Appendix C: Complete BARR Drought Mitigation Measure Profiles

Drought Mitigation Measure 1: Transfer-Bethany Pipeline

Drought Mitigation Measure 2: Zone 7-EBMUD Intertie

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

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

Drought Mitigation Measure 4: West Side SFPUC-SCVWD Intertie

Drought Mitigation Measure 5: SFPUC-Zone 7 Intertie

Drought Mitigation Measure 6: MMWD-EBMUD Intertie

Drought Mitigation Measure 7: Los Vaqueros Expansion

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

Drought Mitigation Measure 9: Regional Desalination Plant

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

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

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

Drought Mitigation Measure 13: Regional Advanced Metering Infrastructure Feasibility Assessment

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

Drought Mitigation Measure 15: Regional Exchange Demonstration Project

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DROUGHT MITIGATION MEASURE 1

Transfer-Bethany Pipeline

CONTRA COSTA COUNTY

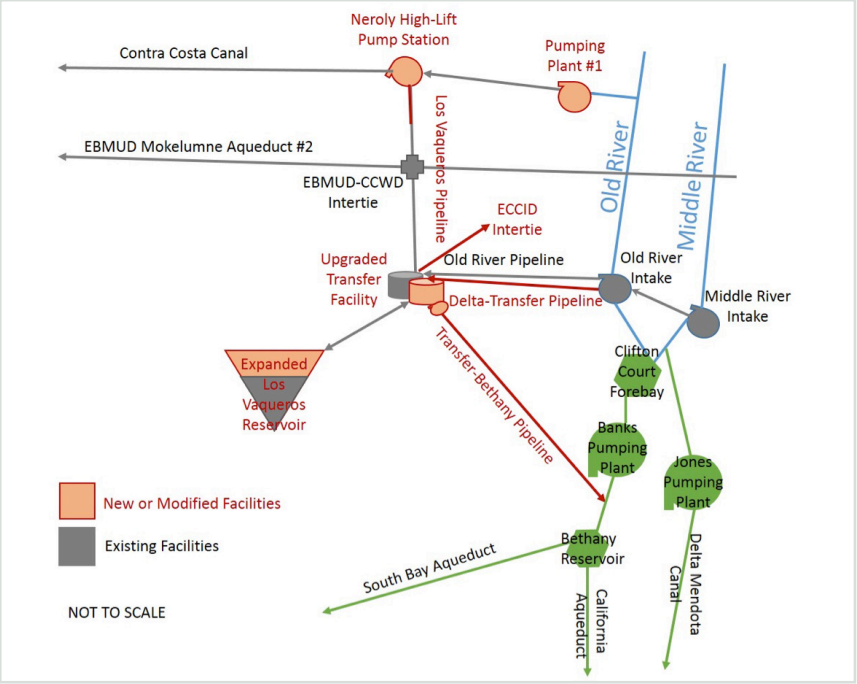
The Transfer-Bethany Pipeline would connect CCWD's Los Vaqueros (LV) Reservoir system and other conveyance facilities to the Bethany Reservoir, providing a mechanism to move water to the South Bay Aqueduct (SBA).

The pipeline would begin just east of the LV Reservoir Transfer Facility—the system hub that regulates flows into and out of the reservoir and into the Contra Costa Canal via the LV Pipeline—and continue approximately 8 miles to the southeast to tie into the Bethany Reservoir. With a diameter up to 96 inches, the Transfer-Bethany Pipeline would have capacity to convey up to 300 cubic feet per second (cfs) to Bethany Reservoir. From Bethany Reservoir, water could be pumped into the SBA via the South Bay Pumping Plant.

By enabling transfers to the SBA, this project would broaden the water sources stored in LV Reservoir and delivered to partner agencies. The new pipeline would allow greater flexibility in water deliveries to the region, provide dry-year reliability, and facilitate water transfers seasonally or during dry years. A companion project (LV Expansion) would increase LV Reservoir's storage capacity.

AT A GLANCE

PROJECT TYPE	Intertie/Conveyance
STATUS	Preliminary design
ENGAGED BARR AGENCIES	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, ZONE 7
AVAILABILITY	All years
POTENTIAL YIELD	Up to 217,000 AFY
COST	Capital: $200M O&M: TBD (likely moderate)



Brown AND Caldwell

Transfer-Bethany Pipeline

DROUGHT MITIGATION MEASURE 1

Water Supply Yield and Availability

Enables conveyance of up to 217,000 acre-feet per year (AFY) (up to 300 cfs). Actual yield would depend on operations.

Regional Resilience

Increases supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Connects existing water system infrastructure. Leverages existing supply sources. Increases the regional use and benefits of LV Reservoir by broadening the sources stored in LV Reservoir and delivered to partner agencies.

Flexibility/Sustainability

Facilitates seasonal and dry year water transfers, providing greater flexibility in water deliveries to the SBA and the region. Increases operational flexibility and enables storage of State Water Project (SWP) and other supplies in LV Reservoir. Incorporates adaptive management of facilities and operations.

Water Quality Considerations

Supports CCWD's operational strategy to fill LV Reservoir during wet periods (i.e., when the Delta is lower in salinity) and release water during dry periods (i.e., when the Delta is more saline). Requires evaluation to determine whether partner agencies' facilities are compatible to treat Delta supplies.

Timing

Preliminary design and environmental analysis/documentation are in process. Construction of the pipeline could start as early as 2020 and conclude within 2 years.

Implementability

In 2017, CCWD will seek California Water Commission funding for this project and release the Supplement to the Final Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), to be finalized by late 2018 along with the Federal Feasibility Study. While the pipeline has a smaller capacity, more efficient alignment, and fewer environmental impacts than the pipeline considered in the 2010 final environmental documentation, easements will need to be acquired for the pipeline. Water rights modifications may also be required to execute transfers/exchanges through the pipeline.

Social and Environmental Considerations

Benefits Delta fisheries through state-of-the-art fish screens and increased operational flexibility (i.e., avoiding diversions at critical times/locations and coordinating operations with SWP and Central Valley Project [CVP] Delta export facilities). Presents potential partnership opportunity with Central Valley wildlife refuges (south of the Delta), due to resulting ecosystem benefits such as supply for wetlands, terrestrial habitats, and waterfowl habitat for migratory birds.

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.
- Enhances ecosystem benefits.
- Improves water quality.

CHALLENGES

- Requires potential water rights modifications to enable transfers/exchanges.
- Requires new easements for construction.

DROUGHT MITIGATION MEASURE 2

Zone 7-EBMUD Intertie

ALAMEDA COUNTY AND CONTRA COSTA COUNTY

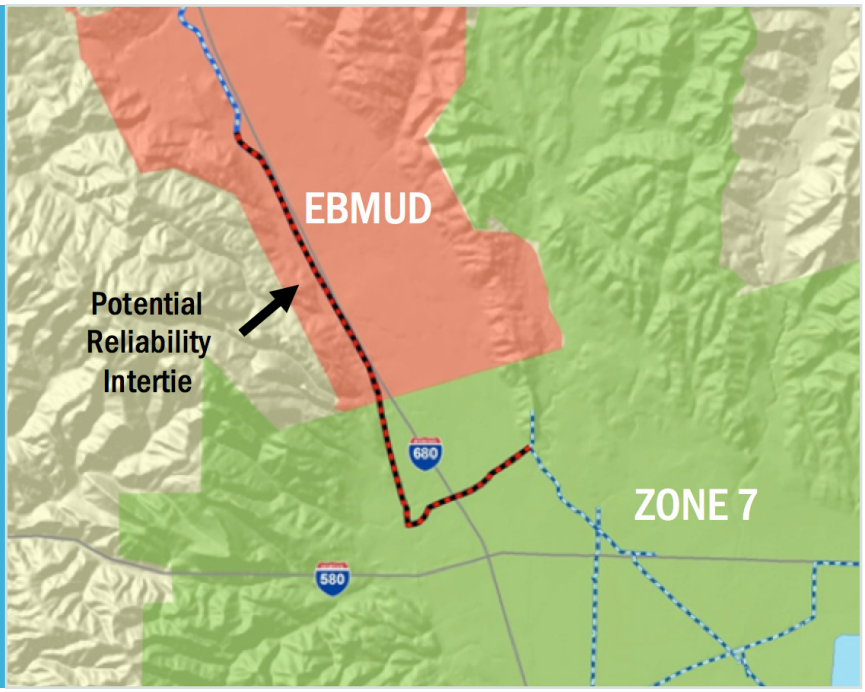
To connect Zone 7 and EBMUD (east of the Berkeley/Oakland hills), this project would involve constructing a 30-inch diameter intertie pipeline (about 36,000 linear feet [LF]), booster pump station, and rate control station through the cities of Dublin and San Ramon.

The intertie would enable the transfer of 11,200 to 28,000 acre-feet per year (AFY) (10 to 25 million gallons per day [mgd]) between the two water systems and provide regional water supply reliability and long-term sustainability by leveraging existing groundwater and surface water resources to meet regional needs.

The project would support transfers in both directions to provide a vital lifeline during droughts, a major earthquake, or other outage conditions. Transfers from EBMUD to Zone 7 are more likely, as the intertie could convey a major alternative supply for Zone 7 and reduce Zone 7's reliance on diversions from the Delta and State Water Project (SWP) during emergencies.

AT A GLANCE

PROJECT TYPE	Intertie
STATUS	Conceptual
ENGAGED BARR AGENCIES	Zone 7 and EBMUD
AVAILABILITY	All years
POTENTIAL YIELD	11,200 to 28,000 AFY
COST	Capital: $43M O&M: TBD (likely low from EBMUD to Zone 7 and medium from Zone 7 to EBMUD, due to pumping costs)



Brown AND Caldwell

Zone 7-EBMUD Intertie

Water Supply Yield and Availability

Enables conveyance of 11,200 to 28,000 AFY, depending on the need and supply availability. The intertie's capacity in normal and wet years could be limited to approximately 10 mgd by EBMUD's wheeling capacity. A greater capacity, up to 25 mgd, may be available during dry years and emergencies.

