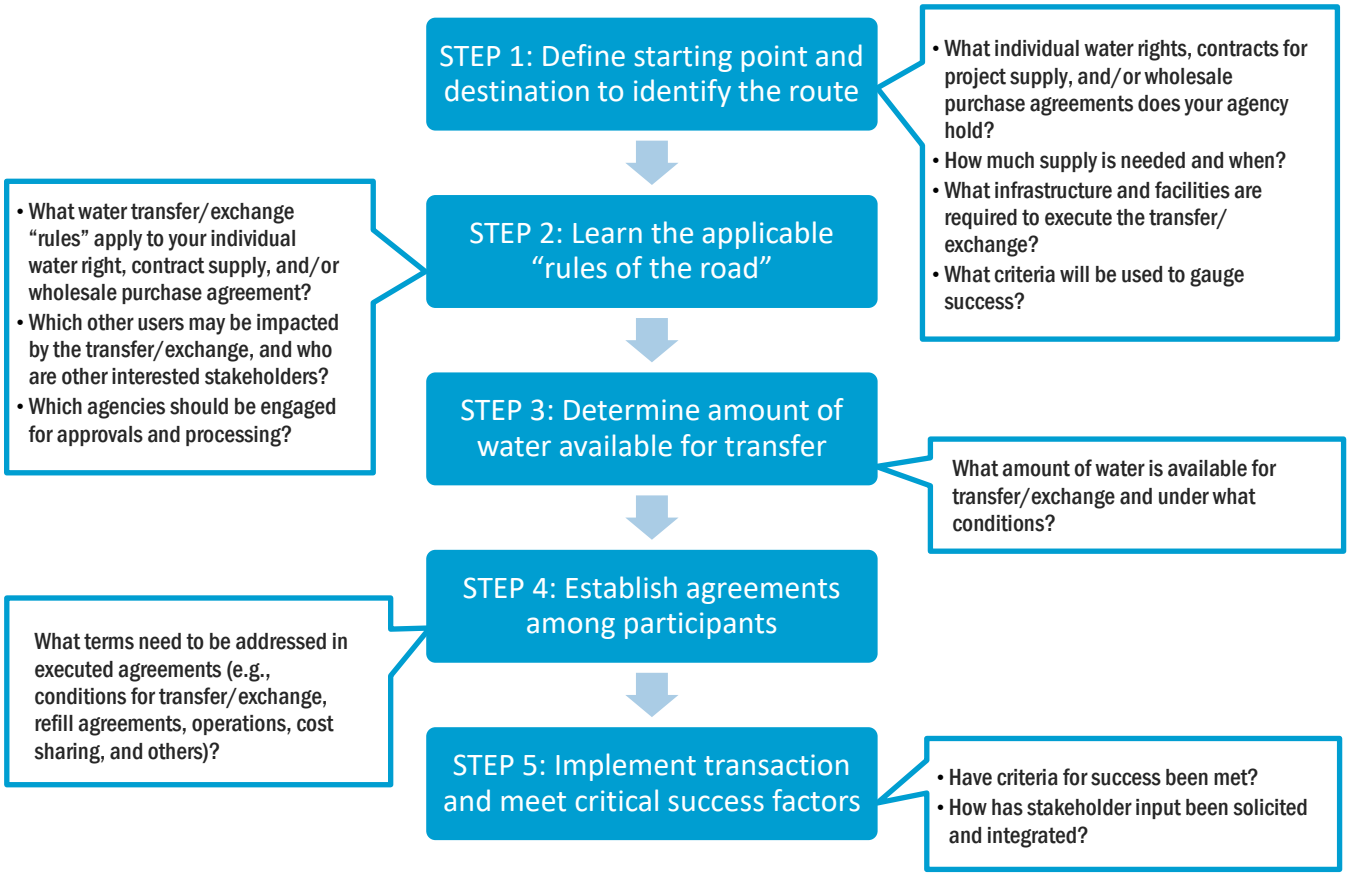


Figure ES-3. Simplified roadmap steps

Lessons Learned in Applying the Roadmap

Building from the roadmap's foundational knowledge, this Strategy Report also incorporates lessons learned from how the roadmap is applied to the BARR SWAP's three pilot projects. BARR SWAP was originally envisioned to include up to two pilot water transfers and/or exchanges and later expanded to involve a third pilot, as ongoing drought conditions presented an opportunity to test a third concept. These pilots were selected to test proofs of concept; carrying out these pilots provides insight into potential implementation of these types of projects, including requirements, challenges, and benefits.

Guiding Future Transfers

The report combines findings from past experiences (including the three pilots) and input from Stakeholder Task Force members to guide implementation of water transactions as one of many options to address regional water resilience. The findings documented in this report also help identify best practices for various types of water supply transfers and exchanges to benefit the Bay Area and support a framework that BARR Partners can expand and adaptively update in the future as new opportunities emerge for regional collaboration and coordinated water management. BARR Partners may use this report over the next year (and beyond) as a reference that documents past actions, current requirements, and resource needs (i.e., funding and staff) related to planning and executing water transactions.

Recommendations for Next Steps

Recommended next steps in implementing the BARR SWAP Roadmap are:

1. Work with regulators to identify strategies that improve efficiency in approving SWAP transfers and support implementation of "California's Water Supply Strategy: Adapting to a Hotter, Drier Future."
2. Develop and evaluate scenarios for potential future water transfers/exchanges.
3. Evaluate transfer concepts using the criteria and selection approach developed for BARR SWAP.
4. Consider social- and equity-focused evaluation criteria for impacts of potential future transfers.
5. Seek stakeholder input to further understand the range of benefits and impacts to other water users, including the environment, and local economies under future scenarios.
6. Provide short summary updates on completion of returned water for relevant pilots on the BARR website, similar to the updates provided for the BARR Drought Contingency Plan Mitigation Measures.
7. Monitor funding opportunities that support further advancing the BARR Partnership through additional pilot transfers or implementing other drought mitigation measures.
8. As appropriate, plan, design, and construct drinking water infrastructure and treatment facilities, including drought mitigation measures explored through the BARR Drought Contingency Plan, to increase opportunities for shared water access. Examples include:
   - Conveyance infrastructure
     - Los Vaqueros Reservoir Expansion facilities, including Transfer-Bethany Pipeline
     - Potential upsizing of SFPUC's intertie to the South Bay Aqueduct near San Antonio Reservoir and Sunol Valley Water Treatment Plant (WTP)
     - Marin Water's Richmond-San Rafael potential intertie to EBMUD
     - Zone 7's potential intertie with EBMUD
     - Expanding use of existing emergency interties to include droughts

- Treatment facilities
  - Pre-treatment upgrades at EBMUD's Walnut Creek WTP
  - Potential treatment additions at SFPUC's Sunol Valley WTP
  - Potential treatment for shared water access using alternative supplies.

9. Take and apply a programmatic approach for processes like documentation for CEQA and requests for change in point of diversion for future transactions to create greater efficiencies.
10. Consider climate impacts and the level of analysis for climate change, especially at the regional level. This could include a regional adaptation strategy that considers increasing aridity as a new general condition.
11. As appropriate, further expand the development of alternative local supplies, such as recycled water, purified water for potable reuse, brackish desalination, stormwater capture, and mitigation of impaired groundwater resources in combination with opportunities for water transactions.
12. In advance of a water shortage, establish new institutional agreements as needed between BARR Partners to formalize terms and conditions of purchasing, storing, and/or conveying supply for temporary transfers in dry years.
13. Consider how to use this Strategy and BARR SWAP as a springboard to integrate wastewater agencies into the process in the future.
14. While continuing to investigate future water transaction opportunities, further explore opportunities to engage as a Partnership in state-level planning initiatives that also seek to improve water management and protect beneficial uses, such as the recently updated California Climate Adaptation Plan and DWR's California Water Plan Update.

Section 1

Introduction

The Bay Area Regional Reliability (BARR) partnership is a collaboration among eight water suppliers to enhance water supply reliability and resilience by leveraging use of existing infrastructure and shared resources during critical shortages. After developing a regional Drought Contingency Plan that identified measures to mitigate the impact of droughts, the BARR Partners launched the Bay Area Shared Water Access Program (SWAP) to conduct pilot transfers/exchanges and inform future decision making. This BARR SWAP Strategy Report intends to summarize lessons learned from past experiences (including three pilots), guide water agencies (including the BARR Partners) in future actions related to water transfers and exchanges, and foster greater regional resilience. BARR Partners may use this report over the next year (and beyond) as a reference that documents past actions, current requirements, and resource needs (i.e., funding and staff) related to planning and executing water transactions.

1.1 BARR Background and History

While drought is a recurring feature of California, the extreme and unprecedented droughts over the past decade have redefined the driest period on record with 2015 as the lowest snowpack since record keeping began in 1895. Following an "average" water year for Northern California precipitation in 2016, water supply conditions improved significantly for water agencies in the San Francisco Bay Area in 2017, which was the wettest year on record. However, the reprieve of drought conditions was fleeting: 2021 marked one of the top five warmest summers on record (NOAA, 2021), and dry conditions returned to Northern California and persisted through 2022, the driest year on record.

The recent and ongoing droughts have inspired more integrated, regional water management and drought mitigation, resulting in the BARR partnership among eight of the largest Bay Area water agencies. These agencies (listed below) collectively serve water supply for urban (municipal and industrial) uses to more than six million people in six counties, which is most of the Bay Area, as well as agricultural uses (Table 1-1).

1. Alameda County Water District (ACWD)
2. Bay Area Water Supply and Conservation Agency (BAWSCA)
3. Contra Costa Water District (CCWD)
4. East Bay Municipal Utility District (EBMUD)
5. Marin Municipal Water District (Marin Water)
6. San Francisco Public Utilities Commission (SFPUC)
7. Santa Clara Valley Water District (Valley Water)
8. Zone 7 Water Agency (Zone 7)

Table 1-1. BARR Partners' Roles in Bay Area Water Management

BARR Partner	Water supplier type		Contract(s) for wholesale water purchases	Other roles		
	Wholesale	Retail		Groundwater Sustainability Agency	Stream/watershed and/or flood protection	Wastewater treatment
ACWD	N/A	Retail population of 357,000 in western Alameda County (cities of Fremont, Newark, and Union City); SFPUC wholesale customer (BAWSCA member agency)	State Water Project (SWP) and SFPUC	GSA Lead: Niles Cone Subbasin	Alameda Creek, Quarry Lakes Recreation Area (with East Bay Regional Park District)	N/A
BAWSCA	(See SFPUC)	26 member agencies (retail water suppliers) in Alameda, Santa Clara, and San Mateo counties (including ACWD) serving a total retail population of 1,843,000	SFPUC Wholesale Supply Agreement with separate Individual Supply Guarantees (ISG) between SFPUC and individual BAWSCA member agencies	GSA Lead: Groundwater Reliability Partnership for San Mateo Plain Subbasin	N/A	N/A
CCWD	6 retailers, including 3 treated water retailers (total population of 553,000)	Retail (treated water) population of 205,000 in central and eastern Contra Costa County	Central Valley Project (CVP)	GSA Participant: Ygnacio Valley, Clayton Valley, Pittsburg Plain, and East Contra Costa Subbasins	Watershed management of for Los Vaqueros Reservoir	N/A
EBMUD	N/A	Retail population of 1,405,000 in northern Alameda County and western Contra Costa County	CVP (dry years only)	GSA Lead: East Bay Plain Subbasin	Watershed management of Mokelumne River, upcountry reservoirs, and local reservoirs	In northern Alameda County and southern Contra Costa County
Marin Water	N/A	Retail population of 191,000 in southern Marin County	Sonoma Water	N/A	Watershed management of 4 local reservoirs	N/A
SFPUC	26 treated water retailers, called *Wholesale Customers* (BAWSCA member agencies) (population of 1.84 million)	Retail population of 900,000 in the City and County of San Francisco (CCSF), as well as several suburban retail areas	Water Supply Agreement between SFPUC and customers, and separate Individual Supply Guarantees (ISG) between SFPUC and each Wholesale Customer	GSA Lead: San Francisco West Side Basin Participant: San Mateo Plain Subbasin	Watershed management of 9 RWS reservoirs	In CCSF
Valley Water	13 retailers, including 8 treated water retailers (total population of Santa Clara County: 1,986,000 [a]), and private well owners	N/A	SWP and CVP	GSA Lead: Santa Clara and Llagas Subbasins	Watershed management and flood protection for reservoirs, streams, and dams in Santa Clara County	N/A
Zone 7	4 treated water retailers and 3,500 acres of agriculture served with untreated water (total population of 266,000)	Less than 3,000 people served directly	SWP	GSA Lead: Livermore Valley Groundwater Basin	Regional flood protection for eastern Alameda County	N/A

a. Includes population of five BAWSCA agencies (SFPUC wholesale customers)

The BARR partnership was established to cooperatively address water supply reliability concerns and drought preparedness on a mutually beneficial and regionally focused basis.[2] After each of the BARR Partners adopted principles in 2014 to guide the collaboration, the Partners executed a Memorandum of Agreement (MOA) in 2015 to create a regional Drought Contingency Plan—the first of its kind. Funded in part by a grant award by U.S. Bureau of Reclamation (Reclamation) in 2015, the BARR Drought Contingency Plan differs from other planning efforts because it focuses on the Bay Area as a region as opposed to individual partners and integrates disparate elements into one cohesive document. In developing the Drought Contingency Plan, the BARR Partners performed a comprehensive review of Bay Area water supplies, demands, and potential vulnerabilities to drought conditions and identified potential regional drought mitigation measures to reduce vulnerability to future water shortage. Throughout this process, the BARR Partners engaged external stakeholders representing various interests, incorporating stakeholder feedback and recommendations into the document and next steps.

As one of fifteen drought mitigation measures identified in the BARR Drought Contingency Plan, BARR SWAP arose from the need for both short- and long-term water supply reliability in the Bay Area. The BARR Partners consider BARR SWAP to be foundational to most of the other drought mitigation measures. As part of these efforts, BARR initiated development of the BARR SWAP with the objective of establishing a roadmap to guide future water supply transfers and exchanges in the region. Like the Drought Contingency Plan, BARR SWAP benefited from external input through the SWAP Stakeholder Task Force (Section 1.3).

1.2 BARR SWAP Purpose and Vision

BARR SWAP aims to elucidate the process of pursuing and conducting water supply transfers and exchanges through maximizing the efficient use of existing assets, including infrastructure, institutional agreements, and water resources. Transfers and exchanges support proactive drought mitigation strategies (e.g., banking supply in storage) and can also address short-term supply gaps during water shortage conditions. BARR SWAP addresses voluntary exchanges among contractual peers, as well as transfers of surface water supply made available by a seller.

BARR Partners secured funding from Reclamation in 2018 to develop a BARR SWAP Strategy Report and pursue pilot projects to test concepts for ways to improve regional water management to address vulnerabilities related to supply reliability.

This Strategy Report provides a “roadmap” that is based on lessons learned from past experiences and the BARR SWAP pilot projects, key references, and stakeholder input. The roadmap serves as a guide to support future water transfers and exchanges in the Bay Area. It also serves as a resource for future Bay Area water managers to develop water exchanges and transfers and is a potential model for other water suppliers in California.

While not a “one-stop shop” solution, the regional perspective of BARR SWAP bridges both institutional and physical barriers and enables more efficient sharing of water resources, especially when emergent conditions require prompt response. By leveraging existing infrastructure and institutional agreements, the vision for BARR SWAP is to support development of regional water reliability strategies. The roadmap introduced in this Strategy Report incorporates insights from

[2] Reliability is defined within BARR as the ability to consistently meet water demands across a full range of climatic conditions and during catastrophic events. This can be enhanced by ongoing demand management; a diverse portfolio of water supplies; and regionally connected and resilient conveyance, storage, and treatment facilities adaptable to future uncertainties, while also providing for aging infrastructure replacement.

BARR SWAP pilots and other experiences of Partners and stakeholders to inform future the program's goals and vision. Five key objectives of this report include:

- ✓ Document lessons learned from past transfers/exchanges, including pilot projects conducted under BARR SWAP to test proof of concept.
- ✓ Identify best practices for various water supply transfers/exchanges to benefit the Bay Area through improved water supply reliability and resilience.
- ✓ Reflect input from external stakeholders (Stakeholder Task Force) collected at key milestones during the program's development.
- ✓ Anticipate challenges related to conducting water transfers/exchanges to mitigate or manage water shortages.
- ✓ Establish a guide for executing water transfers and exchanges and a framework for adaptive updates as new opportunities emerge.

Because of the Bay Area's unique and diverse water challenges, bridging the gap to regional water reliability requires complementing and coordinating existing agencies' efforts. Insights from BARR SWAP can complement and support Urban Water Management Plans (UWMPs), Integrated Regional Water Management Plans (IRWMPs), California's Water Supply Strategy, and the recently updated California Climate Adaptation Plan, as well as other efforts. Relevance to state, regional, and local plans is highlighted in Table 1-2.

Table 1-2. Existing Plans Relevant to BARR SWAP

Existing Plans	Relevance to BARR SWAP
Related plans developed by each BARR Partner individually:	
Urban Water Management Plans (UWMP) *Updated every 5 years*	Prepared by urban water suppliers every five years through a public process to report an assessment of water supply reliability for existing and planned water needs over a 20- or 25-year planning horizon over various hydrologic conditions (i.e., water-year types: normal, single dry year, and a drought lasting at least 5 consecutive years).
Water Shortage Contingency Plans (WSCP) *Updated every 5 years*	Updated every 5 years as a component of UWMPs, WSCPs outline an urban water supplier's approach for monitoring and managing water shortages, including the plan for implementing shortage response actions.
Risk and Resilience Assessments (RRA) *Reviewed every 5 years*	Required by America's Water Infrastructure Act of 2018, RRAs assess the risk and resilience of critical water system assets and relevant threats (natural and manmade).
Water supply planning documents *Varies*	Each utility has their own water supply planning documents, with varying scopes and update schedules based on individual needs. These documents form the basis of each utility's understanding of their system.
Other Bay Area regional or county level plans:	
Integrated Regional Water Management Plans (IRWMP) *Includes San Francisco Bay Area, East Contra Costa County, and Pajaro River Watershed*	A DWR-led collaborative effort to advance long-term water supply planning on a regional scale, IRWMPs reflect a compilation of projects that increase regional self-reliance.
Groundwater Sustainability Plans (GSP) *Updated every 5 years*	Per the Sustainable Groundwater Management Act, GSPs identify the planned approach for managing groundwater basin objectives, actions, and assessment of performance metrics over time to reach and/or maintain long-term sustainability.

Table 1-2. Existing Plans Relevant to BARR SWAP	
Existing Plans	**Relevance to BARR SWAP**
BARR Drought Contingency Plan, June 2017	Assesses regional water supply vulnerabilities. Identifies 15 collaborative projects (drought mitigation measures) among BARR Partners that focus primarily on increasing utilization of existing assets and resources to improve the greater region's water supply reliability. As one of the 15 drought mitigation measures, BARR SWAP embodies the blueprint for putting the regional Drought Contingency Plan into action by identifying opportunities/challenges for shared access to individual agencies' existing resources and assets and documenting experiences and guidelines/requirements for knowledge transfer and posterity to benefit the region in the future.
Statewide plans:	
California Water Resilience Portfolio, 2020	Identifies diverse strategies to improve statewide water resilience (such as water transfers) as California faces more extreme events due to climate change.
California's Water Supply Strategy 2022, Adapting to a Hotter, Drier Future	Focuses State policy on four main themes: developing new water supplies, expanding water storage capacity, reducing demand, and improving forecasting, data, and management including modernization of water rights. Provides specific priorities and targets around urban water supply. Efforts from BARR SWAP support a component of the fourth theme to improve the flexibility of current water systems to move water throughout the state.
California Water Plan, Update 2018 *Updated every 5 years*; *Update 2023 currently in development*	Reflects DWR's comprehensive strategic plan for managing water throughout the state; updated every five years to incorporate and reflect current information and science. Update 2018 includes an objective related to improving operational efficiency and transfers with four related corresponding Resource Management Strategies: Delta conveyance, regional and local conveyance, system reoperation, and water transfers. BARR SWAP efforts can help support this important strategic plan.
SWP Delivery Capability Report *Updated every 2 years by DWR*	Addresses key factors affecting SWP and CVP operations, delivery capability under current regulatory requirements, and estimated long-term future (20-year planning horizon) water supplies from the SWP and CVP for beneficial use. Based on CalSim[a] modeling results. Discusses various processes affecting reliability, such as changes in climate and hydrology, regulation, and facilities. Provides an important basis of understanding for need and opportunities of the BARR SWAP considering SWP and CVP resources are key components of several BARR Partners' water portfolios.
California Climate Adaptation Strategy, Update 2021 *Updated every 3 years*	Outlines the state's priorities for climate adaptation and a framework with measurable steps to improve statewide climate resilience. Innovative strategies to improve water supply reliability like BARR SWAP will help the region adapt to climate change impacts.
Water Quality Control Plan for the Sacramento-San Joaquin Delta (Bay-Delta Plan) *Phase 1: 2018; Phase 2: ongoing*	State-established water quality control measures and flow requirements for reasonable protection of beneficial uses in the Bay-Delta watershed. Updated in two amendments: the Lower San Joaquin River (Phase 1) and the Sacramento River (Phase 2). BARR SWAP considers opportunities to support flow and water quality objectives in the Bay-Delta.
Delta Plan *Created 2010 (amendments ongoing)*	Constitutes a comprehensive, long-term, legally enforceable plan guiding the management of the Delta's water and environmental resources among multiple federal, state, and local agencies. Important for BARR SWAP, considering the significance of supply originating from the Bay-Delta Watershed to the Bay Area's collective water supply portfolio.
California's Groundwater (Bulletin 118), Update 2020 *Updated every 5 years*	Defines boundaries and hydrologic characteristics of California's groundwater basins. Features groundwater management recommendations. This update is a valuable resource to consider for context on groundwater resources pertinent to BARR SWAP activities.

a. *CalSim is a water resources planning model, jointly developed by DWR and Reclamation, to simulate SWP and CVP operations and much of the water resources infrastructure in the Central Valley of California and the Sacramento-San Joaquin Delta region.*

As an integral aspect of managing water resources, BARR Partners use efficiency and demand management as a priority before considering water exchanges and transfers as a strategy to improve reliability. Efficiency and conservation are critical strategies for managing demands and reducing supply needs; yet may not provide a complete solution for improving water supply reliability in the face of increasingly frequent and intense climatic events, including extreme drought. Especially given

the increased recurrence and intensity of droughts, it is important to consider all approaches including local supply planning as well as expanding the use existing infrastructure (e.g., interties are important when considering a regional approach to resiliency). BARR Partners include local water supply planning as part of their portfolios and are committed to continuing those efforts.

1.3 Collaborative Approach

The regional focus of BARR SWAP included coordination and collaboration among the BARR Partners (Bay Area water suppliers), owners/operators of California water projects (i.e., SWP and CVP) including the DWR and Reclamation, and the Stakeholder Task Force to solicit stakeholder feedback at key milestones during the program's development.

At the start of developing BARR SWAP, the BARR Partners collectively identified potential water transaction concepts that showed promise for improving regional water supply reliability but had not yet been tested or proven. Through a collaborative process, the BARR Partners selected pilots and established term sheets to identify roles/responsibilities, operational considerations, and cost share. The process required coordination across planners, engineers, operators, legal counsel, and financial departments from within and across the BARR Partners, along with coordination with approval agencies (i.e., DWR and Reclamation). BARR SWAP activities build on collective knowledge and momentum gained through the pilots (summarized in Section 3), while opening opportunities for Stakeholder Task Force members to weigh in on the future of water sharing in the Bay Area.

In addition to the intra- and inter-agency collaboration among the water suppliers' organizations, the BARR Partners also convened the Stakeholder Task Force as an advisory group of external representation to provide interested parties and Partners an opportunity for meaningful engagement in the development of BARR SWAP. The members represent 18 organizations spanning a range of interests, including environmental, regional planning, disadvantaged communities, business, recycled water, and more. Task Force members represent the following organizations:

1. Association of Bay Area Governments
2. Bay Area Clean Water Agencies
3. Bay Area Council
4. Bay Planning Coalition
5. Building Industry Association Bay Area
6. California Building Industry Association
7. California Sportfishing Protection Alliance
8. City of Hayward
9. Environmental Defense Fund
10. Pacific Institute
11. Public Policy Institute of California
12. ReNUWIt
13. Sierra Club, Loma Prieta and San Francisco Bay Chapters
14. Silicon Valley Leadership Group
15. Stanford University, Water in the West
16. The Bay Institute
17. UC Davis, Center for Watershed Sciences
18. Wholly H2O

The BARR Partners held two workshops with Stakeholder Task Force members during development of BARR SWAP and the Strategy Report. Due to in-person meeting restrictions during the COVID-19 pandemic, the first workshop was conducted virtually in two separate parts held one week apart. This approach favored greater opportunity for collaboration and integration of feedback while reducing screen fatigue among participants. A brief description of Workshops 1 and 2 are provided as follows.

Workshop 1, Part 1: Held on July 7, 2020, the first part of Workshop 1 solicited input from the Stakeholder Task Force on BARR SWAP's goal and vision, critical success factors, and other project elements (Figure 1-1). The workshop also included a brief review of the historical context leading up to BARR SWAP, which was one of many mitigation measures identified in the BARR Drought Contingency Plan, updates on other Drought Contingency Plan mitigation measures, and a brief overview of the BARR SWAP project and preliminary pilot selection criteria.

Figure 1-1. Focus of input from BARR SWAP Stakeholder Task Force during Workshop 1

Stakeholders discussed desired objectives for a regional water sharing program and offered feedback and suggestions for evaluation and selection criteria for transfers and exchanges. Stakeholder Task Force members also provided recommended references for further consideration.

Input from the Stakeholder Task Force informed suggestions for future criteria and critical success factors presented in part two of the workshop, as described below and further elaborated in Section 4.

Workshop 1, Part 2: Held on July 14, 2020, the second part of Workshop 1 included a review of definitions for water supply reliability and resilience to set a common understanding of terms used in the approach for BARR SWAP. In addition, the BARR Partners summarized Stakeholder Task Force input received in part one and shared a potential approach for the BARR SWAP Strategy Report, requesting feedback from the Task Force on the goal and vision, needs and opportunities, lessons learned, and general strategy components. Feedback from the Task Force is reflected in Section 4 of the Strategy Report.

Workshop 2: The second workshop was held virtually on October 31, 2022, and included updates for the completed BARR SWAP project pilots, as well as a review of the Draft Strategy Report content. Task Force members were asked to review and provide feedback on the Draft Strategy Report. Feedback on the Draft was incorporated throughout the Draft Final version of the Report, especially Sections 4 and 5.

Throughout this Strategy Report, this icon is used to clearly flag areas where Stakeholder Task Force input is incorporated.

1.4 Understanding the Basics for Water Transfers/Exchanges

Water management in California is complex. The context for BARR SWAP requires a baseline understanding of California water rights, project operations, legal/regulatory and environmental considerations, and existing infrastructure and resources available to the San Francisco Bay Area.

Additional background on California water rights and transfers is presented in Appendices A through D. Water transfers are one of various tools used in California water management to improve resilience in water supply and can help in meeting critical needs during drought periods. Transfers must be conducted in a responsible manner to ensure no resulting harm to other legal users of water or unintended environmental effects. Substantial documentation of California state level general requirements and process for transfers and exchanges can be reviewed in the DWR and Reclamation (Mid-Pacific Region) 2019 guidance document entitled *Draft Technical Information for Preparing Water Transfer Proposals* (Water Transfer White Paper). The BARR SWAP Strategy Report builds from this foundational white paper and focuses on guidance for transfers and exchanges for the San Francisco Bay Area.

BARR Partners have unique water supply portfolios that include individual water rights and/or contracts managed by DWR or Reclamation (for SWP and/or CVP supplies, respectively), as well as other contracts or long-term agreements for water supply, including wholesale contracts between BARR Partners. Among their many terms and conditions, water rights and contracts establish guardrails related to permitted surface water supply diversions by water suppliers for urban use, also referred to as municipal and industrial (M&I) use. The specification of water amounts, timing of withdrawals, points of diversion, and place of use are defined in individual water rights and/or contracts.

1.4.1 Key Terms and Water Transaction Types

Understanding specific terms and the different types of transactions is an important foundation to navigate the process, requirements, and opportunities. Table 1-3 describes key terms as used throughout this report.

Table 1-3. Key Terms and Definitions for Understanding Water Transfers and Exchanges in California	
Key Term	**Definition**
Water right	Legal permission (administered by the State Water Resources Control Board [State Water Board]) to use a reasonable amount of water for a beneficial purpose such as indoor household uses, irrigation, farming, industry, swimming, or fishing (State Water Board, 2022).
Point of diversion	Legally defined location where water is diverted from its source (23 CCR § 931).
Place of use	Legally defined areas where water may be used based on the supply's associated water right (23 CCR § 931).
Purpose of use	Reasonable and beneficial use specified in the water right.
Timing/conditions	Timeframe and conditions under which the water right holder may divert and use water.
Water transfer	A transfer is a water transaction between two entities where one entity (seller) sells water to another entity (buyer). Transfers typically require approval from the State Water Board through a change petition, though some transfers are exempt (e.g., CVP/SWP contract forbearance agreements, pre-1914 water rights, and existing authorized water transfer programs).
Water exchange	An exchange is a water transaction involving two or more entities that trade water supplies, generally resulting in no net increase of water supply for any participating entity. Unlike transfers where one entity reduces its consumptive use of a specific water supply to sell to another entity, the key concept to exchanges is the participating entities "swap" water.
Water transfer via exchange	Water transactions involve both a transfer and exchange. Supply is made available through a typical transfer. To complete the transfer and physically convey the supply to the buyer, the delivery mechanism involves an exchange through available facilities.

DWR and the State Water Board define several approaches in the 2019 *Water Transfers White Paper* to make water supply available for transfer. These and additional approaches are summarized as follows and further detailed in Section 2.3.

1. **Reservoir reoperation**: Seller relies on water in storage (that would otherwise remain in storage) instead of diverting the same amount of supply. Alternatively, this may involve an increased release of water from a reservoir compared to normal operations; the transfer water is conveyed downstream to a new point of diversion either within or outside the watershed.
2. **Groundwater substitution**: Seller pumps groundwater (that would otherwise remain in the aquifer) instead of diverting the same amount of supply, thereby making the forgone surface diversions available to another user downstream for the period of the transfer.
3. **Crop idling/shifting**: Growers idle fields that would have been planted during the transfer season absent the transfer; the amount of water made available for transfer is based on the reduction in consumptive use, which is calculated as the evapotranspiration of applied water (ETAW). Crop shifting involves a change in crops planted by a grower, substituting a lower water using crop (one with a lower ETAW) for a more water intensive crop. A cropping history is required to establish baseline cropping patterns. The water available for transfer due to crop shifting is the difference between the ETAW of the historic crop type and the alternate, less water intensive crop.
4. **Contract reallocation**: Water transactions between CVP or SWP contractors that do not require changes to the place of use, purpose of use, point of diversion, or re-diversion of the underlying water right because the existing water rights cover the water contractors involved. Voluntary reallocations are not considered water transfers under California law and policy because the reallocations occur under water rights held by Reclamation (CVP) or DWR (SWP). For example, this could involve reallocating supplies between BARR Partners that are SWP contractors.
5. **Conserved water**: Measures that result in a reduction in the consumptive use of water or prevent water from discharging to an unusable water supply can make water available for transfer.

6. **Recycled water credit**: Water is made available for transfer via California Water Code Section 1010 through substitution of existing recycled water.

1.4.2 Learning from Past Experiences

BARR Partners compiled and reviewed their collective past experiences with water transfers and exchanges over the last decade. A survey was conducted within BARR SWAP to identify these experiences and document historical information on buyers and sellers of water, category or type of transfer and exchange, outcome (i.e., attempted or completed transfer/exchange), quantity of water, implementation challenges, enabling conditions, and potential impacts of changing regional conditions on future transfers (BC, 2019). This information also included transfer costs, staffing capacity, environmental considerations, and sequence/timing for obtaining required approvals. A summary table of lessons learned from past transfers and exchanges is provided in Appendix E. Information in the past transfers survey built on publicly available water transfer records from the State Water Board, which provides information on petitions submitted from 2009 to 2019.

Past water transfers and exchanges provide valuable lessons learned for the San Francisco Bay Area region's water users and suppliers. For the purposes of BARR SWAP "water suppliers" in this case refers to practitioners and managers of water supplies, and for the purposes of BARR SWAP, include those that pursue, plan, and execute transfers and exchanges. The three primary categories for water users within the region, and California, include urban (M&I), agricultural irrigation, and environmental uses (e.g., wild & scenic river, minimum instream flow requirements, Delta outflow requirements, managed wetlands), and represent different applied water use in the Bay Area hydrologic region (DWR, 2020).

BARR SWAP leverages lessons learned from the past transfers survey, incorporating them into the SWAP Roadmap (Section 2). Application of the roadmap to the three SWAP pilot projects carried out by the BARR Partners also produced additional lessons (Section 3). The descriptions of the pilots provide examples of applying the roadmap while testing proofs of concept for different types of transfers and exchanges.

Stakeholder Task Force input influenced the development of this roadmap, particularly in understanding potential impacts and benefits of a transfer and in determining how to measure and define its success. Task Force members also provided general recommendations and considerations for future evaluation, selection, and implementation of transfers and exchanges in the San Francisco Bay Area (Section 4).

All these experiences and input provide the foundation of the guidance provided in the SWAP Roadmap and the lessons learned from BARR SWAP (Section 4) and support next steps (Section 5).

Section 2

Roadmap Introduction

To document the process for planning and executing water transfers and exchanges to benefit the Bay Area, the BARR Partners have developed a roadmap to help guide future efforts by framing requirements and best practices and building on lessons learned from past experiences. This roadmap outlines general steps and guidance to support BARR Partners' future transfers from the perspective of a buyer, as shown in Figure 2-1 with example considerations for each step and as further described in this section.

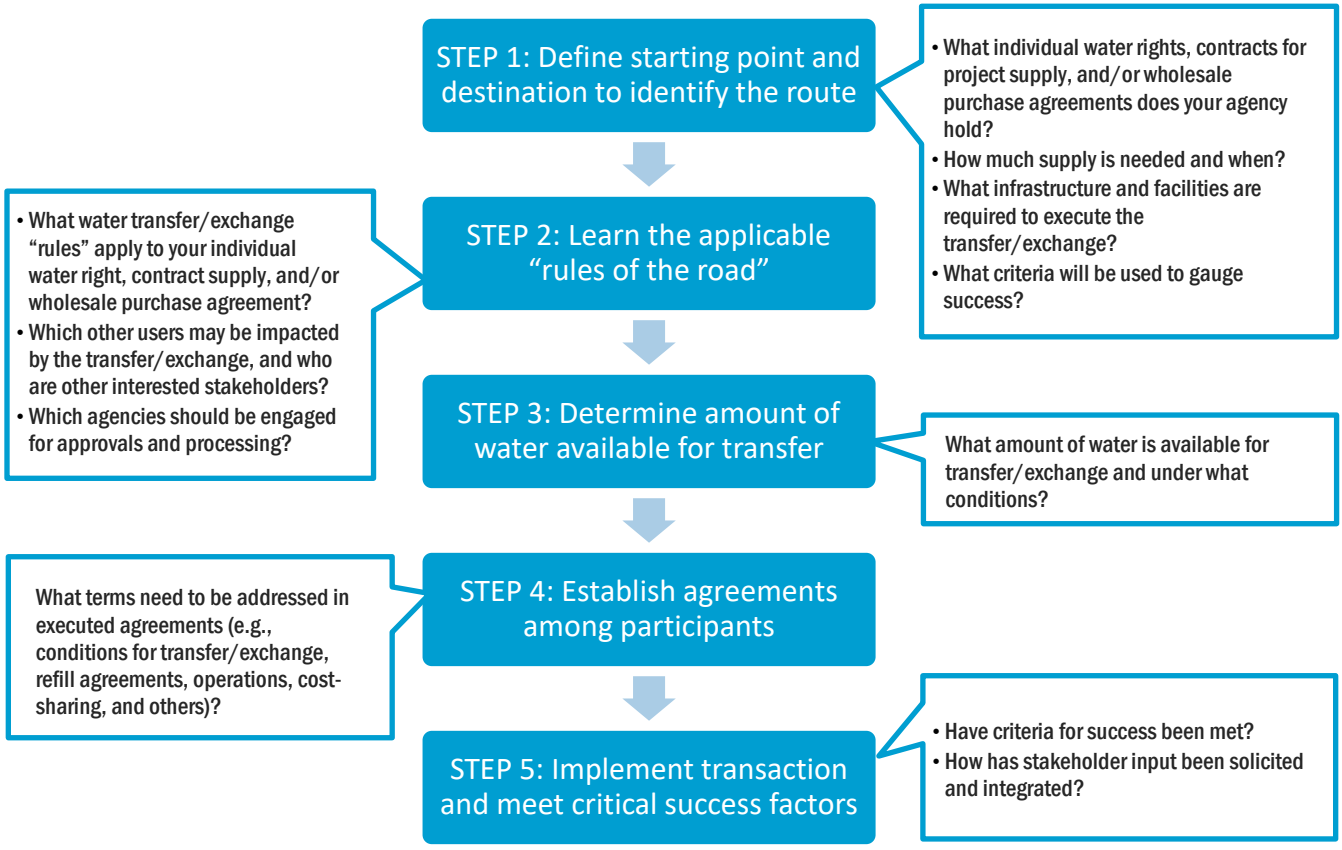


Figure 2-1. Simplified roadmap steps

Content that follows in this roadmap relies heavily on information documented in greater detail in three resources that apply more broadly to water suppliers across California, including:

- *A Guide to Water Transfers*, a State Water Board document that frames the procedures and rules for conducting various types of water transfers (State Water Board, 1999).
- The *Draft, Technical Information for Preparing Water Transfer Proposals*, informally known as the *Water Transfer White Paper*, reflects guidance developed collaboratively between DWR and Reclamation (DWR and Reclamation [Mid-Pacific Region], 2019).

- DWR's *Background and Recent History of Water Transfers in California*, which provides basic understanding of supply transfers with an emphasis on moving water through the Delta, along with an overview of various types of water transfers, their recent history, and the regulatory setting that governs transfers (DWR, 2015).

The BARR SWAP Roadmap refers to these resources in context of distilling relevant aspects that apply to supply transfers to benefit the Bay Area.

2.1 Step 1: Define Starting Point and Destination

Conducting a water supply transfer/exchange involves pairing a willing seller/buyer compatible in terms of institutional, physical, and operational aspects that may otherwise preclude or limit the movement of water supply from one place to another. The step involves considering the following:

- Individual water rights, project supply contracts, and/or wholesale purchase agreements held by each the willing buyer and seller, as well as amount and timeframe/conditions of the buyer's supplemental supply need
- Infrastructure and facilities required to execute the transfer/exchange

2.1.1 Water Resources for Bay Area Transfers and Exchanges

An understanding of BARR Partners' ability to access water supply under existing water rights/contracts is fundamental to accomplishing water transfer and exchanges that may benefit the Bay Area. Each BARR Partner has a unique combination of existing water supply sources, including surface water, groundwater, and reuse currently, as depicted in Table 2-1. Access to these sources of supply depends on the following factors:

- Legal access to surface water supplies requires either a contract for project supply (SWP and/or CVP), long-term wholesale or transfer purchase agreement, or an individual water right.
- Access to local and/or regional groundwater supplies depends on hydrogeologic conditions proximate to an agency's service area. In contrast, out-of-region groundwater banking requires an agreement to divert and store surplus surface water in another agency's groundwater basin to conjunctively manage through in-lieu exchange in dry years.
- Several BARR Partners have developed recycled and/or purified water for reuse at a local level. Some Partners are individually and/or jointly evaluating the opportunity to expand reuse, as noted in UWMPs. With the pending development of direct potable reuse regulations and growing regional interest in exploring purified water opportunities, the BARR Partners could consider adapting and expanding BARR SWAP in the future to incorporate a regional reuse element. However, the roadmap currently focuses on existing water resources accessible to BARR Partners.

As an integral aspect of managing water resources, each of the BARR Partners invests substantial organizational resources and funding for comprehensive water use efficiency/conservation programs that have been in place for over three decades and continue to yield water savings. Efficiency/conservation is a critical strategy for managing demands and reducing supply needs, yet not a panacea for improving water supply reliability in the face of increasingly frequent and intense climatic events, including extreme drought.

Table 2-1. BARR Partners' Existing Supplies and Water Rights/Contracts

	Surface Water Supply				Groundwater (GW)			Reuse
BARR Partner	SWP	CVP	Wholesale supply or long-term transfer	Individual water rights	Local	Regional	Out-of-region GW banking contract(s)	Recycled/ purified water
ACWD	SWP contract (Delta diversions)		SFPUC wholesale agreement	Alameda Creek (post-1914 rights) Arroyo Valle (post-1914 rights)	Local GW (conjunctive use) Desalinated local GW		Semitropic Water Storage District (Kern County)	
BAWSCA			SFPUC wholesale agreement with 26 BAWSCA agencies					
CCWD		CVP contract (Delta diversions)	East Contra Costa Irrigation District water sales agreement	Delta water rights: Los Vaqueros Reservoir and San Joaquin River at Mallard Slough (post-1914 rights)				Recycled water
EBMUD		CVP contract (Freeport Regional Water Facility diversions)		Mokelumne River (post-1914 M&I rights) Upcountry storage: Pardee Reservoir, Camanche Reservoir (post-1914 hydropower rights) Local runoff (pre-2014 rights [Chabot and Upper San Leandro Reservoirs]; post-1914 M&I rights)	Local GW (conjunctive use)		Pilot GW banking project in San Joaquin County	Recycled water
Marin Water			Sonoma Water wholesale agreement (Russian River)	Lake Lagunitas and Phoenix Lake (pre-1914 rights) Bon Tempe, Alpine Lake, Kent Lake, Nicasio Reservoir, Soulajule Reservoir (post-1914 rights)				
SFPUC				Tuolumne River watershed (pre-1914 rights) Runoff from Alameda and Peninsula watersheds (pre-1914 and post-1914 rights)	Local GW	Regional GW (conjunctive use)		Recycled water
Valley Water	SWP contract (Delta diversions)	CVP contract (Delta diversions)		Local runoff (post-1914 rights)	Local GW (conjunctive use)		Semitropic Water Storage District (Kern County)	Recycled and purified water
Zone 7	SWP contract (Delta diversions)			Local runoff (post-1914 rights)	Local GW (conjunctive use)		Semitropic Water Storage District and Cawelo Water District (Kern County)	

2.1.2 Assets for Bay Area Transfers and Exchanges

California has an extensive water infrastructure network that may support transfers and exchanges. However, a pre-requisite for a successful transfer or exchange is the presence of physical systems between the supply source and the agency receiving the water, either directly or indirectly.

Often referred to as the "hub" of water movement in California, the Delta links areas in northern California where water supply is generally more abundant (north of the Delta) to areas where water is less abundant (west and south of the Delta). Two approaches for transferring supply to the Bay Area may be distinguished on a temporal basis; both rely on making water available for transfer (also referred to as "new water" or "real water"), a requirement further discussed in Step 3 (Section 2.3).

1. **Through-Delta conveyance.** Most commonly in transfers to the Bay Area, water supply is made available for transfer by taking measures to reduce the seller's diversion upstream of the Delta in the Sacramento Valley. The offset of supply can then be moved to the Bay Area through diversions at EBMUD's Freeport Water Facility or at Delta intakes owned by DWR, Reclamation, or CCWD.
2. **Off-stream storage and refill.** In some cases, water can be delivered to off-stream storage west and south of the Delta (e.g., San Luis Reservoir) or locally (e.g., LV Reservoir), or to groundwater banks, for later use in dry years.

Use of these pumping and conveyance facilities is contingent upon approval from respective owners and operators and may be limited due by operational constraints.

Despite a lack of direct physical connection, California's extensive water infrastructure network and institutional framework can sometimes support strategies to move water from one point to another by way of water exchanges. All types of transfers typically require securing temporary changes to water rights and addressing operational or institutional complexities. As the number of systems and owners/operators involved increase, so do the number and complexity of operational and institutional issues that need to be addressed.

To conduct a transfer or exchange, opportunities and limitations of existing infrastructure comprising the Bay Area's water systems must be considered. Figure 2-2 shows the location of key water conveyance infrastructure in the region that is owned by BARR Partners or accessible to some subset based on contracts. Table 2-2 summarizes the conveyance infrastructure and local surface storage facilities owned and/or accessible to each of the BARR partners, including project facilities owned by the federal and state governments.

2.1.2.1 SWP/CVP Systems

Water transfers from willing sellers to willing buyers in California occur in almost all dry and critically dry years, and in some below-normal years. Transfers from north of the Delta to SWP or CVP contractors south of the Delta can occur when the SWP or CVP systems have capacity beyond that needed to convey supply to respective contract-holders under existing contracts. CWC Section 1810 applies to all California water agencies and requires DWR to accommodate SWP facility use among non-contract-holders in times of excess system capacity.[3]

[3] See Appendix B for more information on Section 1810. Further information is also available through a review of past water transfers on DWR's Water Transfer webpage and in *Background and Recent History of Water Transfers in California*.

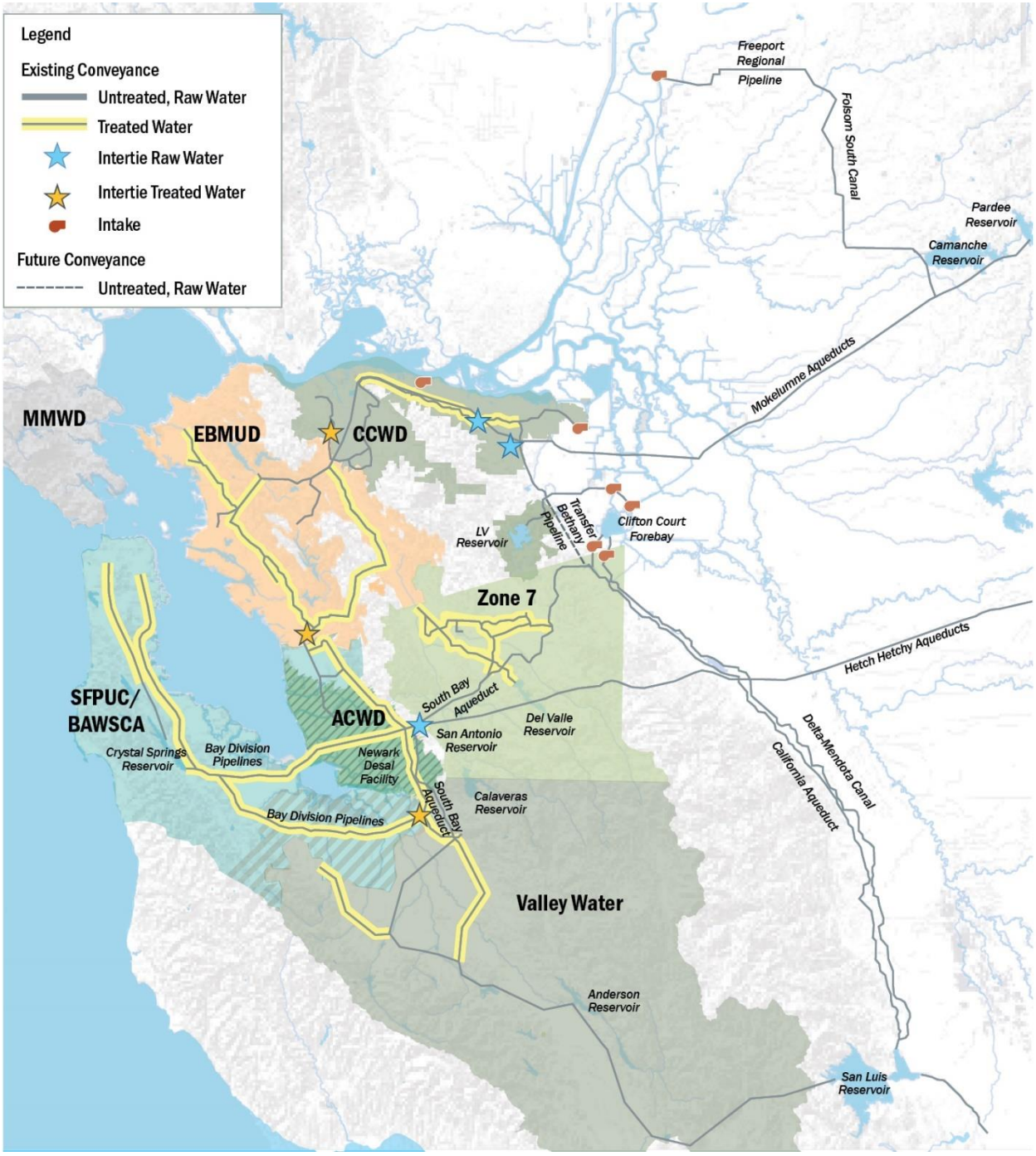


Figure 2-2. General map of BARR Partners' service areas and existing water infrastructure.

(Hatched areas of the map indicate areas that are served by more than one Partner Agency.)

Table 2-2. Bay Area Infrastructure and Facilities Pertinent to Regional Shared Water Access

	Infrastructure and Facilities							
	Surface Water Systems				Groundwater		Reuse	
BARR Partner	SWP	CVP	Wholesale supply or long-term transfer	Conveyance and storage under individual water rights	Local/ Regional	Out-of-region groundwater banks	Recycled/ purified water	Interties between treated and/or raw water systems
ACWD	SBA Lake Del Valle Banks Pumping Plant California Aqueduct San Luis Reservoir		SF Regional Water System (RWS)		Local GW basin	Semitropic groundwater basin		
BAWSCA			SF RWS					
CCWD		Contra Costa Canal		Delta intakes (at Old River, Middle River, Mallard Slough) LV Reservoir			Local distribution	EBMUD (treated and raw)
EBMUD		Freeport Regional Water Facility Folsom South Canal Connection		Mokelumne Aqueducts Local surface water reservoirs	Local GW basin	Pilot GW banking project in San Joaquin County	Local distribution	CCWD (treated and raw) SFPUC (treated; emergency uses)
Marin Water			Russian River Aqueduct	Local surface water reservoirs				
SFPUC				SF RWS Local surface water reservoirs	Local/ regional GW basins		Local distribution Onsite reuse systems	EBMUD (treated, emergency uses) Valley Water (treated, emergency uses) SBA turnout (raw)
Valley Water	SBA Banks Pumping Plant California Aqueduct San Luis Reservoir	Jones Pumping Plant San Luis Reservoir San Felipe Division		Local surface water reservoirs	Local GW basin	Semitropic groundwater basin	Local distribution	SFPUC Intertie
Zone 7	SBA Lake Del Valle Banks Pumping Plant California Aqueduct San Luis Reservoir			Lake I and Cope Lake	Local GW basin	Semitropic and Cawelo GW basins		

The current Biological Opinions that regulate SWP and CVP operations in the Delta limit the allowable timeframe for diverting transferred water at the SWP and CVP pumping plants (Banks and Jones, respectively) to five months: July through November. In some cases, this "transfer window" constrains the amount of supply that can be transferred across the Delta.

To use either the CVP or SWP facilities, a water conveyance agreement is needed. DWR and Reclamation have prepared guidance for obtaining a water conveyance agreement in the *Draft Technical Information for Preparing Water Transfer Proposals* (also referred to as the *Water Transfer White Paper*), which is updated almost every year to reflect new information. Changes are kept to a minimum to provide some stability to entities that wish to conduct water transfers using SWP or CVP facilities. The white paper outlines information needed to pursue a water transfer that proposes use of CVP or SWP facilities in the Delta.

2.1.2.2 Local Storage for Regional Benefit: Los Vaqueros Reservoir Example

The BARR Partners are exploring opportunities to use local surface water storage for regional benefit. One example of this strategy involves use of CCWD's LV Reservoir. In addition to CCWD's individual water rights to divert and store Delta supply in LV Reservoir, CCWD's CVP contract also allows for diverting water from the Delta for direct use and/or storage in the reservoir. In most years, CCWD's diversions under its CVP contract are sufficient for meeting customer demands. Thus, CCWD typically uses LV Reservoir to improve water quality by blending freshwater runoff captured in the watershed with Delta diversions to reduce salinity of water delivered to customers. On occasion, CCWD uses supply in LV storage to meet customer demands when CVP allocations have been cut to 50 percent (2014) or, further, to public health and safety levels (2015, 2021, and 2022).

CCWD, along with local agency partners including many BARR partners, is undertaking the LV Reservoir Expansion (LVE) project to raise the existing dam and expand the storage volume from 160,000 acre-feet (AF) to 275,000 AF. The project also includes construction of the Transfer-Bethany Pipeline to connect LV system to the California Aqueduct near Bethany Reservoir. The California Aqueduct delivers water to the South Bay Aqueduct, a SWP facility owned by DWR and a key conveyance facility for importing Delta supply to the Bay Area. The main objectives of the expansion are to increase water supply reliability for municipal, industrial, and agricultural customers and to support ecosystem benefits to south-of-Delta wildlife refuges and Delta fisheries.

While the existing reservoir is owned and operated by CCWD for the benefit of its ratepayers, CCWD will operate the LVE project to yield regional benefits. CCWD and the LVE project local agency partners (many are BARR/SWAP participants) formed a Joint Powers Authority (JPA) in October 2021 to manage and finance the LVE project. LVE construction is expected to be complete by 2029.

With agreement from CCWD, JPA members could make use of LV Reservoir's storage capabilities. Options to make use of this storage will be simpler once Transfer-Bethany Pipeline directly connects LV Reservoir to the California Aqueduct.

2.1.2.3 BARR Partners' Interties

As noted in Table 2-2, interties (or physical connections) currently exist between several BARR Partners' water transmission systems. Intertie facilities typically include pipelines, pump stations, and/or pressure regulating valves to allow transfer of water supply between systems. Some BARR Partners' interties are limited for use only in emergencies.

Use of interties is typically contingent on various factors and requires reaching mutually agreeable terms. Among other considerations, the following must be confirmed:

- Agreement between system/facility owner(s) specifying terms and conditions of approved use
- Roles and responsibilities, including operations and maintenance of intertie facilities and cost-share
- System capacity, hydraulics, and pressure regulation
- Water quality compatibility
- Effective life of agreement (start and expiration date)

2.1.3 Operational Complexities

When planning water transfers, operational aspects need to be reviewed and addressed early to allow flexibility for adapting to changed conditions. Water transfers add additional operational complexity to the normal operations of conveyance systems. The sellers need to change operations or work with their water customers to make "new water" available to the system. This could be changes in consumptive use by taking crops out of production, pumping groundwater or releases of water from storage. There are constraints of how much those normal operations can be changed that have to be taken into consideration. For the buyers, these issues include the flexibility of taking the transferred water into their system, and how changes in water quality may affect their water treatment operations.

In addition to direct impacts to sellers' and buyers' operations, there are also operational flexibility issues related to any third-party agencies that are needed to help convey the water, such as DWR and Reclamation. For example, SWP and CVP have limited windows of excess pumping and water conveyance capacity through the Delta that need to match up with the timing of the proposed transfer and the availability of the source water.

When there is more water in the Bay-Delta watershed than needed to meet the needs of all water users and Delta outflow requirements, the Delta is said to be in "Excess Conditions." Adding water to the system in the form of a water transfer under excess conditions provides no benefit quantifiable by SWP/CVP water accounting and is therefore not likely to be approved by DWR and Reclamation. Water transfers can only happen when the system is in "Balanced Conditions," meaning that the SWP/CVP are controlling operations to maintain Delta outflow needs, and if they are going to move the water, they need to have excess capacity available. Furthermore, when the transfer or exchange would result in an increase of exports from the southern Delta, additional outflow (known as "carriage water;" see Appendix A for additional information) must be provided to maintain compliance with Delta salinity standards.

2.1.4 Critical Success Factors

Critical success factors can be used to gauge the success of water transaction implementation (Step 5) and should be developed in Step 1. In developing this regional program and roadmap, a set of critical success factors were developed and then elaborated upon with input from the Stakeholder Task Force. The following represents desired objectives BARR Partners can strive to achieve in implementing BARR SWAP:

1. Before planning and executing a water transfer or exchange, assess regulatory framework, impacts, and benefits considering the following:
   - Opportunities for achieving multiple benefits and avoiding negative impacts
   - Principle of "do no harm"

   - System-wide needs and impacts across various hydrologic years and water users (e.g., urban/M&I, agricultural, and environment)
2. Leverage opportunistic strategies at hand, such as:
   - Development of alternative water supplies
   - System scale and size and potential existing interconnections
   - Surplus supply management especially for existing storage facilities
3. Evaluate available information and funding opportunities:
   - Water transfers and exchanges are just one tool, among many, in BARR Partners' water management toolboxes. BARR Partners will implement SWAP along with their broader portfolio of strategies for managing their respective systems
   - Consider quality and purpose of tools when evaluating source/destination/system of travel
   - Form partnerships to generate greater funding opportunities

2.2 Step 2: Learn the Applicable "Rules of the Road"

Being familiar with the "rules of the road" improves the ease and success rate of executing a water transfer or exchange. As reflected in the flowchart and accompanying insets in Appendix C, the rules vary depending on several factors that build on Step 1 (determining accessibility to a supply based on existing water rights, wholesale purchase agreements, and/or contracts) and involve identifying required actions based on source of supply.

For BARR Partners with access to wholesale or SWP/CVP supply, the long-term water purchase agreement/contract for supply may specify rules that affect use/transfer of that supply. Coordinating with the wholesale supplier or DWR/Reclamation (as applicable) is important early in the process.

In addition to a willing buyer and seller, several approval agencies may be involved in the transfer or exchange depending on the scope of the process and water rights impacted. Roles and responsibilities of key agencies are summarized in Table 2-3.

Approval of a water transfer is an involved process meant to promote responsible transfers (DWR, 2012). Rules in the California Code of Regulations (CCR) and California's Water Code (CWC) provide conditions that must be met to ensure a responsible transfer. (Refer to Appendices A and B for additional explanation of these conditions and the relevant CWC sections.) At a basic level, these conditions include:

- No injury to other legal users of water (CWC 1702, 1706, 1727, 1736, 1810).
- No unreasonable effects to fish or wildlife (CWC 1727, 1736, 1810).
- If the SWP or conveyance system owned by another public agency is used, no unreasonable economic impacts to the overall economy or the environment of the county from which the water is transferred (CWC 1810).

Table 2-3. State and Federal Agencies Responsible for Overseeing Water Supply Reallocations in California	
Agency	**Water Transfers/Exchanges Roles and Responsibilities**
State entities	
California Department of Fish and Wildlife (CDFW)	Trustee for the state's fish and wildlife resources with authority over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. When considering the appropriation of water, the CWC requires the State Water Board to consult with CDFW on water supply needs for fish and wildlife. CDFW staff review applications to appropriate new water sources, change existing water uses, and conduct water transfers.
California Department of Water Resources (DWR)	Water right holder managing SWP. Reviews and approves transfer that propose using SWP conveyance facilities and oversees responsible transfer that may affect its own water rights in the Delta. DWR's Water Transfers website (hyperlink embedded) provides checklists to help water managers with decision-making.
State Water Resources Control Board (State Water Board)	Regulates temporary and long-term water transfers of post-1914 appropriative water rights from individuals, municipalities, and water agencies/districts to others, including changes in point of diversion, place of use, and/or purpose of use. Some key resources (hyperlinked): • State Water Board's Water Transfers Program, with tables summarizing past water transfers (2009-2019) • Guide to Water Transfers (go-to reference to guide reader through CWC)
Federal entities	
U.S. Bureau of Reclamation (Reclamation)	Water right holder managing CVP. Owns and operates the CVP. The Central Valley Project Improvement Act of 1992 (CVPIA) authorizes the transfer of all or a portion of a CVP contractor's supply to any other California water user or water agency, state or federal agency, Indian tribe, or private nonprofit organization for project purposes or any purpose recognized as beneficial under state law. Several key resources (hyperlinked): • Reclamation Mid-Pacific Region Water Transfer Information • Reclamation NEPA Environmental Documents • Example Project: Water Transfers for the San Luis & Delta-Mendota Water Authority in 2014 • Technical Information for Preparing Water Transfer Proposals
U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries)	SWP and CVP operations are governed by regulatory restrictions, including Water Right Decision 1641 (D-1641), the 2019 USFWS biological opinion for the coordinated long-term operations of the CVP and SWP, and the 2020 CDFW incidental take permit (ITP) for SWP. SWP and CVP export facilities can only convey transfers over a five-month window, July through November, consistent with biological opinions issued by the USFWS and NOAA Fisheries for CVP and SWP operations. To move water through the Delta outside the existing transfer window, a buyer or seller must first consult with USFWS and NOAA Fisheries. Some key resources (hyperlinked): • Water Project Operations • Biological Opinion on Long Term Operation of the Central Valley Project and the State Water Project

2.3 Step 3: Determine Amount of Water Available for Transfer

To make water available for transfer, the seller (or transferor) must take measures to develop new water—meaning, supply that would not be present otherwise—to confirm the proposed transfer will not cause injury to other users or the environment. The determination of water available for transfer needs to be established before beginning the activity that makes new water available for transfer. (See the 2019 *Water Transfers White Paper* for more detail.)

Making new water available to the system requires some accounting to determine the amount of water made available. The accounting starts by defining a baseline for comparison against conditions after taking measures to reduce the transferor's diversion. The water accounting must then balance out the water being transferred or exchanged with respect to the baseline and the new water added to the system. The new water made available by the seller frees unused surface water supply for transfer and use by others. In almost all water year types including some droughts, substantial amounts of water have been successfully developed and transferred using the following approaches.