Regional Resilience

Facilitates water transfers between Zone 7 and EBMUD (both directions), increasing supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Connects existing water system infrastructure. Leverages existing groundwater and surface water supply sources within the region.

Flexibility/Sustainability

Increases flexibility to move water where needed and may enhance conjunctive use through recharge of Zone 7's groundwater basin.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality; minimize potential taste and odor issues). If used to recharge Zone 7's groundwater basin, lower-salinity water from EBMUD would reduce salt loading in the Livermore Valley Groundwater Basin, an ongoing water quality issue.

Timing

Conceptual plans are complete; detailed design has not begun. California Environmental Quality Act (CEQA) review could be conducted within 1 year, and the project could be fully implemented within 4 to 5 years.

Implementability

Constructing the intertie pipeline in an urban area necessitates permits and traffic control plans. Water rights modifications may be required to execute transfers/exchanges through the intertie pipeline.

Social and Environmental Considerations

Construction of this major infrastructure project will likely require mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Provides water supply alternatives during emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.

CHALLENGES

- Requires potential water rights modifications to enable transfers/exchanges.
- Involves construction in a highly-urbanized area (potentially disruptive to transportation and local community).
- Requires significant permitting and CEQA evaluation.

DROUGHT MITIGATION MEASURE 3A

ACWD-SFPUC Intertie and Local Supply

ALAMEDA COUNTY

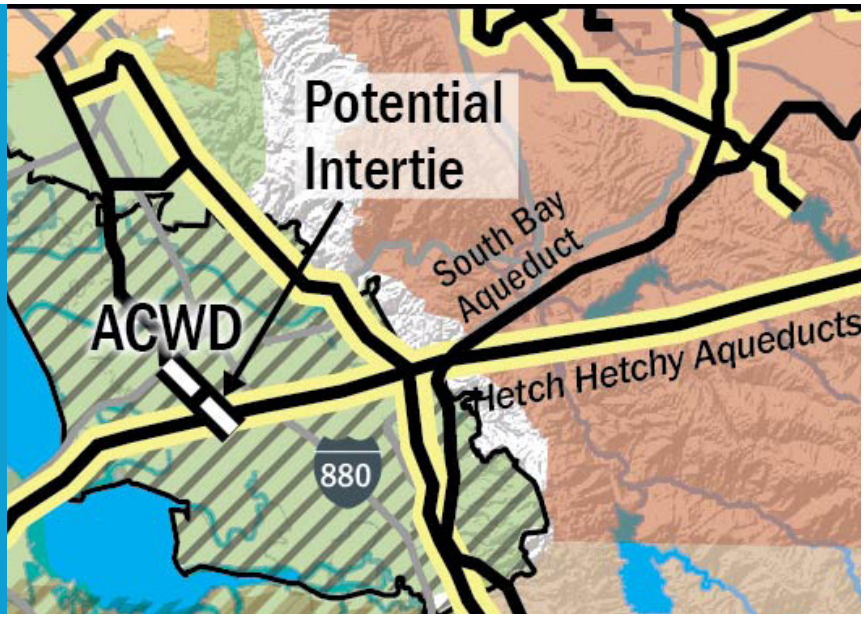
A new intertie pipeline (approximately 1,200 linear feet [LF]) would enable bi-directional water transfers between ACWD's Newark Brackish Groundwater Desalination Facility (NDF) and SFPUC's Bay Division Pipeline (BDP).

ACWD extracts trapped brackish groundwater and filters it into high-quality drinking water at the NDF. To create a pressure gradient and push brackish groundwater toward San Francisco Bay, ACWD adds runoff from the Alameda Creek watershed to the aquifer through the Quarry Lakes Groundwater Recharge System. The cycle of recharging runoff and extracting brackish groundwater is steadily restoring the Niles Cone Groundwater Basin, a critical drinking water supply under ACWD's service area. Freshwater recharge is a limiting factor for aquifer reclamation (i.e., annual reclamation cannot exceed annual recharge).

Though its production capacity is 12.5 million gallons per day (mgd), the NDF typically optimizes operations at 7 to 10 mgd due to hydraulic and recharge considerations. Connecting ACWD to SFPUC would allow additional hydraulic capability at NDF and enable use of available treatment capacity in average and above-average rainfall years, when freshwater recharges the aquifer. ACWD could transfer some product water to SFPUC and use some for local supply. Because the operating pressure in SFPUC's BDP (141 pounds per square inch [psi]) exceeds ACWD's system pressure (80 psi), a booster station would be installed.

AT A GLANCE

PROJECT TYPE	Intertie
STATUS	Conceptual
ENGAGED BARR AGENCIES	ACWD, BAWSCA, SFPUC
AVAILABILITY	Normal and wet years
POTENTIAL YIELD	Up to 5,600 AFY
COST	Capital: $7.7M O&M: TBD (moderate)



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ACWD-SFPUC Intertie and Local Supply

DROUGHT MITIGATION MEASURE 3A

Water Supply Yield and Availability

Enables conveyance of up to 5,600 AFY in normal and wet years.

Regional Resilience

Facilitates water transfers from ACWD to SFPUC in normal and wet years to provide emergency supply and/or to bank water within SFPUC's storage reservoir system for both agencies to use in dry years. Increases supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes). ACWD and SFPUC have not yet conducted mutual water supply reliability analyses.

Efficiency

Leverages NDF's available treatment capacity. Connects existing water system infrastructure and stretches existing supply sources.

Flexibility/Sustainability

Provides ability for bi-directional transfers between ACWD and SFPUC. Increases flexibility for in-lieu exchanges and transfers using excess delivery capacity in SFPUC's system turnouts to ACWD.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality; minimize potential taste and odor issues). Anticipated to maintain/improve groundwater quality in ACWD's Niles Cone Groundwater Basin (because of increased desalination of trapped brackish groundwater).

Timing

This project is in the conceptual phase and could be implemented within 2 to 5 years.

Implementability

Constructing the intertie pipeline necessitates permits. An operating plan and booster pump station would also be needed to address the differential in system operating pressures—SFPUC's BDP operating pressure (141 psi) exceeds that of ACWD's system (80 psi).

Social and Environmental Considerations

The project may provide environmental benefits by reducing demand on surface water supplies within ACWD's service area. Any additions or modifications to water supply would involve outreach and communications with customers.

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.
- Improves groundwater quality (because of increased reclamation of trapped brackish groundwater).

CHALLENGES

- Requires a surplus of groundwater recharge (typically available only in average and above average rainfall years), which limits availability of this during dry years.
- Warrants significant customer outreach and communications before modifying water supply.

DROUGHT MITIGATION MEASURE 3B

ACWD-SFPUC Intertie and IPR

ALAMEDA COUNTY

This project builds on the ACWD-SFPUC Intertie and Local Supply (BARR Drought Mitigation Measure 3a), which involves constructing an intertie pipeline and booster pump station to enable water transfers from ACWD's Newark Brackish Groundwater Desalination Facility (NDF) to SFPUC's Bay Division Pipeline (BDP) during normal or wet years.

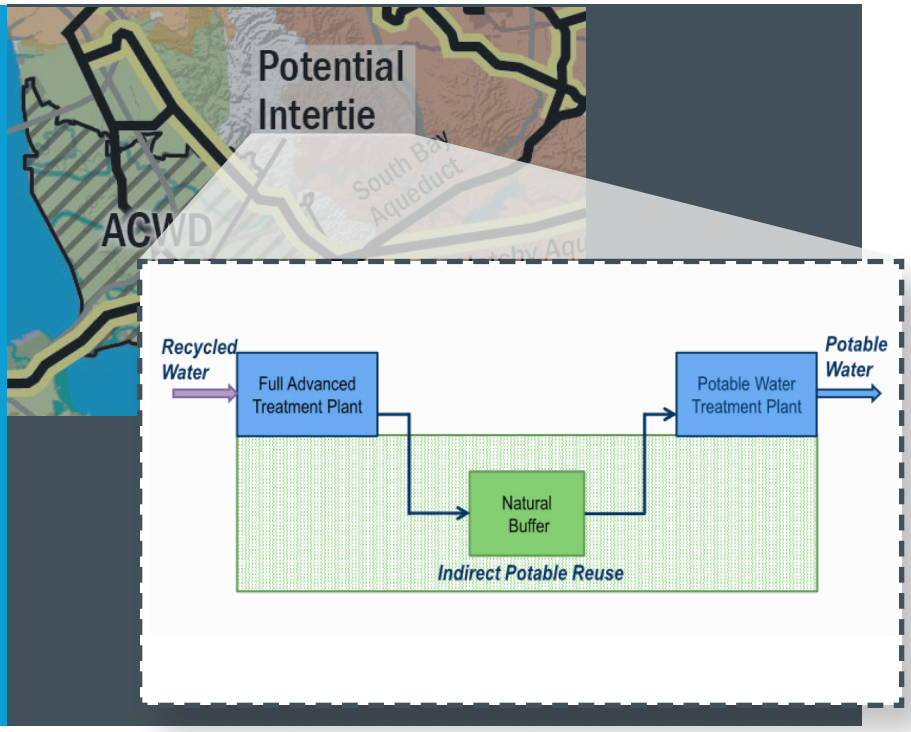
To address the dry-year constraint, this variation on the project involves constructing a 4 million gallons per day (mgd) facility providing advanced treatment to effluent from the Union Sanitary District Alvarado Wastewater Treatment Plant for indirect potable reuse (IPR). ACWD could inject the newly purified water into the Niles Cone Groundwater Basin and/or infiltrate it in the Quarry Lakes Groundwater Recharge System, thus allowing for more brackish groundwater to be extracted and treated at the NDF.

While Union Sanitary District's wastewater flows could produce up to 15 mgd of advanced treated water, ACWD cannot accommodate that level without massively redesigning the water supply system. Further, since ACWD alone cannot use more than approximately 4 mgd given projected demands, the additional supply could benefit SFPUC (and other regional partners) if transferred.

While the intertie pipeline would be located in Newark, proximate to ACWD's NDF, the location for an advanced water treatment facility has not yet been identified.

AT A GLANCE

PROJECT TYPE	Intertie
STATUS	Conceptual
ENGAGED BARR AGENCIES	ACWD, BAWSCA, and SFPUC
AVAILABILITY	All years
POTENTIAL YIELD	Dry years: 4,480 to 17,000 AFY Normal/wet years: 10,000 to 22,600 AFY
COST	Capital: $93M to $500M O&M: TBD (high)



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ACWD-SFPUC Intertie and IPR

Water Supply Yield and Availability

Enables treatment and conveyance of about 4,480 to 17,000 AFY in dry years and about 10,000 to 22,600 AFY in normal and wet years.

Regional Resilience

Facilitates water transfers from ACWD to SFPUC to provide emergency supply and/or to bank water within SFPUC's storage reservoir system for both agencies to use in all year types. Increases supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes). ACWD and SFPUC have not conducted mutual water supply reliability analyses.

Efficiency

Leverages NDF's available treatment capacity. Connects existing water and wastewater system infrastructure. Stretches existing supply sources and recovers wastewater as a new, local, drought-resistant supply.

Flexibility/Sustainability

Provides ability for bi-directional transfers between ACWD and SFPUC in both wet and dry years. Increases flexibility for in-lieu exchanges and transfers using excess delivery capacity in SFPUC's system turnouts to ACWD.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines; minimize potential taste and odor issues). Anticipated to maintain/improve groundwater quality in ACWD's Niles Cone Groundwater Basin (because of increased desalination of trapped brackish groundwater).

Advanced treatment, stabilization, and monitoring of purified water would protect groundwater quality from brackish inflow, dilute micro-contaminants already present in the native groundwater, and decrease nutrient discharges to the San Francisco Bay.

Timing

This project is in the conceptual phase and could be implemented within 5 to 10 years.

Implementability

Constructing the intertie pipeline necessitates permits. An operating plan and booster pump station would also be needed to address the differential in system operating pressures—SFPUC's BDP operating pressure (141 psi) exceeds that of ACWD's system (80 psi).

Additional limnological studies would be needed to evaluate the effect of advanced treated water for IPR into Quarry Lakes given its current use as park facility recreational activities and beneficial uses including human contact (e.g., swimming and fishing).

Social and Environmental Considerations

The project may provide environmental benefits by reducing demand on surface water supplies within ACWD's service area. Any additions or modifications to water supply would involve outreach and communications with customers. The partner agencies would conduct studies to ensure appropriate measures are taken to continue the recreational beneficial uses at Quarry Lakes and to provide related customer communications.

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.
- Increase groundwater quality (because of increased reclamation of trapped brackish groundwater).

CHALLENGES

- Warrants significant customer outreach and communications before modifying water supply..
- Requires an evaluation of the impacts of IPR discharges to Quarry Lakes.

DROUGHT MITIGATION MEASURE 4

West Side SFPUC-SCVWD Intertie

SANTA CLARA COUNTY

SFPUC and SCVWD currently have an emergency intertie connecting their systems in Milpitas—the east side of SCVWD's treated water system, which has pipeline and treatment facility redundancy. The intertie improves reliability for SFPUC and SCVWD customers during outages and planned interruptions. This project would construct a second bi-directional intertie pipeline between SFPUC and SCVWD, on the west side of SCVWD's system.

This second intertie would address SCVWD's lack of redundancy in its west side treated water system by connecting to the SFPUC system. SCVWD would extend the West Pipeline that conveys treated water from SCVWD's Rinconada Water Treatment Plant in Los Gatos about 29,500 linear feet (LF) to Page Mill Road in Palo Alto, where an intertie would connect to SFPUC's Bay Division Pipelines 3 and 4.

This project could transfer up to 50 million gallons per day (mgd) of water between the SFPUC and SCVWD systems, providing additional emergency backup supply to both agencies and redundancy for Palo Alto and other cities that rely heavily on SFPUC supplies.

AT A GLANCE

PROJECT TYPE	Intertie
STATUS	Conceptual
ENGAGED BARR AGENCIES	SFPUC, BAWSCA, and SCVWD
AVAILABILITY	Normal and wet years
POTENTIAL YIELD	Capacity of up to 55,000 AFY; actual yield would depend on need and water availability
COST	Capital: $150M O&M: TBD (likely moderate)

Brown AND Caldwell

West Side SFPUC-SCVWD Intertie

Water Supply Yield and Availability

Enables conveyance of up to 55,000 AFY in terms of capacity. However, the total yield would vary significantly from year to year depending on water need and availability. SCVWD has excess supply in normal and wet years.

Regional Resilience

Facilitates water transfers between SFPUC and SCVWD (both directions), increasing supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes). Enables exchanges during any year type to support partnerships related to potable reuse and other sources of supply. Provides redundancy for Palo Alto and other cities that rely heavily on SFPUC supplies.

Efficiency

Connects existing water system infrastructure between SFPUC and SCVWD's west side treated water system. Leverages existing supply sources within the SFPUC and SCVWD systems.

Flexibility/Sustainability

Increases flexibility to move water between the SFPUC and SCVWD and among common water retailers as necessary.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines; minimize potential taste and odor issues). Retail agencies' water quality needs are also a consideration, since SFPUC and SCVWD supplies are from different sources.

Timing

The project is in a conceptual phase and could be implemented within 7 to 9 years.

Implementability

Constructing the intertie pipeline necessitates permits and California Environmental Quality Act (CEQA) compliance.

Social and Environmental Considerations

Construction of this major infrastructure project will likely require mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions). Any additions or modifications to water supply would involve outreach and communications with customers.

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change.
- Increases system redundancy on the west side of SCVWD's treated water system.

CHALLENGES

- Warrants significant customer outreach and communications before modifying water supply.

DROUGHT MITIGATION MEASURE 5

SFPUC-Zone 7 Intertie

ALAMEDA COUNTY

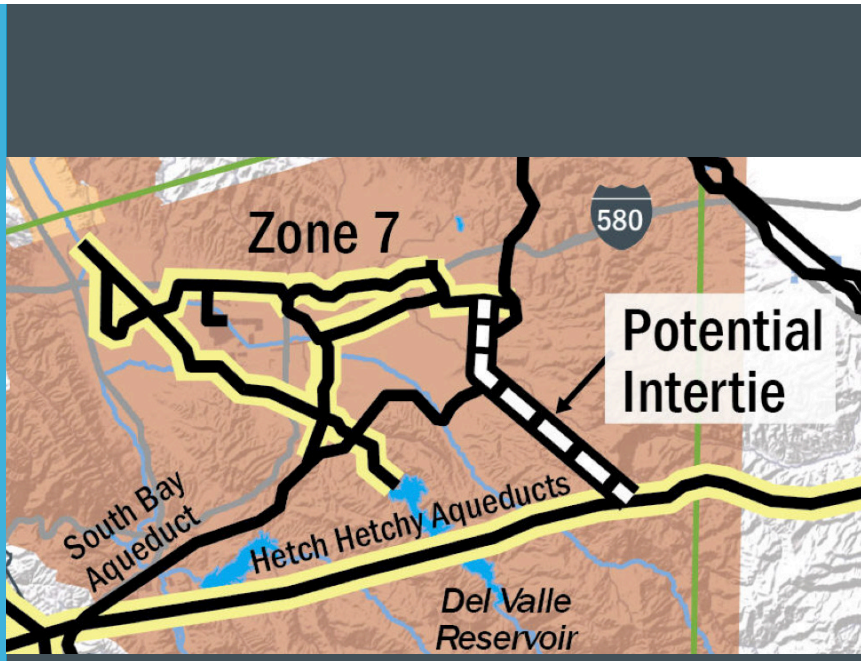
To enable water transfers, Zone 7 and SFPUC would construct an intertie pipeline (approximately 8.5 miles, 24-inch diameter) along with a pumping station, rate control station, and disinfection facility.

The pipeline would connect SFPUC's Hetch Hetchy Regional Water System and the east side of Zone 7's water service area. The intertie's general location would be east of Del Valle Reservoir, about 10 miles south of the City of Livermore. An alternate alignment could cross through the Sunol Valley, connecting to the west side of Zone 7's service area. A disinfection facility may not be necessary at the latter location. The intertie would allow the transfer of up to 11,200 to 28,000 acre-feet per year (AFY), or 10 to 25 million gallons per day (mgd), between SFPUC's aqueduct and Zone 7.

The project would enable transfers in both directions to provide a vital lifeline during drought, major earthquake, or other outage conditions. The project would reduce Zone 7's reliance on diversions from the Delta and State Water Project (SWP) during emergencies. The project also would benefit the SFPUC system during loss of service through the Hetch Hetchy San Joaquin pipelines or further upstream.

AT A GLANCE

PROJECT TYPE	Intertie
STATUS	Conceptual
ENGAGED BARR AGENCIES	SFPUC, BAWSCA, and Zone 7
AVAILABILITY	All years
POTENTIAL YIELD	Up to 11,200 to 28,000 AFY depending on the need and water availability
COST	Capital: $66M O&M: TBD (low from SFPUC to Zone 7; medium from Zone 7 to SFPUC, because of pumping costs)



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SFPUC-Zone 7 Intertie

Water Supply Yield and Availability

Enables transfer of up to 11,200 to 28,000 AFY, depending on the need and supply availability.

Regional Resilience

Facilitates water transfers between SFPUC/BAWSCA and Zone 7 in all year types. Increases supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Connects existing infrastructure in SFPUC's Hetch Hetchy Regional Water System and Zone 7 water service area. Leverages existing supply sources.