- **Agricultural conservation**: Seller reduces consumptive agricultural water use by crop shifting (i.e., growing a less water-intensive crop) or idling crops out of production
  - **Crop idling**: Growers idle fields that would have been planted during the transfer season absent the transfer; the amount of water made available for transfer is based on the reduction in consumptive use, calculated as ETAW.
  - **Crop shifting**: Involve a change in crops planted by a grower, substituting a lower water using crop (one with a lower ETAW) for a more water intensive crop. A cropping history is required to establish baseline cropping patterns. The water available for transfer due to crop shifting is the difference between the ETAW of the historic crop type and the alternate lower water intensive crop.
  - **Water conservation**: Measures that result in a reduction in the consumptive use of water or prevent water from discharging to an unusable water supply can make water available for transfer.
- **Groundwater substitution**: Seller pumps groundwater (that would otherwise remain in the aquifer) instead of diverting the same amount of supply, thereby making the forgone surface diversions available to another user downstream for the period of the transfer.
- **Reservoir reoperation**: Seller relies on water in storage (that would otherwise remain in storage) instead of diverting the same amount of supply. Alternatively, this may involve an increased release of water from a reservoir compared to normal operations; the transfer water is conveyed downstream to a new point of diversion either within or outside the watershed.

The 2019 *Water Transfers White Paper*, defines several steps and a simple calculation for determining the amount of water available for transfer, using the groundwater substitution approach as an example.

2.4 Step 4: Establish Agreements Among Participants

Before conducting a water transfer or exchange, participating water suppliers must establish mutually acceptable terms and conditions, as typically formalized in executed agreements. In addition to the seller (transferor) and buyer of transferred supplies, participants could also include the owners and operators of conveyance systems whose facilities are proposed for use in conducting the transfer despite being neither the seller nor the buyer—an activity typically referred to as *water wheeling*.

Some aspects typically specified in these agreements include the following:

- Conditions for transfer/exchange
- Refill agreements, if using storage (or reservoir reoperation)
- Operations
- Cost-sharing
- Facility use fee, if wheeling water or storing supply in another water supplier's facility

In addition to the above, it is also prudent to assess water exchange ratios and clarify conditions for the exchange rate.

2.5 Step 5: Implement Transaction and Meet Critical Success Factors

Successful implementation can be measured by the ability to complete the water transaction and meet critical success factors developed in Step 1. Understanding potential challenges and how to

overcome these challenges is an important component of successful implementation. Because of the regional nature of water transfers and exchanges and based on past experiences and understanding of the Bay Area water system, there are several common challenges that need to be accounted for in the development of future BARR SWAP opportunities. Challenges may manifest in the form of physical, operational, or institutional complexities as discussed in this section. Identifying complexities early in the process can also lead to better preparation and identification of opportunities to advance the regional shared water program.

2.5.1 Institutional Complexities

Institutional complexity of water transfers results from each institution's need to fulfill their responsibility as defined by the CWC, social and environmental concerns, financial obligations, and general economic interests. Refer to Appendix A for additional explanation of the water rights process and insights into institutional complexities that may arise because of the different types of water rights involved, as well as permitting or modifying water rights.

Approval Oversight. As noted in PPIC's report *Improving California's Water Market* (PPIC, 2021):

> "State Water Board approvals are required for transfers of rights permitted since 1914, and the environmental review requirements of the California Environmental Quality Act (CEQA) apply to all transfers that may have significant environmental impacts—including transfers of the more senior 'pre-1914' water rights. In addition, entities that hold rights to water on behalf of their members—including the CVP and SWP as well as local water districts—set rules for the trading of this water. The CVP, the SWP, and various local entities also have rules on how parties may use their storage and conveyance infrastructure to transfer water."

A schematic flow chart in Appendix D helps with identifying the state and/or federal agency responsible for oversight and approval of transfers based on circumstances.

California Water Code. As mentioned in Section 2.2 and further discussed in Appendices A and B, the CWC calls for three basic requirements that need to be met to allow a water transfer to proceed:

1. No resulting harm (no injury) to other legal users of water (CWC 1702, 1706, 1727, 1736, 1810),
2. No unreasonable effects to fish or wildlife (CWC 1727, 1736, 1810), and
3. If the SWP is used or the facilities of another public agency are used, no unreasonable economic impacts to the overall economy or the environment of the county from which the water is transferred (CWC 1810).

Building on those basic requirements, the State Water Board, DWR, and Reclamation have developed procedures that need to be followed for the approval of water transfers that fall within their jurisdiction. For example, there is a requirement that a water agency wishing to do a water transfer needs to take actions that makes "new water" to the system that would not otherwise be there absent their actions (see Section 2.2). There are technical details for these requirements that need to be met to make sure the water rights of others are not injured. This adds complexity to getting a water transfer approved but is necessary to protect other legal users of water.

To some extent, the institutional complexities of water transfers in California arise from the history of water right law in the state, which has developed into a unique system of different kinds of rights, each with their own set of conditions. For example, pre-1914 surface water rights, post-1914 surface water rights, and groundwater rights all have their own provisions as specified in the CWC. Additional details of the different types of water rights and the permitting process are presented in Appendix A.

2.5.2 Environmental Protections

For short-term water transfers, the State Water Board's process may substitute for compliance with CEQA when water code section 1725 is used. The main difference is that the test for short-term transfers is "no unreasonable effects," instead of CEQA's "no adverse effects". This is a subtle but important difference. Environmental requirements in the operation of water projects under their water rights and the Endangered Species Acts can limit the timing of water transfers. An example of this is the "water transfer window" (July through November) for conveying transfer water across the Delta for diversion at the Banks or Jones pumping plants in the southern Delta.

2.5.3 Financial Obligations

The seller and buyer of transfer water are each obliged to protect the financial stability of their organization and their water users. This comes up in the negotiations over the price set for the water transfer. In addition, any third-party agencies whose facilities are needed to facilitate the transfer have their own financial obligations.

For the sellers, their financial obligations include setting a price that compensates for the cost for taking the action that makes "new water" available for the water transfer plus an incentive for taking the action. Many times, this incentive is to encourage individual water users to participate in the program, for example, by reducing consumptive use. The incentive is also often used by the selling water agency to improve its water delivery infrastructure or that of the community, for example, flood control projects. Negotiating the right price for the water adds complexity to the process.

For the buyers, the financial obligations break down to their need for water in a certain year and whether the cost of the water is reasonable given other sources of water. This can be a complex assessment and may become even more complicated if it requires coordination among several water users with unique needs and priorities.

Third parties also need to be considered, comprising any entities who may not be directly involved in the water transfer but whose facilities are needed to make the water transfer work. This includes access to pumping facilities of the SWP or CVP or other conveyance capabilities. CWC Section 1810 requires that public agencies make their "excess" capacity available for water transfers but allows them to charge a reasonable fee for its use (see Appendix B for additional information). In addition, agencies like the DWR, Reclamation and the SFPUC have contract provisions related to the transfer of water to make sure that water transfers do not undermine the financial integrity of their water projects and are in the public interest. Navigating requirements and issues related to third-party agencies adds complexity but their cooperation may be critical in facilitating a water transfer.

2.5.4 Economic Interests

Water transfers are a voluntary process, and as such they are not likely to be successful unless they are in the economic interests of the entities involved. In addition, the economic interests of the communities impacted are a factor that adds complexity to water transfers. For example, taking land out of production for a water transfer may be beneficial for the seller and the buyer in the short run. However, if those transfers take place over multiple years in a row, it could affect the service capabilities of the farming community. Services like land preparation, aerial spraying, seeding, weeding, and harvesting could be affected over the long-term and should be taken into consideration by the sellers. There are similar considerations for groundwater substitution water transfers that could affect groundwater levels in the long run and impact compliance with Sustainable Groundwater Management Act (SGMA). In either case, developing monitoring and protection programs to protect community interests adds complexity to the proposed water transfers.

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Section 3

Using the Roadmap

BARR Partners conducted three pilots that test proof of concept for exchanges that had not previously been tested. The pilots also demonstrate how the roadmap can be applied for planning, developing, and executing water transfers or exchanges. These pilots exemplify the implementation process, operations, and actual costs and contribute to lessons learned as part of developing the BARR SWAP Roadmap. While pilot transactions were selected to meet specific criteria (described in Section 4.2) and test specific concepts, critical success factors were not explicitly developed and evaluated. Appendix F includes additional details on pilot selection.

The three pilot water transactions are exchanges that test an equitable swapping and accounting of shared resources and supported understand which mechanisms are available to be used for water transactions in a drought. Furthermore, Pilot 2a is an exchange because the infrastructure to move water from Los Vaqueros Reservoir to Valley Water does not yet exist. Pilot 3 is an exchange because of EBMUD's operational preference to use Freeport rather than take water from Los Vaqueros Reservoir.

3.1 Pilot 1a: Investigating Alternative Supplies to Improve Supply Reliability (SFPUC/BAWSCA and ACWD)

This pilot is a desktop study to simulate a scenario related to the LVE project. Along with other BARR Partners, SFPUC and ACWD are participating in the JPA for LVE. SFPUC is planning to reserve up to 40,000 AF of dedicated storage in LVE to supplement water supplies, particularly for drought supply reliability. Pilot 1a simulated the physical conveyance and tested institutional feasibility of water exchanges to benefit SFPUC/BAWSCA. It demonstrated how alternative water supplies obtained by SFPUC or a BAWSCA agency, such as ACWD, could allow other RWS customers to obtain the foregone RWS supply.

Figure 3-1 provides a conceptual graphic overview of Pilot 1a, including a map showing direction of water flow and sequentially numbered steps in a “How it Works” section.

3.1.1 Step 1: Define Starting Point and Destination

Pilot 1a assumes a future scenario in which the facilities of LVE are in place and one or more Partners of this pilot participate in the transfer via exchange. The pilot also assumes that SFPUC has opted-in to LVE with 40,000 AF of storage and that 20,000 AF of supply stored in LV is available for delivery immediately. Based on delivery of 20,000 AF in a single year, this pilot concept is composed of two delivery points and is envisioned to occur over two consecutive critically dry years:

- **ACWD:** Delivery of up to 4,000 AF from SFPUC stored water in LVE to ACWD in exchange for ACWD foregoing a similar amount of its SFPUC contract water for use by SFPUC/BAWSCA members (ACWD is a wholesale customer of SFPUC and a BAWSCA member agency).
- **SFPUC:** Delivery of up to 16,000 AF of SFPUC stored water in LVE for delivery through the SBA to San Antonio Reservoir.

While these delivery assumptions are illustrative and may not represent actual future delivery scenarios, they were selected to be large enough and over a short enough period to test physical, institutional, and regulatory constraints that could impact deliveries in a single drought or in recurring drought scenarios that would require long-term water transfers. Beyond droughts, Pilot 1a has potential applications for other periods when storage may be available in ACWD's service area or the RWS. The pilot defined the contractual arrangements needed to facilitate either a single-year or long-term in-lieu exchange involving deliveries through the SBA and provided an understanding of the potential water quality impacts and treatment needs associated with a new source of supply into San Antonio Reservoir and Sunol Valley WTP. Pilot 1a also estimated ACWD costs to facilitate the exchange. Table 3-1 depicts the various aspects of deliveries that are being tested by this pilot.

Table 3-1. Pilot 1a Deliveries to be Tested

Delivery Points of Exchanged Supply	Single Drought Event over Two Consecutive Years (temporary impact)	Recurring Drought Events (long-term or permanent impact)
Delivery to ACWD service area and system	• Potential for exchange (with capacity of existing infrastructure) • Water supply agreement waivers or exceptions needed • Accounting of benefits derived from exchange • Impact on minimum purchase	• Potential for exchange (with new infrastructure if needed) • Institutional mechanisms or changes needed to enable recurring exchange • Accounting of benefits and distribution of costs among other RWS customers • Impact on minimum purchase • Potential for deliveries during non-drought periods with available storage
Delivery to SFPUC RWS at San Antonio Reservoir or Sunol Valley WTP	• Potential impacts to water quality and mitigation of impacts • Agreement for use of SBA	• Potential impacts to water quality and mitigation of impacts • Agreement for use of SBA • Risks and additional mitigation actions needed • Potential for deliveries during non-drought periods with available storage

3.1.2 Step 2: Rules of the Road

Table 3-2 highlights Pilot 1a preparation, including regulatory and contract-based requirements, permits that would need to be acquired, and potential changes to existing water rights.

Table 3-2. Pilot 1a Preparation Highlights

Item	Pilot 1a
Key Regulatory/ Contract Requirements	• ACWD's individual water purchase contract with SFPUC includes a clause for a minimum purchase guarantee. • While a short-term drought transfer is allowed, a long-term transfer via exchange that extends to normal years would require amending the Amended and Restated Water Supply Agreement between the City and County of San Francisco and Wholesale Customers (WSA) dated November 2018.
Environmental Compliance	• California Environmental Quality Act (CEQA) exempt; a public agency is required to comply with CEQA to complete a water transfer, but under CWC Section 1725, short-term transfers are exempt. • Long-term transfer agreement requires CEQA, e.g., SFPUC's acquisition of 20,000+ AF for LVE, regardless of delivery mechanism, requires CEQA. • Infrastructure improvements to upsize or modify a turn-out on the SBA and intertie to SFPUC's San Antonio Reservoir may be subject to CEQA.
Water Rights Changes/Requirements	No changes are needed except for the SFPUC storage of water in LVE.

For the second part of this desktop pilot, the BARR partners assumed that deliveries through the SBA could be made based on modeled future capacity at Reach 7 of the SBA. Additional efforts are underway to facilitate coordination among the agencies currently served by the SBA, which include Zone 7, ACWD, and Valley Water (referred to as the SBA Contractors), SFPUC, the LVE JPA partners, and DWR. A draft write-up of operation guidelines for conveying and delivering LVE supply through the future Transfer-Bethany Pipeline lays out the LVE partners' needs and constraints for delivery and is considered the first step in establishing the process and timeline for developing future conveyance agreements. Direct deliveries to SFPUC will occur through Reach 7 of the SBA in critically dry years and only when the SBA has available conveyance capacity after all three South Bay Contractors' demands are met.

Though public agencies must comply with CEQA to conduct water transfers, short-term transfers are CEQA exempt per CWC Section 1725. The one-time water transfer under this pilot study is considered short-term. The infrastructure work that would be required to upsize or otherwise improve the turn-out may be subject to CEQA.

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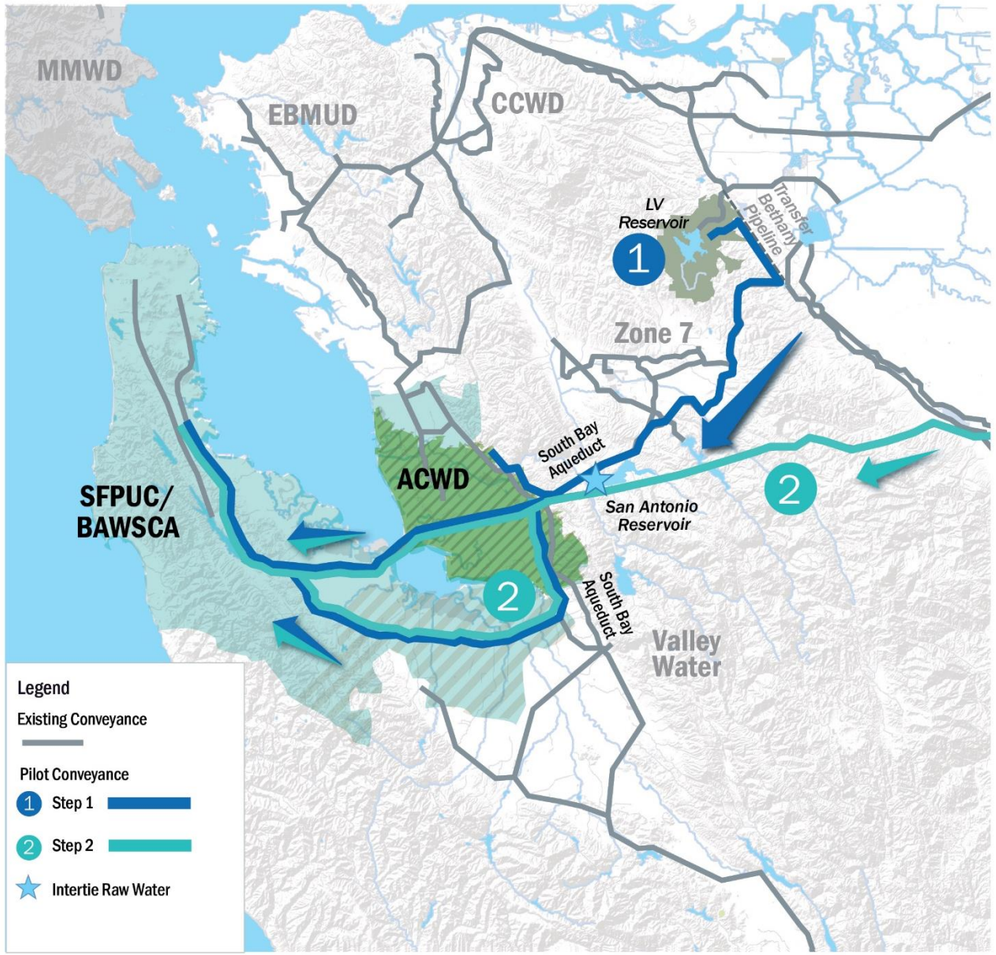
Pilot 1a at a Glance

Simulated exchange of supply stored in LV Reservoir to ACWD and SFPUC, plus wholesale supply offsets that benefit other BAWSCA agencies.

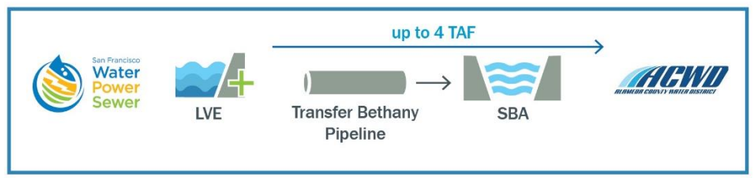
Pilot 1a is a desktop simulation that demonstrates conveyance and institutional agreements that can ultimately benefit SFPUC Regional Water System (RWS) wholesale customers (BAWSCA agencies) and assesses potential impacts of delivering supply from the South Bay Aqueduct (SBA) directly to SFPUC's San Antonio Reservoir.



How it Works:

1 SFPUC would store at least 20 TAF in CCWD's LV Reservoir Expansion (LVE). Of the 20 TAF, SFPUC would convey 16 TAF through the future Transfer-Bethany Pipeline and existing South Bay Aqueduct, then an intertie connecting to the SFPUC RWS at San Antonio Reservoir. Once treated, the supply would travel through the RWS to SFPUC customers, increasing the overall supply within SFPUC's system.

In lieu of purchasing up to 4 TAF of wholesale supply from SFPUC's RWS, ACWD would purchase an equivalent amount from SFPUC's supply stored in CCWD's LVE.



2 In-Lieu Exchange

The foregone purchase of up to 4 TAF by ACWD would become available for purchase by other SFPUC customers.

Figure 3-1. Conceptual overview of ACWD and SFPUC/BAWSCA desktop exchange simulation (Pilot 1a)

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3.1.3 Step 3: Identify Water Available for Transfer

This pilot assumes SFPUC has opted-in to LVE with 40,000 AF of storage and that 20,000 AF of supply stored in LV is available for delivery immediately. Of that amount, ACWD would receive up to 4,000 AF of water supply from LVE conveyed through the SBA for use in ACWD's service area. This in-lieu exchange would allow ACWD to forego an equivalent amount of water purchases from SFPUC that could instead be made available to RWS customers. In addition, this pilot envisions delivery of up to 16,000 AF from LVE directly to the San Antonio Reservoir (an SFPUC facility, part of the San Francisco Regional Water System [RWS]) via the SBA (a state-owned facility, part of the SWP). The direct delivery to San Antonio Reservoir would increase supply availability to RWS customers.

3.1.4 Step 4: Establish Agreements Among Participants

ACWD, BAWSCA, and SFPUC have existing institutional agreements in place that facilitated participation in Pilot 1a. The following are highlights from the term sheets that participants agreed to for the desktop pilot scenario:

- Assume that SFPUC has opted-in to LVE with 40,000 AF of storage and that 20,000 AF of supply stored in LV is available for delivery immediately.
- Of the 20,000 AF stored by SFPUC, ACWD would purchase up to 4,000 AF of supply delivered via the SBA to ACWD as an in-lieu exchange. ACWD would be responsible for treating the up to 4,000 AF supply from LV. ACWD will forego up to 4,000 AF of supply from SFPUC's RWS, making that supply available to other RWS customers.
- SFPUC will reimburse ACWD for facility and treatment costs use.
- SFPUC, BAWSCA, and ACWD are each responsible for their separate/respective staff time.

The participating Pilot 1a Partners do not anticipate that an amendment to the *Amended and Restated Water Supply Agreement between the City and County of San Francisco and Wholesale Customers* (WSA) dated November 2018 would be required. Under a permanent or multi-year exchange via transfer scenario, SFPUC and its wholesale customers would adopt an amendment to the WSA to include additional provisions (see Appendix G for additional details).

Table 3-3 provides a summary of the Pilot 1a partners and their roles.

Table 3-3. Pilot 1a Partners and Roles

Partner	Role in Pilot
ACWD	Receive up to 4,000 AF of additional surface water via the SBA and in return reduce RWS water purchases from SFPUC by an equivalent amount.
BAWSCA	Facilitate the contractual arrangements needed to facilitate either a single-year or long-term in-lieu water exchange.
SFPUC	Account for reduced water purchases from ACWD of up to 4,000 AF for the benefit of RWS customers. Receive up to 16,000 AF of additional surface water from LVE storage via the SBA to San Antonio Reservoir.

3.1.5 Step 5: Implement Transaction

To demonstrate Pilot 1a's feasibility, ACWD simulated a scaled-down version of the Pilot 1a in-lieu exchange concept in September 2020. This month-long desktop simulation included a physical test of SBA delivery and ACWD's production facility capacity by modifying production rates to accommodate a predetermined volume of transfer water for exchange. During the month of September, ACWD reduced RWS imports by 190 AF and increased SBA imports and Water Treatment Plant 2 production by a similar amount.

If carried across the full year (12 months), this represents around 2,300 AFY of reduced SFPUC usage. Based on WTP2 production capacity, water temperature concerns, and distribution system considerations, to carry out the full 4,000 AFY exchange concept of Pilot 1a in practice, ACWD would have to recommission WTP1.

As shown in Table 3-4, ACWD's Production Optimization Model concluded that compared to the existing baseline without Pilot 1a implementation ACWD's capacity for exchange would be limited to 591 AF without recommissioning WTP1 as a one-time or intermittent transaction and increased to 4,100 AF with recommissioning WTP1 (i.e., a continual annual volume).

Table 3-4. ACWD's Potential Exchange Capacity for Pilot 1a

Scenario	ACWD's Stored Supply Purchase (AFY)	ACWD's SFPUC RWS Minimum Purchase Obligation	ACWD's Purchase from SFPUC RWS (AFY)[a]	WTP1 Annualized Production (AFY)	Potential Exchange Capacity (AFY)
A	0	Applicable	8,602[b]	0	0
B	4,000	Waived	8,011	0	591
C	4,000	Waived	4,502	4,502[c]	4,100

a. *Reference for ACWD Demand Source: Draft 2020 UWMP (December 2020)*
b. *ACWD's minimum purchase obligation contract amount: 8,602 AFY (8,567 AF + 0.4% buffer).*
c. *The firm operational capacity of WTP1 is estimated at 7.33 million gallons per day, or 8,215 AFY if operating continuously. ACWD estimates total water production at 95 percent of firm operational capacity (equivalent to 7,808 AFY) at WTP1 in the pilot project.*

The desktop study for Pilot 1a assumes several conditions for feasible implementation, including:

- Assumes that LVE is completed (including construction of Transfer-Bethany Pipeline) and either ACWD, SFPUC, or a BAWSCA member agency participates in the LVE JPA.
- Assumes that SFPUC will be able to move water through Reaches 1-7 of the SBA and either deliver water to San Antonio Reservoir through an existing turnout; future upsizing or upgrades may be needed for long-term use.
- The timing of these deliveries would have to coincide with periods of available capacity on the SBA in Reach 7 and the connected upstream reaches.
- Since ACWD is a SWP contractor, the pilot assumed no losses along the SBA according to its contract; although deliveries to San Antonio Reservoir may incur losses, none are assumed for this Pilot 1a.
- SBA capacity was estimated using the model developed by South Bay Contractors based on future expectations of demands and historic hydrology over DWR's 82-year planning hydrology (1922-2003). Brown and Caldwell refined the model in September 2020 in coordination with the South Bay Contractors. Under the direction of BAWSCA, Hazen and Sawyer used this model to perform a sensitivity analysis on the SBA capacity. Using Valley Water's projected 2040 demands and specific assumptions for future water supply and infrastructure projects, the sensitivity analysis concluded that annual SBA capacity availability over the 82-year planning hydrology is highly variable but anticipated to consistently accommodate 20,000 AFY in deliveries to SFPUC over two consecutive critically dry years. However, if SFPUC's LVE deliveries via the SBA were to occur only in summer months when San Antonio Reservoir levels are typically lower, the frequency of sufficient available capacity for 20,000 AFY would drop to only 56 percent of years out of DWR's full historic 82-year hydrologic record.

- Assumes water quality and invasive species issues would not be a constraint for direct deliveries to San Antonio Reservoir. SBA water quality typically deteriorates during dry years. However, a review of historical water quality data by SFPUC indicated some impacts that could be mitigated through monitoring, inspections, and potential treatment. Mitigation alternatives are subject to further screening and evaluation depending on stakeholder preferences for reliability and redundancy. Deliveries to San Antonio are likely to result in the unavoidable introduction of new invasive species into the RWS. While future additions or improvements may be required at Sunol WTP, none were assumed in Pilot 1a.

Appendix G provides details on the key items and resources utilized by each pilot partner, along with the cost calculation methodology. Deliveries through the Transfer-Bethany Pipeline are subject to a $14/AF usage fee. In addition, to use available SBA capacity, SFPUC is required to pay wheeling costs for use of the SWP infrastructure. DWR charges non-SWP contractors wheeling rates for energy and a capacity charge based on market rates for power secured through California Independent System Operator at the time the water is conveyed. These market rates can fluctuate significantly. These costs are directly assigned, and the intent is to isolate them from other energy costs on the SWP, which are pooled and assessed uniformly to all SWP contractors.

BAWSCA, SFPUC, and ACWD agreed Pilot 1a is intended to be exploratory in nature and is not intended to be an analysis or endorsement of this pilot as a cost-effective drought supply project. For the pilot itself, no participating agencies would recognize financial benefits. For implementation, SFPUC would consider paying for part or all of the recommissioning of WTP1, treatment costs for up to 4,000 AF water, and the estimated useful life of the recommissioned plant for 50 years. This does not include financing costs. Bringing in additional water should benefit all ratepayers. Since ACWD is forgoing its allocation of existing RWS water, the additional water would benefit RWS customers.

3.2 Pilot 2a: Examining Local Storage and Exchange of CVP Supply (CCWD and Valley Water)

The pilot was initially formulated to first store a portion of Valley Water's CVP supply in LV Reservoir, which would then be returned to Valley Water. Due to emerging severe drought conditions in 2020-2021, CCWD and Valley Water agreed to modify the pilot to provide Valley Water with vital additional water in the summer of 2021. For the first stage in July-September 2021, CCWD delivered 5,000 AF of water to Valley Water through an in-lieu Delta exchange, where CCWD used CVP water previously stored by CCWD in LV Reservoir instead of pumping CCWD's CVP contract supplies in the Delta, which made CCWD's CVP water available to be pumped at CVP's Jones Pumping Plant for delivery to Valley Water. For the second stage of the pilot, instead of requesting delivery of a portion of a future year's allocation to its service area, Valley Water will request that Reclamation deliver that water to CCWD for diversion at CCWD's Delta intakes, either for CCWD's direct use or for storage in LV Reservoir (Figure 3-2). The concept demonstrates how existing water allocations can be stored locally for use in drier years and how CVP water contractors can store water supply in LV Reservoir.

3.2.1 Step 1: Define Destination and Starting Point

This pilot concept was developed to explore the regulatory approvals and physical mechanisms necessary to use CCWD's LV Reservoir to store BARR Partners' existing water supplies for later delivery. This concept involves using Valley Water's existing CVP contract supplies from the CVP system and the Delta to test the storage and conveyance of a BARR Partner's water supply using CCWD's LV Reservoir and infrastructure. This pilot explores both the physical mechanisms for conveying the water to and from LV Reservoir and the institutional arrangements that CCWD and Valley Water need with Reclamation (which manages the CVP) as well as other permitting and regulatory approvals needed for that conveyance and storage. The specific findings of this pilot are

also broadly applicable to the greater BARR partnership, since it establishes one pathway for storing and delivering a BARR Partner's water using LV Reservoir. Storage of water supplies already available to BARR Partners under existing contracts or water rights during wetter years for delivery during droughts or other emergencies is a key component for enhancing regional water supply reliability.

3.2.2 Step 2: Rules of the Road

The ability to transfer or exchange water between CVP contractors is provided in each agency's respective CVP water service contract, subject to approval by Reclamation. Though this pilot falls within the BARR Partners' definition of a transfer via exchange, Reclamation staff determined that this pilot is best described as two separate transfers requiring separate approvals at each stage. This approval is meant to ensure that the exchange is consistent with Reclamation law and policy, meets all regulatory requirements for CVP operation, and does not adversely impact other contractors. It involves input and coordination among staff from various Reclamation departments, including contracting, operations, water rights, and environmental compliance. Reclamation performed a review of the exchange for compliance with NEPA, while CCWD and Valley files CEQA exempts with their respective counties. Pilot 2a also required an agreement between CCWD and Valley Water to outline the roles, responsibilities, and obligations of each agency. Execution of this agreement required approval by the CCWD board of directors and Valley Water's chief executive officer.

No water rights changes were required to facilitate the exchange due to Reclamation's previously secured order from the State Water Board approving the consolidated place of use for all CVP water rights, which allows for diversion and storage at CCWD facilities and other CVP facilities in the Delta, including Jones Pumping Plant. However, a thorough review of CVP water rights by Reclamation staff was required prior to Reclamation's approval of the exchange.

Table 3-5 highlights pilot project preparation, including regulatory and contract-based requirements, permits that needed to be acquired, and potential changes to existing water rights.