Flexibility/Sustainability

Provides ability for bi-directional transfers between SFPUC and Zone 7.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines; minimize potential taste and odor issues). If used to recharge Zone 7's groundwater basin, low-salinity water from SFPUC would reduce salt loading in the basin, addressing a long-standing concern over salt accumulation within the Livermore Valley Groundwater Basin.

Timing

The project is in the conceptual phase. Design and California Environmental Quality Act (CEQA) environmental analysis could be completed in approximately 1 or 2 years, and the project could be fully implemented within 4 to 5 years.

Implementability

Constructing the intertie pipeline necessitates permits and CEQA compliance. Water rights modifications may be required to execute transfers/exchanges through the intertie pipeline.

Social and Environmental Considerations

Construction of this major infrastructure project will likely require mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Provides water supply alternatives during emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.

CHALLENGES

- Requires potential water rights modifications to enable transfers/exchanges.
- Involves some construction in a highly-urbanized area (disruptive to transportation and local community).
- Requires significant permitting and CEQA evaluation.

DROUGHT MITIGATION MEASURE 6

MMWD-EBMUD Intertie

CONTRA COSTA COUNTY AND MARIN COUNTY

To enable water transfers under emergency conditions, MMWD and EBMUD would build a bi-directional intertie pipeline (approximately 7 miles long) over the Richmond-San Rafael Bridge or across the floor of the San Francisco Bay (adjacent to the bridge). While the pipeline would enable flows both directions, transfers from EBMUD to MMWD are more likely to occur, because MMWD's supplies are more vulnerable.

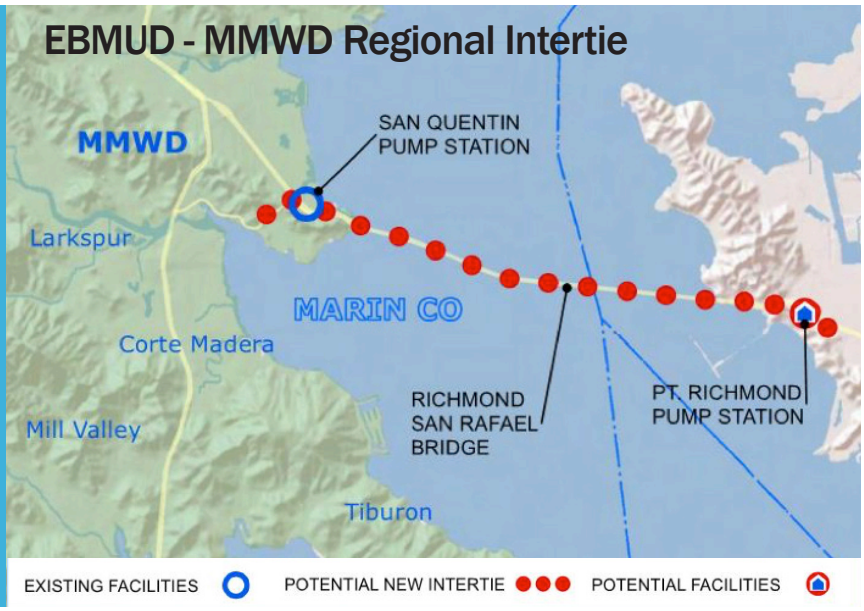
The pipeline would support a normal operating flowrate of 5 million gallons per day (mgd), allowing for transfers of up to 460 acre-feet (AF) per month or about 5,600 acre-feet per year (AFY). The pipeline design would provide flexibility for future expansion to increase the maximum flowrate to 8.9 mgd (10,000 AFY).

The intertie would be constructed in two phases. Phase I consists of approximately 21,400 linear feet (LF) of 24-inch diameter steel pipe installed on the Richmond-San Rafael Bridge. Pipelines must be constructed on the eastern side of the bridge to connect to EBMUD's water distribution system.

Phase II would involve installing pipe connections to the EBMUD and MMWD systems at each end of the bridge and constructing a new pumping station in Point Richmond. The connection point location must be suitable to allow conveyance of an acceptable volume of water, while also not adversely affecting EBMUD's users. The pumping station would convey water from the connection point to MMWD's distribution system. At the bridge's western end, the intertie pipeline would extend to MMWD's San Quentin Pump Station, which may require enhancements to deliver water effectively to MMWD's distribution system.

AT A GLANCE

PROJECT TYPE	Intertie
STATUS	Conceptual
ENGAGED BARR AGENCIES	MMWD and EBMUD
AVAILABILITY	All years
POTENTIAL YIELD	5,600 to 10,000 AFY
COST	Capital: $45M O&M: $100/AF (low)



Brown AND Caldwell

MMWD-EBMUD Intertie

Water Supply Yield and Availability

Enables conveyance of 5,600 to 10,000 AFY (normal operating flow rate of 5 mgd; future expansion maximum flow rate of 8.9 mgd).

Regional Resilience

Facilitates water transfers between MMWD and EBMUD (both directions), increasing supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Connects existing water system infrastructure. Leverages existing supply sources within the region.

Flexibility/Sustainability

Increases flexibility to move water where needed.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality; minimize potential taste and odor issues).

Timing

This project is in the conceptual phase and could be implemented within 3 to 5 years.

Implementability

Constructing the intertie pipeline in an urban area necessitates complying with the California Environmental Quality Act (CEQA); coordinating with many jurisdictions, property owners, and permitting agencies; securing permits; establishing an agreement with Caltrans for access and use of to the Richmond-San Rafael Bridge; and developing traffic control plans. Water rights modifications may be required to execute transfers/exchanges through the intertie pipeline. Construction across the bridge could be challenging and disruptive to traffic flow.

Social and Environmental Considerations

Construction of this major infrastructure project will likely require mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).

BENEFITS

- Leverages existing supply sources and connects existing infrastructure for exchanges/transfers.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change.

CHALLENGES

- Requires potential water rights modifications to enable transfers/exchanges.
- Involves construction in a highly-urbanized area (disruptive to transportation and local community) and may involve coordination with many jurisdictions, property owners, and permitting agencies.

DROUGHT MITIGATION MEASURE 7

Los Vaqueros Expansion

CONTRA COSTA COUNTY

CCWD's Los Vaqueros (LV) Reservoir is located in the foothills east of Mt. Diablo, between the cities of Brentwood and Livermore. This project would expand LV Reservoir capacity by 115,000 acre-feet (AF), from 160,000 AF to 275,000 AF.

A companion project (Transfer-Bethany Pipeline) would construct a pipeline between the LV Reservoir system and the South Bay Aqueduct (SBA). Together, the projects could broaden the sources of water diverted and stored in LV Reservoir to include State Water Project (SWP) supplies and other water supplies on behalf of agencies potentially partnering in the project. Facilities and operations would be adaptively managed in response to environmental conditions, new regulations, and climate change to ensure that water supply reliability is sustained in the future.

The project would improve water operations of regional partners and has the potential to improve operation of the Central Valley Project (CVP) and SWP. Increasing operational flexibility and interagency coordination could improve the ability of the CVP and SWP to meet regulatory requirements.

The project could increase opportunities for partnering agencies that rely on groundwater to improve conjunctive use operations. Coordinating LV Reservoir operations with partner groundwater operations and other independent recharge projects would lead to improved conjunctive use and groundwater management/sustainability throughout the region.

AT A GLANCE

PROJECT TYPE	Expanded Storage
STATUS	Preliminary design
ENGAGED BARR AGENCIES	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7
AVAILABILITY	All years
POTENTIAL YIELD	An additional 115,000 AF
COST	Capital: $600M O&M: TBD (likely low)

Brown AND Caldwell

Los Vaqueros Expansion

Water Supply Yield and Availability

Expands the existing LV Reservoir capacity by 115,000 AF, from 160,000 AF to 275,000 AF.

Regional Resilience

Increases supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Leverages existing infrastructure such as CCWD's Delta intakes, the EBMUD Freeport Intake, regional interties, and the SBA. Leverages existing supply sources from the participating agencies, and also provides the opportunity for SCVWD to store, transfer, or exchange water produced at the Silicon Valley Advanced Water Purification Center expansion to other regional partners.

Flexibility/Sustainability

Increases operational flexibility and regional storage. Facilitates seasonal and dry year water transfers, providing greater flexibility in water deliveries in the region. Incorporates adaptive management of facilities and operations in response to environmental conditions, new regulations, and climate change to ensure water supply reliability.

Timing

The project is in the preliminary design phase. Construction could begin as early as 2022; however, the existing reservoir would need to be drained prior to construction, which would require at least 1 year. The dam expansion could be constructed in 2 years.

Water Quality Considerations

Supports CCWD's operational strategy to fill LV Reservoir during wet periods (i.e., when the Delta is lower in salinity) and release water during dry periods (i.e., when the Delta is more saline). Expands water quality benefits to regional partners and provides protection from future declines in Delta water quality (e.g., climate change impacts and emergencies). Requires evaluation of blending water (treatability and post-treatment stabilization).

Implementability

In 2017, CCWD will seek California Water Commission funding for this project and release the Supplement to the Final Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS), to be finalized by late 2018 along with the Federal Feasibility Study. Water rights modifications may also be required to store others' supplies or execute transfers.

Social and Environmental Considerations

Benefits Delta fisheries through state-of-the-art fish screens and increased operational flexibility (i.e., avoiding diversions at critical times/locations and coordinating operations with SWP and Central Valley Project [CVP] Delta export facilities). Inundates new areas at LV Reservoir, which may affect terrestrial and cultural resources in the watershed.

BENEFITS

- Leverages existing supply sources and infrastructure.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.
- Enhances ecosystem benefits.
- Improves water quality.

CHALLENGES

- Requires potential water rights modifications to enable transfers/exchanges.
- Inundates new areas and may affect terrestrial and cultural resources in the watershed.

DROUGHT MITIGATION MEASURE 8

Walnut Creek Water Treatment Plant Pretreatment Facility

CONTRA COSTA COUNTY

As a companion project to the Transfer-Bethany Pipeline and Los Vaqueros (LV) Reservoir Expansion, this project involves upgrading the Walnut Creek Water Treatment Plant (WCWTP) to treat a more diverse range of supply sources by installing a 115 million gallons per day (mgd) (128,800 acre-feet per year [AFY]) pretreatment facility.

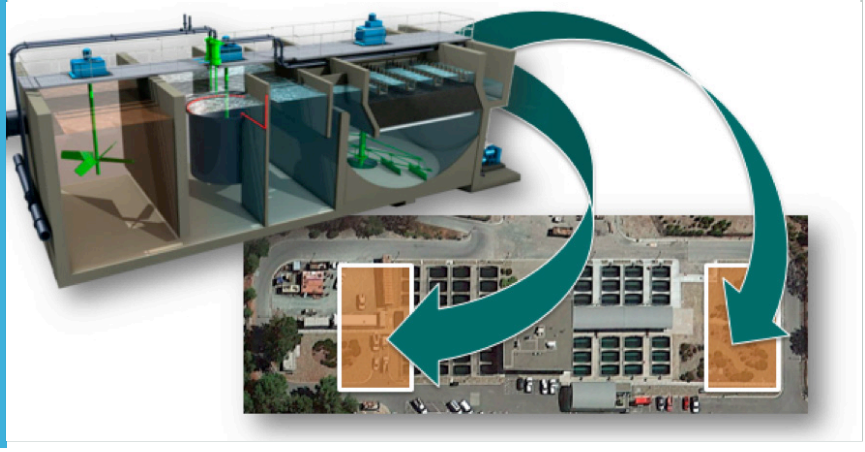
The WCWTP currently treats high-quality raw water from Pardee and Briones reservoirs with low turbidity and total organic carbon (TOC). The current system lacks the capability to treat raw water with relatively high TOC and turbidity (i.e., higher than that of the Mokelumne River). In addition, the current treatment process is vulnerable to water quality variations because of wildfire or landslides within EBMUD's watershed. If water quality were to suffer because of fire or landslide, the current WCWTP could not meet water quality requirements. Addressing this limitation is key in treating and conveying water for the benefit of neighboring agencies.

Pilot testing is currently under way to evaluate pretreatment alternatives to reduce TOC and high turbidity, and improve filterability. Predesign is also in progress on potential designs to solve these water quality challenges; the leading technology proposed is ballasted flocculation/sedimentation and pre-ozone.

AT A GLANCE

PROJECT TYPE	Treatment/supply
STATUS	Preliminary design
ENGAGED BARR AGENCIES	ACWD, BAWSCA, CCWD, EBMUD, SFPUC, SCVWD, and Zone 7 (to be confirmed)
AVAILABILITY	Normal and dry years
POTENTIAL YIELD	128,800 AFY
COST	Capital: $35-60M (depending on scale of capacity) O&M: TBD (likely moderate)

Process Diagram On-site Map



Brown AND Caldwell

Water Supply Yield and Availability

The pretreatment facility would be constructed to meet the hydraulic requirement of the WCWTP and to support the current capacity of 115 mgd (128,800 AFY). Depending on budget constraints, project implementation may be phased to reach the full water treatment plant capacity.

Regional Resilience

Complements regional reliability and resilience benefits of LV Expansion and Transfer-Bethany Pipeline. Allows EBMUD to expand its water supply through WCWTP and convey/treat lower-quality raw water supplies from other Bay Area agencies via existing or new interties.

Efficiency

Leverages existing water system infrastructure by utilizing the existing WCWTP for a wider range of supply sources. Stretches existing supply sources.

Flexibility/Sustainability

Greatly enhances EBMUD's water treatment flexibility to address a wider range of source water quality. For example, the upgraded plant could treat water from the Sacramento River, LV Reservoir, or other sources that require robust treatment. Other Bay Area agencies could receive treated water wheeled through EBMUD's distribution system and interties. Increases opportunities for local groundwater conjunctive storage projects.

Implementability

The proposed project is feasible from a constructability standpoint. However, community involvement and outreach for the project would be required.

Water Quality Considerations

Expands the range of source water quality treated at the WCWTP allowing for treatment of new water sources and blends into the WCWTP, the EBMUD interties, and the distribution system. Improves long-term water quality regulatory compliance during droughts, water quality fluctuations, and Mokelumne supply interruptions (e.g., natural disasters that threaten raw water conveyance). Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality; minimize potential taste and odor issues).

Timing

The project is in the preliminary design phase. Conceptual plans, California Environmental Quality Act (CEQA) evaluation, and land acquisition are complete. Detailed design and construction could require up to 3 years.

Social and Environmental Considerations

The project would improve EBMUD's ability to provide high-quality drinking water during droughts, emergencies, and planned and unplanned shortages. In addition, this project would reduce energy usage and greenhouse gases produced while treating supplemental drought supply. No significant environmental effects are anticipated.

BENEFITS

- Leverages existing supply sources and infrastructure.
- Increases water supplies in emergencies, planned outages, and droughts by enabling treatment of raw water sources of varying quality.
- Increases resilience to climate change and future Delta constraints.
- Increases opportunities for conjunctive use.
- Improves water quality (including taste and odor control, a multiple barrier approach for pathogen control, and emerging contaminants barrier).
- Provides a more energy-efficient mode of treatment for supplemental supply.

CHALLENGES

- Involves construction in a suburban area (disruptive to transportation and local community).
- Warrants significant customer outreach and communications.

DROUGHT MITIGATION MEASURE 9

Regional Desalination Plant

CONTRA COSTA COUNTY

The Bay Area Regional Desalination Project (BARDP) would construct a brackish water treatment plant at CCWD's existing Mallard Slough Pump Station to provide a supplemental water supply and enhance regional resilience during dry water years and emergencies (e.g., earthquakes, levee failures, and maintenance-related outages). The project partners (CCWD, EBMUD, SCVWD, SFPUC, and Zone 7) would work together to leverage and optimize existing infrastructure and assets to convey the desalination product water.

BARDP would use a two-stage reverse osmosis treatment train to filter 28,000 acre-feet per year (AFY) of brackish water from the Mallard Slough to produce 22,400 AFY (80 percent recovery). The remaining 5,600 AFY concentrate stream would be sent to the Central Contra Costa Sanitary District or Delta Diablo Sanitation District for disposal through an existing outfall equipped with a multi-port diffuser.

If operated conjunctively with Los Vaqueros (LV) Reservoir, the project would improve dry-year supply reliability to project partners and provide a base supply during normal years for some partners. Excess production could be stored in LV Reservoir in non-drought years through an exchange with CCWD, and the stored water could be released from LV Reservoir in dry years.

Water Supply Yield and Availability

Produces 22,400 AFY of treated water from a brackish water intake of 28,000 AFY (20 mgd).

AT A GLANCE

PROJECT TYPE	Treatment/supply
STATUS	Preliminary design
ENGAGED BARR AGENCIES	CCWD, EBMUD, SCVWD, SFPUC, and Zone 7
AVAILABILITY	All years
POTENTIAL YIELD	22,400 AFY
COST	Capital: $175M O&M: $300–$390/AF (moderate)

Brown AND Caldwell

Regional Resilience

Provides a local, drought-resistant source of supply for project partners, increasing supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes). If operated conjunctively with LV Reservoir, the project would improve dry-year supply reliability and provide a base supply during normal years for some partners.

Efficiency

Leverages existing infrastructure and assets (e.g., LV Reservoir and transmission lines). Provides cost savings through economies of scale compared to individual supplemental supply projects by each agency.

Flexibility/Sustainability

Allows excess production to be stored in LV Reservoir or delivered to partners in non-drought years, through an exchange with CCWD. The stored water in LV could then be released from the reservoir in drought years.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality; minimize potential taste and odor issues). Brine disposal could increase salinity in receiving waters, but preliminary analyses show that increases in Delta salinity would be insignificant.

Timing

The project is in the preliminary design phase. A feasibility study, pilot testing, and Delta modeling have been conducted. California Environmental Quality Act (CEQA) documentation has not been completed. The project could be constructed as early as 2030.

Implementability

Environmental documentation assessing the potential impacts of the project has not been completed. In the past, similar desalination projects in the region have lacked public support or received strong public opposition.

Conveying new supplies and transferring/exchanging supplies among partner agencies may be challenging and require new agreements and additional interties and infrastructure. Water rights modifications would be required to share water among partner agencies. During critically dry water years, operations would need to be coordinated with the Central Valley Project (CVP)/State Water Project (SWP) and the City of Antioch to avoid potential impacts.

Social and Environmental Considerations

The public has voiced concerns about potential impacts to fisheries, increased energy consumption, increased greenhouse gas emissions. Potential impacts on fisheries could be reduced or avoided through operational best practices and facility design. Recent advances in treatment technologies may also decrease energy usage.

BENEFITS

- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change and future Delta constraints.
- Provides cost savings through economies of scale, as compared to individual supplemental supply projects by each agency.
- Reduces potential adverse environmental impacts associated with construction of separate (decentralized) desalination plants.
- Promotes regional cooperation by joint ownership, operation, and management of the desalination facility.

CHALLENGES

- Requires potential water rights modifications to enable transfers if diversion is increased above 11,900 AFY at Mallard Slough.
- Requires significant permitting and CEQA evaluation.
- Lacks public support/triggers public opposition.

DROUGHT MITIGATION MEASURE 10

Silicon Valley Advanced Water Purification Center Expansion

SANTA CLARA COUNTY

An expansion of the Silicon Valley Advanced Water Purification Center (SVAWPC) of up to about 25 million gallons per day (mgd) would produce additional purified water that could be delivered directly to SCVWD or SFPUC systems and indirectly to regional partners through water banking, exchanges, or transfers. Regional partners are currently assessing the feasibility of such water sharing opportunities.