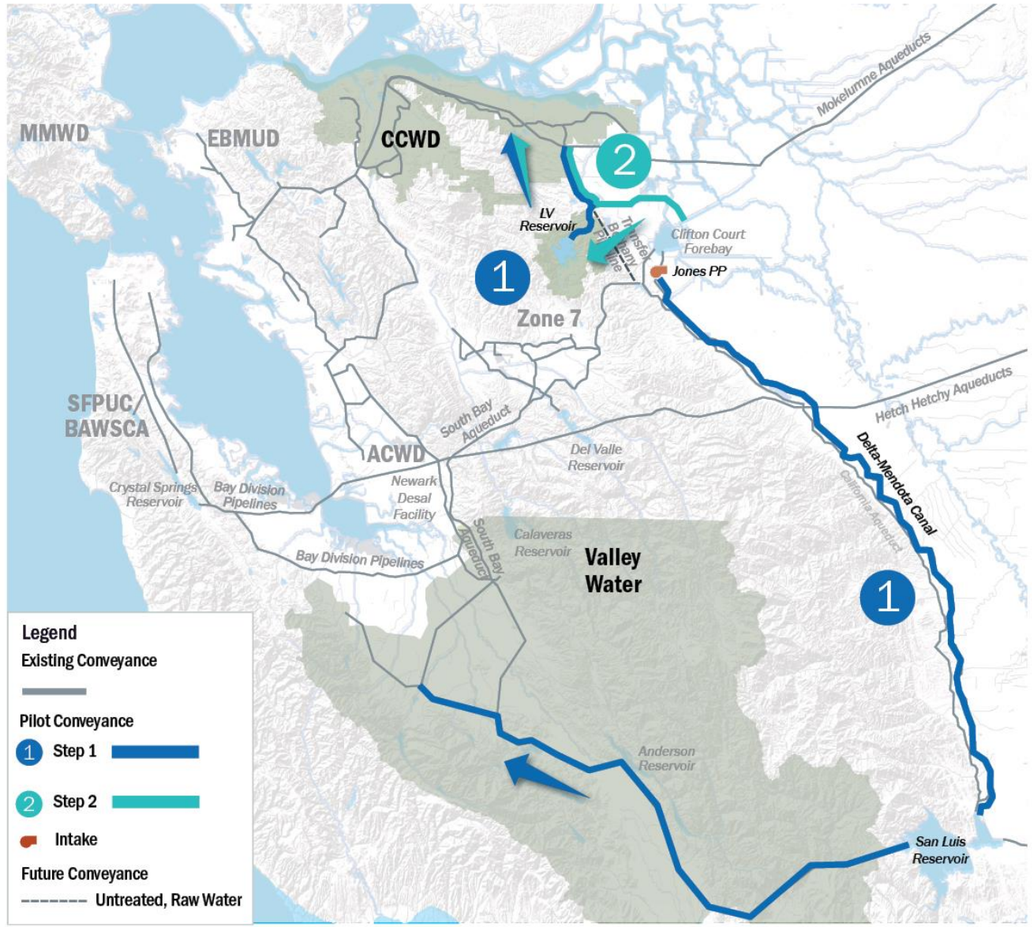
Table 3-5. Pilot 2a Preparation Highlights

Item	Pilot 2a
Key Regulatory/ Contract Requirements	Pilot 2a required: • Approval from Reclamation Contract Officer, pursuant to CCWD's and Valley Water's CVP contracts. • Coordination with Reclamation Central Valley Operations staff on schedule of transfer operations to confirm availability of contract water supply and CVP operational capacity.
Environmental Compliance	Permit: • Reclamation-issued National Environmental Policy Act (NEPA) Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), followed by letter of approval. • CEQA-exempt. Filed Notice of Exemptions (NOE) filed with Contra Costa and Santa Clara counties.
Water Rights Changes/Requirements	No water rights changes required, as confirmed by Reclamation and supported by the following: • CCWD and Valley Water are both CVP contractors within the authorized place of use of the applicable CVP water rights held by Reclamation. • CCWD's Rock Slough, Old River, and Middle River intakes are existing points of diversion for the applicable CVP water rights, and CVP's Jones Pumping Plant is the existing point of diversion for deliveries to Valley Water. • Existing CVP water rights allow CCWD to pump CVP water to storage in LV Reservoir, limited to re-diversion of previously stored CVP water. CCWD may also take delivery of CVP contract water directly to its service area without storing it in LV Reservoir.

Pilot 2a at a Glance

Exchange of stored CVP supply between CCWD and Valley Water

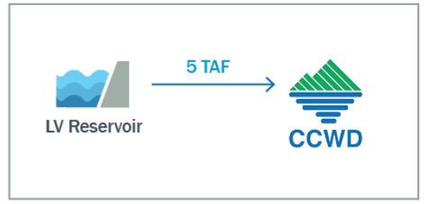
Pilot 2a demonstrates exchange of stored CVP supply between CCWD and Valley Water using Los Vaqueros (LV) Reservoir to test an approach for improving BARR Partner's storage flexibility from the Delta.

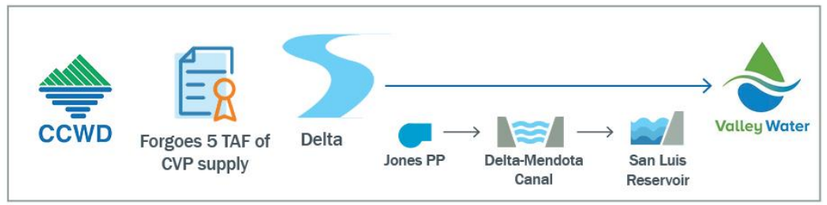


In-Lieu Delta Exchange

How it Works:

1 In lieu of diverting 5 TAF of CVP supply from the Delta, CCWD used supply stored in LV Reservoir, allowing Valley Water to divert CCWD's forgone CVP supply.





2 In a future year, Valley Water forgoes the same amount of CVP supply, allowing CCWD to divert that supply from the Delta in lieu.

Figure 3-2. Conceptual overview of CCWD and Valley Water storage exchange of CVP supply (Pilot 2a)

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3.2.3 Step 3: Identify Water Available for Transfer

To make water available to Valley Water for the first stage of the pilot, CCWD reduced diversions of its CVP water from its facilities in the Delta. Reclamation was then able to divert a like amount of water at Jones Pumping Plant for delivery to Valley Water. CCWD measured and kept accurate records of its releases from Los Vaqueros storage made in lieu of its CVP Delta diversions and maintained close coordination with Reclamation operations to facilitate the exchange. The water accounting required that the total amount of additional pumping at Jones Pumping Plant equaled CCWD's reduced diversions over the total period of the transfer (July-September 2021), but Jones Pumping Plant pumping did not need to match CCWD's reduced diversions on a daily basis. Pilot 2a was ultimately successful and found to be feasible and repeatable, although due to institutional constraints within Reclamation and pressures of the drought, the pilot participants chose to modify the original storage and exchange concept and perform what was intended to be the second leg of the exchange first, with the first leg (storage of a portion of Valley Water's CVP allocation) to follow in a future year.

3.2.4 Step 4: Establish Agreements Among Participants

CCWD and Valley Water Developed a water exchange/transfer agreement to facilitate Pilot 2a. The following includes highlights from the participants' term sheet for the pilot:

- A transfer of CVP contract water up to 5,000 AF from CCWD (seller) to Valley Water (buyer) in 2021 (Stage 1), followed by transfer of an equivalent amount of CVP supply from Valley Water (seller) to CCWD (buyer) in a subsequent year or years (Stage 2).
- CCWD and Valley Water will each pay Reclamation their respective contract water rates/charges for CVP contract water delivered to the other entity in a given contract year. In each of the two stages, the buyer will reimburse such costs to the seller.
- Valley Water will reimburse CCWD for the actual costs of power and facilities usage fees associated with conveying water to Los Vaqueros Reservoir for storage in Stage 2.
- CCWD and Valley Water are each responsible for their separate/respective staff time and related costs for obtaining approvals and coordinating operations.

Table 3-6 provides a summary of the pilot partners and their roles.

Table 3-6. Pilot 2a Partners and Roles

Partner	Pilot Role
CCWD	Transfer water to Valley Water – schedule CCWD CVP contract allocation to be delivered to Valley Water; operations coordination with Reclamation, diversion, and storage of water in LV Reservoir
Valley Water	Return transfer water to CCWD – schedule Valley Water CVP contract allocation to be delivered to CCWD

3.2.5 Step 5: Implement Transaction

For implementation of Pilot 2a, CCWD and Valley Water each agreed to pay their usual CVP rates and charges to Reclamation, as well as other applicable costs normally paid for CVP contract water in a year where up to 5,000 AF would be delivered to the other entity. Such normal CVP contract costs would be reimbursed by the other entity at the time of each transfer. Valley Water agreed to pay CCWD for the actual conveyance pumping power costs and facilities usage fees.

CCWD and Valley Water agreed to develop the pilot using in-house staff, making in-kind contributions to the BARR Program, and did not attempt to seek reimbursement from each other or the BARR Program for these costs. The costs for implementing the exchange are described in the exchange agreement between CCWD and Valley Water. It was agreed that the intent was that cost of the exchanged water would be neutral, or in other words, each entity would pay for the cost of CVP water as it normally would under its CVP contract. However, because the exchange was conducted using CCWD's existing diversion, pumping, conveyance, and storage facilities, Valley Water agreed to pay a unit-based charge (per acre-foot) for the use of these facilities. The basis for these wheeling charges included power use and wear and tear for these facilities. If, for any reason, CCWD and Valley Water do not complete the Stage 2 transfer of water from Valley Water to CCWD before December 31, 2023, CCWD's 2023 CVP water rate would be used to calculate Stage 2 water costs, and an additional charge of $20/AF, in consideration of the costs provided by CCWD, would apply to costs reimbursed from Valley Water to CCWD in 2023. This amount ($100,000) would be sufficient to compensate CCWD for in-kind services for implementing the pilot project.

Appendix G provides details on the key items and resources utilized by each pilot partner, along with the cost calculation methodology. The cost to CCWD is the same as for CCWD's operations absent this pilot project. Total net cost to Valley Water, as the dry-year beneficiary of the exchange, is estimated to be $976,350. If the water cannot be returned in Stage 2 to CCWD, an additional charge of $100,000 would apply. CCWD and Valley Water are each responsible for their own staff time and related costs for obtaining approvals and coordinating operations.

Pilot 2a is similar to other CVP-to-CVP transfers/exchanges commonly conducted between two south-of-Delta CVP contractors through Reclamation's Accelerated Water Transfer Program, with the key difference being that CCWD is not located south of the Delta and does not take delivery of its CVP water through the Jones Pumping Plant (and therefore is not part of the Accelerated Water Transfer Program). Because Pilot 2a is the first time CCWD participated in a transfer of this nature, the approval process and operations for Pilot 2a required greater coordination among all entities. The extreme drought and unprecedented hydrologic and regulatory conditions also affected Reclamation's timing for being able to move transfer water at Jones Pumping Plant.

3.3 Pilot 3: Examining In-Lieu Exchange of Locally Stored CVP Supply (CCWD and EBMUD)

Drought conditions in the summer of 2021 presented an opportunity to build upon the framework of Pilot 2a to test a pilot to explore in-lieu delivery pathways for the BARR Partners involving use of CVP contract supply to satisfy water purchase agreements between Partners. Pilot 3 addresses institutional arrangements between BARR Partners and Reclamation, shared infrastructure for physically conveying water, and storage in CCWD's LV Reservoir used for in-lieu deliveries. This pilot demonstrates a different pathway to delivering transfer water to BARR Partners using the Freeport Regional Water Authority (FRWA) intake and EBMUD's facilities than has been previously successfully demonstrated.

Pilot 3 demonstrated the use of existing water facilities to deliver 2,000 AF of water previously stored in LV Reservoir to EBMUD via a transfer of CCWD's CVP contract water to EBMUD. The pilot was made possible by a 2013 agreement between CCWD and EBMUD that provided valuable water supplies to CCWD in 2013, at the beginning of the previous drought, and allowed EBMUD the option to purchase water stored in LV Reservoir at a future date. Figure 3-3 provides a map of how the transferred water was delivered through in-lieu exchange, including key infrastructure and delivery flow.

3.3.1 Step 1: Define Destination and Starting Point

Pursuant to the 2013 agreement between CCWD and EBMUD, EBMUD exercised an option to purchase 2,000 AF of water previously stored by CCWD in LV Reservoir. The agreed-upon purchase price accounted for the costs of facility usage to convey the water to storage, use of LV Reservoir storage, and evaporative losses between the time the water was stored in LV Reservoir and when the water was delivered to EBMUD. Instead of directly delivering the 2,000 AF of water from LV to EBMUD's system through the EBMUD-CCWD Intertie, CCWD and EBMUD agreed to fulfill the agreement with an in-lieu CVP exchange. CCWD used 2,000 AF of water stored in LV Reservoir instead of diverting 2,000 AF of CCWD's 2021 CVP allocation at CCWD's Delta intakes, which was then made available for transfer. EBMUD received the transferred water at the FRWA intake on the Sacramento River and delivered it to EBMUD's service area through Reclamation's Folsom South Canal and EBMUD's raw water system.

3.3.2 Step 2: Rules of the Road

Three Partners with discretionary actions were involved in Pilot 3: CCWD, EBMUD, and Reclamation. No changes in water rights were required for this pilot. However, CCWD's Reclamation Contracting Officer needed to approve the transfer, which required Reclamation to complete a NEPA analysis consisting of an EA and subsequent FONSI prior to approving the proposed transfer. For CEQA compliance, CCWD and EBMUD developed complimentary NOEs for Partners. Both CCWD and EBMUD filed NOEs on August 25, 2021, and received no protests. Reclamation filed the EA/FONSI for the project on September 8, 2021, and approved the transfer on September 14, 2021. The exchange involved transfer of CVP supply between two CVP contractors; therefore, a Warren Act Contract was not required to deliver the water through the Folsom South Canal to EBMUD's Folsom South Canal Connection (FSCC). Like any water transfer, coordinating environmental documentation and institutional approval between participating agencies took considerable time. CCWD and EBMUD operations staff also coordinated on the timing of CCWD making the water available and EBMUD diverting the water, while coordinating the overall timing with Reclamation staff to secure availability of CVP water at the FRWA intake.

Table 3-7 summarizes preparation actions for the pilot, including regulatory and contract-based requirements, required permits, and potential changes needed to existing water rights.

Table 3-7. Pilot 3 Preparation Highlights

Key Regulatory/Contract Requirements	Pilot 3 required: • EBMUD/CCWD agreement with the option for EBMUD to purchase previously stored water in LV • Offer letter from CCWD and acceptance letter from EBMUD • Reclamation Contracting Officer approval of transfer • Coordination of operations with the Reclamation Central Valley Operations office
Environmental Compliance	Required permits: • CEQA – NOE by participating agencies • NEPA –EA/ FONSI – Reclamation • ESA – No consultation needed. Covered by 2019 LTO of CVP and SWP Biological Opinions.
Water Rights Changes/Requirements	No water rights changes required, as confirmed by Reclamation and supported by the following: • Existing water rights allowed water to be stored in LV Reservoir previously • CCWD and EBMUD hold CVP contracts under existing water rights held by Reclamation

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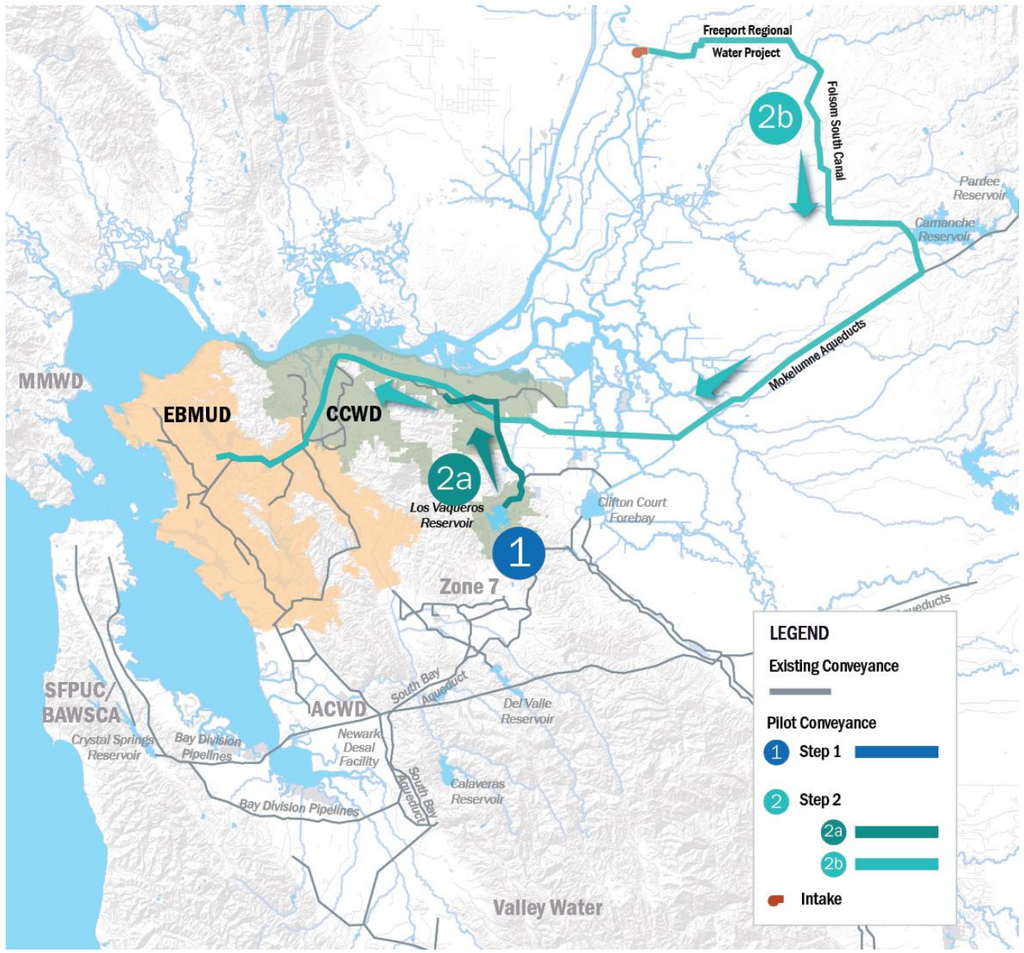
Pilot 3 at a Glance

Exchange of CVP supply between CCWD and EBMUD using Los Vaqueros Reservoir

Pilot 3 demonstrates that existing CVP water allocations can be transferred to other CVP contractors, and that LV Reservoir and FRWP can improve and facilitate exchanges between CCWD and EBMUD.



How it Works:

1 EBMUD and CCWD entered into an agreement for EBMUD to opt to purchase some previously stored LV water.

EBMUD → Mokelumne Aqueduct → CCWD → Los Vaqueros Reservoir

Critical Gate: At a later time, EBMUD and CCWD requested USBR approval for CCWD to forego 2 TAF of 2021 CVP allocation as in-lieu credit to return supply to EBMUD.

Central Valley Project

2 Once approved, EBMUD diverted 2 TAF from FRWP (against CCWD's 2021 CVP allocation), and CCWD relied on 2 TAF of supply stored in LV Reservoir.

In-Lieu Exchange

2a Los Vaqueros Reservoir → CCWD

2b Freeport Regional Water Project → EBMUD

Figure 3-3. Conceptual overview of CCWD and EBMUD exchange of CVP supply (Pilot 3)

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3.3.3 Step 3: Identify Water Available for Transfer

For Pilot 3, the water accounting consists of CCWD using an additional 2,000 AF of water from LV Reservoir to meet customer demands in lieu of diverting that amount of CCWD's CVP water from the Delta. This then makes that water available to EBMUD through an in-lieu CVP exchange. As with Pilot 2a, there are no net additions to the overall water balance, but water is made available at a different time step than it would have originally been available, and this is only possible because of the transfer. Since the water was made available through CCWD's CVP contract, which was last exercised in 2019, EBMUD paid CCWD for two years of evaporation losses (320 AF). From October 1, 2021, through October 15, 2021, CCWD used an additional 2,000 AF of water from LV Reservoir to meet customer demands in lieu of diverting that amount of CCWD's CVP water from the Delta. Within that same time window from October 4, 2021, through October 12, 2021, EBMUD diverted the transferred water at the FRWA intake and conveyed the water through existing FRWA and EBMUD facilities to Reclamation's Folsom South Canal. The water was delivered down the Folsom South Canal to EBMUD's FSCC system, then conveyed through EBMUD's Mokelumne Aqueducts No. 1 and No. 2 and Lafayette Aqueduct No 1 to two EBMUD terminal reservoirs: (1) San Pablo Reservoir and (2) Upper San Leandro Reservoir.

3.3.4 Step 4: Establish Agreements Among Participants

CCWD and EBMUD had an existing agreement in place that facilitated Pilot 3. The following are highlights from the term sheets that participants agreed to for the pilot:

- The exchange is based on Exhibit E of the 2013 CCWD-EBMUD Agreement that gave EBMUD the option to purchase 2,000 AF of water stored in LV Reservoir between 2015 and 2025.
- Instead of delivering water directly from LV Reservoir to EBMUD, CCWD and EBMUD agreed to an in-lieu CVP exchange where CCWD would use 2,000 AF of water previously stored in LV Reservoir in lieu of diverting 2,000 AF of CCWD's 2021 CVP allocation from the Delta, leaving that amount of CVP water available to be transferred to EBMUD.
- EBMUD will divert the transferred water at the FRWA intake.
- EBMUD will pay for 2,320 AF at the 2021 rate for CVP water and evaporative losses in LV Reservoir and storage fees in LV Reservoir since 2019. The cost methodology used is the same as the CCWD usage fees principles developed for LVE.
- Transfer timing: October 2021.

Table 3-8 provides the pilot partners and their roles.

Table 3-8. Pilot 3 Partners and Roles

Partner	Pilot Role
CCWD	Transfer 2,000 AF of water to EBMUD – schedule CCWD CVP contract allocation to be delivered to EBMUD; operations coordination with EBMUD and Reclamation, and drawdown of water in LV.
EBMUD	Purchase and accept 2,000 AF of water stored in LV via transfer of CCWD's CVP contract water to EBMUD at FRWA Intake – operations coordination with CCWD and Reclamation. Pay for evaporative losses since CCWD's last CVP diversion.

3.3.5 Step 5: Implement Transaction

Overall, Pilot 3 operations were straightforward since all facilities besides the Folsom South Canal are operated by BARR Partners. Coordination with Reclamation's Central Valley Operations (CVO) Office on the schedule for the transfer operations was required to confirm that water under Reclamation's American River water rights would be available for diversion at the FRWA intake. Unique operational conditions for the CVP due to the extreme drought conditions meant that re-diversions under CVP American River water rights at the FRWA intake were not possible until the fall of 2021.

The FRWA and EBMUD facilities required to take water from the Sacramento River were already planned to be on-line for delivery of EBMUD's 2021 CVP allocation. EBMUD's raw water system is not always operationally available to accept water from the FRWA intake. Over the next 10 years, EBMUD is embarking on several capital improvement projects that will considerably constrain EBMUD's flexibility to accept transferred water from the FRWA intake, most notably the Mokelumne No. 2 Relining and Orinda Water Treatment Plant Disinfection Improvement projects. Additionally, EBMUD's facilities between the Mokelumne aqueducts and the FRWA intake are typically in service only during droughts. In a non-drought year, a transfer like Pilot 3 would require EBMUD to make difficult operational changes, resulting in significantly increased costs due to start-up and shutdown (currently estimated at $727,000).

Appendix G provides details on the key items and resources utilized by each pilot partner, along with the cost calculation methodology. EBMUD reimbursed CCWD for the actual costs for conveyance of water and storage in LV Reservoir for the water used by CCWD in lieu of CCWD's 2021 CVP water. Partners bear their own costs for staff time spent on implementation of this pilot.

For purchase of the water, CCWD paid Reclamation directly for the CVP water and was reimbursed by EBMUD. For conveyance to and storage in LV Reservoir, EBMUD and CCWD updated the fees outlined in the 2013 EBMUD-CCWD agreement to use the CCWD usage fee principles developed for LVE. EBMUD paid CCWD the actual power costs and usage fees as described. Costs for Reclamation staff time for review of this pilot were covered by the WaterSMART Grant funding set aside for this purpose.

Section 4

Lessons Learned from BARR SWAP

BARR SWAP brings together lessons learned from past water transfers and exchanges conducted and pursued by the BARR SWAP Partners, the recently completed pilot projects that reflect the SWAP Roadmap, and guidance and recommendations from the Stakeholder Task Force to inform and provide direction for future transfers and exchanges in the Bay Area.

4.1 Lessons from Past Experiences

Bay Area water suppliers can glean insights for best practices and lessons learned by reflecting on past experiences with water transfers and exchanges. A review of recent transfers reveals physical and institutional complexities that need to be addressed for water transfers or exchanges to be successful. For example, cross-Delta transfers (the transfer of a supply tributary to the Delta from a point of diversion in the Delta) have proven challenging, despite physical hydrologic connections among trading partners. Challenges have also arisen from conveyance capacity limitations, regulatory constraints, availability of water supplies, and environmental concerns (DWR and State Water Board, 2015a and 2015b). Drivers for previous transfers and exchanges primarily center around drought conditions, including emergency drought declarations, notices of surface water diversion curtailments (or potential curtailment), and water contract allocations.

4.1.1 BARR SWAP Pilots

Partners have taken advantage of past opportunities to test new ways of conducting water transfers through pilot projects. These demonstration projects lay the groundwork and set expectations for paths to approvals for future water transfers. In this process, Partners have also recognized challenges and benefits from which future water managers can learn for transfers and exchanges.

Identified Challenges

Pilot 1a Investigating Alternative Supplies to Improve Supply Reliability (SFPUC/BAWSCA and ACWD)

- Diverting water can present numerous water quality concerns and may require new infrastructure and/or improvements to existing facilities and operational or treatment process modifications.
- Long-term, permanent transfers are contractually more difficult to implement compared to short-term, temporary exchanges/transfers of 1 year or less.

Pilot 2a Examining Local Storage and Exchange of CVP Supply (CCWD and Valley Water)

- Flexibility and a nimbleness to react quickly to modify the original transfer or exchange concept may be required to overcome approval process delays and a reduction in SWP and/or CVP allocation (during drought conditions).
- The process for transfer and/or exchange development should start with a discussion that clearly defines roles and responsibilities and identifies timelines for completing individual tasks.
- Assigning a primary point of contact and/or project manager within each organization and regulatory agency would improve efficiency and accountability to ensure that milestones are reached.

Pilot 3 Examining In-lieu Exchange of Locally Stored CVP Supply (CCWD and EBMUD)

- Evaporative losses at LV Reservoir can be a significant cost consideration when storing water for several years.
- When the need is identified for Reclamation approvals, partners should confirm as early as possible that adequate funds are available for Reclamation's approval process, including environmental review and operations coordination.
- Consider impacts of drought with overall transfer schedule. Drought conditions delayed the timing of transfers.
- Leveraging existing agreements is key. Development of Pilot 3 was enabled through a previously established agreement for an option to purchase CCWD water stored in LV Reservoir.
- Details such as cost calculation methodology, operational scenarios, and roles and responsibilities for securing necessary approvals should be understood ahead of time.

Benefits Realized

Pilot 1a Investigating Alternative Supplies to Improve Supply Reliability (SFPUC/BAWSCA and ACWD).

- This pilot provides an exchange mechanism that can benefit water agencies reliant on SFPUC supplies in times of water shortage. The Pilot 1a concept could allow for ongoing regional water supply improvements based on a regional partnership. It leverages isolated infrastructure spread among multiple agencies and provides an exchange and transfer mechanism that improves regional water supply reliability, assuming that water supply contracts can be amended for such flexibility.

Pilot 2a Examining Local Storage and Exchange of CVP Supply (CCWD and Valley Water).

- Although the initial concept needed to be modified, it proved to be successful and lays the foundation for future exchanges using the same concept. In particular, the approval process (including approval through the Reclamation Contract Officer, pursuant to CCWD's and Valley Water's CVP contracts) could be repeated and streamlined for more efficient implementation now that Reclamation staff are familiar with the concept of CVP-to-CVP transfers or exchanges involving CCWD. The pilot was highly beneficial to Valley Water as it provided a significant improvement in water supply reliability during an extremely challenging drought year, consistent with the intent of the BARR Program. The water provided through this exchange provided Valley Water with a bridge until its other supplies became available later in the summer, which allowed for uninterrupted deliveries to its treated water customers.

Pilot 3 Examining In-lieu Exchange of Locally Stored CVP Supply (CCWD and EBMUD).

- This pilot strengthened the partnership between EBMUD and CCWD to transfer reserved water supplies, a key element of BARR partnerships and LVE. The pilot also demonstrated the ability to leverage existing facilities (the FRWA intake and LV) to deliver supplemental supplies, operating under existing permits and contracts, during extreme drought conditions to a BARR Partner. Pilot 3 also demonstrated flexibility to divert transferred CVP water at the FRWA intake instead of at the SWP Banks Pumping Plant or CVP Jones Pumping Plant, which is a key concept to show how BARR Partners connected to EBMUD's system could receive water stored in LV without using Banks or Jones pumping plants (the use of which has been previously demonstrated but comes with limitations).

4.1.2 Takeaways and Opportunities for Shared Water Access in the Bay Area

While BARR Partners' individual experiences have varied greatly, knowledge gained from the outcome of completing (and in some cases attempting) transfers and exchanges informed the following opportunities. Several of the items below have also been influenced by Task Force input.

Transfers and exchanges of project supply (SWP/CVP) among contractors is easier. The relative ease of conducting water transfers and exchanges of SWP and/or CVP supply depends on whether the participating agencies are contract holders. Exchanges between SWP contractors are the most straightforward, followed by those between CVP contractors. Transfers and exchanges between SWP and CVP contractors are possible and, when available, can be simplified by using the SWP/CVP Joint Point of Diversion (see Appendix A). Transfers of SWP or CVP contract supply to non-contract agencies are generally difficult, given water-rights-related requirements such as water balance accounting (Step 3 of Roadmap). However, non-contract agencies may access SWP facilities in times of available capacity when allowable under a conveyance agreement executed with DWR.

One-year agreements may be more feasible than long-term agreements. The lead time to get long-term agreements in place requires a commitment to continue to work on the project and have schedules to evaluate progress. Temporary, one-year agreements seem most feasible and may be sufficient to provide regional reliability.

Overcome staff limitations through organizing institutional knowledge. Limited internal staff experience with water transfers and staff turnover at local, state, and federal levels as well as at agencies can prolong the approval process. Capturing and organizing institutional knowledge can proactively mitigate these impacts to the approval process.

Drought as a window of opportunity. Drought conditions, particularly involving reduced SWP/CVP contract allocations, increase the need for transfers/exchanges and generally intensify market competition for water supplies among buyers. These conditions also tend to increase regulatory and public support for transfers. Thus, drought conditions and emergency declarations can stoke innovation and lead to lasting partnerships and improved regional water management. However, it is also important to consider possible physical impacts of drought or other hydrologic conditions on feasibility or timing of a transaction.

Costs are largely variable. Past experiences are not inherently indicative of future costs for water transfers, especially given cost increases in the past decade. Further, costs involved in developing and conducting pilot transfers tend to far exceed those of subsequent "at-scale" occurrences. Construction in general has become extremely expensive and is not likely to decrease in the future. Using existing infrastructure will help reduce overall costs for water transactions as opposed to constructing new infrastructure.

Environmental benefits can be realized. Partners can consider how to realize environmental benefits through approaches such as coordinating release of supply stored in upstream reservoirs to manage temperature for sensitive aquatic species (e.g., salmonids) and recharging aquifers that support groundwater-dependent ecosystems. Other potential considerations could include how the water transaction reduces reliance on the Delta (allowing greater in-stream flows for Delta ecosystems), and how intakes used in the water transaction may impact the protection of local fish species.