SVAWPC currently purifies up to 8 mgd of recycled water from the San Jose-Santa Clara Regional Wastewater Facility (RWF) using microfiltration, reverse osmosis, and ultraviolet light. The facility's current use is essentially a pilot project. Water from SVAWPC is blended with tertiary-treated effluent from the RWF to reduce total dissolved solids (TDS), sodium, silica, organics, and other constituents. The blended supply enhances the recycled water quality, enabling expanded recycled water use for non-potable purposes.

Independent of the BARR partnership, SCVWD is planning to construct a new treatment facility adjacent to the existing facility in San Jose.

The new facility will have advanced oxidation in the treatment train to produce a more purified product and will have a capacity of about 20 million gallons per day (mgd). Water from the new facility would be used for indirect potable reuse (IPR) through groundwater recharge and/or injection or both IPR and direct potable reuse (DPR) through augmenting SCVWD's raw water system. Adding this new supply would help to maintain groundwater storage and minimize the risk of land subsidence in northern Santa Clara County.

The project considered in the BARR partnership involves an incremental expansion of the new treatment facility from the baseline capacity of about 20 mgd to about 45 mgd.

AT A GLANCE

PROJECT TYPE	Treatment/supply
STATUS	Preliminary design (SVAWPC Expansion) and Planning (regional partnerships)
ENGAGED BARR AGENCIES	SCVWD, SFPUC, and BAWSCA
AVAILABILITY	All years
POTENTIAL YIELD	Up to 25,000 AFY
COST	Capital: $600M O&M: $10M/year; ~$700/AF (high)

Brown AND Caldwell

Water Supply Yield and Availability

Produces up to an additional 25,000 acre-feet per year (AFY) (25 mgd) of purified drinking water, operating year-round in all water year types.

Regional Resilience

Provides a supplemental, local, drought-resistant supply, increasing groundwater recharge, supply reliability, and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Builds on existing infrastructure and assets, including the SVAWPC and San Jose-Santa Clara RWF. Recovers a local water resource otherwise discharged to the San Francisco Bay.

Flexibility/Sustainability

Provides an increased supply for groundwater recharge in Santa Clara County, a region that historically experienced subsidence because of groundwater over pumping. Contributes additional supply to storage, which may support increased conjunctive management.

Water Quality Considerations

Produces highly treated water with low TDS, and may improve lower-quality supplies if blended. Reduces wastewater flows and nutrient loading to the San Francisco Bay. Whether used for groundwater or surface water augmentation the water would receive post-treatment stabilization for corrosion control and aesthetics. Advanced treatment processes will be designed to ensure protection of public health and groundwater quality.

Timing

The project is in the preliminary design phase and is estimated to require 5 to 10 years to complete.

Implementability

Project implementation challenges include managing reverse osmosis concentrate and fully utilizing the purified water during low-demand periods. In addition, work is ongoing to determine the allocation of wastewater flows between potable reuse, non-potable reuse, and outflows to the Bay. The project will require close coordination and collaboration with the City of San Jose, which manages the RWF, on managing/disposing reverse osmosis concentrate and securing source water for purification.

Social and Environmental Considerations

The project would improve the agencies' ability to provide water during dry years, emergencies, and maintenance-related outages, which improves economic security and quality of life for customers. A reliable water supply in the agencies' service area is critical to health and safety, as well as local agriculture and the many businesses in Silicon Valley that contribute significantly to the economic health of the Bay Area.

California Environmental Quality Act (CEQA) analysis and engineering controls would be needed to mitigate increased salinity concentrate disposal that could increase receiving water salinity.

BENEFITS

- Leverages existing local, drought-resilient supply source and infrastructure.
- Capitalizes on large groundwater basin and multiple treatment facilities.

CHALLENGES

- Requires significant permitting.
- Requires significant cooperation and coordination with wastewater producer.
- Involves determining allocation of wastewater flows between potable reuse, non-potable reuse, and outflows to the Bay.
- Requires CEQA analysis and engineering controls to mitigate increased salinity concentrate disposal.

DROUGHT MITIGATION MEASURE 11

Mid-Peninsula Potable Reuse Exploratory Plan

SAN MATEO COUNTY

The Mid-Peninsula Potable Reuse Exploratory Plan (PREP) project involves a partnership among three water agencies (SFPUC, BAWSCA, and California Water Service Company [Cal Water]) and a wastewater agency (Silicon Valley Clean Water [SVCW]), to explore implementation of indirect potable reuse (IPR).

SVCW provides wastewater services including collection, treatment, and discharge of treated water to the San Francisco Bay. In addition, SVCW produces tertiary-treated recycled water for customers in the mid-peninsula region (south of San Francisco). In planning a facility upgrade and anticipating potential regulatory changes on the horizon, SVCW approached SFPUC, BAWSCA, and Cal Water to explore the feasibility and mutual interest in a collaborative IPR project that could address water supply reliability and drought preparedness for the mid-peninsula. The project would use reverse osmosis and other advanced purification technologies to produce up to 6,720 acre-feet per year (AFY) (6 million gallons per day [mgd]) of drinking water quality supply for the region.

The agencies will consider changes to infrastructure (including new interconnections), water transfers/exchanges, capacity of existing facilities, and institutional arrangements needed to support the collaborative partnership.

AT A GLANCE

PROJECT TYPE	Treatment/supply
STATUS	Planning
ENGAGED BARR AGENCIES	SFPUC and BAWSCA
AVAILABILITY	All years
POTENTIAL YIELD	Up to 6,720 AFY
COST	Capital: TBD O&M: TBD (high)

Brown AND Caldwell

Water Supply Yield and Availability

Produces up to approximately 6,720 AFY (6 mgd) of purified drinking water, operating year-round in all water year types.

Regional Resilience

Provides a supplemental, local, drought-resistant water supply for the SFPUC and BAWSCA service area, including Cal Water.

Efficiency

Recovers a local water resource otherwise discharged to the San Francisco Bay. Builds on SVCW's anticipated upgrade to existing recycled water infrastructure and assets to provide multiple, mutual benefits such as managing wastewater discharges, supporting discharge regulatory compliance, and producing a drought-resistant, reliable water supply.

Flexibility/Sustainability

Provides an additional reliable, drought-resistant local water supply for SFPUC and BAWSCA (including Cal Water), which may reduce demand on surface water and groundwater supplies.

Water Quality Considerations

Produces highly treated water with low total dissolved solids (TDS), and may improve lower-quality supplies if blended. Reduces wastewater flows and nutrient loading to the San Francisco Bay.

Whether used for groundwater or surface water augmentation the water would receive post-treatment stabilization for corrosion control and aesthetics. Advanced treatment processes would be designed to ensure protection of public health and groundwater/surface water quality.

Timing

An initial feasibility study is currently underway and will be complete in mid-2017.

Implementability

The initial feasibility study will identify implementation challenges. Interagency agreements would be required to share water among partner agencies. The project may require a wastewater change petition, as well as significant permitting and a California Environmental Quality Act (CEQA) evaluation.

Social and Environmental Considerations

The project would improve the agencies' ability to provide water during dry years, emergencies, and maintenance-related outages, which would improve the economic security and quality of life for customers. A reliable water supply is critical to health and safety, as well as the many businesses in Silicon Valley that contribute significantly to the economic health of the Bay Area.

Concentrate disposal could increase salinity in receiving waters and would have an environmental impact (which may be positive). Rigorous analysis would be needed to select the best disposal option(s).

BENEFITS

- Leverages existing local, drought-resilient supply source and infrastructure.
- Increases water supplies in emergencies, planned outages, and droughts by enabling treatment of raw water sources of varying quality.

CHALLENGES

- Requires potential wastewater change petition.
- Requires significant brackish waste disposal.
- Requires significant permitting and CEQA evaluation.

DROUGHT MITIGATION MEASURE 12

Joint Tri-Valley Potable Reuse Feasibility Study

ALAMEDA COUNTY AND CONTRA COSTA COUNTY

The Joint Tri-Valley Potable Reuse Feasibility Study involves a partnership among Zone 7, California Water Service Company (Cal Water), Dublin San Ramon Services District (DSRSD), and the Cities of Livermore and Pleasanton to explore potential regional potable reuse opportunities.

The partnership would complement other ongoing wastewater reuse efforts—such as joint powers authority formed in 1995 between DSRSD and EBMUD, the DSRSD-EBMUD Recycled Water Authority (DERWA).

The project would produce an estimated 4,800 to 7,700 acre-feet per year (AFY) of purified drinking water supply for the Tri-Valley region (Zone 7 and its retailers) through purification of wastewater using advanced treatment technologies—including membrane filtration, reverse osmosis, followed by ultraviolet light/advanced oxidation.

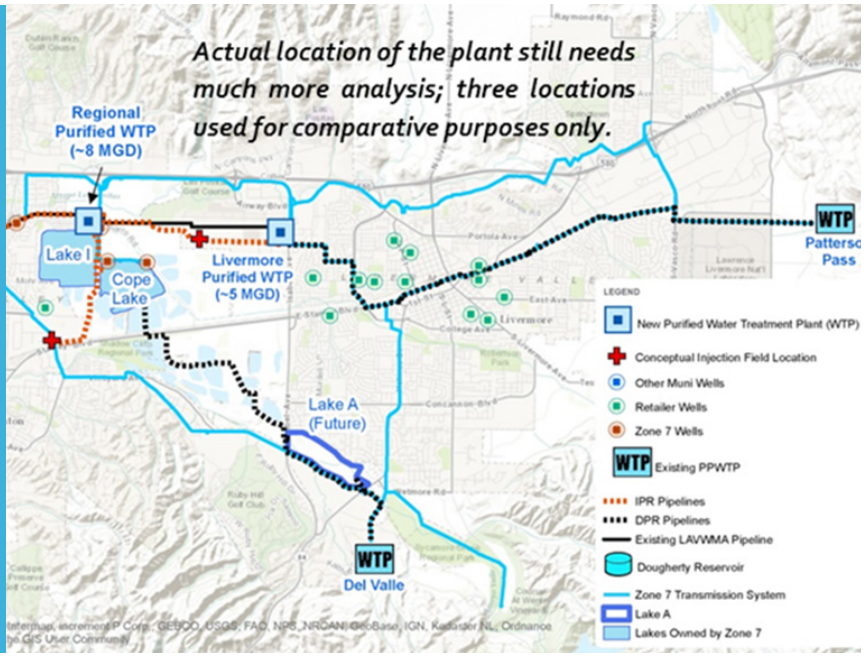
The project partners are considering potable reuse applications such as injecting the purified water into the groundwater basin before extracting for later use as a potable water supply, surface water recharge of the groundwater basin, and introduction of purified water upstream of a water treatment plant.