Choice of intake related to environmental benefits. Some intakes, such as those owned by CCWD, are more environmentally protective as compared to others like Banks and Jones. Greater environmental benefits can be realized when considering use of Los Vaqueros Reservoir and moving water through the South Bay Aqueduct.

4.1.3 Best Practices

Lessons learned from both past transfers and recent BARR SWAP pilots indicated benefits of early action best practices as follows:

Negotiate terms ahead of shortage. Negotiating terms and executing new institutional agreements among participating BARR Partners and others in advance of water shortage is a best practice. This enables increased stakeholder engagement, improves agency readiness, and reduces uncertainty and risk.

Allow sufficient time for planning multi-year transfers. Because multi-year transfers typically require extensive environmental review and documentation and possible Delta Stewardship Council approval, planning and developing the arrangement must be initiated well in advance of implementation.

Engage approval agencies. Early engagement and communication with approval agencies is important for the timing and successful completion of transfers and exchanges, especially when aligning windows of opportunity for transfers.

Communicate with participants and interested parties. Communication is needed early in the transfer development process to seek input and understanding among participating agencies and interested parties. Diverse perspectives and representation often add new dimensions to problem solving and may strengthen protections of other users, the environment, and local economies when conducting transfers as part of BARR SWAP.

4.2 Stakeholder Task Force Input

BARR SWAP builds from lessons learned from past experiences (including the three pilots) and reflects input from Stakeholder Task Force members on selection and evaluation criteria and critical success factors. Figure 4-1 depicts the types of input received from Task Force members.

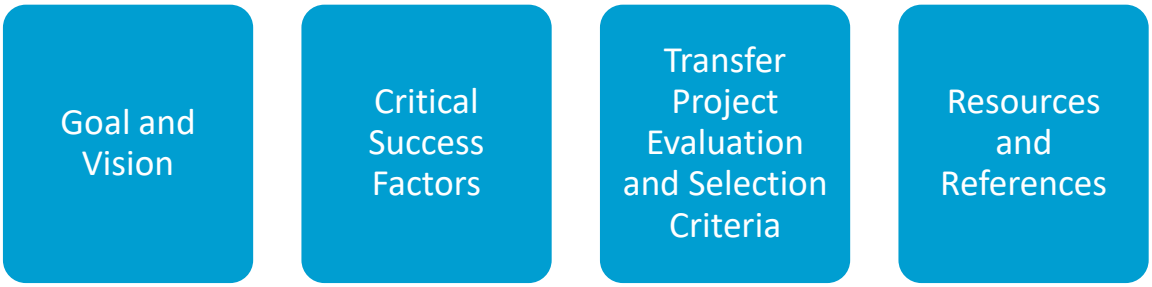

Figure 4-1. Themes of input from external BARR SWAP Stakeholder Task Force

The Stakeholder Task Force contributed input on the overall goal and vision for BARR SWAP, including an emphasis on considering both short-term and long-term opportunities for shared water access to promote supply reliability to address for a more holistic and sustainable approach to transfer and exchange development and building greater regional resilience. Furthermore, the approach should continue to focus on overall reliability, but especially for potential future emergency conditions and droughts. The Task Force also reiterated that the BARR SWAP should include an understanding of institutional and physical pathways and potential challenges. As noted by Task Force members, BARR SWAP is not a "one-stop shop" solution, but rather one among many measures that must work in tandem for greater regional resilience.

4.2.1 Assessing Feasibility of Transfers and Exchanges

Taking a holistic approach when considering project implementation under BARR SWAP sets a foundation for assessing feasibility and selection of potential transfers and exchanges. When planning a potential transfer or exchange within the regional BARR SWAP framework, BARR Partners need to consider feasibility based on reviewing requirements and the criteria summarized in the first two columns of Table 4-1. The third column of Table 4-1 identifies specific Stakeholder Task Force input on the different categories of the initial criteria list. This input highlights issues to consider, such as affordability, community benefits, alignment with relevant regional and local plans, and further environmental considerations, including flow requirements and reduced Delta reliance.

Table 4-1. Stakeholder Task Force Input on Evaluation Criteria for Assessing Feasibility of Transfers and Exchanges

Initial list of evaluation factors		Task Force input in response to initial list: "Holistic assessment from source to end user should consider..."
Categories	Criteria	
Technical and operational	Pathway	Consistency and alignment with other regional long-range planning SGMA compliance Findings and recommendations from water suppliers' Risk and Resilience Assessments
	Supply capacity	
	Duration of benefits	
	Season/conditions	
	Water quality compatibility	
Political and institutional	Willing seller and willing buyer	Community benefits and equity (possibly under a new "Societal" category)
	Institutional agreements	
Legal and environmental	Environmental review	Alignment with Bay Delta Water Quality Control Plan and instream flow requirements Improved environmental performance Reduced Delta reliance
	Water right process	
	DWR/Reclamation agreements	
Economic	Water cost	Affordability (utilities and rate payers)
	Operations and maintenance cost	

Following stakeholder feedback, the BARR Partners expanded on Table 4-1 to incorporate Stakeholder Task Force members' input. The information was expanded to include the following general categories of criteria (Table 4-2):

- **Institutional and regulatory feasibility**: Existing agreements, contracts, and water rights that could either facilitate or create barriers for a transfer or exchange.
- **Physical feasibility**: Physical capacity for wheeling water, water quality and quantity of supply, and potential impacts to other water users.
- **Technical and operational conditions**: Known complexities, such as seasonal conditions, environmental flows, scheduled maintenance events, or anticipated disruptions.

Table 4-2. Feasibility Considerations for Transfers and Exchanges within BARR SWAP

Considerations/Requirements			Evaluation Criteria	Corresponding Actions
Institutional and regulatory	Willing parties (seller and buyer)	All transfers/exchanges start with identifying and matching a willing seller and willing buyer.	Willing parties	Identify willing seller(s) as a first step.
	Water rights/ contracts	Requirements differ based on supply source to be transferred or exchanged (e.g., surface water or groundwater). Legal basis allowing buyer access to seller's supply requires review and confirmation of water rights (or SWP/CVP contracts).	Water rights/contracts process DWR/Reclamation agreements	Determine if supply source is surface water or groundwater as a starting point for determining water rights issues and potential SGMA implications.
	Duration	The transfer/exchange duration determines applicability or extent of some requirements.	Duration of benefits	Identify water supply availability (seller) and needs (buyer). Identify requirements of both short- and long-term transfers of the available supply sources.
	Regulatory/ legal	Regulatory and legal issues pertain to water rights, contract supplies, environmental review, and approvals/permits by regulating agencies.	Environmental review	Identify modifications needed for water; contract supply terms (if applicable); NEPA/CEQA requirements; regulating agencies at local, state, and federal levels; and relevant approvals/permits required.
	Institutional arrangements	Agreements establish terms between parties selling and buying water.	Agreements and/or other institutional arrangements	Identify operations coordination needed among participating agencies. Consider new institutional arrangements, such as a JPA, to promote collaboration and avoid competition among participating agencies pursuing purchase of a same supply source.
	Economic and social	Parties involved must agree on a fair price, accounting for water quality, reliability, and other factors.	Water cost O&M costs Conveyance or facility use fee Affordability (utilities and rate payers) Community benefits Equitable access to reliable, safe drinking water	Rely on the BARR Guiding Principles (adopted in 2014) and Memorandum of Agreement (originally executed in 2015) as a starting point to inform cost share/ allocation. Consider factors of equitable price, such as reliability, water quality, treatment, energy, watershed management, O&M, equipment/system wear and tear, storage, staff resources required, and environmental review/permit costs.

Table 4-2. Feasibility Considerations for Transfers and Exchanges within BARR SWAP				
Considerations/Requirements			Evaluation Criteria	Corresponding Actions
Physical	Conveyance pathway	Conveyance pathways refer to the physical means for transferring water and exchanging via in-lieu arrangements.	Physical pathway to move supply (pipeline, aqueduct, canal) Season/conditions Connection to other regional long-range planning Reduced vulnerability/risk and improved resilience	Assess the controlling factors influencing the viability of transferring supplies physically and through an in-lieu exchange. Evaluate various options for alternative pathways to enable sharing. Evaluate reservoir and/or groundwater basin capacity for in-lieu exchange opportunities involving supply carryover or banking.
	Capacity	Direct transfers may be hindered by capacity limitations in conveyance infrastructure.	Capacity (conveyance, storage, treatment)	Determine capacity of conveyance, storage, and treatment (as applicable) and terms of other users reliant on facilities needed for transfer/exchange.
	Water quality compatibility	Blending water from different sources may affect treatment compatibility or corrosivity of distributed supply.	Blended supply impacts on treatability and corrosion control of distribution system	Evaluate the water quality compatibility upstream of distribution in treated water systems and determine whether additional treatment is necessary for corrosion control.
Technical and operational	Season/ conditions and planned maintenance	Instream flow requirements, other environmental protections, and other terms on timeframes or conditions limit supply availability. DWR and Reclamation typically approve water transfers/ exchanges between February-May of the year the transfer is proposed to occur.	Impact to instream flows and Bay-Delta Plan Reduced reliance on Delta Environmental performance	Identify supply predictability. Consider Biological Opinions, water quality conditions, and/or other seasonal limitations pertaining to other supply sources. As relevant, account for limitations of transferring supplies through Banks (SWP) and Jones (CVP) pumping plants, only permitted July-November, with additional restrictions possible. Consider impacts of scheduled maintenance of physical systems/facilities involved in transfer/exchange.

4.2.2 Meeting Critical Success Factors

The Stakeholder Task Force provided input for BARR SWAP critical success factors developed to support successful development and implementation of transfers and exchanges under BARR SWAP (Table 4-3). The content below is a summary of Task Force members' responses to the question, "What do you consider as critical success factors for a regional water sharing program?"

Table 4-3. Stakeholder Task Force Input on Critical Success Factors	
Impacts and Benefits	Consider multi-benefit solutions and impact avoidance, "do no harm" principle, and systemwide needs and impacts across various hydrologic years
Strategies	Leverage and integrate existing infrastructure and facilities, alternative local supply sources, decentralized and smaller systems, and storage for wet year surplus supply
Well-informed and Funded Solutions	Quality and purpose of tools when evaluating supply source, determination of water available for transfer, conveyance path, and delivery point No "one-stop shop" solution; SWAP is one strategy to be implemented and considered among many strategies Funding opportunities focused on supporting collaborative regional solutions

BARR Partners shared a summary of this input with the Stakeholder Task Force during part two of Workshop 1 to confirm understanding. The suggested factors were grouped into three general categories that highlight impacts and benefits of transfers and exchanges, consider strategies that the Stakeholder Task Force recommends be pursued, and consider factors related to successful implementation through well-informed and funded solutions.

In addition, Stakeholder Task Force members provided several references to help future water managers in the Bay Area better understand, develop, and implement transactions. These references include resources that can support water managers understand and plan transfers and exchanges that consider multiple benefits, green infrastructure, and social and economic dynamics. These references are provided as an addition to the references list in Section 6.

Section 5

Next Steps

The collaborative efforts of the BARR Partners and input from the Stakeholder Task Force throughout the BARR SWAP development provides valuable findings and recommendations for regionally focused efforts to enhance drought resilience. This report introduces the general context for water transfers and exchanges in the Bay Area and considers knowledge gained from past transfers and exchanges to build regional resilience and support overall water supply reliability in the San Francisco Bay Area. Key assumptions driving the guidance provided in the BARR SWAP Strategy Report for the region are:

- We are working together to enhance regional reliability.
- We have assets, infrastructure, and water rights that can be leveraged to get there.
- We can build from what has happened before.
- We can and have tested new concepts to explore and inform opportunities.
- We can navigate future opportunities building from our partnership, existing resources, what we have accomplished before, and concepts we explore.

BARR SWAP complements BARR Partners' individual long-range water management efforts and outreach for future water supply reliability and climate resilience. This effort also addresses strategies identified in the state's California Water Plan (2018 and 2023 updates), Climate Adaptation Strategy (2021), Water Resilience Portfolio (2020), and Water Supply Strategy (2022) through actions such as improving the flexibility of current systems to move water throughout the region.

The Strategy Report provides a guidance for future transfers and exchanges to address urgent supply shortfalls in times of need. Findings from the program support future development of transfers and exchanges in the Bay Area by drawing from past experiences, exploring new concepts, and collaborating with and seeking input across stakeholder groups at a regional level. BARR Partners may use this report over the next year (and beyond) as a reference that documents past actions, current requirements, and resource needs (i.e., funding and staff) related to planning and executing water transactions.

Advancing Concepts from BARR SWAP Pilots

The three pilot projects provide valuable insight into the physical, operational, and institutional complexities that may be encountered as water transfer and exchange opportunities continue to be evaluated and developed. Pilot 1a demonstrates how alternative water supplies obtained by one BAWSCA agency can allow other RWS customers to obtain foregone RWS supply. Pilot 2a demonstrates how existing water allocations can be stored locally for use in drier years and how CVP water contractors can store water supply in LV Reservoir. Pilot 3 demonstrates a different pathway to delivering transfer water to BARR Partners than has been previously successfully demonstrated using EBMUD's Freeport intake and associated conveyance facilities. Table 5-1 identifies the concepts, issues addressed, and next steps for each of the pilots.

Table 5-1. Next Steps to Advance Concepts Tested in BARR SWAP Pilot Projects

Concept/Pilot	Issues Addressed by Pilot	Next Steps
Concept: Test the use of alternative supplies and storage to improve SFPUC/BAWSCA supply reliability		
Pilot 1a: Simulation of delivery from LVE to ACWD (exchange) and San Antonio Reservoir via the SBA	• Account for exchanging SFPUC's RWS supply and consider waiving minimum purchase requirements for ACWD to allow for water transfers during dry years, as needed • Test conveyance and institutional agreements for water transfers to ultimately benefit RWS customers • Demonstrate how water supplies obtained by one BARR agency can allow other BARR Partners to benefit • Describe potential impacts of delivering water from the SBA directly to San Antonio Reservoir, a part of SFPUC's RWS	• Address minimum-purchase requirements and individual supply guarantee impacts for RWS water • Leverage SBA Capacity Analysis to understand SBA and ACWD infrastructure capacity to transfer water via exchange • Evaluate cost of transfer and exchange concepts • Identify institutional and infrastructure needs to deliver water to the RWS
Concept: Test the use of LV Reservoir to improve BARR Partners' storage and supply flexibility		
Pilot 2a: Supply exchange of stored CVP supply between CCWD and Valley Water	• Demonstrate transfer of CVP water from CCWD to Valley Water, supported by previously stored water in LV Reservoir, including Reclamation approval process and operations coordination and accounting	• Confirm institutional arrangements between CCWD and Valley Water • Pursue Step 2 of exchange to demonstrate storage of CVP water from other CVP contractors in LV
Pilot 3: Exchange of CVP supply between CCWD and EBMUD using LV	• Demonstrate that existing CVP water allocations can be transferred to other CVP contractors • Demonstrate that LV and FRWA can improve and facilitate exchanges between CCWD and EBMUD	• Further evaluate cost, capacity, and operations • Availability of CVP to conduct exchanges in extremely dry conditions

Applying the BARR SWAP Roadmap for Future Water Transactions

Recommended next steps in implementing the BARR SWAP Roadmap are as follows and incorporate recommendations from Task Force Members:

1. Work with regulators to identify strategies that improve efficiency in approving SWAP transfers and support implementation of "California's Water Supply Strategy: Adapting to a Hotter, Drier Future."
2. Develop and evaluate scenarios for potential future water transfers/exchanges.
3. Evaluate transfer concepts using the criteria and selection approach developed for BARR SWAP.
4. Consider social- and equity-focused evaluation criteria for impacts of potential future transfers.
5. Seek stakeholder input to further understand the range of benefits and impacts to other water users, including the environment, and local economies under future scenarios.
6. Provide brief summary updates on completion of returned water for relevant pilots on the BARR website, similar to the updates provided for the BARR Drought Contingency Plan Mitigation Measures.
7. Monitor funding opportunities that support further advancing the BARR Partnership through additional pilot transfers or implementing other drought mitigation measures.
8. As appropriate, plan, design, and construct drinking water infrastructure and treatment facilities, including drought mitigation measures explored through the BARR Drought Contingency Plan, to increase opportunities for shared water access. Examples include:
   - Conveyance infrastructure
     - Los Vaqueros Reservoir Expansion facilities, including Transfer-Bethany Pipeline

- Potential upsizing of SFPUC's intertie to the South Bay Aqueduct near San Antonio Reservoir and Sunol Valley Water Treatment Plant (WTP)
- Marin Water's Richmond-San Rafael potential intertie to EBMUD
- Zone 7's potential intertie with EBMUD
- Expanding use of existing emergency interties to include droughts

– Treatment facilities

- Pre-treatment upgrades at EBMUD's Walnut Creek WTP
- Potential treatment additions at SFPUC's Sunol Valley WTP
- Potential treatment for shared water access using alternative supplies.

9. Take and apply a programmatic approach for processes like documentation for CEQA and requests for change in point of diversion for future transactions to create greater efficiencies.
10. Consider climate impacts and the level of analysis for climate change, especially at the regional level. This could include considering a regional adaptation strategy, and consider increasing aridity as a new general condition.
11. As appropriate, further expand the development of alternative local supplies, such as recycled water, purified water for potable reuse, brackish desalination, stormwater capture, and mitigation of impaired groundwater resources in combination with opportunities for water transactions.
12. In advance of a water shortage, establish new institutional agreements as needed between BARR Partners to formalize terms and conditions of purchasing, storing, and/or conveying supply for temporary transfers in dry years.
13. Consider how to use this Strategy and BARR SWAP as a springboard to integrate wastewater agencies into the process in the future.
14. While continuing to investigate future water transaction opportunities, further explore opportunities to engage as a Partnership in state-level planning initiatives that also seek to improve water management and protect beneficial uses, such as the recently updated California Climate Adaptation Plan and DWR's California Water Plan Update.

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Section 6

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Appendix A: Water Rights in California

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Contents

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A.1 Water Rights Process

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Water rights are property rights, but their holders do not own the water itself. They possess the right to use it. The exercise of some water rights requires a permit or license from the State Water Resources Control Board (State Board), whose objective is to ensure that the State's waters are put to the best possible use, and that the public interest is served (see Figure A-1 for the process for obtaining a water right).

In making decisions, the State Board must keep three major goals in mind:

- Developing water resources in an orderly manner;
- Preventing waste and unreasonable use of water; and
- Protecting the environment.

The State Board's duties are by no means limited to permits and licenses. It may be called upon to adjudicate water for entire systems or to act as a "referee" or fact finder in court cases involving water rights.

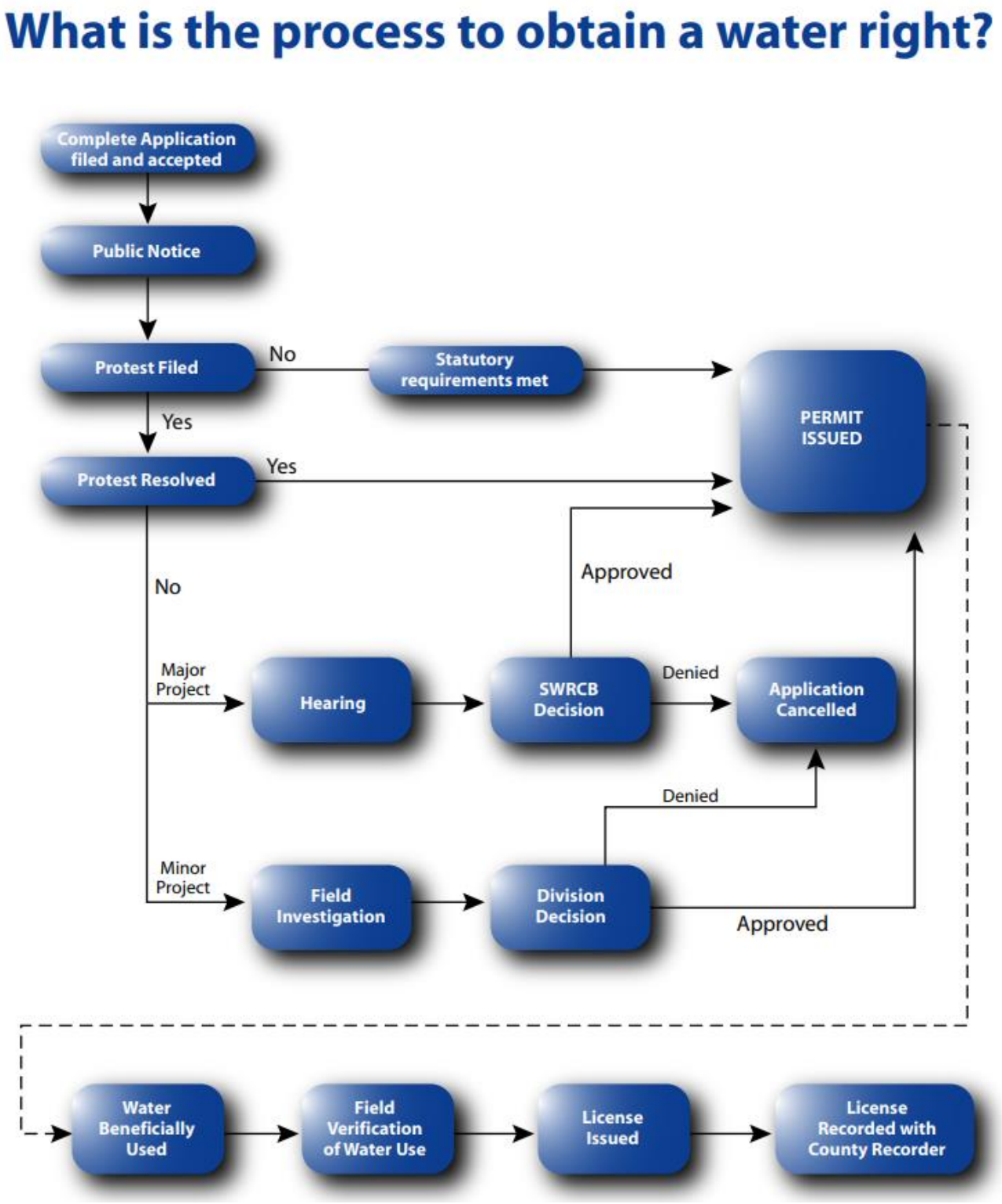

Figure A-1. Process for obtaining a water right in California

A.2 Types of Surface Water Rights

Water right law in California and the rest of the West is markedly different from the laws governing water use in the eastern United States. Water rights in California have a complex history.

Historical, seasonal, geographic, and quantitative differences in precipitation caused California's system to develop into a unique blend of different kinds of rights, including:

- Pueblo
- Riparian
- Federal reserved
- Appropriative
  - Pre-1914
  - Section 12
  - Post-1914
- Prescriptive
- Adjudicated

A summary of each type follows.

Pueblo Rights

California cities that are successors of Spanish or Mexican pueblos (settlements), and followed claim procedures establishing their pueblo rights, possess a paramount right to the beneficial use of all needed, naturally occurring surface and subsurface water from the entire watershed of the stream flowing through the original pueblo. Water use under a pueblo right must occur within the modern city limits, and excess water may not be sold outside the city. The quantity of water available for use under a pueblo right increases with population growth and city limit expansion (i.e., annexed land beyond the original pueblo).

Most prominently, the cities of Los Angeles and San Diego have pueblo rights recognized by judicial decisions. The pueblo water right supplied much of Los Angeles' water use until completion of the Owens Valley Aqueduct in 1913.

Riparian Rights

Riparian rights are surface water rights and usually come with owning a parcel of land that is adjacent to a source of water. With statehood, California adopted the English common law familiar to the eastern seaboard; such law also included the riparian doctrine. A riparian right entitles the landowner to use a correlative share of the water flowing past his or her property. Riparian rights do not require permits, licenses, or government approval, but they apply only to the water which would naturally flow in the stream. While there is no permit required to divert or use the water, the State Board does have jurisdiction over these rights related to waste and unreasonable use and riparian right holders are required to report their water use to the State Board. Riparian rights do not entitle a water user to divert water to storage in a reservoir for use in the dry season or to use water on land outside of the watershed. Riparian rights remain with the property when it changes hands, although parcels severed from the adjacent water source generally lose their right to the water.

Riparian rights have a higher priority than appropriative rights. The priorities of riparian right holders generally carry equal weight; during a drought, all share the shortage among themselves.

Federal Reserved Rights

Federal reserved rights were created when the United States set aside water for reserved land from the public domain for uses such as Indian reservations, military bases and national parks, forests, and monuments. Federal reserved water rights are often senior in priority to water rights established under state law. The date of priority of a federal reserved right is the date the reservation was established, and many were established prior to state water claims.

While judicial decisions have been clarifying the dimensions of federal reserved rights throughout the West, reserved rights are of less importance in California than in other Western states because of the California Supreme Court's 1988 decision in In Re Waters of Hallett Creek Stream System. Here, the court ruled that under California law, riparian rights exist on federal reserved lands abutting state waterways. These riparian rights are broader than federal reserved rights that are limited by the purpose of the reservation and priority date of its establishment.

Appropriative Rights

The system of appropriative rights dates to the Gold Rush, when miners diverted water from its source, often for hydraulic or placer mining. To stake water claims, miners followed a practice similar to staking land claims for gold; they posted a notice of their claim to the water at the point of diversion. Mining communities recognized and protected the rights of "posted" appropriators and the practice of appropriating rights to water on public lands, as did the state Supreme Court in the 1855 landmark case of Irwin v. Phillips.

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 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[4] (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. In 1914, the Water Commission Act formalized the appropriation system and centralized appropriative water right records at the state level (now the State Water Resources Control Board). Under the act, the state required new appropriators to obtain a permit from the state prior to diverting water. When one applies to appropriate water, the application must specify where the water will be used, period of diversion, purpose for which the water will be used, and point and type of diversion. The date of first appropriation and the estimated size of the completed project are also critical to establishing an appropriator's seniority on the stream and the volume of water to which the right applies.

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

In times of drought when there is not enough water in the stream to satisfy all claims, the most recent ("junior") claim is the first to curtail its diversion. Each right's priority dates to the time the permit application was filed with the State Board. If the water shortage is extreme, even the most senior appropriators will be required to give way to all riparian rights on the water source. Although pre- and post-1914 appropriative rights are similar, post-1914 rights are subject to a much greater degree of scrutiny and regulation by the State Board.

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.

Adjudicated

In addition to administering the state's water rights permit and licensing system, the State Board has several other major water right responsibilities, including statutory adjudication and court reference. Statutory adjudication is a process by which the comprehensive determination of all water rights in a stream system is made. This happens if a claimant petitions the State Board for an adjudication and the Board finds the action necessary and in the public interest. The California Supreme Court has held that claimants or petitioners can include not only water users, but also those seeking recognition of public trust values on a stream wide basis.

After granting the petition, State Board staff investigates the matter and issues a report with a draft Order of Determination. After holding a hearing on objections to the draft report, the State Board adopts a final Order of Determination and files it with the appropriate Superior Court. Objections to the final order are heard in a court hearing, after which the court may determine their merits. The final step is a court decree that determines all water rights within the disputed system.

The State Board may also be called upon to act as a "referee" in water right lawsuits, either recommending a decision on the entire case in dispute or answering questions of physical fact. Board staff carefully studies the matter, then issues a draft report to which the interested parties may file objections; a hearing on these objections is authorized but is not required by law. The Board's report becomes evidence, but the court is also required to hear any other evidence offered in rebuttal.

A.3 Groundwater Rights

The California Supreme Court decided in the 1903 case Katz v. Walkinshaw that the "reasonable use" provision that governs other types of water rights also applies to groundwater. Prior to this time, the English system of unregulated groundwater pumping had dominated but proved to be inappropriate to California's semiarid climate. The Supreme Court case established the concept of overlying rights, in which the rights of others with land overlying the aquifer must be considered. Later court decisions established that groundwater may be appropriated for use outside the basin, although appropriator's rights are subordinate to those with overlying rights.

In 2014, Governor Jerry Brown signed the Sustainable Groundwater Management Act (SGMA) into law, creating a framework for sustainable groundwater management for the first time in California history. SGMA distinguishes required actions based on groundwater basin prioritization, as follows:

- SGMA requires local governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. Under SGMA, these basins should reach sustainability within 20 years of implementing their

sustainability plans. For critically over-drafted basins, that will be 2040. For the remaining high and medium priority basins, 2042 is the deadline. SGMA empowers local agencies to form Groundwater Sustainability Agencies (GSAs) to manage basins sustainably and requires those GSAs to adopt Groundwater Sustainability Plans (GSPs) for crucial groundwater basins in California.

- Low and very low priority basins, as designated by DWR, and court-adjudicated basins are exempt from SGMA. As this legislation is implemented, it will have significant impacts to the water users within the basin, with potential impacts for neighboring surface water right holders that use water conjunctively.

A.4 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 CWC (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.

Section 12. Refers to Section 1212, which provides that a wastewater discharger ("wastewater producer") can introduce wastewater into a watercourse with the stated intention of maintaining or enhancing instream beneficial uses, such as fishery, wildlife, or recreation.

A.5 Permit Process

Water right permittees run the gamut from water districts and electric utilities to farmers and ranchers. Besides riparian right holders and groundwater users, permits are not required of users of purchased water or those who use water from springs or standing pools lacking natural outlets on the land where they are located. However, unauthorized appropriation of water is against the law and can result in court action and fines.

Water right permits carefully spell out the amounts, conditions, and construction timetables for the proposed water project. Before the State Board issues a permit, it must consider all prior rights and the availability of water in the basin. The State Board also considers the flows needed to preserve instream uses, such as recreation and fish and wildlife habitat. The State Board's Division of Water Rights maintains statewide records of water appropriation and use.

To obtain a permit, the prospective appropriator must follow these steps:

- **Application Filing and Acceptance**. The process is initiated when a permit application is filed by the person or agency desiring to divert water. This application specifically describes the proposed project's source, place of use, purpose, point(s) of diversion and quantity to be diverted. The State Board notifies the applicant within 30 days whether the application is incomplete or accepted. Acceptance establishes priority as the date of filing.
- **Environmental Review**. Consideration of environmental effects is required by the California Environmental Quality Act before a permit can be issued. Large projects that could endanger or degrade natural habitat or water quality usually require preparation of an Environmental Impact

Report. The State Board examines the proposed project's potential environmental impacts and determines whether conservation measures will be needed.