Water Supply Yield and Availability

Produces about 4,800 to 7,700 AFY of purified drinking water, operating year-round in all water year types. (Yield estimates are being refined through an ongoing feasibility study.)

AT A GLANCE

PROJECT TYPE	Treatment/supply
STATUS	Planning
ENGAGED BARR AGENCIES	Zone 7; other regional partners TBD, potentially including CCWD, EBMUD, and/or SFPUC
AVAILABILITY	All years
POTENTIAL YIELD	4,800 to 7,700 AFY
COST	Capital: $76M - $152M O&M: Likely high



Brown AND Caldwell

Regional Resilience

Provides a supplemental, local, drought-resistant supply for the Tri-Valley region, which could make water available and enable transfers and/or water marketing opportunities with other BARR partners through future interties (e.g., EBMUD, SFPUC) and/or exchanges of State Water Project (SWP) supplies in above normal/wet years). Increases groundwater recharge, supply reliability, and resilience to droughts, climate change impacts, planned outages, Delta levee failures, and other emergencies (e.g., earthquakes).

Efficiency

Builds on existing infrastructure and assets to the extent possible. Recovers a local water resource otherwise discharged to the San Francisco Bay.

Flexibility/Sustainability

Provides an increased supply for groundwater recharge. Contributes additional supply to storage, which may support increased conjunctive management.

Water Quality Considerations

Produces highly treated water with low TDS, and may improve lower-quality supplies if blended. Reduces wastewater flows and nutrient loading to the San Francisco Bay. Whether used for groundwater or surface water augmentation the water would receive post-treatment stabilization for corrosion control and aesthetics. Advanced treatment processes would be designed to ensure protection of public health and groundwater/surface water quality.

Timing

An initial feasibility study is currently underway and will be complete by early 2018.

Implementability

The initial feasibility study will identify implementation challenges. Interagency agreements would be among water/wastewater agencies. The project will likely require significant permitting and California Environmental Quality Act (CEQA) evaluation. Local control of this water supply would likely be a motivating factor and implementation driver.

Social and Environmental Considerations

The project would improve the agencies' ability to provide water during dry years, emergencies, and maintenance-related outages, which would improve the economic security and quality of life for customers. A reliable water supply is critical to health and safety, as well as local agriculture and the many businesses in that contribute significantly to the economic health of the Bay Area.

Concentrate disposal may increase salinity in receiving waters and may have an environmental impact. An analysis would be needed to select the best disposal option(s). Advanced treatment processes can be energy-intensive.

Effective public communication and education will be needed in order to address any public concerns over the safety of potable reuse.

BENEFITS

- Recovers a local water resource otherwise discharged to the San Francisco Bay.
- Provides a supplemental, local, drought-resistant supply for the Tri-Valley region.

CHALLENGES

- Requires concentrate disposal and possible concentrate treatment.
- Requires effective public communication and education to address any public concerns over the safety of potable reuse.

DROUGHT MITIGATION MEASURE 13

Regional Advanced Metering Infrastructure Feasibility Assessment

ALAMEDA, CONTRA COSTA, MARIN, AND SANTA CLARA COUNTIES

Advanced Metering Infrastructure (AMI) is a wireless technology effective for measuring/monitoring water consumption and leaks and for promoting customer awareness of water use. Most BARR agencies are already exploring or implementing AMI, and this project would involve a regional feasibility study to evaluate further AMI expansion on an agency-by-agency basis.

The study would leverage lessons learned, best practices, and key strategies from agencies that have implemented pilot and full-scale AMI projects. In addition to identifying opportunities for AMI expansion, the study would also involve identifying potential implementation barriers and a benefit-cost assessment, based on existing programs.

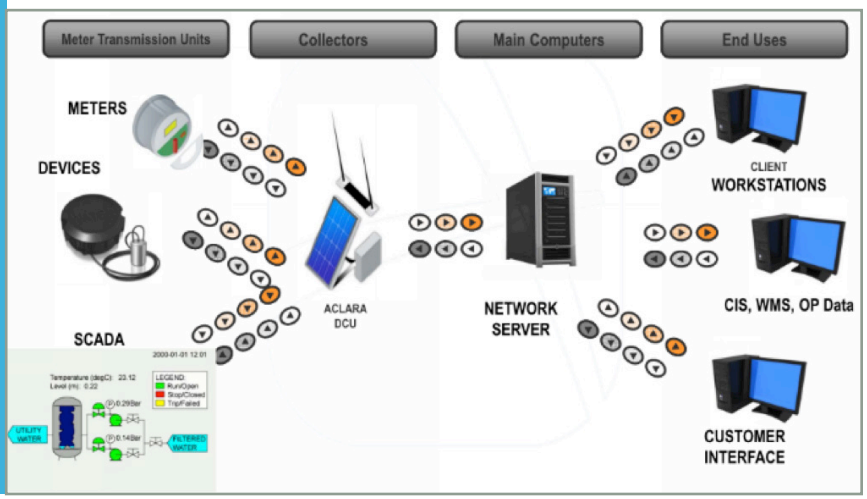
Data collected through AMI may improve water management at both the utility and customer levels, enabling prompt leak detection in distribution systems and on the customer side of meters.

The information produced through AMI can also serve a number of other applications that benefit utilities and customers, such as improvements related to customer service and operational efficiencies. Water agencies can recover revenue through reducing distribution system water losses from leaks and unauthorized uses. Improved accuracy of water use supports billing equity among ratepayers and collection of fees for all water used. AMI can also allow customers to access real-time information on their water use, which helps in identifying leaks and opportunities for other water use efficiency improvements (e.g., irrigation modifications).

The extent to which BARR agencies have implemented AMI in their systems and service areas varies by agency. Some agencies do not yet have AMI, while some agencies have conducted small-scale pilot projects with a subset of customers (e.g., EBMUD). Others have already implemented AMI either partially or fully (e.g., SFPUC).

AT A GLANCE

PROJECT TYPE	Operations
STATUS	Conceptual
ENGAGED BARR AGENCIES	ACWD, CCWD, EBMUD, MMWD, and SCVWD (through partnerships with water retailers)
AVAILABILITY	All years
POTENTIAL YIELD	0.07 AFY/meter installed (70,000 AFY for 1M meters)
COST	Capital: $250/meter installed ($250M for 1M meters) O&M: TBD (moderate)



Brown AND Caldwell

Water Supply Yield and Availability

Reduces water use by an estimated 5 to 10 percent of total demand, based on EBMUD's pilot test results. The supply yield depends on the number of AMI meters installed. Assuming a 1-million AMI meter installation project, water use could be reduced by about 70,000 acre-feet (AF).

Regional Resilience

Supports water use efficiency by enhancing customer awareness of water use (prompting behavioral changes and leak identification/ reduction) and utility monitoring.

Efficiency

Real-time AMI data helps utilities identify system leaks, detect unauthorized use, and improve system operation and facility sizing.

Flexibility/Sustainability

AMI increases water use efficiency, which may stretch existing supplies; delay planned development of new (or expanded) supply projects; and reduce pumping, treatment, distribution, and disposal costs.

Water Quality Considerations

AMI systems could be equipped with sensors to provide real-time water quality data to identify problems with pipeline integrity that may contribute to water quality degradation.

Timing

The regional feasibility assessment is currently conceptual, though some agencies are further along in planning or implementing AMI.

Implementability

Based on the results of existing AMI programs, the most significant concern of AMI implementation is related to cost. AMI meter installation may be phased over time.

Social and Environmental Considerations

Customer outreach is a critical element in garnering ratepayer support for AMI implementation. Communications should clearly address the economic and water conservation benefits to water metering. Increased accuracy of water use data can improve billing equity among ratepayers and support collection of fees for all water used, eventually providing dividends that delay the need for water rate increases. Providing customers with better usage data would also help them understand where and how they can use water more efficiently to reduce demand on surface water and groundwater supplies.

BENEFITS

- Reduces water loss (both in distribution systems and on customer side of meters).
- Elevates customer awareness of water use.
- Increases accuracy of meter reading (which can reduce injuries and claims and support planning/design for sizing future facilities).
- Supports drought outreach and enforcement.

CHALLENGES

- Costs may be prohibitively high for some agencies.
- Warrants significant customer outreach and communications.

DROUGHT MITIGATION MEASURE 14

Del Valle Reservoir Water Supply Storage Expansion Project

ALAMEDA COUNTY

Lake Del Valle is an off-stream reservoir located 10 miles south of the City of Livermore within Del Valle Regional Park and owned and operated by the California Department of Water Resources (DWR) as part of the State Water Project (SWP) system for water supply and flood storage. This project would modernize flood management rules to allow for using a greater portion of existing reservoir capacity to store water supply while maintaining necessary flood protection.

The change would make a greater amount of emergency water supply available to South Bay Aqueduct (SBA) Contractors (ACWD, SCVWD, and Zone 7) during system outages or periods when Delta pumping is limited due to environmental or water quality constraints.

The participating agencies would implement a Forecast Informed Reservoir Operation (FIRO) and use modeling and forecasting tools to improve flood control and water supply operations. Existing East Bay Regional Park District (EBRPD) facilities would be relocated to higher elevations or floatable structures to accommodate water storage goals while improving recreational opportunities.

Because the Del Valle Dam currently provides an excess amount of flood protection storage, it would not be physically altered as part of this project.

Additional storage and operational changes could help meet multiple water supply objectives while maintaining acceptable flood protection, including: (1) improve regional water supply reliability, (2) improve source water quality, (3) improve regional conjunctive use, (4) increase emergency water supplies, (5) increase flexibility to accommodate environmental constraints in the SWP Delta operations, (6) create new recreational opportunities, and (7) improve resilience to climate change and Delta pumping restrictions.

AT A GLANCE

PROJECT TYPE	Operations
STATUS	Conceptual
ENGAGED BARR AGENCIES	ACWD, SCVWD, and Zone 7
AVAILABILITY	Normal and dry years
POTENTIAL YIELD	Up to 35,000 AFY of additional storage
COST	Capital: $150M (initial estimate, studies under way) O&M: TBD (low, studies under way)

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Water Supply Yield and Availability

Up to 37,000 AFY of additional storage in normal and dry years.

Regional Resilience

Increases locally accessible supplies for SBA Contractors by storing water pumped from the south Delta when conditions are favorable and by capturing additional local runoff. Potentially more than doubles supply storage capacity from 30,000 acre-feet (AF) to as much as 67,000 AF, increasing supply reliability and resilience to droughts, climate change impacts, planned outages, Delta levee failures/pumping restrictions, and other emergencies (e.g., earthquakes).

Efficiency

Leverages existing infrastructure and assets at Lake Del Valle Reservoir and makes more effective use of existing supplies.

Flexibility/Sustainability

Increases SWP operational flexibility through the improved ability to manage pumping from the south Delta. Contributes additional supply to storage, which may support increased conjunctive management.

Water Quality Considerations

Increases water levels, which may reduce harmful algal blooms that occur at low reservoir water levels and improves water quality for both recreation and potable use. Reduces treatment needs for potable use due to improved source water quality.

Expanded supply storage increases blending of Delta and local supplies in the SBA, which can reduce disinfection by-products formation in treated supplies.

Timing

The project is in the conceptual phase and could be implemented within 5 years.

Implementability

In 2017, the SBA Contractors will seek California Water Commission funding for this project. The SBA Contractors are currently evaluating the feasibility of modernizing flood rules, expanding emergency storage, and replacing/relocating EBRPD facilities (which may be costly). Federal, state, and local review and permits would be required, and additional project constraints may be identified during that process that could affect implementation feasibility.

Social and Environmental Considerations

The project would benefit the environment by improving the operational flexibility of the SWP in managing pumping from the south Delta to minimize fish entrainment and meet water quality and flow objectives.

The project would increase the area available for enhanced recreational opportunities (e.g., boating and fishing), replace EBRPD facilities currently near the water's edge, and improve water quality leading to reduced algal blooms and use restrictions. Impacts to recreation, if any, would be addressed with enhanced recreational facilities, which would require both public support and cooperation from EBRPD.

BENEFITS

- Leverages existing supply sources and infrastructure.
- Increases water supplies in emergencies and planned outages for all SBA contractors.
- Increases resilience to climate change and future Delta constraints.
- Improves source water quality for SBA contractors' treatment plants.
- Improves regional conjunctive use for all SBA contractors.
- Enhances the Delta ecosystem.

CHALLENGES

- Requires costly relocation and enhancement of existing EBRPD facilities to higher elevations or floatable structures to increase water storage.
- Requires approvals by multiple agencies at federal, state, and local levels.

Bay Area Regional Water Market (Exchanges/Transfers) Program

SAN FRANCISCO BAY AREA

The Bay Area Water Market (Exchange/Transfer) Program would involve a one-time transfer of water between two or more Bay Area Regional Reliability (BARR) agencies, with the objective of developing and demonstrating an effective technical, institutional, and permitting framework for Bay Area partner agencies to secure and execute regional exchange projects.

This project would help to identify and resolve barriers that limit water transfer opportunities that would otherwise improve regional reliability and resilience. A tool in the form of a roadmap document would be developed to enable future water exchanges/transfers by documenting lessons learned and best practices based on interagency transactions completed as part of this effort and in the recent past.

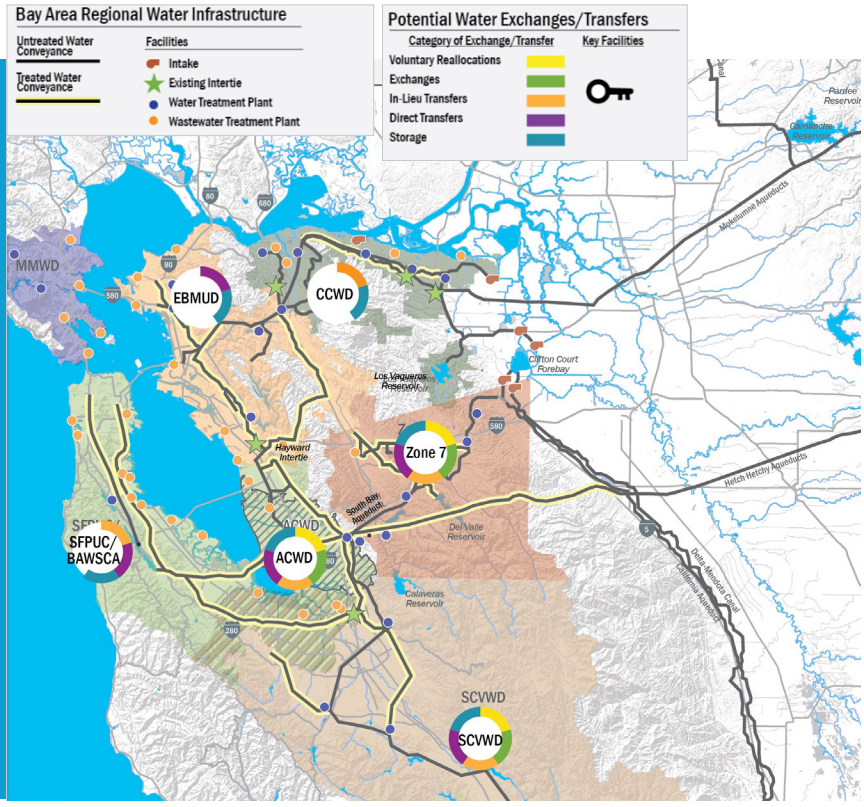
Though the project is currently at the conceptual stage, several potential variations are being considered. Water could be purchased from the Sacramento region and wheeled through EBMUD's Freeport facility and stored in Los Vaqueros (LV) Reservoir.

From LV Reservoir, there are several possible scenarios for transferring either treated or raw water to partner agencies. Exchanges (including in-lieu options) could be completed as well.

This water could provide a reliable supply for transfers and exchanges to BAWSCA member agencies in 2018 during SFPUC's temporary closure of Mountain Tunnel. The transferred water could also be delivered through existing and planned interties and/or exchanges to other participating agencies (ACWD, SCVWD, Zone 7, SFPUC, and/or BAWSCA).

AT A GLANCE

PROJECT TYPE	Operations
STATUS	Planning
ENGAGED BARR AGENCIES	ACWD, BAWSCA, CCWD, EBMUD, SCVWD, SFPUC, and Zone 7
AVAILABILITY	One Time
POTENTIAL YIELD	At least 3,000 AF
COST	TBD (based on exchanges/ transfers)



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Water Supply Yield and Availability

Entails a one-time transfer or exchange of at least 3,000 acre-feet (AF) between two or more Bay Area agencies.

Regional Resilience

Provides supplemental supply to an agency experiencing a water shortage emergency or temporary disruptions caused by planned maintenance. Lays the foundation for broader regional water sharing in the future by conducting near-term pilot projects.

Efficiency

Largely leverages existing resources, supplies, and assets, though new intertie pipelines and associated infrastructure would be needed to most flexibly and effectively share supplies in the region.

Flexibility/Sustainability

Helps identify and resolve barriers limiting opportunities to flexibly transfer supplies in the region.

Water Quality Considerations

Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality; minimize potential taste and odor issues).

Timing

The project is in the conceptual phase, and the timing depends on the specific exchange/transfer to be completed. The exchanges/transfers being considered for this program are anticipated to be completed within 1 to 3 years.

Implementability

The project involves 1 or more short-term pilot water transfer/exchange water among 2 or more BARR agencies within the next 3 years. Implementation challenges would be specific to the agencies, facilities, and water sources involved in the transfer/exchange. Most would involve filing for a short-term transfer with the State Water Resources Control Board, modifying water rights, securing additional permits, determining restrictions (e.g., timing constraints), and seeking approvals by agencies at federal, state, and/or local levels. Participating agencies would resolve technical challenges (water quality, treatment, intertie operations) before conducting this one-time demonstration test.

Social and Environmental Considerations

Water transfers largely leverage existing resources, supplies, and assets, thereby lowering their environmental burden. Facilitating development of a regional exchange project would allow the BARR agencies to improve their dry-year water supply resilience, which improves economic security and quality of life for the Bay Area.

BENEFITS

- Leverages existing supply sources and infrastructure.
- Could lead to increased water supplies in emergencies, planned outages, and droughts.
- Evaluates institutional, permitting, financial, and operational feasibility of regional exchanges.
- Lays the foundation for broader water sharing in the future.

CHALLENGES

- Requires approvals by multiple agencies at federal, state, and local levels.
- Requires institutional arrangements, permits, re-operation of regional water projects, and coordinated operations among participating agencies.
- Poses potential treatment compatibility issues, due to blending different source waters.
- Requires potential water rights modifications to enable transfers/exchanges.