- **Public Notice**. The State Board then publishes a notice of the applicant's intent and invites comment. Copies of any protests are given to the applicant who is required to respond.
- **Protest Resolution**. The State Board takes actions to resolve any protests that have been filed. If both parties can agree to mutually acceptable conditions, the protest is resolved at this point in the process. In the event it is not resolved for small projects, the issue may be solved through an engineering field investigation report from the State Board's Division of Water Rights. For appeals from the report and for large projects, a formal hearing is held before one or more members of the State Board. The Board's decision is based upon the record produced by the hearing.
- **Permit Issuance**. Two initial State Board findings are required before a permit can be issued: that unappropriated water is available to supply the applicant, and that the applicant's appropriation is in the public interest, a concept that is an overriding concern in all State Board decisions. The permit is then issued if the State Board determines that the proposed use of water best meets these criteria. If it determines otherwise, conditions may be imposed to ensure they are satisfied, or the application may be denied. In most cases, the applicant is required to begin project construction within two years of permit issuance.

  Other conditions are placed on the permit, such as construction completion dates and when water use is to be completed. The permittee may petition for an extension. Unlike riparian rights, appropriative rights are quantified as the maximum amount that would ultimately be needed by the proposed project (or "beneficial use[s]"), for as long a time as the project is deemed reasonable and diligently pursued.

  Any change in purpose, place of use, or point of diversion requires State Board approval. The proposed change cannot initiate a new right or injure any other legal user of water.
- **Licensing**. When the project is completed, terms of the permit have been met, and largest volume of water under the permit is put to beneficial use, the State Board confirms the terms and conditions and issues a license to the appropriator. This license is the final confirmation of the water right and remains effective provided its conditions are fulfilled and beneficial use continues.

  The State Board is authorized to enforce the conditions of both permit and license and empowered to revoke either in case the conditions are not met. Other, less severe action may be taken, or the State Board may issue a cease-and-desist order to ensure that the terms are complied with in a timely fashion.

A.6 Modifying Water Rights

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).

A.7 Public Trust

As increasing emphasis is placed on protecting instream uses – fish, wildlife, recreation and scenic enjoyment – surface water allocations are administered under ever-tightening restrictions, posing new challenges and giving new direction to the State Board's water right activities.

Under the public trust doctrine, certain resources are held to be the property of all citizens and subject to continuing supervision by the State. Originally, the public trust was limited to commerce, navigation, and fisheries, but over the years the courts have broadened the definition to include recreational and ecological values.

In a landmark case, the California Supreme Court held that California water law is an integration of both public trust and appropriative right systems, and that all appropriations may be subject to review if "changing circumstances" warrant their reconsideration and reallocation. The courts also have concurrent jurisdiction in this area. At the same time, it held that like other uses, public trust values are subject to the reasonable and beneficial use provisions of the California Constitution.

The difficulty comes in balancing the potential value of a proposed or existing water diversion with the impact it may have on the public trust. After carefully weighing the issues and arriving at a determination, the State Board is charged with implementing the action which would protect the latter. The courts also have concurrent jurisdiction in this area. As with all the other pieces of the California water puzzle, allocating the limited resource fairly and impartially among many competing users represents one of the State Board's greatest challenges.

A.8 Complaints

The State Board also is responsible for investigating possible illegal, wasteful or unreasonable uses of water, either in response to a complaint or on the State Board's own initiative. If the State Board's staff investigation determines that a misuse of water is occurring, the State Board generally notifies the affected persons and allows a reasonable period of time to terminate the misuse. The State Board may also hold a hearing to determine if a misuse of water has occurred or is occurring. Water users who do not terminate a misuse of water are subject to various administrative enforcement measures including possible fines and revocation of a permit or license. In appropriate cases, the State Board may also seek judicial relief in the courts.

A.9 Water Transfers

In recent years, temporary transfers of water from one water user to another have been used increasingly as a way of meeting statewide water demands, particularly in drought years. Temporary transfers of post 1914 water rights are initiated by petition to the State Board. If the Board finds the proposed transfer will not injure any other legal user of water and will not unreasonably affect fish, wildlife, or other instream users, then the transfer is approved. If the State Board cannot make the required findings within 60 days, a hearing is held prior to State Board action on the proposed transfer. Temporary transfers are defined to be for a period of one year or less. A similar review and approval process applies to long-term transfers lasting more than one year.

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.

Recently, the Department of Water Resources amended the State Water Project (SWP) contracts to incorporate the "Water Management Amendment" (effective February 2021). This amendment is intended "to create a programmatic solution through transfers or exchanges of SWP water supplies that encourages regional approaches among water users sharing watersheds and strengthening partnerships with local water agencies, irrigation districts, and other stakeholders." This amendment "supplements and clarifies terms of the SWP water supply contract that will provide greater water management regarding transfers and exchanges of SWP water within the SWP service area". Effectively, this streamlines the process for transfers or exchanges among SWP contractors, allowing for temporary transfers of SWP water and exchanges up to a 5:1 basis. BARR agencies such as Zone 7 Water Agency have been able to use this mechanism to access supplemental supplies during the current drought.

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 (BiOp) and/or changes to water-right permit conditions (NMFS, 2009; Reclamation, 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

A.9.1 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 Reclamation 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 limited 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 Biological Opinion (BiOp. These BiOp 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 BiOp limit the water transfers by others at the SWP and CVP facilities in the southern Delta to five months: July through November. 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 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 cubic foot/feet per second (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. Sacramento County Water Agency and EBMUD share the FRWP diversions. Sacramento County Water Agency 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 BiOp 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 Reclamation 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 Valley Water for the use of the FRWP that have a small impact on capacity. EBMUD developed, and is in process of updating, the *Principles for the Use of Unassigned Capacity*. Further, EBMUD also developed principles for internal guidance related to using its system for water wheeling. Generally, EBMUD is open to allowing others to use the Freeport Diversions and is actively working with other water districts to expand the use of the Freeport Diversion facility.

A.9.2 Points of Diversion Changes

Classic water transfers are basically a change in the point of diversion and the place of use of the seller's water rights to allow the buyer to access and use the supply. Not only do changes in points of diversion have the largest potential expand Bay Area water supplies, but also, BARR Partners may need to change only the points of diversion for most water exchanges between or among themselves.

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 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.

Water Rights Decision 1641 (D-1641): D-1641 allows DWR and Reclamation to exchange points of diversion at Banks and Jones under certain conditions. While three defined stages depend on the level of exports (Table A-1), each is only allowed when the following provisions are met:

1. Use of Joint Point under excess conditions does not cause the X2 position to move beyond certain points (X2 is the location in the Delta where the salinity is 2 parts per thousand).

2. Diversions do not cause the system to go from excess to balanced conditions.
3. Water level and water quality response plans are prepared.
4. All provisions of Water Right Decision 1641 are met.

Table A-1. Conditions Allowing Use of the SWP/CVP Delta Joint Point of Diversion

Stage	Allowable Conditions
1	Joint Point of Diversion may be used when it: • Recovers export reductions taken to benefit fish • Avoids an increase of annual exports that would occur in the absence of its use • Matches increase in pumping by reductions within 12 months • Accompanies a Fishery Response Plan approved by the State Board Executive Director
2	Joint Point may be used when the diversion: • Occurs under an Operations Plan approved by the State Board Executive Director that includes: • (a) measures to avoid or minimize the effects of the use of Joint Point on salmon in the Delta and upstream • (b) operating criteria to ensure that use of the Joint POD does not significantly impact aquatic resources in upstream areas due to changes in flow, water temperature, and reservoir water levels • (c) specific measures to protect other legal users of water • Includes specific measures to mitigate significant effects on recreational and cultural resources at affected reservoirs. • Ensures export rates at the Banks and Jones Pumping Plants do not exceed certain limits.
3	Stage 3 allows the use of Banks and Jones Pumping Plants up to the physical capacity of each pumping plant provided: • An Operations Plan is developed acceptable to the Executive Director of the State Board, which will protect aquatic resources and their habitat and will protect other legal users of water. The Operations Plan shall include the same elements required for Stage 2. • DWR and Reclamation protect water levels in the southern Delta through measures to maintain water levels at elevations adequate for diversion of water for agricultural uses. This requirement can be satisfied through construction and operation of three permanent tidal barriers in the southern Delta or through other measures that protect water quality in the southern and central Delta and protect water levels at elevations adequate to maintain agricultural diversions. If construction and operation of tidal barriers is used as a basis for Stage 3 operation, such construction and operation shall be subject to certification of a project-level Environmental Impact Report by the DWR that discloses the impacts of the tidal barriers

A.9.3 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 arranged 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 BiOp in 2008 and 2009. The BiOp 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 BiOp 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 BiOp 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 (Cawelo). 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.

A.9.4 "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 effectively "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 Reclamation and DWR.

A.9.5 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.

A.10 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.

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 BiOp, 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 Reclamation 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.

A.11 Carriage Water Related to Water Transfers Made Simple

(Draft prepared: 2/12/2018)

The purpose of this paper is to explain the concept of carriage water and how it is implemented with water transfers conveyed through Department of Water Resources (DWR) and United States Bureau of Reclamation (Reclamation) Delta facilities.

Definition

When there is not surplus water in the Delta, the State Water Project (SWP) and Central Valley Project (CVP) (together called Projects in this paper) must provide the outflow necessary to meet Delta standards. If they desire to increase their exports from the southern Delta, whether from their own stored water or from water supplied for export transfer, and reverse flow conditions exist in the lower San Joaquin River, extra outflow must be provided to maintain compliance with Delta salinity standards. This is because, at these times, the new water to be exported, rather than coming directly across the Delta from the Sacramento, must go around its western end of Sherman Island and up the San Joaquin–tending to worsen salinity on the San Joaquin side of the Delta. To prevent that worsening, an increment of water for extra outflow must be added to the export amount from the Sacramento to keep the San Joaquin fresh despite the existence of reverse flow in that channel.

That added increment of outflow is called “carriage water.” The amount of water a transferor must thus provide for an export transfer must include a carriage water component in addition to amount to be delivered to the export transferee–just as the projects must add carriage water to support their own exports of stored water. Carriage water is the incremental water cost of adding a unit of export under conditions of reverse flow. As explained in more detail below, the carriage water rate is thus expressed as a percentage of the transfer water. Computer modeling simulations of Delta conditions with and without the transfer are used to determine the carriage water rate.

For example, if 70 AF is desired to be transferred and the carriage water requirement is 30 percent, then 100 AF must be provided to the Sacramento River inflow by the transferor to support the transfer: 70 AF for the transfer and 30 AF for the added Delta outflow to counteract the effects of reverse flow. The sum of the amount to be transferred by export and the carriage water is what the transferor must agree to provide as Sacramento River inflow.

Delta Salinity

The Delta is connected to the Pacific Ocean via the San Francisco Bay. The water in the Bay is more saline than fresh water from the rivers upstream of the Delta. If there were no Delta outflow, salt water from the Bay would enter the Delta and move further upstream to about sea level. This location roughly corresponds to the City of Sacramento on the Sacramento River and Vernalis on the San Joaquin River depending on the amount of precipitation in the year. Many factors affect salinity levels in the Delta, such as Delta inflow and outflow, tides, winds, in-Delta water diversions and agricultural return flows, Delta channel capacities, water levels, circulation, and SWP and CVP operations (like Delta Cross Channel Gates, South Delta pumping plants, and temporary barriers).

The State Board’s Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan) contains objectives to protect water quality. The State Board’s Water

Right Decision 1641 (D-1641) includes requirements specific to the SWP and CVP to meet certain water quality standards in the Bay-Delta Plan. These regulatory requirements may control SWP and CVP operations during the time when water is transferred across the Delta. The SWP and CVP water, and other agencies' transfer water, is diverted from the southern Delta at the SWP and CVP pumping plants to serve water users south and west of the Delta. When the pumps are operating, they can disrupt the direction of flow in the nearby Delta channels and induce the upstream freshwater flow from the San Joaquin River, allowing salty Bay water to flow into the Delta. Export pumping can cause net flow reversal in the lower San Joaquin River, allowing more saline water to encroach into the Delta and threaten compliance with salinity standards. To avoid that happening, when transfer water is pumped at those times, the transferor must also provide water for the extra outflow needed to counteract the effects of pumping the transfer water.

How is Carriage Water calculated?

DWR performed studies in the 1990's and the results indicated that carriage water rate varied between zero and 60 percent or more of the transfer amount depending upon hydrology and other operational parameters.

Computer simulations using the Delta Simulation Model 2 (DSM2) are used to derive the carriage water rate. Typically, in wetter years, the carriage water rate may be lower due to higher Delta inflows being able to freshen the interior of the Delta. In dry years, the carriage water rate may be higher due to lower Delta inflows being unable to repulse the saline water from the Bay. The need for water exports is typically higher in dry years, increasing the potential for decreased outflow and increased salinity intrusion. DSM2 computer simulations are applied to deal with complexities such as this. (Technical discussions about modeling can be found at: http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/carriagewater.cfm).

Prior to the start of the water transfer period (July through September), DSM2 is used in a preliminary assessment to determine an estimate for the carriage water rate based on the assumed volume of transfers that year. The estimated carriage water rate is then used for all transfers during the transfer period that year. This minimizes the resources required to complete the assessment and evenly distributes the costs among all parties. It also addresses issues with potential disparities in daily transfer amounts, avoids any water delivery priority conflicts, and addresses the effects of transfers on the water quality conditions related to compliance concerns.

Once the water transfer period is over, data collected during the water transfer period is used in DSM2 computer simulations to develop carriage water rates based on the actual conditions during the water transfer period. First, a without-transfer scenario is developed to represent conditions that would have occurred without the transfer while meeting all regulatory requirements. Then additional scenarios are run by increasing exports and adjusting the assumed carriage water rate to estimate salinity. The process usually involves trial and error that requires multiple runs to get a reasonable estimate of the carriage water component of the water transfer.

The results of the additional scenarios are compared to the without transfer scenario at Jersey Point, Bethel Island, and Bacon Island to determine what amount of carriage water is needed to maintain a without water transfer level of salinity. The rational for using these locations are:

i) They represent interior Delta locations with salinity standards that often control Delta water operations and
ii) Salinity-outflow relations at these locations are relatively complicated.

The generated carriage water rates for Jersey Point, Bethel Island, and Bacon Island are compared, and the highest percentage is selected as the final value to represent carriage water rate for the transfer period that year.

How is Carriage Water accounted for in the conveyance agreements and how are adjustments made?

Every water conveyance agreement approved by DWR for water transfers through SWP facilities states that carriage water and other water losses will be assessed against the transfers. This provision is in the conveyance agreement in a section titled "Conveyance". The estimated carriage water rate for each year is communicated to the buyers and sellers before any water transfers begin. Initially, the estimated carriage water rate is incorporated into the agreements with a provision in some cases that allows adjustments based on actual conditions as discussed below.

For buyers of a water transfer who are SWP contractors, the initial estimate of the carriage water rate is reviewed at the end of the water transfer period and adjusted accordingly after the transfer period is over based on additional analyses. This adjustment is discussed in the conveyance agreement in the section titled "Reclassification of Transfer Water Deliveries". These adjustments are made in the accounting for the transfer water and Table A water that were delivered to the corresponding SWP contractors. If the final carriage water determined after the water transfer period was higher than the estimated carriage water rate determined before the water transfer period, then the adjustments would show that less transfer water was delivered each month during summer, and more Table A water was delivered. The same is true in the reverse if the carriage water rate determined after the water transfer period showed that carriage water was less than the amount estimated before the water transfer period. No change is made to the actual overall quantity of water that was delivered to the contractor. The State Water Project Analysis Office (SWPAO) maintains data about the actual amounts of the water delivered. What this does in effect is to change the amount of Table A carryover water the contractor may have in the next year.

For water transfer buyers that are not SWP contractors, the process is not as flexible. When the carriage water rate determined after the water transfer period is lower than the carriage water rate estimated before the water transfer period, there is no way to return the water to the buyer. This is because the carriage water rate estimate is defined as a fixed value in the conveyance agreement and does not change regardless of the values determined after the water transfer period. In effect, both DWR and the non-SWP buyers are taking a risk on the initial estimate of carriage water rate. Either party could lose water if the estimate differs substantially from the carriage water rate computed after the water transfer period. If the carriage water rate determined after the transfer period is higher than the estimate, then DWR delivered more transfer water than was made available. On the other hand, if the carriage water rate determined after the transfer period is lower than what was estimated, then the purchaser received less water than what was available. When the initial estimate of the carriage water rate is determined and defined in the conveyance agreement, appropriate decisions on water price can be made while negotiating those agreements.

Some non-SWP parties who have carryover water in the San Luis Reservoir are attempting to develop a method to allow water to be exchanged between DWR and Reclamation to allow for adjustments in the carriage water rate in a way similar to that performed for the SWP contractors. They are working with Reclamation on a proposal for review which could possibly be included in future water conveyance agreements.

Appendix B: California Water Code 1810 and 1811

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CWC 1810.

Notwithstanding any other provision of law, neither the state, nor any regional or local public agency may deny a bona fide transferor of water the use of a water conveyance facility which has unused capacity, for the period of time for which that capacity is available, if fair compensation is paid for that use, subject to the following:

(a) Any person or public agency that has a long-term water service contract with or the right to receive water from the owner of the conveyance facility shall have the right to use any unused capacity prior to any bona fide transferor.

(b) The commingling of transferred water does not result in a diminution of the beneficial uses or quality of the water in the facility, except that the transferor may, at the transferor's own expense, provide for treatment to prevent the diminution, and the transferred water is of substantially the same quality as the water in the facility.

(c) Any person or public agency that has a water service contract with or the right to receive water from the owner of the conveyance facility who has an emergency need may utilize the unused capacity that was made available pursuant to this section for the duration of the emergency.

(d) This use of a water conveyance facility is to be made without injuring any legal user of water and without unreasonably affecting fish, wildlife, or other instream beneficial uses and without unreasonably affecting the overall economy or the environment of the county from which the water is being transferred.

CWC 1811.

As used in this article, the following terms shall have the following meanings:

(a) "Bona fide transferor" means a person or public agency as defined in Section 20009 of the Government Code with a contract for sale of water that may be conditioned upon the acquisition of conveyance facility capacity to convey the water that is the subject of the contract.

(b) "Emergency" means a sudden occurrence such as a storm, flood, fire, or an unexpected equipment outage impairing the ability of a person or public agency to make water deliveries.

(c) "Fair compensation" means the reasonable charges incurred by the owner of the conveyance system, including capital, operation, maintenance, and replacement costs, increased costs from any necessitated purchase of supplemental power, and including reasonable credit for any offsetting benefits for the use of the conveyance system.

(d) "Replacement costs" mean the reasonable portion of costs associated with material acquisition for the correction of irreparable wear or other deterioration of conveyance facility parts that have an anticipated life that is less than the conveyance facility repayment period and which costs are attributable to the proposed use.

(e) "Unused capacity" means space that is available within the operational limits of the conveyance system and that the owner is not using during the period for which the transfer is proposed and for which space is sufficient to convey the quantity of water proposed to be transferred.

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Appendix C: Water Transfers in California

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C.1 Overview of Water Transfers

Water transfers between willing sellers and willing buyers can help stretch California's water supplies in dry times and move water to places of critical need. The majority of the hundreds of water transfers in California each year occur between agricultural water users in the same basin.

Willing sellers holding legal rights to a water supply of interest to a potential buyer propose and initiate water transfer. The seller must take specific actions within its service area to make "new water" available to the buyer that would otherwise not be available for diversion. Several key departments and agencies are consulted and coordinated with to meet requirements and achieve regulatory approvals throughout different parts of the water transfer development process.

C.2 DWR/State Water Resources Control Board (State Board) Transfer Categories and Descriptions

Approaches to Make Water Available for Transfer

As described in the DWR/State Water Board's 2019 *Water Transfers White Paper*, DWR and the State Board define several approaches that can be used for making water available for transfer, summarized as follows.

Agricultural Conservation

This approach involves the seller reducing consumptive agricultural water use by idling crops out of production, crop shifting (i.e., growing a less water-intensive crop), or taking other measures that result in reduced water use.

Crop idling

Water can also be made available for transfer through crop idling. In crop idling-based transfers, growers fallow land that would have been planted during the transfer season absent the transfer. The amount of water made available for transfer is based on the reduction in consumptive use, which is calculated as the evapotranspiration of applied water (ETAW). ETAW is the portion of applied water that is evaporated from the soil and plant surfaces and actually used by the crop. ETAW does not include the portion of the applied water that is lost as deep percolation to groundwater or conveyance losses without project specific documentation supporting an alternate method. Unless the acreage overlies an unusable groundwater basin or discharges to a saline sink, these depletions contribute to the overall water supply and are excluded from the calculation of transferable water.

Actual crop water requirements vary by crop, region, and growing season. It is not feasible to determine the actual ETAW for the specific conditions of each individual transfer, therefore, average ETAW values are used to estimate transfer water. Historic cropping patterns are used to establish baseline crop acreage. Baseline acreage is important to establish what would have been planted in the absence of the transfer.

Idling agricultural acreage can result in impacts to parties not directly involved in the transfer, such as agricultural workers and seed or equipment suppliers. In order to minimize such potential economic effects in the county resulting from crop idling transfers, crop idling is typically limited to no more than twenty percent of the irrigated acreage within the agency transferring water or within the county from which the water is transferred.

Water made available by crop idling is made available on the actual ETAW pattern during the year. Unless storage is available, export capacity must coincide with the pattern of availability to allow export of the transfer water. The existing window for transfer capacity at the SWP and CVP export facilities in the Delta is currently limited to July through September (discussed below in Regulatory Framework). Depending on the crop, transfer water from crop idling is typically made available May through September. Unless storage capacity upstream of the export location is available, any water made available from crop idling outside the transfer window cannot be exported by either the SWP or CVP Delta pumps. Crop idling water made available from May through June ETAW can represent a significant portion of the transfer water, and the loss of this portion can make crop idling transfers that lack access to storage infeasible. A change in the seasonal restriction on export of transfer water could affect the feasibility of crop idling transfers in areas within the Delta watershed.

Crop shifting

Water transfers based on crop shifting involve a change in crops planted by a grower, substituting a lower water using crop (one with a lower ETAW) for a more water intensive crop. A cropping history is required to establish baseline cropping patterns. The water available for transfer resulting from crop shifting is the difference between the ETAW of the historic crop type and the alternate lower water intensive crop. Crop shifting transfers are only practical in regions where the agricultural land is suited to multiple crop types, allowing a shift to an alternate crop. The restrictions on export of transfer water noted above under crop idling apply to crop shifting as well.

Water conservation

Implementation of water conservation measures can result in numerous benefits for an agricultural or municipal user, such as reduction in the discharge of poor-quality agricultural drainage, or improved availability of limited supplies within the user's service area. However, only those conservation measures that result in a reduction in the consumptive use of water or prevent water from discharging to an unusable water supply make water available for transfer. Conservation measures such as lining or replacing an unlined ditch may generate water for transfer to the extent that riparian vegetation is reduced or surface or groundwater discharges to an unusable basin are eliminated. Documentation of the conditions, including water diversion and use, before and after the conservation measures were implemented is necessary to demonstrate the amount of transferrable water. Transfers based on implementation of water conservation measures have been limited, because most conservation programs do not meet the above tests.

Groundwater Substitution

In a groundwater substitution transfer, a water user with a right to divert surface water forgoes this right and pumps groundwater for the period of the transfer, thereby making the forgone surface diversions available to a user downstream. The quantity of surface water available is based on the quantity of groundwater actually pumped less any streamflow depletion losses.

Additional groundwater pumping will, to some extent, influence the surface water supply, referred to as streamflow depletion. The impacts of the transfer on streamflow can continue to occur long after the transfer has been completed. If the additional streamflow depletion occurs at a time when excess flow is available, downstream users are not affected. However, if the depletion occurs at a time when other downstream users could divert that water, the transfer could have an impact on other legal users.

Accounting for the impact of the transfer on streamflow is essential to determining the amount of new water available for transfer and to avoid injury to downstream water users. The amount and timing of the impacts, however, cannot be directly measured but can be estimated using mathematical models. Although the work required to accurately assess the appropriate streamflow depletion factor for a particular transfer can be time-consuming and costly, the assessment of an appropriate streamflow depletion factor is necessary to protect other legal users of water. An increase in groundwater pumping has the potential to affect not only the streamflow, but other groundwater users and water quality as well. DWR and Reclamation require that the transferor implement a monitoring program to assess potential groundwater level and water quality impacts. For transfers conveyed through either the SWP or the CVP, the Seller is required to develop and implement a monitoring and mitigation plan to address any concerns raised by the monitoring data or other potentially affected parties.

Reservoir Reoperation

Reservoir reoperation involves an increased release of water from a reservoir compared to normal operations. The transfer water is conveyed downstream to a new point of diversion either within or outside the watershed. It is important that storage releases are coordinated with the agency conveying the water to assure that the additional flows can be rediverted at the new downstream diversion point.

The release of additional water from the reservoir for transfer creates a lower “end of season” storage in the reservoir than would have existed absent the transfer. Consequently, more water must be captured the following year to refill the reservoir. If the reservoir operator refills the additional vacated storage at a time when those flows would also have been available to other legal users downstream of the reservoir, the transfer would result in an injury to other downstream legal users in the year(s) following the transfer. To avoid injuring downstream users, sellers must refill the vacated reservoir storage at a time when downstream users would not have otherwise been able to capture the water, either in downstream reservoirs or direct diversion facilities. If refill causes an injury due to its timing, additional water must be released to compensate for the injury. This means that the storage capacity vacated due to the transfer can only be refilled at times when the Delta is in excess conditions or, if there is another reservoir downstream of the transfer reservoir, the storage space can only be refilled after the downstream reservoir fills or reaches its flood control elevations. Reservoir refill criteria are typically included in any reservoir reoperation water transfer agreement to ensure that no other legal users of water are injured by the transfer. These water transfer agreements need to be in place along with any needed changes to water rights before the water transfer begins.

C.3 Water Transfer Rules

Figure C-1 and subsequent insets summarize the actions required for water transfers based on the water supply source. These rules are defined within the State Water Board’s *Guidelines for Water Transfers* (State Board, 1999).

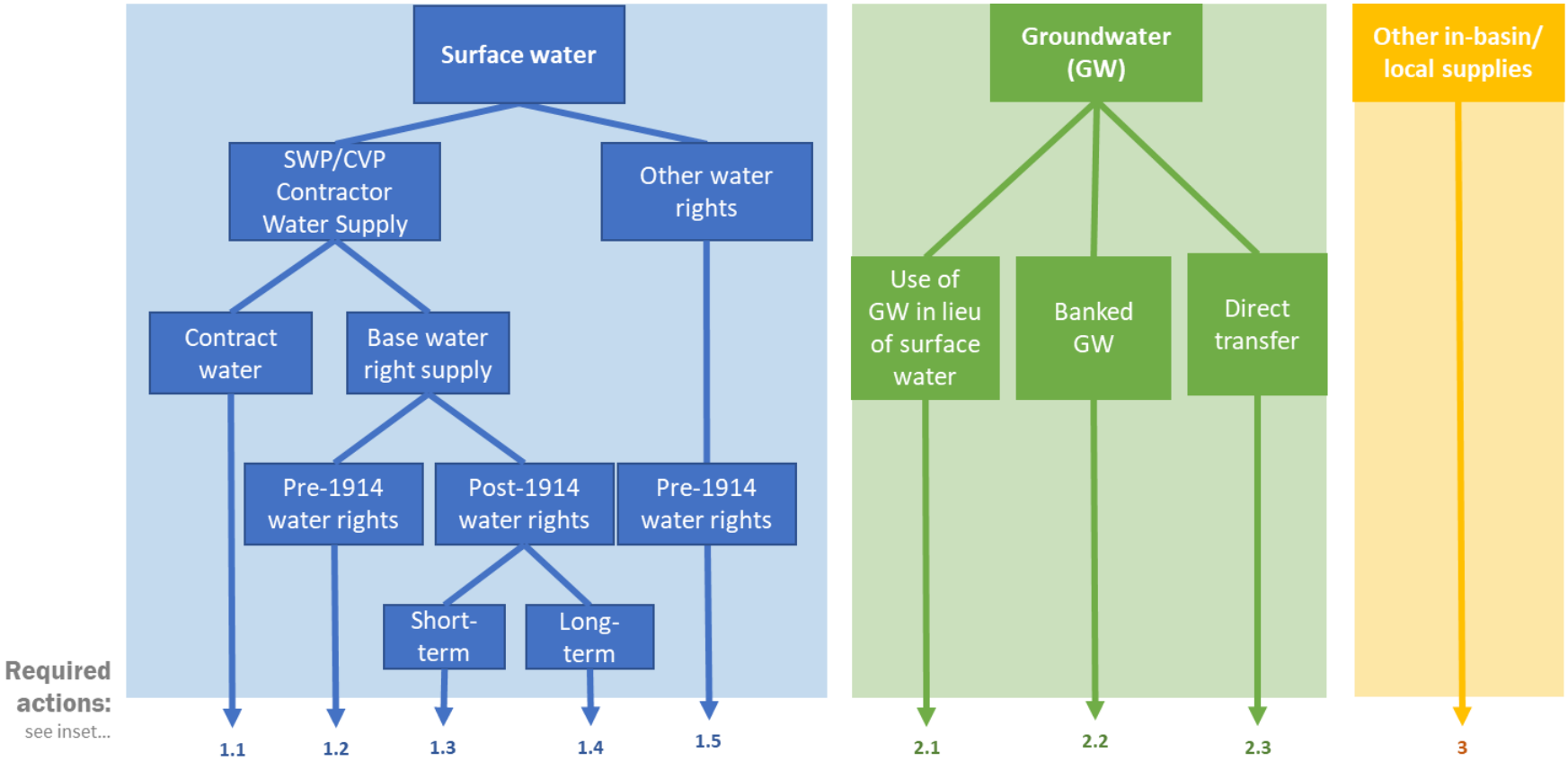

Figure C-1. Flowchart of water transfer rules allows for identifying required actions based on source of supply

Note: See Appendix A for additional information on types of water rights and the permitting process

Inset 1: Surface water

1.1: Transfer within rights of water district, DWR, or Reclamation

Transfer = contract allocation* – actual use

***for CVP, limited to historical use except if in Sacramento Valley**

- Requires complying with any special provisions of water district, DWR, and/or Reclamation.
- If transfer involves DWR or Reclamation facilities, comply with DWR or Reclamation transfer information needs.

1.2: Transfer of base supply under a CVP or DWR contract that has pre-1914 water rights

Transfer = contract allocation* – actual use

***for CVP, limited to historical use except if in Sacramento Valley**

- Requires approval from DWR or Reclamation but not from State Board.
- Requires demonstrating no injury to other legal users of water (CWC 1706).
- Useful for short-term changes; long-term changes may result in contract revisions.

1.3: Transfer with short-term changes in post-1914 water rights

For direct use rights: Transfer = reduction in consumptive use (via fallowing, crop change, or conservation) to extent of direct diversion water rights; valid water rights must exist at time of transfer.

For storage rights: Transfer = water in storage, or water that would have been stored.

- If transfer involves DWR/Reclamation approval or use of facilities, needs to comply with any special provisions of the water district and DWR and/or Reclamation.
- Exempt from CEQA but requires State Board approval (CWC 1725).
- Requires demonstrating no injury to other legal users of water (CWC 1706).
  - For direct use rights, needs to be savings from reductions in consumptive use of water (like taking crops out of production).
  - For storage rights, this involves water that would normally stay in storage but for the transfer or water that would have been stored. There can be refill impacts that need to be addressed.
- Requires demonstrating no unreasonable effects to fish and wildlife.
- If DWR facilities or facilities of another public agency are used, requires demonstrating no unreasonable effect to the overall economy or environment of the county from which the water is transferred.

1.4: Transfer with long-term changes in post-1914 water rights

For direct use rights: Transfer = reduction in consumptive use (via fallowing, crop change, or conservation) to extent of direct diversion water rights; valid water rights must exist at time of transfer.

For storage rights: Transfer = water in storage, or water that would have been stored.

- If the transfer involves DWR/Reclamation approval or use of facilities owned by a public agency, need to comply with any special provisions of the water district and DWR and/or Reclamation.
- Requires State Board approval as well as CEQA compliance.
- Requires demonstrating no injury to other legal users of water (CWC 1706).
  - For direct use rights, this needs to be savings from reductions in consumptive use of water (like taking crops out of production).
  - For storage rights, this involves water that would normally stay in storage but for the

transfer or water that would have been stored. Refill impacts may need to be addressed.

- Requires demonstrating no unreasonable effects to fish and wildlife.
- If DWR facilities or facilities of another public agency are used, requires demonstrating no unreasonable effect to the overall economy or environment of the county from which the water is transferred.

1.5: Transfer involving changes to pre-1914 water rights

- Does not require State Board action.
- Requires demonstrating no injury to other legal uses of water (CWC 1706).
- CEQA compliance needed.
- If the transfer involves DWR/Reclamation approval or use of facilities owned by a public agency, need to comply with any special provisions of the water district, DWR, and/or Reclamation.

Inset 2: Groundwater

2.1: Use of groundwater in lieu of surface water rights

Transfer = evapotranspiration + deep percolation + surface returns of crop in the ground for which groundwater is used to the extent of surface direct diversion rights.

- Comply with applicable groundwater management plans per CWC 10750 or approved by water supplier pursuant to CWC 1745.10.
- Evaluate effects on other groundwater users, downstream users, and avoid impacts.
- Track flows to place of use and protect from diversion by junior rights.

2.2: Banked groundwater

Transfer = banked water taken from groundwater storage

- If banked by contractor, is ultimate Place of Use covered in original water rights?
  - Yes → Comply with any groundwater management plan per CWC 10750, local ordinance, and CWC 1215. No State Board approval needed.
  - No → Seek appropriate changes to water rights.
- If banked by original water right holder, do water rights include groundwater storage?
  - No → Seek appropriate changes to water rights.
  - If yes, is ultimate Place of Use covered in original water rights?
    - Yes → Comply with any groundwater management plan per CWC 10750, local ordinance, and CWC 1215. No State Board approval needed.
    - No → Seek appropriate changes to water rights.

2.3: Direct transfer of groundwater

- No State Board approval needed.
- For exports from combined Sacramento and Delta Sierra Basins, per CWC 1220:
- Not possible to transfer groundwater from the Sacramento Valley. See CWC 1220.
- If exported by CVP/SWP: Comply with watershed protection per CWC 11460.
- If exported by others: See CWC 1220.
- For other direct groundwater transfers: Comply with groundwater management plan (CWC

10750), local ordinance, and CWC 1215.

Inset 3: Other In-Basin/Local Supplies

Additional requirements may apply to transfers of other in-basin/local supplies, such as:

- Reuse, including recycled water (non-potable reuse) and purified water (potable reuse)
- Desalination
- Urban stormwater capture

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Appendix D: Water Rights Process Overview

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The schematic flow chart shown in Figure D-1 below helps with identifying the state and/or federal agency responsible for oversight and approval of transfers based on circumstances.

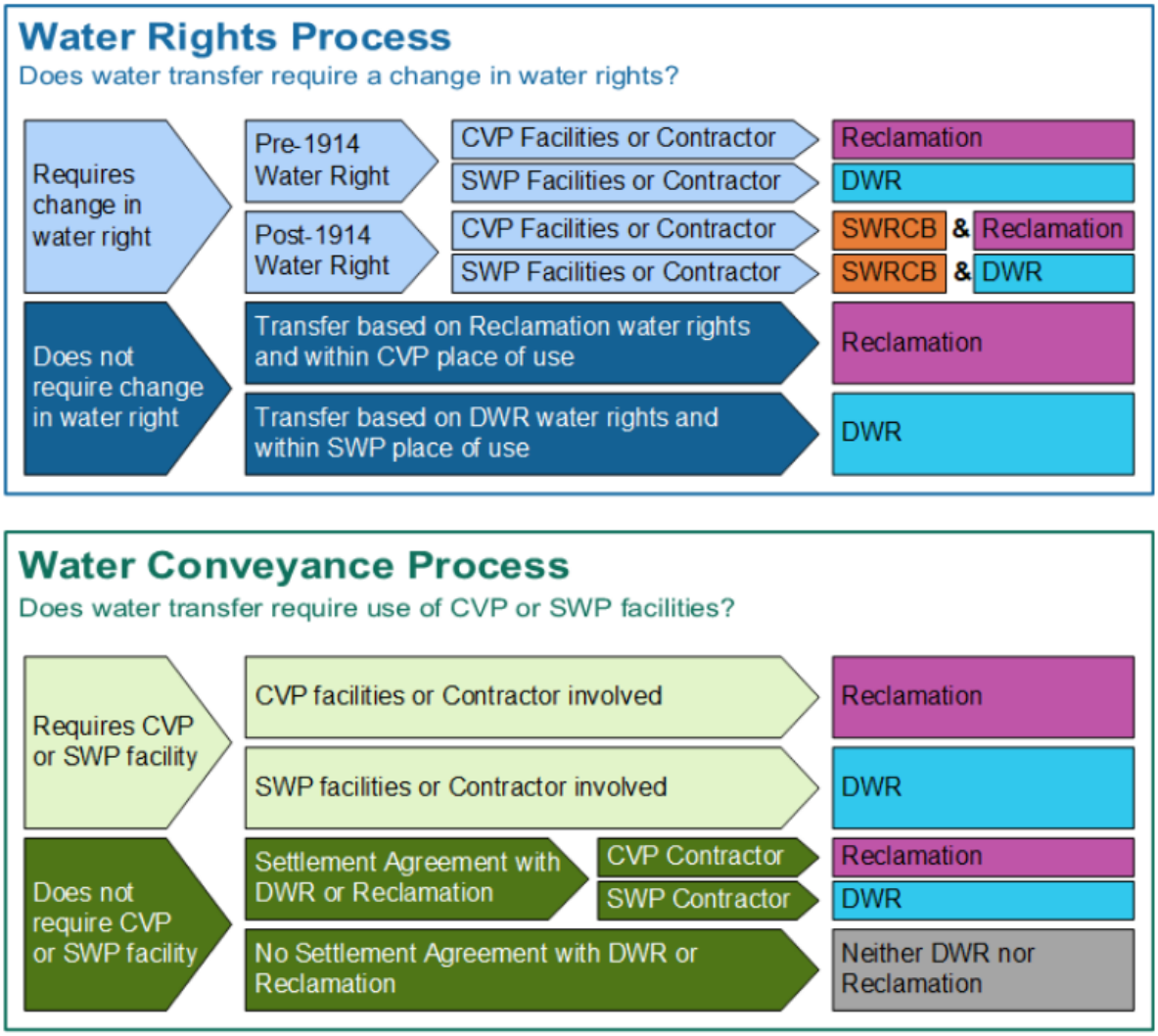

Figure D-1. Flow chart for determining agencies responsible for approving water transfers in California

(Source: DWR and State Water Board, Draft Water Transfer White Paper, 2019)

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Appendix E: Summary of Past BARR Partners' Water Transactions

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Despite its limitations, information on BARR Partners' past water transactions provided an important basis for exploring lessons learned and SWAP recommendations. Tables E-1 through E-3 present a summary of these past water transactions based on several sources of information, including:

- Publicly available water transfer records from the State Board, which provide information on petitions submitted from 2009 to 2019.
- Information provided by BARR Partners as part of the Bay Area SWAP effort to update, complement, and/or augment the State Board transfer records.
- Information related to the pilot projects conducted by BARR Partners as part of Bay Area SWAP.

This summary of past water transactions represents a single snapshot in time and may not be complete beyond 2019. The summary is organized in three groups based on previously defined BARR transfer categories that have been updated to support the Bay Area SWAP roadmap. Tables E-1 through E-3 group the water transactions into three types, as follows.

Type 1: Transfers (Table E-1)

A transfer is a water transaction between two parties where one entity (seller) sells water to another entity (buyer). Transfers typically require approval from the State Water Board through a change petition, though some transfers are exempt (e.g., CVP/SWP contract forbearance agreements, pre-1914 water rights, and existing authorized water transfer programs). In the 2019 *Water Transfers White Paper,* DWR and the State Water Board have defined several methods to make water supply available for transfer. These and other approaches include the following, as defined in Section 1.4 of the SWAP Strategy Report:

1. Reservoir reoperation
2. Groundwater substitution
3. Crop idling/shifting
4. Contract reallocation
5. Conserved water
6. Recycled water credit via California Water Code Section 1010

Type 2: Exchanges (Table E-2)

An exchange is a water transaction involving two or more entities that trade water supplies, generally resulting in no net increase of water supply for any participating entity. Unlike transfers where one entity reduces its consumptive use of a specific water supply to sell to another entity, the key concept to exchanges is the participating entities "swap" water.

Type 3: Transfers via Exchange (Table E-3)

Type 3 water transactions involve both a transfer (Type 1) and exchange (Type 2). Supply is made available through a typical transfer. To complete the transfer and physically convey the supply to the buyer, the delivery mechanism involves an exchange through available facilities.

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Table E-1. Experiences and Lessons Learned from BARR Partners' Past Water Supply Transactions Defined as Type 1 (Transfers)

Method Making Transfer Water Available	Agencies Involved	Year	Supply Origin/Watershed	Need/Driver or Opportunity	Challenges/Notes for Future
1. Reservoir Reoperation	Foresthill Public Utility District (seller) Valley Water (buyer)	2015	Delta		
	CCWD (seller) BBID (buyer)	2014 and 2015	Delta	CCWD interested in pilot project to test regional partnership in then-newly expanded 160,000-AF LV Reservoir; favorable hydrologic conditions following completion of construction had enabled storage to support a limited pilot project, particularly to assist neighboring water agency during drought emergency. This differed from the 2014 CCWD-ACWD pilot in that BBID is a CVP contractor with its own point of diversion. State Board issued notice of potential curtailment of pre-1914 water rights due to the historically unprecedented drought conditions. BBID farmers had already planted crops, and since pre-1914 rights had never been curtailed before, their decision making had not previously considered drought. Thus, BBID needed a backup water supply in case of curtailment. Approach for making water available: Reservoir Reoperation. Involves an increased release of water from a reservoir compared to normal operations; the transfer water is conveyed downstream to a new point of diversion either within or outside the watershed.	Amount of water transferred was initially limited by infrastructure capacity within BBID system. Construction of the Transfer-Bethany Pipeline connecting CCWD's Los Vaqueros system to the California Aqueduct near Bethany Reservoir would facilitate transfer of water from Los Vaqueros storage to the southern portion of BBID's service area by removing the need to use the in-lieu through-Delta exchange of CVP water (but water for the northern portion would still need to be served using BBID's point of diversion). Drought emergency declaration and direction to streamline transfer approvals seemed to be helpful. No identified fishery component. Because agencies were not able to move all the water, and the drought continued, the CCWD-BBID agreement was extended into 2015.
	Placer County Water Agency (PCWA) (seller) EBMUD (buyer)	2015	American River	Curtailment of Mokelumne River diversions prompted need for supplemental supply. Board of Directors declared a Stage 4 Drought Emergency, authorizing the purchase of 25,000 AF of supplemental supply. Supply reallocation enabled under Water Forum Agreement. Approach for making water available: Reservoir Reoperation. Involves an increased release of water from a reservoir compared to normal operations; the transfer water is conveyed downstream to a new point of diversion either within or outside the watershed. Environmental benefit: Coordinated release to support temperature management for fall-run Chinook salmon.	EBMUD has right of first refusal to purchase dry year temporary transfer water from PCWA, as set in EBMUD-PCWA MOU.
	Merced Irrigation District (seller) Valley Water and/or San Luis & Delta-Mendota Water Authority (buyer)	2014	Merced River	Pulse flow for fishery assistance in April 2014	
	PCWA (seller) EBMUD (buyer)	2014	American River	Prompted by low reservoir storage (before EBMUD established official drought stages). Enabled by Water Forum Agreement.	EBMUD and PCWA have an MOU under which EBMUD has right of first refusal to purchase dry year temporary transfer water from PCWA.
2. Groundwater Substitution	River Garden Farms (seller) Zone 7 (buyer)	2018	Yolo County	Zone 7 is interested in seeking water transfers to address potential supply needs in interim timeframe before completing certain CIP projects and wanted a better sense of the transfer market, including pricing and potential opportunities between an SWP contractor and settlement CVP contractor. Supported by seller's willingness to reallocate supply. Approach for making water available: Groundwater Substitution. A water user with a right to divert surface water forgoes this right and pumps groundwater for the period of the transfer, thereby making the forgone surface diversions available to a user downstream.	Challenge concerning political or other implications for a SWP partner to seek out a CVP partner. Delay on completing NEPA in part due to clarity needed for Zone 7 to also complete CEQA if there is post-1914 water right curtailment and the statutory CEQA exemption under the CWC no longer applies.
3. Crop Idling/ Shifting	Reclamation District 756 (seller) ACWD, Zone 7, Valley Water, and others (buyer)	2014	Delta		In Delta transfer. No fishery assistance. Right curtailed after transfer approved.
	Delta Farms Reclamation District 2026 (seller) ACWD, Zone 7, Valley Water, and others (buyer)	2014	Delta		In Delta transfer. No fishery assistance. Right curtailed after transfer approved.
	Reclamation District 1004 (seller) EBMUD (buyer)	2015	Sacramento River	Curtailment of Mokelumne River diversions prompted need for supplemental supply. Board of Directors declared a Stage 4 Drought Emergency, authorizing the purchase of 25,000 AF of supplemental supply. Approach for making water available: Crop Idling. Growers fallow land that would have been planted during the transfer season absent the transfer; the amount of water made available for transfer is based on the reduction in consumptive use, which is calculated as the ETAW.	
	Sycamore Mutual Water Company (seller) EBMUD (buyer)	2015	Sacramento River	Curtailment of Mokelumne River diversions prompted need for supplemental supply. Board of Directors declared a Stage 4 Drought Emergency, authorizing the purchase of 25,000 AF of supplemental supply. Approach for making water available: Crop Idling. Growers fallow land that would have been planted during the transfer season absent the transfer; the amount of water made available for transfer is based on the reduction in consumptive use, which is calculated as the ETAW.	

Table E-1. Experiences and Lessons Learned from BARR Partners' Past Water Supply Transactions Defined as Type 1 (Transfers)

Method Making Transfer Water Available	Agencies Involved	Year	Supply Origin/Watershed	Need/Driver or Opportunity	Challenges/Notes for Future
4. Contract Reallocation	DWR/Reclamation (seller) Valley Water and others (buyer)	2010	Delta		
	DWR/Reclamation (seller) Valley Water and others (buyer)	2012, 2013, 2014	Delta		
	Reclamation (seller) ACWD and Zone 7 (buyer)	2015	Delta		
	DWR/Reclamation (seller) Valley Water and others (buyer)	2016, 2017, 2018, 2019	Delta		
5. Conserved Water	Byron-Bethany Irrigation District (BBID) (seller) Zone 7 (buyer)	1998	Delta	Zone 7 needed additional supply for projected development in the Tri-Valley. Supported by seller's willingness reallocate supply.	Challenges: DWR and Reclamation disagreed with BBID's ability to transfer this water, due to pre-existing settlement agreement between BBID and DWR.

Table E-2. Experiences and Lessons Learned from BARR Partners' Past Water Supply Transactions – Type 2 (Exchanges)

Method Making Transfer Water Available	Agencies Involved	Year	Supply Origin/Watershed	Need/Driver or Opportunity	Challenges/Notes for Future
4. Contract Reallocation	(attempted) ACWD (seller) Valley Water (buyer)	2016	Delta (SWP)	The concept for this transfer was that ACWD would provide Valley Water an unbalanced exchange from its Semitropic bank during the drought. The benefit would be to move available surplus supply from Semitropic storage to Valley Water's groundwater basin. Environmental benefits include protecting local groundwater basin from saltwater intrusion and subsidence.	Sale of SWP supply was not allowed. This may be feasible with contract amendments in the future. Potential opportunity initially indicated via excess storage in Semitropic groundwater bank and available storage in the Bay Area (Valley Water groundwater basin) The challenge was ACWD's drought ordinance would not allow this. Crisis/pressure to meet demands seems to improve feasibility, in general. What could have been done differently: ACWD's drought ordinance should be less restrictive on water management strategies. Suggest that agencies should be discussing these topics prior to the next drought to get more stakeholder support and buy in.
(Conjunctive Use) 1. Reservoir Reoperation and 2. Groundwater Substitution	EBMUD (seller) North San Joaquin Water Conservation District (buyer)	2018 - ongoing	Mokelumne River watershed and San Joaquin County	Groundwater banking pilot (1,000 AF of surface water used during irrigation season instead of groundwater; 500 AF of groundwater extracted during non-irrigation season). Opportunity identified because of the critically over drafted conditions in the Eastern San Joaquin Groundwater Subbasin.	Pilot is still in progress.

Table E-3. Experiences and Lessons Learned from BARR Partners' Past Water Supply Transactions – Type 3 (Transfers via Exchange)

Method Making Transfer Water Available	Agencies Involved	Year	Supply Origin/Watershed	Need/Driver or Opportunity	Challenges/Notes for Future
1. Reservoir Reoperation (Transfer) and 4. Contract Reallocation (Exchange)	(attempted) SFPUC/BAWSCA via ACWD (seller) Western Growers Kern County Collective (buyer)	2015	SFPUC Supply (RWS)	Extreme drought conditions prompted Delta shutdown (0% Table A allocations). ACWD had stored supply available in Semitropic groundwater bank. Extreme water scarcity created a situation that enabled regulatory and public support for quick action. This may be instructive in times of future shortage.	SFPUC would be selling this water to a non-BAWSCA agency. This was never done before, and the participating agencies did not go far enough down the path of implementation to evaluate any potential fatal flaws. What could have been done differently: Longer and more discussion with SFPUC and BAWSCA regarding selling, on paper, water to Central Valley customers. Whether worth repeating: Maybe obsolete after contract amendments to SWP. Further suggestions: It would be beneficial to consider the feasibility of banking SFPUC's RWS supplies in areas outside current places of use. This would require proactive discussions and possibly amendments to existing contracts prior to a future drought or water supply shortfall. This transfer was deemed as a potentially "disguised sale of Table A". Contract amendments may eliminate this problem.
4. Contract Reallocation (Transfer) and 4. In-Lieu Contract Reallocation (Exchange)	(attempted) Zone 7 and ACWD (sellers) via exchange with CCWD (buyer)	2015-2016	Delta	With storage capacity available during the drought, the opportunity arose for ACWD and Zone 7 to store SWP supply in LV Reservoir through exchange in the fall when CCWD CVP allocation was short Without this exchange, CCWD would have been required to use supply stored in LV to meet customer demand, in addition to its usual purpose of managing water quality. Later delivery to ACWD and Zone 7 would use in-lieu through-Delta exchange of CVP water for water stored in LV, as demonstrated in the 2014 ACWD-CCWD pilot. This transaction would have tested the concept of storing water in LV Reservoir for regional partners and created an opportunity for efficiently managing available water supplies among Bay Area regional partners during the drought. Construction of the Transfer-Bethany Pipeline connecting CCWD's Los Vaqueros system to the California Aqueduct near Bethany Reservoir would facilitate transfer of water from Los Vaqueros storage to ACWD and Zone 7 by removing the need to use the in-lieu through-Delta exchange of CVP water. Approach for making water available: Reservoir Reoperation. Involves an increased release of water from a reservoir compared to normal operations; the transfer water is conveyed downstream to a new point of diversion either within or outside the watershed.	Permits and approvals were secured for 2016, but coordination with DWR and CVP operations staff to implement the exchange proved to be difficult to schedule (lack of time and priority, due to other pressing issues on DWR and CVP staff). The DWR Conveyance Agreement was secured in mid-December of 2015, and upon the Delta shifting to in-balance conditions on January 6, 2016, the window of opportunity closed for the first step of the exchange (CCWD diversion of ACWD and Zone 7 SWP water to create a storage credit for ACWD and Zone 7 in LV Reservoir).
	CCWD (seller, CVP contract supply) ACWD (buyer, SWP contractor)	2014	Delta	Initial discussions started in 2012 to explore the opportunity to test the institutional and operational logistics of moving water from LV Reservoir storage via exchange with CVP water to a SWP contractor using Banks Pumping Plant and SBA. ACWD needed supplemental water supply in 2014 due to the drought (reduced SWP and Hetch Hetchy supply) and construction that had drawn down its groundwater basin (reduced water supply from brackish groundwater desalination). CCWD interested in pilot project to test regional partnership in then-newly expanded 160,000-AF LV Reservoir; favorable hydrologic conditions following completion of construction had enabled storage to support a limited pilot project, particularly to assist neighboring water agency during drought emergency.	Experience laid the groundwork, set expectations, and forged path to approvals for Bay Area SWAP pilots that followed.

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Appendix F: BARR SWAP Pilots Selection Detail

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F.1 High-Level Screening for Bay Area SWAP Pilot Projects

The purpose of the high-level screening was to parse out potential pilot transfers/exchanges based on how well they fit the specific needs and timeline of this project. Key considerations driving the pilot screen criteria included:

- **Scope:** The overarching purpose of this project is to help improve regional water supply reliability by identifying and facilitating future water transfers and exchanges between BARR Partners. As such, pilot selection was based partly on the ability of the project to address new or important issues in the region.
- **Timeline:** The original grant agreement with Reclamation provides three years for the project, including startup, pilot operation, and final reporting. To meet this timeline, BARR Partners plan to test pilots that use CVP and/or SWP facilities in the southern Delta during the months of July through September 2020. Pilots that do not need to use Delta pumping facilities are not limited by this transfer window and instead have a target timeline of July to December 2020. Consequently, the availability of information and ability to overcome political, legal, and operational requirements on a timely manner were also key considerations.
- **Volume of the transfer/exchange:** Per the grant agreement with Reclamation, the pilot is meant to represent a small transfer or exchange. Though there are no specific limits, an amount of less than 1,000 AF was proposed in the agreement.

The flowchart in Figure F-1 summarizes key questions used to guide the high-level screening. As depicted in this flowchart, the purpose of the high-level screening was not to discard any ideas but rather to identify the most promising projects by categorizing them as:

- Red – no potential for future or pilot
- Yellow – potential for future but not pilot
- Green – potential for future and pilot

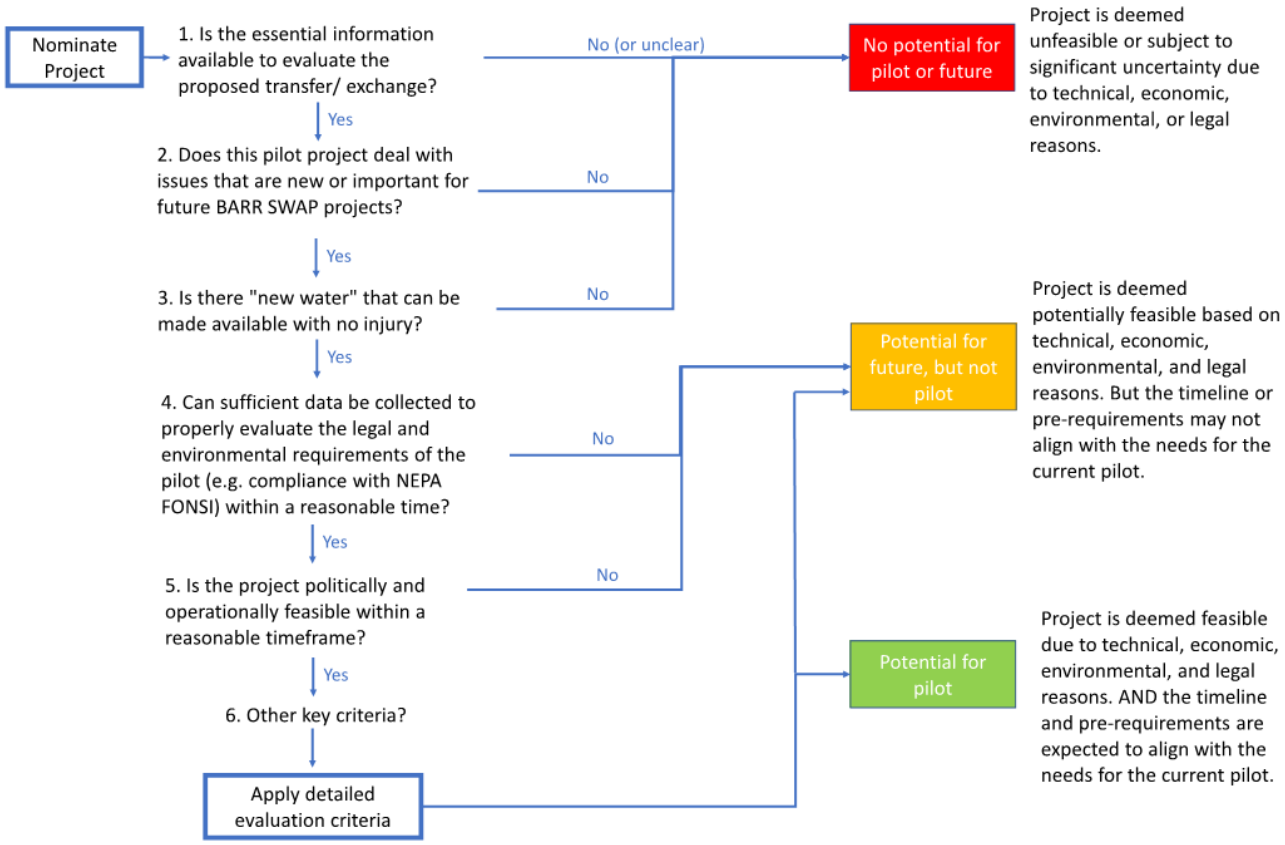

Figure F-1. High-level screening for pilot selection

The BARR Partners evaluated opportunities shown the green “potential for pilot” box in Figure F-1. Additional transfers and exchanges, depicted in the yellow “potential for future” box, were not evaluated by the BARR Partners but could be pursed in the future. The need to incorporate this screening phase is based on requirements set forth by the current scope of work and grant proposal submitted to Reclamation. Thus, pilots not currently deemed feasible may be re-evaluated in the future, and the screening criteria may be re-visited to better suit future needs.

F.2 Detailed Evaluation Criteria

After the initial screening, projects deemed potentially feasible for pilot implementation were assessed holistically using 12 criteria that fall under four main categories:

1. Technical and operational
2. Political and institutional
3. Legal and environmental
4. Economic

Pilots were assigned a score of 1 (low), 2 (medium), or 3 (high) for each criterion, based on a qualitative assessment of benefits and challenges of implementation. A score of 3 represents highest performance (greatest benefit/fewest challenges) with respect to the relevant criterion. The BARR Partners will further discuss the highest ranked projects and select up to two pilots for implementation. To enhance the learning opportunity provided by the pilots, BARR Partners will consider the benefits of choosing pilot projects that are feasible to implement within the time provided, and also break new ground in terms of challenge or uncertainty. Seeking out appropriate challenge is a key distinguishing factor between the project selection for this pilot opportunity and the project selection for future Bay Area SWAP transfers and exchanges.

F.2.1 Technical and Operational Criteria

Technical and operational criteria were selected based on relevant physical requirements and considerations and are summarized in Table F-1. The necessary information to evaluate the pilots against the criteria came primarily from utilities' records and documents as provided in the survey, with additional information and clarifications from the project team's subject matter experts.

Table F-1. Technical and Operational Criteria

Criteria	Description	Scoring		
		1 (Low)	2 (Medium)	3 (High)
Pathway	Is there existing infrastructure for conveyance and storage or potential for in-lieu arrangements such that the project is physically implementable in 2020?	Infrastructure is not available or may require significant technical modifications	Infrastructure is available but may require some technical modifications	Infrastructure is available and in good operational condition
Supply capacity	Is there enough capacity in the conveyance infrastructure such that this project is physically implementable in 2020?	Unlikely to have sufficient capacity available for the proposed pilot	Some capacity available, but some uncertainty	Capacity available
Duration of benefits	Would this pilot inform or contribute to any long-term transfers/exchanges?	May only be implemented as a short-term option	May expand in the future but involves some uncertainty	Could likely develop into a long-term program/option
Season/ Conditions	Can the project be implemented if the next year is an "above normal" year or wetter?	Timeframe and necessary conditions are unlikely to be met next year	Some limitations about the timeframe and necessary conditions	Very likely implementable next year
Water quality compatibility	Would blending water from different sources affect the treatment compatibility or corrosivity of the water supplies without significant additional treatment?	Significant changes to treatment needed	Minor treatment adjustments needed	Compatible water quality without additional treatment needs

Notes:
Color-coded blocks indicate qualitative performance of each pilot (columns) with respect to each consideration (rows).

1	= *major roadblocks or significant uncertainties*
2	= *some challenges or uncertainties*
3	= *simple process with no major challenges identified*

F.2.2 Political and Institutional Criteria

Political and institutional criteria reflect the inter-agency agreements needed to execute a transfer or exchange among agency partners, as summarized in Table F-2. Information to evaluate potential pilots against these criteria were provided by BARR Partners based on working knowledge and documentation from previous transfers and exchanges collected during the survey process.

Table F-2. Political and Institutional Criteria

Criteria	Description	Scoring		
		1 (Low)	2 (Medium)	3 (High)
Willing seller and willing buyer	Is there a willing seller and willing buyer for the proposed project?	Defining the parties may be challenging	Potential parties have been identified but willingness needs to be confirmed	Yes. There is a willing seller and a willing buyer
Institutional agreements	Can agreements be agreed to in principle by November and in place by March 1, considering all agencies involved?	Extensive work may be needed to come up with a reasonable arrangement	There is some uncertainty around the necessary agreements or timeframe	Yes. There is a precedent or conditions are simple

F.2.3 Legal and Environmental Criteria

Legal and environmental criteria capture the legal requirements of operating a given transfer or exchange, as summarized in Table F-3. The necessary information to evaluate pilots against these criteria came primarily from BARR Partners' knowledge and documentation as collected during the survey process, with subject matter expert knowledge support from the project team.[5]

Table F-3. Legal and Environmental Criteria

Criteria	Description	Scoring		
		1 (Low)	2 (Medium)	3 (High)
Environmental review	Can the environmental review process be completed by March 1?	Requires significant work, or carries much risk or uncertainty	Likely doable, but carries some risk or uncertainty	Simple process, and achievable within timeframe
Water right process	What will be the level of effort for securing water rights?	Unclear process, or may require extensive work	Process may require some work	Simple process, if needed at all
DWR/Reclamation agreements	How complex are the agreements needed from DWR or Reclamation? Can they be secured by March 1?	Significant uncertainty	Some uncertainty, but expected to be doable	Agreements would be few, simple and likely timely

F.2.4 Economic Criteria

Economic criteria are summarized in Table F-4. This evaluation only incorporates changes in the cost of water and operations and maintenance (O&M). Per the agreement with Reclamation, grant funding cannot be used to purchase water. Thus, economic considerations need to account for both the costs of purchasing water and the costs of making and transporting water. The purchasing parties would pay for the difference not covered by the grant. Staff costs and environmental or legal costs may also be associated with the process. Though these costs are difficult to quantify, the

[5] Water conveyance approvals must comply with CWC 1810, which is summarized in Attachment C. It stipulates that neither the state, nor any regional or local public agency, may deny a bona fide transferor of water the use of a water conveyance facility which has unused capacity.

relative complexity of the project may be used as a proxy and is captured under the political, institutional, legal, and environmental criteria.

Table F-4. Economic Criteria

Criteria	Description	Scoring		
		1 (Low)	2 (Medium)	3 (High)
Water cost	Are the likely costs of the water delivered to the BARR agency reasonable and affordable, accounting for water quality, reliability, and other factors?	Water is expensive, or cost involves a lot of uncertainty	There is some uncertainty around water costs	There is no known additional water cost
O&M cost	Are the likely costs of water treatment, energy, equipment/system wear and tear, and storage reasonable and affordable?	O&M is expensive, or cost involves a lot of uncertainty	There is some uncertainty around O&M costs	There is no known additional O&M cost

The necessary information to evaluate costs came primarily from BARR Partners' knowledge and documentation as collected during the survey process, with subject matter expert knowledge support from the project team.

F.3 Evaluation Results

This section presents high-level outcomes of the evaluation along with a detailed scoring summary.

F.3.1 Concept Comparison

This section presents key take-aways of the evaluation of the transfer and exchange concepts applied by BARR Partners. A more detailed description of the considerations for each pilot is presented in the Strategy Report.

Overall, Concept 1 (use of alternative supplies to improve SFPUC/BAWSCA supply reliability) is relatively simple both legally and operationally. A pilot project under Concept 1 involving the exchange of RWS water could likely be accomplished within the timeframe and requirements of the Reclamation grant, though the experience and lessons learned through this process might not be as significant as pursuing a more complex transfer or exchange. Concept 1 also has some key challenges that would need to be addressed, including agreements between SFPUC and BAWSCA agencies regarding changes in the allocation and minimum purchase requirements of RWS water, as well as cost complications arising from BAWSCA agencies having to cover additional RWS purchases at about $1,700 per AF. Obtaining a short-term water transfer from a water user upstream of the Delta will require negotiations, coordination with both DWR and Reclamation, and likely use of the Water Code 1725 process with the State Board.

ACWD's Newark Desalination Facility has spare capacity in all water year types, surplus water in average and above-average years, and surplus in dry year winter months on occasion. Under Pilot 1a circumstances, ACWD could produce surplus desalinated water in drier water years with supplies delivered through the SBA and infiltrated as supplemental groundwater recharge. Pilot 1b would be consistent with ACWD's Groundwater Sustainability Plan provided average or above-average hydrologic conditions. Dry year conditions carry less certainty, requiring ACWD to evaluate the prevailing aquifer storage conditions and make a year-specific determination. However, for purposes of testing this pilot, ACWD would be willing to supplement groundwater recharge using their own imported supply to prevent a potential single-year overdraft of the basin.

Concept 2 (use of LV to improve BARR Partners' storage flexibility) may prove to be more challenging to implement than Concept 1. However, Concept 2 pilots, which involve Valley Water exchanges and regional storage options, attempt to address more complicated questions. Though some aspects of the proposed pilots will not be implementable next year, variations can still provide important insights and set the stage for future transfers and exchanges once conditions align. Additionally, there is precedent for delivery of water from LV storage via Delta exchange, as successfully piloted in 2014 with ACWD. Thus, additional pilots under Concept 2 could further explore possibilities for leveraging LV storage. Key considerations on the use of LV storage by other BARR agencies are summarized below, with more detail provided in Attachment C, Part 1.

- Reclamation has points of re-diversion at the CCWD Delta intakes to LV which allows them and their contractors to re-store previously stored CVP water in LV. DWR does not have these as points of re-diversion in their permits; thus, SWP water cannot be re-stored in LV until the re-diversion points are added to the DWR SWP permits. These would likely have to be long-term changes since short-term changes would only allow SWP water to be stored in LV for up to one year.
- For a CVP contractor like Valley Water to take advantage of storing some CVP allocation in LV, Reclamation approval is required to change the point of delivery for some of Valley Water's CVP allocation to the CCWD Delta intakes to LV.
- Transferred supply from upstream of the Delta cannot be stored in LV; in most cases, the water rights from which the water is transferred are direct diversion water rights, not storage rights (i.e., holding water for 30 days or more). Even if a reservoir release water transfer was possible, a short-term transfer under Water Code 1725 would only allow that water to be stored for up to one year. Therefore, a long-term change to add points of re-diversion to the CCWD Delta LV intake would be needed. This would likely not be feasible within the timeframe of this effort.
- CCWD is willing to allow unspillable storage in LV; another BARR agency's stored water would not be subject to releases or competing with others for that storage capacity. While storage makes the most sense as a near-term option (due to evaporation rates of around eight percent per year), CCWD may be willing to be flexible about how such arrangement could be structured to the satisfaction of both parties.
- LV storage is subject to water quality and operational limitations. The filling window is typically between April and May in coordination with CVP and SWP operations. In addition, there is a 75-day no-fill period under the Delta BiOp, to be observed between January and June each year. Filling is limited to 200 cubic feet per second (cfs) (7-day average) under CVP and CCWD water rights.

Table F-5 summarizes key issues being addressed, opportunities, drivers, challenges, and constraints of the two concepts.

F.3.2 Detailed Pilot Evaluation

Table F-6 summarizes a comprehensive assessment of each pilot project with respect to the 12 criteria detailed in Section 4. The matrix shows color-coded scores corresponding to the performance of each pilot, roughly indicating:

- Red = significant challenges or uncertainties
- Yellow = some challenges or uncertainties
- Green = simple process with no major challenges identified

Table F-5. Summary of Concept Evaluation

Concept	Pilot	Issues Addressed by Pilot	Opportunities and Drivers	Challenges and Constraints	Next Steps
Concept 1: Use of alternative supplies to improve SFPUC/BAWSCA supply reliability	General Considerations	• Demonstrate how alternative water supplies obtained by one BARR agency can provide cost savings and allow other BARR agencies to obtain resulting RWS supply • Account for exchanging RWS supply and waiving minimum purchase requirements for ACWD to allow for water transfers during dry years	• There is precedent from previous exchanges • Relatively simple legal/regulatory process • Cost savings to ACWD on water deliveries	• ACWD has a minimum purchase requirement on RWS water • BAWSCA/SFPUC would need to pick up the cost of lost sales due to ACWD's purchase of non-RWS water	• Pilot-dependent (see below)
	Pilot 1a: ACWD and SFPUC/BAWSCA RWS exchange	• Test conveyance and institutional agreements for through-Delta water transfers to benefit SFPUC/BAWSCA	• Pumping option available through DWR Banks Pumping Plant	• CWC 1725 change petition needed for ACWD to secure transfer water from upstream of the Delta. A conveyance agreement with DWR would also be needed	• Identify willing upstream of Delta sellers to transfer water to ACWD • Engage SFPUC to address minimum purchase requirements for RWS water • Initiate CWC change petition and conveyance agreement with DWR to secure transfer from upstream of Delta and pumping at Banks Pumping Plant
	Pilot 1b: ACWD sale of local desalinated water (in-lieu delivery)	• Provide new supplies (such as desalination)	• Desalination facility often has excess capacity • Feasible in both below- and above-normal years • ACWD does not have any policy limitations for conveyance or for groundwater exports	• Desalination facility would require expanded redundancies to ensure water quality (infrastructure needs and added cost)	• Confirm water quantity and quality availability from ACWD's Newark Desalination Facility • Evaluate current groundwater storage conditions to determine source of ACWD supply
Concept 2: Use of LV to improve BARR Partners' storage flexibility	General Considerations	• Confirm institutional arrangements between CCWD and Valley Water • Allow CVP water contractors to store in LV • Change CVP Point of Delivery	• Potential for regional expansion of exchanges leveraging recycled water and conserved water • Storage in LV provides flexibility for various exchanges • CCWD nearly always has capacity due to system redundancies	• Diversions of Valley Water's CVP allocations for storage in LV are limited to balanced conditions • Need Reclamation approval for all changes in point of delivery of CVP water	• Pilot-dependent (see below)
	Pilot 2a: CCWD and Valley Water storage exchange of CVP supply	• Demonstrate how existing water allocations can be stored locally for later use in drier years	• No water rights changes needed	• Change location of Delta pumping will likely require environmental review	• Confirm institutional arrangements between CCWD and Valley Water • Pursue Reclamation approval to change CVP contract water point of delivery • Initiate environmental review
	Pilot 2b: CCWD and Valley Water local supply exchange (in-lieu delivery)	• Test use of Banks Pumping Plant (SWP) or Jones Pumping Plant (CVP) for transfer among contractors • Identify alternative supply sources (such as stored water or recycled water) • Demonstrate how new water supplies obtained by one BARR agency can allow BARR Partners to benefit	• No change in amount of water pumped from the Delta means minimal environmental issues	• When CCCSD facility increases capacity use of recycled water would require wastewater change petition	• Confirm institutional arrangements between CCWD and Valley Water • Pursue Reclamation approval to change CVP contract water point of delivery • Confirm capacity to implement Joint POD

Table F-6. Detailed Evaluation Matrix

Pilot	Concept 1		Concept 2	
	1a: ACWD and SFPUC/BAWSCA RWS exchange	1b: ACWD sale of local desalinated water (in-lieu delivery)	2a: CCWD and Valley Water storage exchange of CVP supply	2b: CCWD and Valley Water local supply exchange (in-lieu delivery)
Pathway	Infrastructure is available through the South Bay Aqueduct (SBA) and existing RWS pipelines/interties	Infrastructure is available through RWS and SWP	Infrastructure is available through CCWD's Old and Middle River intakes, LV reservoir, and SWP Banks Pumping Plant	Infrastructure is available through CVP and the CVP Jones Pumping Plant or (more likely due to capacity) the SWP Banks Pumping Plant
Supply capacity	Assumes that ACWD could secure a transfer water from sources upstream of the Delta at a reasonable price	ACWD would forego use of its RWS or SWP allocations which would normally be available. Assumes a like amount of desalinated groundwater is available to use in the ACWD service area. Assumes there is enough demand/distribution capacity as this is a potable supply. (SWP can only be exchanged, not sold.)	Valley Water would take delivery of some if its CVP allocation at the CCWD Old and Middle River POD and have that water stored for them in LV by CCWD	CCWD has access to water stored in LV Reservoir as an alternative water supply instead of recycled water.
Duration of benefits	Pilot could be operated short-term and develop into a long-term option in the future	Pilot could be operated short-term and develop into a long-term option in the future. If successful, ACWD's Newark Desalination Facility often has spare production capacity and could be an easy source of additional water for sharing within the region	Pilot could be operated short-term and could develop into long-term option in the future. If Valley Water shifts storage of CVP water from San Luis Reservoir to LV, this provides flexibility in timing, as opposed to depending on the Anderson reservoir construction timeline.	Pilot could be operated short-term and develop into a long-term option in the future. In the future, pilots could provide evidence for successful potential long-term transfers for CCCSD to sell recycled water to Valley Water once facility is on-line.
Season/Conditions	• Possible only during Delta balanced conditions (more likely to occur in dry years) • The direct delivery of transfer water to ACWD would need to occur between July and September (the transfer window for Banks Pumping Plant). • Groundwater substitution out of Yuba should be available this year.	Obtain approval from GSA to increase pumping for use within ACWD service area	• If using LV for some of Valley Water's CVP water instead of San Luis, the pilot could be implemented next year. • CCWD would be able to divert the Valley Water CVP water allocation in Delta balanced conditions (typically in the spring) when water quality conditions at the CCWD diversion locations are acceptable for storage in LV.	Moving water from CCWD would have to be done when the Delta is under balanced conditions which occurs generally in the late spring through much of the fall.
Water quality compatibility	Water sources and pathways are the same as currently used (SBA, RWS, Delta). Assuming this means no water quality issues	• Desalination facility was designed as secondary treatment; expanded use will require upgrades for redundancy. • Treated desalination water must be blended with groundwater to avoid pipe corrosion.	Water quality at the CCWD points of diversion at the time of storing the Valley Water supply in LV will have to be acceptable for storage	LV provides a high-quality water source for use within CCWD service area. In-lieu transfer of CVP water is just shifting an existing CCWD water allocation to Valley Water; thus, not an issue.
Willing seller and willing buyer	A willing seller is needed upstream of the Delta, but it should be easy to find one unless it is an extremely dry year. The exchange of water is between two willing BARR agencies. BAWSCA/SFPUC only willing to participate if the quantity being exchanged is relatively small (few AF).	Potential buyers: SFPUC/BAWSCA or SWP contractors	Exchange is between willing agencies	Exchange is between willing agencies
Institutional agreements	• There is a precedent from previous exchanges, and the exchange is between SFPUC and/or BAWSCA agencies. • Need to engage SFPUC and BAWSCA to address minimum purchase requirements for RWS water	Agencies involved are supportive. Exchange with ACWD could be between SFPUC/BAWSCA or SWP contractors	Agencies involved are supportive. Exchange is between CVP contractors	Agencies involved are supportive. Exchange is between CVP contractors
Environmental review	Water transfer would likely be under CWC 1725 that is exempt from the California Environmental Quality Act (CEQA), but the impacts of the transfer would need to be evaluated and found to be "reasonable"	No environmental requirements expected	Under both the storage of the Valley Water supply in LV and the exchange of that water from LV back to Valley Water, the total daily Delta exports are the same. The only difference is where the water is pumped in the southern Delta.	No mention of environmental review requirements in proposal. However, the same amount of water is pumped from the Delta under the base case and that of the proposal. It is just a change in where the water is pumped from CCWD diversions to either Jones or Banks Pumping Plants.

Table F-6. Detailed Evaluation Matrix

Pilot	Concept 1		Concept 2	
	1a: ACWD and SFPUC/BAWSCA RWS exchange	1b: ACWD sale of local desalinated water (in-lieu delivery)	2a: CCWD and Valley Water storage exchange of CVP supply	2b: CCWD and Valley Water local supply exchange (in-lieu delivery)
Water right process	CWC 1725 change petition would be needed to allow the upstream water transfer to ACWD.	Treated brackish groundwater is presumed to be outside the permitting authority of the State Board. Thus, likely would not require water rights change petition.	Water rights are probably not an issue as Reclamation allows contractors within CVP POU to swap water, including CCWD and Valley Water. However, the exchange of water back to Valley Water will likely require the use of the SWP Banks Pumping Plant. If Joint POD is not available, a CWC 1725 change petition will be needed to add the Banks Pumping Plant to the CVP permits.	CVP-CVP transfer with same POU. If Joint POD is not available, then a CWC 1725 change petition will be needed to add the SWP Banks Pumping Plant into the CVP permits.
DWR/Reclamation agreements	Assumes ACWD would secure transfer water diverted at the SWP Banks Pumping Plant. A conveyance agreement with DWR will be needed	Legal analysis concluded that a transfer of desalinated water most likely would not be under the State Board jurisdiction	Reclamation will have to approve change in the point of delivery of the Valley Water supply to the CCWD POD. Returning the water to Valley Water may also require a change to allow the CCWD water that would have been diverted to direct use by CCWD, to be diverted at Jones or Banks Pumping Plants instead for use by Valley Water.	• Reclamation would need to approve this exchange under CVP Improvement Act (CVPIA) rules and would have to approve a change of CCWD's point of delivery to Banks Pumping Plant. • Valley Water is a CVP Contractor and within CVP POU • If using recycled water in the future, the current CCCSD discharge is not included in Delta outflow index. This requires a wastewater change petition from the State Board under CWC section 1210.
Water cost	ACWD would pay less for transfer water ($500-800 per AF, raw water) than RWS supply ($1,700 per AF, treated water). However, transfer water would involve additional expenses for transportation and treatment. BAWSCA water costs are split proportionally amongst agencies according to system purchases for that month.	ACWD would incur reduced costs from avoided SFPUC purchases ($1,700 per AF for RWS supply vs $1,000 per AF for desalinated water)	No supply purchase costs (stored and then exchanged).	There are no water costs since it is LV water stored and then exchanged.
O&M cost	Expected to be comparable to other SWP costs. The DWR Conveyance Agreement will address the conveyance costs to deliver the transfer water to ACWD.	ACWD would incur increased costs from additional operation of desalination facility	Pumping and storage costs associated with storing Valley Water supply in LV	Magnitude of O&M costs for recycled water is unclear. O&M costs for pumping water at Banks or Jones Pumping Plants is known.

Notes:
Color-coded blocks indicate qualitative performance of each pilot (columns) with respect to each consideration (rows).

1 = major roadblocks or significant uncertainties
2 = some challenges or uncertainties
3 = simple process with no major challenges identified

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Appendix G: Additional Pilot Content

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This section includes information about the pilot concept development, as well as additional information about the three BARR SWAP pilots.

G.1 Developing Pilot Concepts

Partners developed pilot concepts to test the physical capacity, permitting required, opportunities and constraints. These concepts considered opportunities to leverage BARR Partners' existing contracts to test exchanges for stored supply.

Concept 1 - Test the use of alternative supplies and storage to improve supply reliability of the SFPUC's Regional Water System

This concept involves water transfers/exchanges among agencies with common reliance on the San Francisco Regional Water System (RWS) and aims to create a framework for reducing RWS water use by one BAWSCA agency to make more available for others. This concept involves using stored water through a combination of: (a) a water exchange with an agency that relies on the RWS and (b) a new water supply source being added directly to the RWS, with the aim of making more water available for RWS users collectively. Pilot projects under this concept would help create a guiding framework for institutional arrangements between ACWD and SFPUC defining when and how to account for reducing RWS water use. If pursuing a physical transfer of water supplies, projects could test the physical infrastructure, institutional arrangements, and permitting required to use different conveyance mechanisms. Alternatively, in-lieu deliveries could be tested to leverage potential new supplies, such as locally desalinated brackish groundwater, which would help confirm physical and regulatory requirements.

The pilot for this concept tests the physical capacity and permitting required for physical exchanges (using shared infrastructure), opportunities and constraints for in-lieu deliveries of new supplies, and the potential impact of adding supply from a new source into the existing RWS conveyance.

Concept 2 -Test the use of LV to improve BARR Partners' storage flexibility

This concept involves using BARR Partners' existing contracts from the SWP and/or the Central Valley Project (CVP) systems to test exchange of stored supply. Depending on the water source and specific transfer/exchange mechanism used to execute the pilot, this concept addresses institutional arrangements between BARR Partners and SWP/CVP managing agencies (such as DWR and Reclamation, respectively), shared infrastructure for physically conveying water, and/or storage in CCWD's LV for in-lieu deliveries.

G.2 Pilot 1a Additional Information

Additional information is presented here to support the pilot descriptions as presented in the Strategy Report.

Institutional Considerations

No amendments to the existing WSA are anticipated to carry forward Pilot 1a as a one-time transfer scenario. In the event of a multi-year transfer scenario, SFPUC and its wholesale customers would adopt an amendment to the WSA to include, but not limited to, the following key provisions:

- The transfer partners may implement a program that yields regional benefits for the wholesale customers and SFPUC after completing all required regulatory permits, approvals, environmental compliance and reviews, the execution of all required transfer and wheeling agreements, and any other approvals or agreements deemed necessary by the transfer partners.

- Pursuant to the transfer agreements, SFPUC will deliver up to 4,000 AFY of water stored in LV Reservoir to ACWD at the water rates charged by SFPUC to the wholesale customers under the WSA. ACWD will accept the transfer water in lieu of accepting delivery of the same amount of water from the upcountry system (in-lieu water transfer).
- The upcountry system water foregone by ACWD will accrue to storage upstream and will be recovered during shortages for the benefit of SFPUC customers.
- All in-lieu water delivered to ACWD will be counted toward its Individual Supply Guarantee (ISG) set forth in an attachment to the WSA (WSA Attachment C). Any in-lieu water delivered to ACWD shall not be construed to affect, limit, or increase ACWD's ISG or to otherwise entitle ACWD to any claim of water beyond its ISG.
- All in-lieu water delivered to ACWD will be temporary and interruptible in nature and delivered pursuant to the terms of the transfer agreement. Environmental enhancement surcharges pursuant to Section 4.04 of the WSA will not be applied by SFPUC to any quantity of in-lieu water delivered to ACWD but will instead by based solely on water deliveries to ACWD beyond its interim supply allocation.
- In the event SFPUC seeks to deliver in-lieu water to ACWD in a year in which it has not also waived the minimum purchase requirement, all in-lieu water shall be counted toward ACWD's minimum annual purchase quantity set forth in Attachment E to the WSA.
- SFPUC will evaluate reimbursement to ACWD for the capital costs of recommissioning ACWD's Mission San Jose Water Treatment Plant (WTP), which is a currently dormant surface water treatment plant known as WTP1, and the operations and maintenance costs related to treating in-lieu water. Capital costs will be allocated as regional costs pursuant to Section 5.04 of the WSA, and the operations and maintenance costs related to treating in-lieu water will be allocated as regional treatment expenses under Section 5.05.C of the WSA; all such costs will be included as part of the wholesale revenue requirement.
- SFPUC will audit capital, operation, and maintenance expenses submitted by ACWD for reimbursement to confirm that such costs were incurred because of operating WTP1. SFPUC is responsible for resolving disputes with ACWD concerning expense allocations. Program expense documentation, including documentation of negotiation and settlement of disputed costs, will be available for review during the compliance audit described in Section 7.04 of the WSA. Wholesale customers may dispute SFPUC's resolution of expense allocations through the arbitration provisions in Section 8.01 of the WSA.

Key Items and Resources

Table G-1 lists key items and resources for Pilot 1a.

Table G-1. Pilot 1a Preparation Key Items and Resources List

Item	Pilot 1a
Staff Involved (internal to Partner agency)	ACWD • Water Supply and Planning Manager • Water Resources Engineer BAWSCA • Water Resources Manager • Senior Water Resources Engineer SFPUC • Alternative Water Supply Program Manager • LVE Project Manager
Others Involved (external to Partner agency)	Hanson Bridgett (external legal counsel) reviewed water supply agreement and proposed potential amendments if a long-term transfer were to take place.
Staff Hours	Total hours of ACWD, BAWSCA, and SFPUC staff time to conduct pilot: 296 hours • ACWD: 32 hours • BAWSCA: 106 hours • SFPUC: 158 hours
Anticipated Time to Develop the Pilot[a]	Short-term transfer (drought): less than 1 year Long-term transfer (permanent): up to 5 years
Anticipated Pilot Duration[b]	Short-term transfer (drought): less than 1 year Long-term transfer (permanent): duration of water shortage and subsequent years to refill water levels

a. *Anticipated time to develop pilot includes estimation of time needed for carrying out all preparation activities prior to pilot implementation.*
b. *Anticipated pilot duration includes the estimated duration of time a transfer would be implemented.*

Costs

The evaluation of Pilot 1a costs was limited to ACWD's estimated costs to facilitate the long-term exchange of transfer water in all years. The evaluation focused only on ACWD's long-term capital and operational costs for the additional treatment capacity needed for Pilot 1a and does not include evaluation of upstream costs such as water purchases, wheeling rates, and project participation costs (LVE or other). This allows for greater future flexibility depending on the source of water supply, upstream costs such as water purchase costs, wheeling rates, and project participation costs. Under this scenario, ACWD receives the full 4,000 AF of additional surface water on an annual basis via the SBA and in return reduces wholesale water purchases from SFPUC's RWS by 4,000 AF.

Table G-2 summarizes estimated costs.

Table G-2. Pilot 1a Cost Components

Component	Unit Cost (2021$ per AF)	Approximate Cost	Notes
Capital Cost			
WTP1	Range: $97.38 - $200[a]	$800,000/year	Estimated capital cost for WTP1 recommission is $40 million (not including financing costs) with an expected useful life of 50 years.
Operations and Maintenance Costs			
Power	$2.52	--	
Chemicals	$66.90	--	
Solids Handling	$7.49	--	
Maintenance	$12.81	$100,000/year	Maintenance costs for equipment replacement and outside contractors.
Staffing	$320.63	$2,503,476/year	Includes six treatment plant operators and two maintenance staff. Total cost determined considering WTP1 production of 7,808 AFY.
Total	Range: $507.73 - $610.35	--	Depends on assumptions regarding capital cost allocation

a. Three possible approaches for capital cost allocation include:

- *Assigning the full cost to the pilot project, because without the pilot the recommissioning project would not be required (i.e., $800,000 divided by 4,000 AF, or $200/AF)*
- *Allocating capital costs in accordance with actual water production at WTP1 (i.e., $800,000 divided by 7,808 AF, or $102.46/AF)*
- *Allocating capital costs based on firm operational capacity (i.e., $800,000 divided by 8,215 AF, or $97.38/AF)*

Pilot 2a Additional Information

Additional information is presented here to support the pilot descriptions as presented in the Strategy Report.

Key Items and Resources

Table G-3 lists key items and resources for Pilot 2a.

Table G-3. Pilot 2a Preparation Key Items and Resources List

Item	Pilot 2a
Staff Involved (internal to Partner agency)	CCWD • Water Resources and Strategic Initiatives departments (project management, coordination with Reclamation water rights, coordination with Central Valley Operations [CVO], and coordination with USBR Contracting Officer for project approval) • Legal counsel (review of agreement) Valley Water • Water Supply Planning and Conservation Unit (project management and internal coordination) • Imported Water Unit (coordination with Reclamation on obtaining the approval and implementation of the pilot, with CCWD on development of agreement, and with CVO on operations) • Legal counsel (review of agreement)
Others Involved (external to Partner agency)	• Reclamation Contracting Officer, South-Central California Area Office (SCCAO) (receive transfer request, including proposed schedule and operations, and issue letter of approval) • NEPA review (with assistance from Del Puerto Water District consultant to draft the EA) • CVO (coordinate real-time transfer operations) • Reclamation Contracts and Water Rights (review water rights availability)
Staff Hours	Total hours of CCWD and Valley Water staff time to conduct pilot: 1,050 hours (over 20-month duration) • CCWD: 687 hours • Valley Water: 363 hours
Anticipated Time to Develop the Pilot	20 months from initial concept development in September 2019 to final approval in July 2021
Anticipated Pilot Duration	Stage 1 (transfer to Valley Water): 3 months (completed) Stage 2 (transfer to CCWD): 1 month (anticipated)

Costs

Tables G-4 and G-5 summarize estimated costs.

Table G-4. Pilot 2a, Stage 1 (Transfer to Valley Water) Cost Components

Component	Unit Cost (2021 $ per AF)	Approximate Cost	Notes
Water			
CVP Contract	$77.20	$386,000	2021 CCWD CVP transfer rate to Valley Water (municipal and industrial [M&I]), paid to Reclamation by CCWD and reimbursed by Valley Water.
Sub-total:	$77.20	$386,000	
Conveyance			
Power	$78.96	$394,800	Power cost for pumping CVP water at CCWD's Old River Pump Station ($16.10/AF) and CCWD's Transfer Pump Station ($62.86/AF).
Facilities Fees	$25.40	$127,000	Conveyance includes capital rental and wear and tear of facilities. Conveyance rates determined for CCWD's 2013 pilot storage project have been escalated by the San Francisco Engineering News-Record Construction Cost Index.
Sub-Total	$104.36	$521,800	
Total	$181.56	$907,800	Stage 1 payment from Valley Water to CCWD in 2021 (preliminary estimate)

Table G-5. Pilot 2a, Stage 2 (Transfer Water to CCWD) Cost Components

Component	Unit Cost (2021 $ per AF)	Approximate Cost	Notes
Water			
CVP Contract	$4.12	$20,600	Difference between Stage 1 water payment and Valley Water CVP water rate at time of return (paid to Reclamation by Valley Water, with CCWD to separately reimburse Valle Water for this payment), estimated to be $81.32/AF[a]
Sub-Total:	$4.12	$20,600	
Conveyance			
Power	$7.32	$36,600	Difference between Stage 1 conveyance power payment and CCWD power costs at time of return, estimated to be $91.41/AF[b]
Facilities Fees	$2.27	$11,350	Difference between Stage 1 conveyance facilities fees payment and escalated conveyance facilities fees at time of return, estimated to be $26.77/AF[b]
Sub-Total	$9.59	$47,950	
Total	$13.71	$68,550	Stage 2 payment from Valley Water to CCWD in a subsequent year, assumed to be 2023 (preliminary estimate)

a. Based on current (2021) Valley Water M&I costs and assumed annual increase of 5 percent.

b. Based on current (2021) costs and assumed annual increase of 3 percent.

Pilot 3 Additional Information

Additional information is presented here to support the pilot descriptions as presented in the Strategy Report.

Key Items and Resources

Table G-6 lists key items and resources for Pilot 3.

Table G-6. Pilot 3 Preparation Key Items and Resources List

Item	Pilot 3
Staff Involved (internal to Partner agency)	• EBMUD: Water Supply Improvements Division and Operations & Maintenance Department • CCWD: Water Resources Department and Operations & Maintenance Department
Others Involved (external to Partner agency)	Reclamation staff: • Contract Analyst (SCCAO) to approve transfer of CCWD CVP water to EBMUD • SCCAO for EA/FONSI preparation and posting for public comment • CVO for operations coordination
Staff Hours	Total hours of CCWD and EBMUD time to develop pilot: 278 hours • EBMUD: 100 hours • CCWD: 178 hours
Anticipated Time to Develop Pilot	3 to 5 months (pilot has been completed)
Anticipated Pilot Duration	2 weeks: from October 1 –15, 2021, CCWD released supply stored in LV for delivery to EBMUD

Costs

Table G-7 summarizes estimated costs.

Table G-7. Pilot 3 Approximate Costs

Item	Cost
Reclamation 2021 CVP M&I Rate [a] (rate paid by CCWD to Reclamation)	$60/AF
CCWD conveyance [a] (power and facilities fee paid to CCWD)	$104/AF
CCWD storage fees for each year since 2019[a] (paid to CCWD over 2 years related to: LV facilities, operations, and maintenance)	$178/AF total ($89/AFY)
CCWD evaporative losses since 2019[a] (paid to CCWD at evaporation rate of 8% per year for 2,000 AF of LV storage at using CCWD's CVP M&I rate)	$22,000 (water cost only)
Approximate Total Cost	$791,000

a. *Attachment 2: CCWD-EBMUC CVP Transfer Cost Calculation in 2013 Wheeling Agreement Option for 2,000 AF – Offer to Convey Option Water (Letter)*

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